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Bank cost and alternative profit efficiency in Algeria, Morocco and Tunisia over the period 1994-2001

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BANK COST AND ALTERNATIVE PROFIT EFFICIENCY IN ALGERIA, MOROCCO AND TUNISIA, OVER THE PERIOD 1994-2001

by

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Dedication

I would like to dedicate this thesis to my dear parents, *the memory of my grand-parents*, members of my beloved family, and to all friends whom I love, respect and care about, in Algeria and the UK.

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Abstract

This thesis examines the cost and alternative profit efficiency of a sample of Algerian, Moroccan and Tunisian banks over the financial liberalisation period 1994-2001. The translog functional form and intermediation approach are employed in this study to derive inefficiency estimates as well as scale economies levels and scale inefficiencies estimates. The results show that inefficiencies are substantial in the three banking systems under study, with an average of 29% of cost inefficiency and 32% of alternative profit inefficiency. Scale economies and scale inefficiencies are also found to be not negligible at an average level of 46% and 9%, respectively, with a negative relationship between assets size class and scale economies and scale inefficiencies estimates. The analysis also principally reveals that; first, Moroccan and Tunisian banks are more cost efficient than their counterparts in Algeria, secondly, banks that are involved in traditional income-generating activities are more profit efficient that other banks, and thirdly, banking firms with mixed structures of ownership (a combination of private, public and foreign), or listed, are more cost and profit efficient than their counterparts with a single type of ownership. We suggest that the three types of ownership may combine so as to reduce various inefficiencies associated with single ownership types. For example, foreign ownership might bring new technology and updated systems of risk management, the private sector emphasises the profitability motive and lending to more profitable sectors, whereas government ownership brings experience and knowledge in the domestic market. These factors combined seem to result in a more efficient bank operating units than those that have sole ownership features. As our results seem to be very sensitive to the data used in this study, we can conclude that the cost and profit inefficiencies, and the substantial level of potential gains from scale economies that appear to prevail in North African banking, we argue, are likely to reflect the still limited presence of competitive pressures in the banking systems under study. We conclude that inefficient banks in North African countries (Algeria, Morocco and Tunisia) continue to exist because they have been (or still) protected, especially as we know that the largest banks are typically State-owned or have major state shareholders.

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Chapter 1 Background, Objectives, Methodology and Structure of the Study

1-1 Introduction

The three North African countries of Algeria, Morocco and Tunisia have witnessed substantial programmes of economic and financial reforms over the last two decades. These reforms have affected the main characteristics of the banking sector. For example, financial reforms have ended the prolonged period of heavy regulations and constraints on banking sector activities.

During the period of financial regulation and repression from the 1960s to the early 1990s, the central planning systems of Algeria, Morocco and Tunisia were exploited by planning officials to channel government-owned funds to government-owned enterprises, labelled as the "*Secteur Public*". Within this system, the government imposed administrative fixing procedures on lending and deposit interest rates, which for most of this period, were either negative or below real market rates. In addition, the banking sector suffered from the absence of necessary instruments for credit risk management, which are well used in market-based banking systems. Lending and borrowing decisions were made by officials outside the banking sector; usually by political supervisors and/or party officials, which increased the likelihood of corruption and misconduct. The *Secteur Public* utilised banking funds to finance its planned projects, which in most cases, prioritised social objectives over promoting economic efficiency. This behaviour has resulted in a large numbers of insolvent government-owned enterprises as well as the emergence of substantial *non-performing loans* in the banking sectors under study over the last two decades.

Since the early 1990s, the banking sectors of Algeria, Morocco and Tunisia have experienced, to varying degrees, financial liberalisation programmes. This involves the transference of the banking systems from a government-controlled to a more market-based system characterised by greater rates of competition. This is achieved by increasing the presence of private and foreign-owned banks, reducing the size of government-owned banks, and eventually fully privatising these banks. Nowadays in the three financial systems under study, interest rates are liberalised and the administrative allocations of credit according to the French style *l'encadrement du Credit* have been discontinued. Under the centrally planned-based banking system, banks were performing inefficiently, due to the non-market allocation of credits and the heavy social functions they performed. Social objectives were placed ahead of economic objectives. As such, one would expect that after experiencing various liberalisation programmes, the banking systems of Algeria, Morocco and Tunisia should have benefited from improved efficiency of operations.

1-2 Objectives of the Study

The primary objective of this thesis therefore, is to assess the cost and profit efficiency of banking firms in the three North African countries of Algeria, Morocco and Tunisia using a dataset covering the period from 1994 to 2001. The thesis aims to determine the main factors that influence bank cost and profit efficiency in the three countries, and to see whether the liberalisation programmes in the countries have actually resulted in improved banking sector efficiency. Finally, the investigation of cost and profit efficiency addresses the question as to whether bank management have been able to control expenses and generate revenues at the best practice level. If banks are found to be inefficient, this suggests that bank management have failed to organise their institution to the level occupied by the best practice banks. Bank management might have used too many input to produce the same amount of outputs, compared to the best practice firms, and/or bank management might have not utilised the optimal or best practice level of input/output combination in the light of input prices. Also, bank managers might have failed to develop efficient credit risk management skills, due either to the absence of a recognised risk management approach, or they might have been denied making optimal decisions due to interferences from their owners or political pressures.

The second main objective of this study is to examine whether financial liberalisation measures have affected cost and profit efficiency of Algeria, Morocco and Tunisia's banking sectors. Financial deregulation, in the form of allowing foreign and private banks to invest domestically, and discontinuing the utilisation of administrative interest rates and allocation of credits, was expected to result in the banking sectors in the three countries to operate under increasing levels of competition. When competition was denied under the central planning system, banking firms were compulsorily lending money to underperforming government-owned sectors. One might expect that this situation would lead banks to have low levels of cost and profit efficiency. Also, economic conditions are believed to have important impact on bank efficiency. Lozano-Vivas (2000) compares bank cost efficiency between Spain and France, and finds that country macroeconomic conditions represent an important factor in the process of determination of bank cost and profit efficiency. The relationship between macroeconomic conditions and banking sector performance and efficiency are also addressed on this thesis.

Overall, this study undertakes a detailed comparison of bank cost and profit efficiency levels in Algeria, Morocco and Tunisia. These three countries are key members of the Arab Maghreb Union (AMU), which intends to form a political and economic union similar to that of the EU. This thesis will investigate the evolution of cost and profit efficiency, particularly in terms of bank assets size and for different types of banks to see if size or ownership types have substantially different efficiency levels.

1-3 The structure of the Study

The structure of this thesis is organised as follows;

Chapter 1 introduces the main objective of the thesis, and outlines the structure of the study.

Second, Chapter 2 reviews the main characteristics of the Algerian, Moroccan and Tunisian economies. While the Algerian economy relied strongly on the hydrocarbon sector, the Moroccan and Tunisian economies are more diversified with the agricultural, services and light industrial sectors. Also, Chapter 2 overviews the political economy of the three countries in the Central Planning era, and economic reforms are also indicated.

Third, Chapter 3 reviews the main characteristics of the banking sectors in the three countries. Particular focus will be oriented towards size, ownership, and banking penetration. Financial liberalisation measures are also reviewed including the deregulation of interest rates, the elimination of constraints on allocating credits, and the permission of private and foreign-owned banks to function in the domestic banking systems.

Fourth, Chapter 4 introduces the theoretical framework of the concept of bank efficiency. The chapter provides a conceptional framework of cost and profit efficiency and its type. Also, the chapter presents the main methodological approaches that are extensively used to model cost and profit efficiency, which are the parametric approaches and the non-parametric approaches. In addition, the main approaches employed to define output and input variables used in the modelling process, the intermediary and production approaches, will be provided in Chapter 4.

Fifth, Chapter 5 reviews a number of previous studies that investigated cost and profit efficiency in US banking, European banking and transition banking systems.

Sixth, Chapter 6 presents the methodology, data, inputs and outputs' variables definition and the results of this study. The methodology used in this study is the stochastic frontier approach with the translog function specification. The dataset includes 287 observations for a sample of 50 banking and financial firms that functioned in Algeria, Morocco and Tunisia during the period 1994-2001. Using the intermediation approach, three output variables are used, loans, other performing assets and off-balance sheet items, and three inputs variables, deposits, labour and physical assets. The results are presented according to size, country location, ownership and bank type.

Finally, Chapter 7 presents the main findings of the study along side with the implication of the results. Also, the chapter includes the main limitations and difficulties encountered while carrying out the current research.

Chapter 2 Structural Characteristics of the Algeria, Morocco and Tunisia Economies

2-1 Introduction

Algeria, Morocco and Tunisia have experienced features of political, social and economic distortions in the post independence State-interventionist era, reflected in imbalances in macro-economic, financial and other indictors, including low and sometimes negative economic growth rates. The three countries' governments recognised the inevitable need to correct these distortions by embarking upon a major transformation of their economies through the implementation of a wide range of fundamental reforms compatible with the principles of creating freer market-based economies. These reforms, in the form of economic liberalisation and financial deregulation, have obtained significant technical support and financial assistance from major international financial institutions such as the IMF and the World Bank. The relative disparity in the speed, timing and breadth of the reforms in the three countries, has resulted in different effects of these policy actions on the respective local markets.

One main objective of economic and financial liberalisation is to create an appropriate regulatory framework together with encouraging macro-economic conditions, so as to diminish the instability of the economy, and to improve the role of the local financial system in the economy. Pesola (2001) states that a stable financial system is significantly associated with a strong macro-economic environment, including a sound course of economic growth. Economic liberalisation and financial deregulation also aim to create an environment conducive to the reduction in cost and profit inefficiencies in the banking and financial sectors. Dietsch and Lozano-Vivas (2000), for instance, recognise that macro-economic conditions seem to partly explain the efficiency of banks. The more favourable the country-specific economic conditions are the greater the improvements in the efficiency of the banking sector.

The present chapter examines the main structural economic characteristics of Algeria, Morocco and Tunisia and the changes that have taken place over recent decades. Over the last twenty years, the three countries have implemented a series of economic and financial reforms that have led to a reshaping of their economies. First, the chapter will present the geographical, demographic and social characteristics of the three countries. Second, the chapter will explore the main economic trends that occurred over the period prior to the economic and financial liberalisation reforms. The chapter will focus on assessing the consequences of the main economic liberalisation measures that were implemented in the 1980s and 1990s. The investigation of the financial systems and the financial liberalisation measures in the three countries are discussed afterwards in Chapter 3.

2-2 Overall Description

2-2-1 Geographic Location

Algeria, Morocco and Tunisia are located in the North Western corner of Africa and the South West of the Mediterranean basin. The three countries constitute the main key members of the Arab Maghreb[1] Union organisation (AMU) created in 1989, which also includes Libya and Mauritania. Algeria, Morocco and Tunisia occupy a total surface area of more than three million square kilometres, in which Algeria takes up about 70%, and nearly a quarter of the total surface area of North Africa and the Middle East countries (MENA, IMF, 2000)[2]. The three countries are bordered by Libya from the east, Western Sahara[3], Mauritania, Niger and Mali from the south, the Atlantic Ocean from the west, and the Mediterranean Sea from the north.

Figure 2-1 illustrates the geographic location of Algeria, Morocco and Tunisia and the region of the Maghreb as a whole. As it can be seen, the three Maghreb countries are located in a historically vital geo-strategic location as they intersect between Europe from the north, the Middle East from the east and the Sub-Sahara Africa from the south. Over history, the Maghreb region always attracted foreign invaders. For instance, while the Colonial France used the region as a departure point to penetrate the African continent;

[1] Maghreb is the Arabic word for West.
[2] "Middle East and North Africa countries (MENA)" is a new appellation for Arab-speaking countries that are members of the Arab League Organisation based at Cairo. The acronym MENA was introduced in early 1990s at the Peace Conference in Egypt. MENA is also applied to Maghreb (West) and Mashriq (East) countries.
[3] The territory of Western Sahara is not a member of the UMA. This territory is still under dispute between Morocco and the Algeria-backed Sahraoui dissident group "Polisario". Morocco claims that the Western Sahara territory is historically part of its national sovereignty.

Muslim Arabs used the region as a base to invade West Africa and Europe through Spain.

In terms of natural resources and strategic economic capacities, the geography occupied by the three Maghreb countries is rich in hydrocarbons and minerals, especially gas and oil reserves in Algeria and Phosphate in Morocco and Tunisia, a long coast facing the Mediterranean Basin and the Atlantic Ocean, the two ranges of the Atlas Mountains, and spectacular tourism locations in both the southern desert and the northern and western coast. Also, the three countries embrace nearly a third of the total MENA countries forests. Despite the natural wealth of the Maghreb region, especially in Algeria, the World Bank has always classified the three countries as 'developing' countries that belong to the lower-middle income economies (World Bank Report, 2001)[4]. Table 2–1 summarises a number of geographic and environmental characteristics of the three countries over the years 1997 and 2000, while Figure 2-1 shows the geographical location of the Maghreb region.

Table 2–1: The Geographic and environmental characteristics of Algeria, Morocco and Tunisia and MENA Countries

Year	1997				2000			
Countries	MENA	Algeria	Morocco	Tunisia	MENA	Algeria	Morocco	Tunisia
Surface area (million Sq. Km)	11.1	2.1	0.447	0.164	11.1	2.1	0.447	0.164
Forests (million Sq. Km)	-	-	-	-	1.676	0.214	0.302	0.051
Deforestation (average annual % 1990-2000)	-	-	-	-	-0.1	-1.3	0.00	-0.2
CO_2 emissions (metric ton per Capita)	3.7	3.4	1.1	1.8	-	-	-	-
Access to improved water resource (% of total population)	-	-	-	-	88.2	89.0	80.0	80.0
Access to improved sanitation (% of urban population)	-	-	-	-	93.9	99.0	86.0	96.0
Energy use per Capita (Kg of oil equivalent)	1,264.90	895.7	333.6	751.6	1,368.30	956.4	358.6	824.8
Electricity use per Capita (K. watt)	1,218.00	523.2	422.7	783	1,345.80	611.9	447.2	938.9

Source: World Development Indicators Database, April 2003.
MENA: Middle East and North African countries.

[4] See White (2001) for more details about lower-middle income economies characteristics.

Figure 2-1: The Geography of Maghreb

Source: http://www.lib.utexas.edu/maps

2-2-2 Arab Maghreb Union (AMU)

White (2001) asserts that in the broader context of comparison to other countries and to other regions, Algeria, Morocco and Tunisia exhibit similar identical, historical, social and political characteristics. As the vast majority of the people follow Islam and speak Arabic, Arabs and Berbers[5], the original population of North Africa, are the main ethnic components of the population in the three countries[6]. These similarities have created a sense of unity and community[7], widely and remarkably seen during the independence

[5] The Berber communities include mainly Kabyle, Chaouia, Mizab and Touarag in Algeria and Tarifit, Tamazight and Tachalhit in Morocco (Vermeren, 2002).

[6] Due to historical events related to decolonisation process in the fifties and sixties and the creation of Israel, Maghribi Jewish and Christians are tenuous minorities in Morocco and Tunisia, but they could hardly be present in Algeria.

[7] The Solidarity of Maghrebi countries was well seen during the independence war in Algeria. Algerian fighters used Tunisia and (intensively) Morocco to transport logistic aid.

war in Algeria. In addition, historically imposed unification has further linked the three countries particularly under the rule of the Romans and Islamic dynasties. Over history, the three countries were relatively colonised and ruled by the same power including the Romans, Arab Muslims, Turks[8], and finally the French.

One major event in the post-independence[9] era of Algeria, Morocco and Tunisia is the formation of the Arab Maghreb Union (AMU) organisation. For the first time in modern history, the heads of state of Algeria, Libya, Mauritania, Morocco and Tunisia met in June 1988 in Ziralda, Algeria, to discuss potential economic and political cooperation. In February 1989, the same five heads of state re-met in Marrakech, Morocco, and signed the "Traité de Marrakech" announcing the creation of the Arab Maghreb Union (AMU) (El-Moujahid, February 1989). Darrat and Pennathur (2002) state that the AMU aimed at achieving objectives similar to those of the European Union (EU) and North American Free-Trade agreement (NAFTA), including coordinating economic policy between the state members and strengthening economic and financial linkage across all economic sectors.

According to the "Traité de Marrakech", the AMU has three main objectives; first, strengthening the fraternity relations between the members states and people and defending their rights; second, the progressive adoption of free movements of people, goods and capital between the members; and finally, the implementation of common and coherent policies in economic and political affairs in order to drive the countries members to a fully integrated single market. The AMU intended to follow the example of the European Union (EU) to bring the five countries together, therefore, with full economic and institutional political integration. One practical measure implemented by the Union was the free movement of people and goods by removing the imposition of visa requirements, which has resulted in more than three million people having moved between Algeria, Morocco and Tunisia over the period from 1989 to 1994.

[8] The Ottoman Turks did not formally occupy Morocco.

[9] Post independence era starts from the day of independence from the France until present. Algeria obtained its independence from France in 1962, while Morocco and Tunisia obtained their independence in 1956.

However, since 1994, the integration process has been slow and often static and the situation at present (2004) is still a long way from an integrated Single Maghrebi market. Political disputes between the countries, in particular Algeria and Morocco, can explain this lack of movement towards further integration. In August 1994, Morocco imposed a unilateral temporary cessation of the Union as a result of the "*Meurtres de Marrakech*" incident. A number of armed Franco-Algerian extremists attacked "*Hôtel Atlas-Asni*" in Marrakech killing a number of tourists (le Monde, 25th August 2003). The Moroccan Government subsequently accused Algerian Intelligence Services of being implicated and took restricting measures including the re-imposition of visa entry requirements on Algerian citizens wishing to travel to Morocco. The Algerian Government replied by imposing similar restrictions on Moroccan citizens wishing to travel to Algeria, and further, the Algerian Government retaliated by closing the frontiers between Algeria and Morocco[10] (Le Monde, 31st August 1994). The consequence of this unpredictable incident was a massive decline in Algerian visitors to Morocco[11]. Overall, although a number of agreements have since been signed, Vermeren (2002) contends that security and political instability in Algeria and the dispute over Western Sahara between Algeria and Morocco remain the main obstacles to developing further integration in the Arab Maghreb Union (AMU).

2-2-3 The Demographic Characteristics of Algeria, Morocco and Tunisia

As of the end of 2001, the total population of Algeria, Morocco and Tunisia was estimated at seventy million people. Algeria has the largest population with about thirty-one million people, followed by Morocco (29.2 million) and Tunisia (9.7 million). The population of the three countries is approximately the same size as Egypt and less than one tenth of Africa's population (World Bank Statistics, April 2003). One important demographic feature of the countries under study is the over-representation of the

[10] The frontiers between Algeria and Morocco and Visa requirements were valid until the 30/07/2004. King of Morocco Mohamed VI decided unilaterally to lift visa requirements on Algerian nationals. The Algerian Government welcomed this initiative but refused to do the same for Moroccan nationals. The Algerian Government thinks that imposing or lifting visa requirements is unilatellay taken by the Moroccan Government, and this is considered as a manoeuvre to influence the Algerian official position towards the Cause of Western Sahara (Liberate, 31/07/2004).
[11] In 1992, around 1.66 million Algerian visited Morocco; the number fell to 13 thousand in 1995.

younger age groups as more than 60% of the total population are under the age of 30 years. Table 2–2 accommodates selected data on the demographic characteristics of Algeria, Morocco and Tunisia in comparison to MENA region countries. Table A1–1, Table A1–2, Table A1–3 and Table A1–4 in Appendix A1 display various other statistics about the populations of the three countries under study including education, health and population indicators.

Table 2–2: A number of demographic characteristics of Algeria, Morocco and Tunisia and Middle East and North Africa (MENA) Countries

Year	1997				2001			
Countries	MENA	Algeria	Morocco	Tunisia	MENA	Algeria	Morocco	Tunisia
Total Population (million)	278.4	29.0	27.3	9.2	300.6	30.8	29.2	9.6
Population growth (%)	2.0	1.6	1.7	1.3	1.9	1.6	1.6	1.2
Life expectancy (years)	66.8	70.1	66.6	71.9	68.2	70.6	68.0	72.4
Fertility rate (birth per woman)	3.7	3.5	3.1	2.4	3.3	2.9	2.8	2.1
Infant mortality rate (per 1,000 live births)	49.1	40.0	47	27.6	43.6	39.0	39.0	21.0
Child immunisation, measles (% of under 12 months)	88.3	92.0	92.0	92.00	92.3	96.0	83.0	92.00
Total illiteracy (% of 15 years old and above)	39.6	37.1	54.0	32.8	35.5	32.2	50.2	27.9
Female illiteracy (% of 15 years old and above	51.4	47.5	67.2	43.8	46.3	41.7	62.8	38.1
Primary enrolment (% relevant age group)	-	-	75.5	100.0	82.2*	61.8*	78.0*	99.2*

Source: World Development Indicators Database, April 2003, various pages.
* Statistics of 2000.

Table 2–2 shows that Tunisia has a relatively higher living standard than Algeria and Morocco, and the MENA countries overall as measured by life expectancy. The latter, can be considered reasonable, even though it is lower than in developed countries (which is higher than 74 years).[12] Also, Table 2–2 displays that adult illiteracy rates are higher in Morocco (50%)[13] than in Algeria (30%) and Tunisia (28%), due to higher rates of female illiteracy. As of the end of 2001, 62% of Moroccan woman aged fifteen and above were illiterate, while, for the same age group, 40% and 32% of Algerian and Tunisia women were illiterate, respectively. Most of the illiterate population in the three countries either

[12] Life expectancy in France was 79 in 2001.
[13] According to Vermeren (2002), the demographic course of the three countries is related to the demographic policies and woman status. For more details, read the presentation and analysis of Vermeren (2002.p83).

belong to older age groups or live in distant rural areas. Besides, Table 2–1 shows that, demographic growth in Tunisia is lower than in Algeria and Morocco. The low rate of population growth in Tunisia is viewed by White (2001) as a conspicuous outcome of the 1957 Personnel Status Code. This code abolishes polygamy, established a minimum age of woman to marry, giving women the right to sign their own marriage certificate and gave them the right to demand divorce, to vote and to hold office. The code also might have helped to increase the education and literacy of women, and in turn, their inclination towards family planning due to their entrance into the labour force.

2-3 Overview of the Economic Policies of Algeria, Morocco and Tunisia

This section reviews the main economic policies that were implemented in Algeria, Morocco and Tunisia over the period starting from the sixties. The implementation of a broad range of economic and financial reforms in Algeria, Morocco and Tunisia in recent decades, implied that the authorities implicitly and explicitly recognised that the strategies of economic development and growth undertaken by then (during the 1960s, 1970s and part of the 1980s), had not been as successful as deserved in achieving the quantitative objectives of economic welfare set out in various development plans. Overall, these earlier development strategies were based on constructing large-scale government-owned enterprises using the centrally planned model. The latter was adopted to create a modern economy that was believed to replace the economic structures inherited from the French colonial era. In the three countries under study, the centrally planned model required the governments to establish, own and manage their central banks and nationalise the remaining industries and companies as a symbol of economic self-assertion and sovereignty (Khouri, 1998).

2-3-1 Algeria

When Algeria declared independence from France, the country had a predominant agrarian economy, which was primarily serving the needs of metropolitan industries (Goumiri, 1993). The new Government realised this characteristic, and intended to execute a major change from an agrarian economy with a limited industrial base, to a non-traditional economy with a heavy industrial base, by adopting the central planning model. On the political side, the Government in power, headed by Ben Bella and from 1965 by the President Boumediene[14], opposed multi-party democracy and imposed one party rule by the party of *Front de Liberalisation Nationale* (FLN)[15]. President Boumediene confirmed the adoption of nationalisation, central planning and the industrialisation model (Aissaoui, 2001), and appointed Belaid Abdessalam as minister of economy and planning. They both embraced the dirigist development theory of "Industries Industrialisantes" or "Industrialising Industries" proposed by De Bernis[16]. According to BenBitour[17] (1998) and Dolman (2000), the "Industries Industrialisantes" theory, was based on the total intervention of State in the economy by using external borrowings and oil exports revenues to construct a solid economic and industrial base. Aissaoui (2001) and Dillman (2000) mention that the central planning system used hydrocarbon revenues to finance a capital-intensive industrialisation programme within the State sector. Over the 1960s and 1970s, the government invested heavily in the industrial sector and created large state-owned enterprises using oil revenues, placing Algeria as one of the most Dirigist and Developmentist State in the Third World (Dillman, 2000). Thus, the new Algerian government intended to reduce the political, economic and cultural links with France (as an ex-colonial power). One practical measure was the substantial campaign of nationalisation of all economic sectors, including the hydrocarbon and financial sectors (Vermeren, 2002)[18].

[14] BenBella was the first president of Algeria and was in power from 1962 to 1965. On 5th June 1965, Boumediene, who was by then the Minister of Defence, headed a non-violent military *coup* against the president BenBella, and then declared the presidency of "the revolutionary Council" (composed of the main Army commanders), which was the government of Algeria from 1965 to 1976. In 1976, a new constitution was drawn and accepted by the People and Boumediene was elected as President in a referendum. He governed Algeria until he died on 28th December 1978.

[15] The Front de Liberalisation Nationale (FLN) is the organisation that led the war of independence of the Algerian people against the French colonial from 1954 until 1962. After the independence, the FLN was converted into a political party and the government used it as a heavy beaurocratic machine for populist purposes. The party is still operating in the current political scene in Algeria (2004).

[16] The French economist Gerard de Stanne De Bernis was lecturing at the University of Algiers.

[17] Ahmed BenBitour is an economist that served as a minister of Finance (1993-1995) and as a Prime Minister (2000-2001). He headed (with Mourad BenAchenhou) the official Algerian delegation to negotiate the external debt reschedule of with the IMF in 1993-1995, and other agreements with the IMF.

[18]For more details, see Dillman (2000) who uses the Development Theory and the Rentier-State Theory to explain the failure of development in Algeria.

The implementation of De Bernis' theory generated a situation where the State was entirely the main economic agent and social operator in the country, being both interventionist and monopolistic. BenBitour (1998) analyses the period from 1970 to 1978 and observes that the Algerian central planners benefited from an encouraging international environment. That is, increasing amounts of hydrocarbon export revenues and external borrowings with lower prices supported a favourable investment rate of 45% in the recently established state-owned industrial sector (the public sector). BenBitour (1998) recognises that, by 1979, the central economy was physically in place and covering, at least, the main economic sectors and dominated by many large-sized enterprises owned by the government. One consequence of De Bernis' strategy was that the privately-owned sector was neglected, and even dis-encouraged by the government. The Government monopolised the ownership and the management of almost all economic sectors, and imposed a total absence of market-based instruments and practices, as competition, especially in the financial sector, which was entirely owned by the Government and was subject to heavy administrative practices (BenIssad, 1991).

Chemingui (2000) notes that Algeria experienced high rates of economic growth averaging around 7% per year over the period from 1962 to 1985. The industrial sector, led by the upstream hydrocarbon sector, was the source of this growth, driven also by large amounts of government investments. In the three development plans from 1966 to 1979[19], more than half of total investments were allocated towards the industrial sector whereas only one tenth of the total investments was allocated to the agricultural sector. Consequently, an important government-owned sector was gradually constructed, particularly, in heavy industries, external and internal trade, banking and insurance, and also resulting in the marginalisation of private capital. The private sector was evolving outside a strongly concentrated and centralised public sector, but in limited activities in non-strategic industries.

Naas (2003) examines the situation of the private sector in Algeria during the first economic plans. He finds that the private sector was marginalised by the planning

[19] Bali (1993) mentions that Algeria experienced five major development plans: the First triennial plan (1968 to 1970), the first quadrennial plan (1971-1974), the second quadrennial plan (1975-1979), the first pentrennial plan (1980-1984), and finally the second pentrennial plan (1985-1989).

authorities. The Investment Law of 1967, which was maintained until 1994, organised private investments as well as the relationship between these and Government-owned banking structures. As the law did not impose principles of banking domiciliation and specialisation, it outlawed any forms of long term credits for the non-public sector, and it set the allowable amount of loans to the limit of 25-30% of total investment expenses. The marginalisation of the private sector is clearly indicated by the share of the private sector in total bank loans, which was between 3-10%, whereas the share of the private sector in total bank deposits was between 43-50% in the 1970s.

The death of President Boumediene in December 1978 allowed the Algerian government to reconsider and revise its "developmentalist"[20] role in economic development and growth strategies. The new government headed by the President Chadli Benjdid[21]recognised that the economy needed reforming to correct the distortions inherited from the Boumediene's era. Tlamaçani (1999) states that the President Chadli manufactured his range of reform measures under the term "Infitah"[22] in the form of two five-year development plans financed by hydrocarbon revenues and external debts.

In the first plan (1980-1984), the government focused on injecting public investments into non-heavy industrial sectors. For instance, the agricultural sector and infrastructures received an unprecedented third of total government investments, whereas the industrial sector received less than 40% (Bali, 1993). Furthermore, the first three-year plan stated the approach that the government would follow was to restructure large enterprises created in the sixties and seventies, which were mostly headquartered in Algiers. The approach consisted of scaling down every large enterprise into a number of smaller and medium-sized independent units with separate headquarters distributed around the country. The aim of this "downsizing" was to help improve the efficiency and performance of larger companies, and also to foster development and employment to other regions in Algeria.

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[20] This term has been used by Vermeren (2002) to refer to the Central Planning Model.
[21] President Chadli BenJdid governed Algeria from 1979 to January 1992. The Army forced him to resign as he allegedly showed indications of weaknesses in dealing with the Islamist party, FIS.
[22] Infitah is the Arabic work for Openness.

In the second three-year development plan (1985-1989)[23], the projects and financial allocations did not significantly differ from those in the first. Investments in the agricultural sector, infrastructure and non-productive sectors were prioritised. However, the plan did not achieve its objectives due to a severe lack of funds. In 1986, Algeria sensed the shock of the twin assault of a Saudi Arabia-inspired lowering of world oil prices and a dramatic decline in the value of the US Dollar, the currency in which energy trade was transacted (ICG, 2001). Mouhoubi (1998) states that the terms of trade and hydrocarbon budgetary revenues declined by half, and subsequently, the government suffered from a budgetary deficit of a third of GDP. Aissaoui (2001) reports that exports earnings from hydrocarbons fell to $7.3 billion in 1986 from a peak of $14.2 billion in 1981. The 1986 collapse affected investments and production as the level of activity in domestic industries substantially decreased. In parallel, the scarcity of consumption products emerged, consumption per capita declined, unemployment and inflation rates soared, which, according to Chemingui (2000), precipitated an acute and enduring social, economic and political crisis, culminating in civil unrest and the 1986 and 1988 riots[24].

The 1986 shock was considered as clear evidence of the sensitivity of the Algerian economy to international energy markets. President Chadli realised the urgent need to address deep-seated structural and macroeconomic stabilisation reform programmes so as to establish the conditions for sustainable long-term growth, contain price distortions and correct macro-economic imbalances (Chemingui, 2000). In parallel, president Chadli initiated a programme of political and constitutional reforms in favour of a multi-party political regime. He released political prisoners, and permitted expelled political opponents to return home and form opposition parties (Volpi, 2003). President Chadli appointed the reformist Mouloud Hamrouche as a new Prime Minister, who was in favour of a freer-market approach. His priority objectives were to 1) promote private sector development, 2) restructure public enterprises, 3) encourage agricultural reform, 4) develop a competitive financial sector, and 5) establish an organised labour market.

[23] This plan was not carried to its planned terms due to the 1986 shock and 1988 youth riots.
[24] For more details about these riots and related events are masterfully analysed by Volpi (2003).

However, this programme did not come to fruition due to the dramatic political events[25], which reduced Algeria to terrorism, particularly from 1992 to 1999.

Over the period from 1991 to 1994, macro-economic unbalances became severe. The government budget and balance of payments continued to record deficits; both external indebtness and debt servicing requirements increased to the level where the Algerian government could not honour its obligations (Naas, 2003). In response, the new government appointed by President Zaroual in 1994 recognised this inability, and subsequently entered into extensive negotiations to reschedule external debts with the main borrowers in Paris and London Clubs[26]. In parallel, Naas (2003) details that the government formulated a comprehensive structural adjustment programme that has changed the regulatory framework of the Algerian economy in terms of allowing for more competition and gradual disengagement of the State from the economy. The programme received the assistance of the IMF and World Bank on two occasions: in May 1994 through an intentional one-year Stand-By Arrangement, and in May 1995 through the three-year Extended Fund Facility Arrangement. The structural adjustment programme consisted of fiscal, economic (including financial sector), and social reforms.

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[25] The new constitution of 24th February 1989 allowed the establishment of political parties with different ideologies. The Islamist party, Front Islamique du Salut (FIS), won the multi-party local elections of 1989 and later the multi-party legislative elections of December 1991. In June 1991, the FIS declared a civilian rebellion to push President Chadli to resign and call for an early multi-candidate presidential election. The rebellion witnessed violent incidents between security services and FIS activists, and resulted in the arrest of the leaders of the Islamist party and the fall of the Hamrouche government, which was succeeded by the Ghouzali government. Ghouzali's mission was primarily the organisation of the legislative elections in December 1991, in which the majority of the electorate favoured the Islamist party, FIS. On January 1992, Army officers forced President Chadli to resign, annulled the elections results, suspended the electoral process, and outlawed the Islamist party FIS. The militants of this party were frustrated and changed their focus from an intimidating opposition to an armed insurgency. Since then, Algeria fell into violence, crime, massacres, terrorism and confrontations between the Army forces and the FIS armed wings, in which more than 150 thousand civilians died. The Army appointed the five-member "High Council of State (HCS)" headed by the historical prestigious figure of the Algerian revolution Boudiaf to fulfil the role of the President until 1993. Boudiaf had lived in Morocco since the early 1960s, and, however, was assassinated by a security officer, in June 1992. The HCS organised a National Concord Conference (Platform for National Consensus over the Period of Transition), in which a number of non-elect political, associative, and other movements and organisations representing the society gathered and "elected" the general Zaroual, then Minister of Defence, as a President of State of Algeria. Zaroual organised presidential elections in November 1995 in which three other candidates participated. Zaroual won the elections and became the President of the Republic of Algeria, which encouraged him to establish his legitimacy and encouraged him to press on with constitutional and political reforms. (for more details, read the excellent work of Aissaoui (2001)).

[26] While Club de Londres musters private lenders, Club de Paris consists of Public lenders. Naas (2003) elaborates the contents and terms of rescheduling agreements.

First, the fiscal reforms aimed to diminish the interventionist role of the government as a major provider of goods and services. The government intended to gradually cease subsidising basic goods and services, especially milk, bread, construction materials, and transport. Second, the main economic reforms allowed the private sector to invest in industries that were considered strategic, such as banking. The government reaffirmed its commitment to establish a market-based system of bank intermediation and to further the utilisation of indirect market-based monetary instruments. Third, the social reform consisted of discontinuing a variety of subsidies and transfers that protected employment in the public sectors; instead, the government proposed an unemployment insurance scheme. Also, the structural adjustment programme of reforms covered exchange rate liberalisation, price and internal and external trade liberalisation, public enterprise reform (liquidation of large number of local enterprises), and financial and monetary reforms. Consequently, the implementation of the structural reforms in Algeria has been seen as a gradual abandonment of the central planning state developmentalist model in favour of the role of the market (Naas, 2003).

The first Government of the Prime Minister Ouyahya (1995-1998) substantially extended the programme of reforms especially on the fiscal and social sides. Hundreds of companies were liquidated; thousands of employees were dismissed, unemployment increased and widespread lifting of subsidies on basic consumption goods plus freezes on public sector pay. On the macro-economic side, Ouyahya's reforms succeeded in increasing the stock of reserves, reducing balance of payments' deficits and the government budget.

Aissaoui (2001) notes that when President Zaroual decided to cut short his presidential mandate, his successor, Boutaflika[27] (1999-2004) has had "a sense of purpose" in favour of restoring political tolerance and ending the country's isolation from the rest of the world. On the economic side, Boutaflika has aimed at restoring investor confidence, and focused on attracting foreign investment into the country. He established his inner core,

[27] Boutaflika served as Foreign Minister most of the sixties and seventies, but had been in the political wilderness since the end of the Boumediene era. Bouteflika came to power when General Zaroual decided to step down in September 1998. Bouteflika won elections held in April 1999 and a second mandate with landslide results (85%) in April 2004. Boutaflika is considered as liberal and pragmatic in favour of free market.

including Chakib Khelil and Abdelatif BenAchenhou as Ministers of Energy and Finance, respectively, in order to hasten the process of the economic and financial reforms. Khelil is strongly in favour of the full liberalisation of the upstream hydrocarbon sector, and confronted substantial political and social opposition when he drafted legislation to open up the possibility of SONATRACH (the oil state company) raising new finance by opening its capital or that of its affiliates to private and foreign investors. During his ongoing tenure, Boutaflika benefited from the recovery of oil prices since March 1999[28], which has strengthened the internal and external economic balances. The country reserves in foreign exchange reached more than $30 billion in 2003.

2-3-2 Morocco

After obtaining independence from France in 1956, the King of Morocco Mohamed V, focused more on constructing his monarchy than on economic development and growth. His successor, Hassan II[29], invested as King of Morocco in 1961, continued the approach of his father to set the foundation to the Alaoui monarchy and extend the purview of his dominion by appointing his devoted followers in conspicuous institutional positions.

Hassan II faced the reality that Morocco was a primarily rural society and did not have, as its Algerian neighbour, substantial natural resources such as hydrocarbons (Vermeren, 2002). Also, the King Hassan II realised the absence of a basic economic infrastructure and the weakness of private capital. As a consequence, he initially used the State-led system to outline economic development plans[30] in which the government was the major investor without severely restricting private capital. The development plans outlined in the 1960s and 1970s were set out primarily to boost the agricultural sector and agriculture-related industries and activities. The implementation of the plans resulted in

[28] Oil prices remained above $30 per barrel for most of the year 2000, and jumped to more than $35 during the course of 2004.
[29] King Hassan II was appointed commander of the Royal Armed Forces (1955) and deputy premier (1960) and succeeded to the throne on the death of his father, Muhammad V (1961). He introduced a new constitution (1962) that provided for a popularly elected legislature while maintaining a strong executive branch headed by the King. From 1965 to 1970 he exercised severe authoritarian rule in order to contain opposition to his regime, but he restored limited parliamentary government under a new constitution in 1970 and instituted some socio-economic reforms following attempted coups in 1971, 1972, and 1973. The king Hassan II died on July 23rd, 1999, and was succeeded by his oldest son, King Muhammad VI.
[30] One famous economic plan is the Five year development Plan (1973-1977). According to White (2001), this plan called for an annual economic growth rate of 7.5%. The plan also outlines the efforts to make the economy more Moroccan by featuring requirements that all major businesses be 51% Moroccan-owned.

the construction of numerous agricultural structures such as water dams, and developing various agricultural-based industries, such as food processing and vegetable and fruit exports. Besides, White (2001) and Vermeren (2002) mention that, since the seventies[31], mineral industries, especially, phosphate; have occupied an important part in the economy of Morocco. Over the period 1973-75, phosphate prices increased on international markets witnessing a threefold rise by January 1974. This tripling prompted the government to extend its substantial planned investments, already financed partly by external debt and phosphate revenues. The government raised substantial funds in the international debt market to finance their investment and consumption.

Similar to Algeria, in 1973, Hassan II utilised the process of "Morroconisation" to enjoy sovereignty over economic resources in Morocco in favour of national public and private ownership (White, 2001). The process consisted of nationalising a number of enterprises in the secondary and tertiary sectors and linking them to the Moroccan national-owned sector. However, foreign ownership access to Moroccan enterprises was not entirely denied as it was permitted to a maximum of 49% of capital. The Morroconisation law[32] stipulated that national Moroccans had to be in a majority on shareholding and management councils and for appointed managers in joint stock companies. The chairmen of joint-stock companies had also to be Moroccans. According to Vermeren (2002), this law reduced the important dominance of the French banks, already present for approximately a century, in favour of local capitalists.

Belghazi (2000) believes that the process of the Morocconisation, associated with the aforementioned investments allowed the government to create a substantial network of public enterprises in all sectors of the economy. Hamdouche (1997) believes that the "Morocconisation" of foreign enterprises marked an important turning point in the development of Morocco's private capital, particularly for large companies in the form of agro-industrial and financial groups. Moroccan private capital was permitted to enter new branches of economic activity that required new expertise, especially in the agro-industry business, tourism, textiles and construction. During the 1960s and 1970s, the

[31] Morocco has 75% of world's reserves of phosphate, and is the second largest phosphate exporter after the US, with less than US$2 billion a year (nearly 30% of total world exports) (Vermeren, 2002).
[32] Dahir #210 of 2nd March 1973.

Morocconisation and development plans adopted a relatively liberal approach toward private ownership. While the State was engaged in strategic sectors and investments that needed large amounts of capital (as in banking, manufacturing, phosphate extraction and infrastructure projects), private capital appears to dominate in activities requiring fewer funds, including tourism and in a broad range of agricultural activities. However, Vermeren (2002) believes that the Morocconisation process launched in 1973 was politically and domestically important for the Throne. King Hasssn II used the nationalisation process to assign his most loyal supporters as heads of the Morocconised companies[33].

As mentioned earlier, Morrisson (1991), White (2001) and Vermeren (2002) review the main economic characteristics of Morocco over the sixties and seventies. Similar to Algeria, Morrisson (1991) states that the Moroccan government utilised substantial amounts of borrowed loans to fund consumption, investment programmes and budgetary deficits. As a consequence, external debt increased from US$2.3bn in 1976 to US$11.9bn in 1983, by which time the budgetary deficit reached more than one tenth of GDP, and debt servicing costs jumped to half of exports. This situation forced the Moroccan government to approach its main lenders to negotiate debt rescheduling and the IMF for assistance resulting in the launching of a stabilisation and structural adjustment reform programme in 1983-1984. The reform programmes aimed at encouraging private ownership of production tools and management, and further market-based practices. The reform plan also included progressive liberalisation of prices and external trade, gradual elimination of subsidies, and gradual abolition of constraints on foreign capital, and also restructuring and privatising various public enterprises, including the banking sector.

2-3-3 Tunisia

Tunisia obtained its official independence from France in 1956. By then, "the supreme-combatant" President Bourguiba[34], who headed the new New-Doustour Party[35]

[33] For more details, read the excellent analysis of Vermeren (2002), who examines Morocco under the reign of Hassan II from different angles, including the political and social aspects of the Maghreb.

[34] Habib Bourguiba was "elected" president of Tunisia in 1957. Two years later, he imposed a constitution that, while retaining Islam as the religion of state, abolished polygamy, controlled divorce, and attempted to make certain that the Friday Pray and month-long fast of Ramadan did not curtail workers' productivity.

government, was aware of the major economic problems of Tunisia, including the lack of vast hydrocarbon resources, however, his efforts were oriented towards enforcing the foundations of his recently established regime as a new constitution was drafted out and measures were taken to avoid military coups (White, 2001). He kept the Tunisian army at a low profile by allocating it no more than one tenth of total government spending, whereas health and agricultural sectors received together more than half of the budget funds. Besides this, Bourguiba embraced publicly secular pro-Western principles, which were conspicuously manifested in the 1957 Personnel Status Code. This code stated that women are equal to men in every thing, including heritage, voting and divorce rights; and also polygamy became severely restricted (Verderen, 2002).

During the 1960s, and similar to the other two Maghreb countries under study, Bourguiba drove Tunisia to engage in a series of development plans that created the infrastructure and structure of the economy. Implemented by his pro-nationalisation Prime Minister Ben Salah, Bourguiba's economic strategy was to enhance the role of the State in all economic and productions sectors. Ben Salah's policy was based on "*national sovereignty and development*" that consisted of nationalising most enterprises owned by foreign nationals and, in 1964, nationalising all the land still owned by French settlers. In the mid-1960s, Ben Salah imposed a strict form of agricultural co-operatives and state control of much trade and industry. Bechri and Naccache (2002) mention that, during the sixties, the Tunisian government adopted the central planning model[36] and, intensively invested in agriculture, manufacturing and in the tertiary sector, resulting in establishing large-sized government-owned enterprises in the main economic sectors. About 185

In 1975, the Tunisian National Assembly made him president for life. On April 6th, 2000, Bourguiba died at the age of 96 in his hometown of Al-Munastir.

[35] Discontented young members of the more conservative Destour Party formed the Neo-Destour party in 1934. After a bitter struggle with the parent organisation, it became the predominant party under the leadership of Habib Bourguiba in 1937. It was harassed by French authorities throughout the 1940s and began an armed rebellion in 1953 that led to Tunisian independence in 1956. A Neo-Destour government was then formed. In 1958, Bourguiba was appointed the first premier of Tunisia, and in 1959 he was overwhelmingly voted president. The party consolidated its hold on all levels of Tunisian society and constituted itself (1963) as Tunisia's sole political party, renaming itself "*Democratic Constitutional Assembly*" in 1964. Not until 1981 were opposition parties permitted. In 1987, Zine el-Abidine Ben Ali succeeded Bourguiba as leader of the party and president of Tunisia. Under Ben Ali the party pursued free market economic policies and a perceived open political atmosphere. To reflect these changes, the party's name was again changed in 1988 to the "*Democratic Constitutional Assembly*".

[36] The major plans in the Ben Salah era are Plan I from 1962 to 1964 and Plan II from 1965 to 1968. These two plans set the strategies for agricultural reforms (cooperativisation) and state-led growth.

State-owned enterprises were created in the 1960s. By 1969, the government had complete monopoly over all sectors of the economy including the financial sector and external trade with tight foreign exchange control.

However, due to his penchant to enforce Tunisia's ties with the European Union, Bourguiba removed Ben Salah and appointed former Central Bank Governor pro-free market Hédi Nouira[37] as Prime Minister throughout the 1970s. Nouira was advocate of "*economic security and growth*" and his appointment indicated that the policy of strict central planning followed by Ben Salah (who planned to extend the *co-operativisation* system) generated disputes with local groups, including landowners. In addition, the economy suffered from deep-seated budgetary deficits, which would have led, according to the World Bank Report (1969), to a severe economic crisis. White (2001) indicates that during the sixties, direct foreign investment in Tunisia's industry represented only 1.2% of total investment in the sector. In 1970, in opposite to neighbouring Algeria, President Bourguiba decided to implement a reform programme that shifted the economy from a strict central planning to a relaxed market-based economy in favour of export-based industrialisation without excluding private and foreign investments. Textiles industries (low labour costs), agricultural and agro-agricultural, and tourism industries benefited from this strategy based on devoting exports toward the European Market (White, 2001). Nevertheless, the new strategy of Bourguiba practically favoured the dominance of the public sector, especially in sectors deemed as strategic as in the banking sector.

Tunisia experienced high rates of economic growth due conspicuously to the aforementioned association accords with Europe signed in 1969. White (2001) mentions that GNP to capita average annual growth recorded an annual increase rate of 4.7% over 1965-80, compared to 1.3% over 1980-1992. By the late 1970s, due to the vulnerability of the Tunisian economy and its growing dependence on external factors, economic difficulties and social pressure came to ahead and led to violent riots in 1978 (and later in

[37] The major plans in the Nouira era are Plan III from 1970 to 1972 and Plan IV from 1973 to 1976. These two plans set the strategies for gradual decentralisation and export-oriented industrialisation but still with prominent presence of the State in the economy.

1984). Over the 1970s, the current account balance and the external trade deficits worsened, surpassing US$1.4 billion by 1982.

White (2001) reveals that one other striking difference between Ban Salah's "*national sovereignty and development*" strategy and Nouira's "*Economic Security and growth*" strategy was the regional distribution of public investments. During the 1960s, Ben Salah allocated State investments to peripheral areas in Tunisia to balance the share of development all around Tunisia. During the 1970s, Nouira relatively liberal policy generated regional unbalances as investments were conspicuously concentrated in urban and coastal region (Bizert, Sousse, Gabes, and Sfax) and the capital. Only 14% of total investment was allocated to the interior of the country creating only 10.9% of total employment created. This concentration of investment created rural exodus to cities, and therefore higher unemployment rates, at around 16% by 1985. The regional unbalance had dramatic effects on the social front as riots erupted in "unfortunate regions" and resulted in many fatalities[38].

Therefore, under social pressure in 1982, the government decreed a wage increase, which was particularly unwarranted since productivity was declining at that time resulting in an increase in inflation to 14%, the highest since 1964. The economic situation witnessed deterioration in both fiscal and current account deficits and these rose to unprecedented levels, 6.6% and 7.1% of GDP, respectively, by 1985. The economy deteriorated further in early 1986 reflected in the dramatic depletion of foreign exchange reserves and the government was in a situation of not being able to repay its external debts[39]. This was associated with a severe drought, oil export dropped and tourism receipts decreased. In August 1986, Prime minister Mohammed Mzali, who was appointed in 1983, led his government to reschedule its external debt payments with its main lenders and signed a one-year Stand-By Agreement with the IMF implying an explicit commitment to pursue liberalisation measures in the form of a structural adjustment programme starting from 1987.

[38] See White (2001) for more details.

[39] The drop of oil prices in mid-1980s caused receipts from oil exports to drop from 778million dinar from 1984 to 322 million dinar in 1986. In addition, drought caused a catastrophic harvest in 1986 and income from tourism dell from 489 million dinar in 1985 to 437 million dinar in 1986.

The structural reform programme that had to be implemented as a part of the IMF agreement, aimed at liberalising prices, investments and trade regimes, and relaxing the role of State in ownership of the economy. For instance, investment licensing by centralised government agencies was eliminated and import licensing and duties were gradually reduced[40]. The reforms continued thought the nineties under the reign of President Ben Ali and allowed Tunisia to record relatively higher growth rates.

2-4 Overview of the Main Economic Reform Measures

This section of the chapter overviews the main economic reforms implemented in Algeria, Morocco and Tunisia during the nineties (and financial reforms are discussed in more detail in Chapter 3). Economic reforms consist mainly of those liberalisation, stabilisation and structural adjustment measures that have aimed to transfer the economies of the three countries into market-oriented systems. Overall, the reform programmes in the three countries are similar in terms of their objectives and in all cases, have been designed under the technical supervision of the IMF. One major objective is the disengagement of the State from the direct ownership and management of the economy in almost all spheres of activity. One important observation about economic reform in Algeria, Morocco and Tunisia is their speed. While major economic reforms were undertaken between 1989 and 1995 in Tunisia and Morocco[41], these were implemented between 1989 and 2001 in Algeria.

Morrisson (1991) outlines the main features of the stabilisation and structural adjustments measures. First, the stabilisation measures include a reduction of consumption subsidies, slower growth in domestic credit, currency devaluation, a larger reduction in investment expenditure, and slower growth in public sector employment. Second, the structural adjustment measures contain fiscal reforms related to the introduction of value-added tax (VAT), the lowering towards eradicating of various

[40] Import licensing was lifted on 15% of imports in terms if tariff lines to reach 60% of tariff lines and 70% of imports in 19991. Import duties were reduced from an average if 41% in 1986 to 33% in 1987 and to 29% in 1990.
[41] Vermeren (2002) mentions that the first reform agreement signed between Morocco and international financial institutions was in 1983 in the form if "structural adjustment programme".

consumption subsidies, the dissolution of the state monopoly on external trade including the elimination of export duties and the dismantling of the system of quantitative restrictions on imports, and the abolition of price controls over consumer goods and services. Also, the reform programmes included the gradual liberalisation of foreign exchange rates, the deregulation of interest rates and financial markets, and the encouragement of private and foreign capital investments.

Table 2–3 summarises the most important measures taken in Algeria, Morocco and Tunisia in recent years. The next section will present and evaluate the success of these reforms.

Table 2–3: The main economic reform measures undertaken in Algeria, Morocco and Tunisia from 1989 to 2001

Measure	Algeria	Morocco	Tunisia
Petroleum Code	1986- Allow foreign participation in oil exploration under concession agreements. Allow joint ventures in oil production and gas fields development, But the government maintains majority	-	-
Money and Credit Law	1990, See Chapter 3	1993, See chapter 3	1987, See chapter 3
Amendments to 1986 petroleum Code	1991- Terminate SONATRACH monopoly over oil transportation oil. Foreign companies are grated fiscal status, and are allowed to enter Algerian market	-	-
Full Foreign trade Liberalisation	1995	1992-1993	1994
Trade Liberalisation	1991 Trade is fully liberalised		
Currency Devaluation	- September 1991, 22% - April 1994, 40%	1990, 9.3%	-
Foreign exchange market creation	1994	1996	1995
Price liberalisation	1994- Full price liberalisation of housing, and agricultural inputs and output.	1990	1987
Privatisation Laws	1995	1989	1989
Exchange rate Liberalisation	1997- Full convertibility of Algerian Dinar and current account	1993	1994-
Amendments to Petroleum 1986 Law	1996- Foreign companies are no longer required to form a commercial firm subject to the Algerian Law with head office in Algiers, if it sets up a joint venture with SONATRACH (the state oil company)	-	-

Source: Various

To summarise, Algeria, Morocco and Tunisia have experienced two major changes in the post-colonialism era. From the 1960s to the 1980s, the three countries adopted the State developmentalist model with different degrees of discipline. The central planning model resulted in the establishment of dominant government-owned sectors and forced the monopolistic and interventionist role of the State, at least in strategic economic sectors. By the 1980s, the limitations of this policy became apparent culminating in the non-ability of the respective governments to pay their external debts. Consequently, the three countries signed agreements with the IMF and were committed to pursue structural reform programmes aimed at liberalising their economies.

2-5 The Main Economic Trends since the Early 1990s

This section of the chapter analyses the main economic and social trends in Algeria, Morocco and Tunisia since early 1990s. The aim of this analysis is to provide a broad overview of the main economic features of the three countries under study so that later the analyses of the banking systems can be placed in context. This section focuses on the growth of the respective economies (as measured by GDP growth) plus various other features of the structure of their systems (GDP components). In addition, we briefly examine a variety of other trends relating to privatisation, inflation, unemployment, indebtness and external trade.

2-5-1 Economic Growth

As of the end of 2000, the total GDP of the Algerian, Moroccan and Tunisia economies was estimated at US$105bn. This was approximately equal to the Egyptian economy, and slightly less than 15% of the total GDP of Middle East and North African economies (MENA). Considering the three countries under study, the Algerian and Tunisian economies are the largest and smallest economies, respectively. In terms of GDP, the Algerian economy is larger than the Moroccan and Tunisia economies by approximately 50% and 150%, respectively. However, GDP per capita estimates indicate that Tunisia had the highest income per capita.

Table 2–4 shows details of GDP evolution over the period from 1990 to 2000. nominal GDP, Nominal GDP growth, real GDP growth, GDP per capita and GDP per capita growth also included in Table 2–4.

Table 2–4: Selected Macro-economic Indicators for Algeria, Morocco and Tunisia from 1990 to 2000

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Algeria													
GDP at market rates (US$ billion)	62.05	45.71	47.87	49.77	41.97	41.26	46.84	47.35	48.19	48.85	54.52	54.85	55.90
Nominal GDP growth (%)	11.7	-26.3	4.7	4.0	-15.7	-1.7	13.5	2.2	10.4	14.8	26.2	3.5	5.0
Real GDP growth (%)	-	-	-	-2.12	-0.92	3.82	3.80	1.12	5.12	3.9	5.0	3.8	3.0
Nominal GDP per capita (US$)	2,449	1,771	1,821	1,858	1,538	1,484	1,667	1,680	1,638	1,633	1,740	1,775	
GDP per capita growth (%)	8.6	-27.7	2.8	2.1	-17.2	-3.5	12.3	0.8	-2.5	-3.1	6.5		
Morocco													
GDP at market rates (US$ billion)	25.82	27.83	28.45	26.80	30.35	32.98	36.69	33.41	35.54	35.13	33.32	33.49	
Nominal GDP growth (%)	13.0	7.8	2.2	-5.8	13.2	8.7	11.1	-8.8	6.4	-1.2	-5.1	1.8	
Real GDP growth (%)		6.92	-4.01	-1.02	10.42	-6.62	12.22	-2.22	6.82	-0.72	0.82		
Nominal GDP per capita (US$)	1,055	1,113	1,114	1,028	1,141	1,216	1,324	1,184	1,235	1,197	1,592	1,146	
GDP per capita growth (%)	10.5	5.5	0.1	-7.7	11.1	6.5	8.9	-10.6	4.3	-3.1	-2.3		
Tunisia													
GDP at market rates (US$mn)	13.31	13.01	15.50	14.61	15.63	18.03	19.59	18.90	20.01	20.78	21.00	20.55	
Nominal GDP growth (%)	22.7	5.7	19.1	-5.7	7.0	15.3	8.7	-3.5	5.9	3.8	2.8	3.2	
Real GDP growth (%)	-	-	-	-	3.34	2.33	7.13	5.43	4.83	6.13	4.73		
Nominal GDP per capita (US$)	1,520	1,574	1,838	1,698	1,781	2,013	2,155	2,051	2,144	2,201	2,260	2,140	

GDP per capita growth (%)	20.1	3.5	16.7	-7.6	4.9	13.0	7.1	-4.8	4.6	2.6	2.7

Source: various, but mainly IMF Statistics Yearbooks 2001/2002.

Table 2–4 shows that, over the nineties, Tunisia's real GDP and GDP per capita increased at average growth rates faster than in Algeria and Morocco, which had low GDP per capita. The average of the three countries' GDP per capita was lower than that of the MENA countries, but higher than the Egyptian average ($1,500), except for Morocco.

In the first half of the 1990s, the Algerian economy experienced a substantial decline in GDP, from US$62bn in 1990 to a low of US$41bn in1995, resulting in GDP per capita falling to as low as $1,500 by 1995, the lowest in the decade. This period witnessed a decline in the price of energy in international markets and in the production of the local industrial and agricultural sectors. In the second half of the nineties, the Algerian economy stabilised and the GDP increased to more than US$50bn in 2000, due to the relative increase in hydrocarbon prices (Aissaoui, 2001).

Over the 1990s, the Moroccan economy grew at an average yearly rate of two percent. However, the GDP trend exhibits some volatility, due to instability in the main sectors of the Moroccan economy such as agriculture, where performance is strongly related to climate conditions. Throughout the decade, the income per capita in Morocco has been systematically lower than in Algeria and Tunisia.

For Tunisia, the economy experienced a positive growth of around 4.8%, over the period, while GDP per capita increased at an average annual rate of 5.7%. The growth in the agricultural, manufacturing industries and tourism sectors can be seen as the main source of growth. Liberalisation reforms implemented in these sectors can be considered the main reason put forward for this growth.

Overall, the table exhibits that the Tunisian economy and GDP per capita grew faster than in Algeria and Morocco. This also may imply that Tunisia, to a certain extent, succeeded in bringing the imbalances between demographic growth and economic growth under control.

2-5-2 Structure of the Economies and GDP Components: Hydrocarbons (Algeria) and non-hydrocarbon sectors in Morocco and Tunisia)

One can investigate the main components of GDP in order to explore the major economic sectors that drive growth within the respective economies. Overall, the structures of the economies in Algeria, Morocco and Tunisia show some indications of diversity, but in general they are strongly dependent on external forces and climatic conditions. Due to development strategies followed in the sixties and seventies, the industrial sector (hydrocarbons and construction included) constitute approximately three quarters of the Algerian economy, whereas the primary sector (agriculture and fishing), and manufacturing and tertiary sector (tourism) account for the same proportion of the economy in Morocco[42] and Tunisia. As such, the principal driver of growth in Algeria relates to the hydrocarbon industries, whereas, light manufacturing, services and agriculture predominate in Morocco and Tunisia[43]. This section will concentrate on the upstream hydrocarbon sector in Algeria, and agriculture and tertiary sectors in Morocco and Tunisia. Detailed statistics about the whole economic activities and GDP development in Algeria, Morocco and Tunisia are reported in Table A1–5, Table A1–6, Table A1–7, Table A1–8, Table A1–9, Table A1–10 and Table A1–11in Appendix A1.

2-5-2-1 The Hydrocarbon Sector in Algeria[44]

In Algeria, the hydrocarbon industries play a significant role in the economy. In 2000, the share of the hydrocarbon sector accounted for two fifths of GDP. Other sectors such as manufacturing and construction represented around one fifth of GDP, the distributive and tertiary sector accounted for around a quarter of the economy, whereas the agrarian sector represented, on average, less than one tenth of the economy. White (2001) recognises that the position of the hydrocarbon sector within the Algerian economy has strengthened its ties with external economies. He mentions that the hydrocarbon sector is

[42] Morocco has substantial phosphate reserves equal to 75% of the world total reserves. Morocco is third largest producer and biggest export of phosphate in the world.
[43] The IMF economy tables reported in the Appendix support this fact.
[44] See Aissaoui (2002) for detailed and comprehensive analysis on the hydrocarbon sector and the political economy of oil and gas in Algeria, See Aissaoui (2002).

the main provider of foreign currency, generally more than 95% of foreign exchange revenues.

Algeria has substantial hydrocarbon reserves and is a large producer and exporter of gas in international markets[45]. Western Europe is the first client of Algeria, in particular, Italy, Portugal and Spain. These countries are directly linked to the oil and gas fields in the south of Algeria through two pipelines, namely; Trans-Med and Maghreb-Europe[46]. Algeria is the third biggest gas supplier to Europe, with approximately one tenth of total European consumption in 2000, and this rate is expected to increase to half of total consumption by 2010 (Arabies, 2002). In the last decade or so, the Algerian government has undertaken a number of reform measures in the upstream hydrocarbon sector. The Gouzali's government[47] implemented a major reform that consisted of the passing of the new Hydrocarbon Law in 1991 (which was amended many times thereafter). This new piece of legislation primarily permits foreign capital to invest in the upstream hydrocarbon sector. Arabies (2002) reported that many international companies are currently and intensively operating in Algeria close to Algeria's oil company SONATRACH, including BP-ANADARCO, TOTAL-ELF, and SHELL.

The intensive foreign investment in the hydrocarbons sector have permitted Algeria to develop its existing oil and gas fields, discover new fields and promote greater production and export capacities. For instance, the number of new oil and gas fields' discoveries increased from twenty between 1986 and 1989, to thirty-four between 1990 and 1994 and to forty-six from 1996 to 1999[48]. These new discoveries allowed the sector to grow at an annual average real growth rate of five percent, higher than the real growth rate of the economy as a whole.

[45] Algeria is a member of the OPEC Organisation

[46] Trans-Med crosses Tunisia and the Mediterranean to Italy. It was built in the 1986. The Maghreb-Europe pipeline crosses Morocco and the Mediterranean to Spain and Portugal. Another pipeline is being built to link the south of Algeria directly to Spain without crossing Morocco.

[47] In the summer of 1991, Prime Minister Ghouzali revealed his plan to sell up to a quarter of the famous Hassi-Messaoud oil field reserves to service the heavy burden of external debts. His plan received condemnations from nationalistic, Islamist and communist parties as well as trade unions and other organisations.

[48] In 1995, Algeria produced 56.5mn tons of oil and 138bn cubic meters of gas. In 2000, the production of oil and gas increased to 66.8mn tons and 170bn cubic meters, respectively. Similarly, gas exports increased from 31bn cubic meters in 1994 to 63bn cubic meters in 2000, whereas the oil exports rose from 47.6mn tons in 1994 I 58.3mn tons in 2000.

BenBitour (1998) and BenAchenhou (2000) [49]recognise the "*pivotality*" of the upstream hydrocarbon sector in the growth of the Algerian economy. The sector accounts for about 95% of total exports and more than half of the government budget revenues. As such, the hydrocarbon sector is the main provider of foreign currency as well as being the major determinant of government spending. BenAchenhou (2000) notes that revenues generated from hydrocarbons exports are used not only for the purchase of consumptive imports but also for productive imports including industry equipment and technologies, necessary for employment creation. This strong dependence on the upstream hydrocarbon sector has positioned Algeria in a delicate situation as the performance of the economy is strongly related to fluctuations in international energy prices. Table 2–5 presents macroeconomic indicators relating to the hydrocarbon sector in Algeria.

Table 2–5: Selected Macro-economic Indicators and the average oil price for Algeria from 1995 to 2000

Year	1995	1996	1997	1998	1999	2000	2001	2002
Average Oil Price per barrel (US $)	17.6	21.7	19.5	12.6	17.9	28.5	24.8	25.5
Total Exports (US$ billion)	10.26	13.47	13.71	10.05	12.33	21.68	20.17	18.71
Oil and gas Exports Revenues (US$ billion)	9.73	12.65	13.18	9.77	11.90	21.06	19.09	18.11
Current GDP (US$ million)	41.2	46.9	47.9	47.4	47.6	53.3	54.68	55.90
Government Revenues (US$ billion)	12.6	15.08	16.06	13.20	14.29	20.96	19.84	20.11
End of period Exchange Rate (One Dollar to Algeria Dinar) *	47.7	56.18	58.14	60.35	69.31	75.34	77.82	79.72

Source: IMF Country Reports, 1998, 2004.
*IMF, (2004), "International Financial Statistics", February PP.90-93.

Table 2–5 suggests a strong positive relationship between the price of hydrocarbons and Algerian macro-economic indicators. For instance, the price of oil per barrel fell to an average of US$12.9 in 1998; driving oil exports revenues to as low as US$9.7bn, and GDP and total government revenues to US$47.4bn and US$13.2bn, respectively. While the price of oil per barrel increased to an average of US$28.5 in 2000, exports revenues,

[49] Ahmed BenBitour and Mourad BenAchenhou both served as Ministers of Finance and economy, respectively, in the governments of Gouzali (1993-1994), Sifi (1994-1995) and Ouyahya (1995-1998). BenBitour was appointed as a prime Minister (2000-2001) but resigned after differences with President Boutaflika (1999-2004).

GDP and government spending increased to unprecedented levels of US$21bn, US$53.3 and US$20.9bn, respectively. Overall, the significant dependence of the Algeria economy on the upstream hydrocarbon sector is mainly the result of the industrialisation policy implemented throughout the sixties and seventies associated with a lack of diversification in its periodic development plans.

2-5-2-2 Non-Hydrocarbon Sectors in Morocco and Tunisia

2-5-2-2-1 Primary sectors including Agriculture

The primary sectors including agriculture represent one major sector in the economies of Morocco and Tunisia. For both countries, during the nineties, the agricultural sector accounted for approximately 15% of GDP, 20% of total exports, and 40% of total employment. In contrast, in Algeria, agriculture represents less than eight percent of GDP. In real terms, the average annual growth rate of the sector has been around ten percent in Morocco and six percent in Tunisia during the last decade. Table 2–6 also shows that the growth in the agricultural sector in Morocco and Tunisia has been relatively volatile.

Table 2-6: The Importance of the agricultural Sector in Algeria, Morocco and Tunisia from 1992 to 2002

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Algeria											
The share of Agriculture in GDP (%)	10.95	10.88	9.55	9.66	10.83	9.44	10.84	10.52	7.99	9.17	
Morocco											
The share of Agriculture in GDP (%)	15.4	14.7	18.5	14.8	20.4	-	16.4	13.7	11.5	12.29	
Real agriculture growth (%)	-36.9	-4.7	61.4	-43.9	78.7	-	27.9	-16.7	-14.7		
Real GDP growth (%)	-4.0	-1.0	10.4	-7.0	12.0	-	7.7	-0.1	1.0		
Real GDP growth outside agriculture (%)							4.4	3.2	3.4		
Tunisia											
The share of Agriculture in GDP (%)	16.12	14.71	12.56	11.4	13.7	13.3	12.5	12.8	12.1	11.85	
Real agriculture growth (%)				-9.9	29.5	3.0	-1.0	11.1	-1.0		
Real GDP Growth (%)				2.3	7.1	5.4	4.8	6.5	5.0		

Source: IMF, Selected Statistics from Country Reports 1998 and 2003. Ministry of Privatisation and Finance in Morocco, 2003.

As noted already, Table 2-6 shows that, overall, agriculture represents about 15% of GDP in Morocco and Tunisia compared to less than an average of 8% in Algeria. The table also suggests the relative important dependency of economic growth on the agricultural sector. In addition, the table shows that performance of the three countries' agricultural sectors is significantly dependent on climatic conditions. For instance, in 1996, farm outputs rose by 20%, 80% and 30% in Algeria, Morocco and Tunisia, consecutively, owing to favourable weather conditions as reflected by increased average rain fall. In 1997, agricultural outputs declined due to the decrease in the rain fall and drought.

In contrast to Algeria, the importance of agriculture in Morocco and Tunisia has resulted in these countries achieving high rates of effective self-sufficiency in agricultural and related products. BenBitour (1998) notes that Algeria imports an annual value of US$3-4bn of basic commodities such as oil, sugar, dairy products, cereals and legumes.

BenBitour (1998) states that dependence on food imports is the consequence of the imbalance between the growth of consumption driven by demographic growth, and the weakness of the agricultural sector. Confined to only three percent of Algerian territory, agriculture satisfies less than a quarter of Algeria's food needs.

2-5-2-2-2The Tertiary sectors and Services

Similar to agriculture, the tertiary and services sector is also important for the Moroccan and Tunisian economies. Services can be defined to include commerce, banking, transport and tourism. Throughout the 1990s, services represented approximately less than 20% of Algeria's GDP, 38% of Morocco's GDP, and 45% of Tunisia's GDP. Since 1994, services, particularly in the hospitality industry, grew rapidly as a result of large national and foreign investments and construction of hotels and other structures in the tourism sector. For Morocco and Tunisia, tourism is primarily dependent on European visitors, particularly, from France and Germany, which represent half of total visitors. White (2001) reports that EU tourists accounted for 44% and 50% of total tourists in 1996 in Morocco and Tunisia respectively, compared to 37% and 43.8% for Egypt and Turkey respectively. Consequently, growth in the services sector is evidently dependent on European visitors. Tourism is the main foreign currency generator for both Morocco and Tunisia, while the currency transfers of Moroccan and Tunisian immigrants comes second.

Porier (1995) relates the growing importance of tourism in North Africa, particularly in Tunisia, to the policy of permitting foreign and private capital to invest in the tourism industry. Porier (1995) believes that the gradual capital account liberalisation, started in the early nineties, was most responsible for encouraging foreign investment and capital growth in the sector. The liberalisation programme included allowing for the convertibility of local currencies and lifting all restrictions on capital and profit repatriation by foreign investors. The liberalisation and investments in the tourism industry resulted in increasing foreign visitors, from approximately one and half million in 1990 to three million in 2000 for Morocco[50], and from three million in 1995 to five million in 2000 for Tunisia.

Overall, the structure of the economies of Algeria, Morocco and Tunisia suggest a lack of diversification, concentration and unpredictability. In Algeria, which has the largest economy in the region, growth is dependent on the hydrocarbon sector, which is, in turn, dependent on the international financial market. In Morocco and Tunisia, the economy is concentrated around agriculture and the tertiary sector (especially tourism). The growth in these two sectors depends on climatic conditions and the number of European visitors.

2-5-3 External Trade: Imports and Exports Structure

This section of the chapter examines the exports and imports structure of the three countries. Table A1–12 (structure of imports and exports) and Table A1–13 (balance of payments) in Appendix A1 contain the main indicators of external trade and balance of payments items in Algeria, Morocco and Tunisia in the 1990s. Overall, Algeria, on average, benefited from a trade surplus, especially in the second half of the 1990s due to improvements in oil prices, whereas Morocco and Tunisia suffered from a trade deficit. Also, the tables suggest three main factors relating to the external trade of these countries and this relates to their: volatility, concentration and dependency.

Algeria has maintained a positive balance of trade as exports outweighed imports mainly due to growing export revenues, although there were large fluctuations in some years due to falling oil prices. The hydrocarbon export revenues account for more than 95% of Algeria's total export revenues, which are used to finance imports including food commodities (25%), industrial equipment and technology (50%) and also to service external debts. In 1999, Algeria's non-hydrocarbon exports amounted to US$41 per capita as compared to US$200-650 in Morocco and Tunisia. As it has been noted earlier, the dependency on hydrocarbon exports implies that the Algerian external trade is closely related to the behaviour of energy prices on international markets, and therefore, the

[50] Morocco attracted 2.98 million visitors in 1990, compared to 1.68 million in 1995. As discussed earlier, the reduction was subsequent result of the measures undertaken by the Algerian and Moroccan government in the wake of the Marrakech incidents in 1993. Algerian visitors represented approximate 45% of total foreign visitors to Morocco in 1993.

external terms of trade is dependent on international market forces, which makes revenues fluctuate on an annual basis.

For Morocco and Tunisia, while external trade has increased by three quarters in the nineties, imports have grown faster than exports. Agricultural products (fruits and vegetables) and raw materials (phosphate[51]) represent three quarters of Morocco's exports, while the structure of imports include hydrocarbon products (20%), food including cereals and sugar (20%), capital and semi-finished goods (45%). For Tunisia, textiles and leather products export are the main exported products (50%), then agricultural products (20%). Tunisia imports' structure contains energy and raw material (35%), machine equipment, technology, food and other consumer goods (60%). Vermeron (2002) mentions that agricultural products, textiles products and phosphate are the main exports of Morocco. He indicates that the development of the textile industry is due to the strategy of imports-substitution in this industry launched in the eighties. This strategy encouraged foreign capital to invest in this sector benefiting from its low production expenses.

The European Union (EU) is the main trading partner of all these countries, accounting for more than, on average, two thirds of foreign trade over the period 1994-2000. France, Italy, Spain and Germany are the prime clients and suppliers. The geographical approximation and historical and cultural relationships help explain these trade features (De Anca, 1997). France accounts for an average of one third of total trade with Algeria, Morocco and Tunisia. In contrast to trade with the EU, trade between the three countries under study has been insignificant (less than one percent) and often decreasing during the second half of the nineties, as for instance, Tunisia exported to Algeria less than one percent of its total exports. The structure of exports and imports helps explain this low level of inter-Maghreb trade; for all countries, about half of imports are advanced industrial equipment and capital goods that typically come from developed markets such as Western Europe.

[51] Vermeren (2002) indicates that, during the seventies, the phosphate boom on international markets helped Morocco to finance its industrialisation programmes. Huge amounts of money in the form of technology and modern equipments sourced mainly from foreign debts were invested towards this industry. But from 1975, as phosphate prices declined, the country experienced increasing deficits in balance of payment associated with increases of external debts. In 1980-82, the current deficit reached 12.7% of GDP.

2-5-4 External Debt

External debts are one of the most conspicuous determinants of development and growth, particularly in Algeria and Morocco, as it represented, on average, more than half of GDP during the nineties. According to Sekkak (1990), the problem of external debts in Maghrebi countries is an immediate result of (inadequately managed) previous policies of using large foreign credits to finance consumption, infrastructure and investments, which generated non-sufficient returns. As of the end of 2000, external debts of the three countries under study reached more than US$55bn, approximately twice the external debt of Egypt.

Sekkak (1990) analyses the evolution and causes of Maghreb external indebtness. The strategy of accelerated growth adopted by these countries, particularly in Algeria, encouraged the importation of funds that could not be provided by internal financing. The increased borrowing was motivated by factors such as the over-liquidity of international financial markets pushed by the recycling of Petro-Dollars. Sekkak (1990) notes that the non-economic absorption of external debts is the main reason that aggravated the situation, as external loans financed massive public investments and social programmes in businesses in protected markets with non-market disciplined management. These investments were not entirely economically profitable, as they did not produce satisfactory cash flows and surpluses within the expected time. If they had, they would have facilitated debt repayments. Also, Sekkak (1990) notes the unnecessary use of external debts to finance consumption rather than cash flow-generating investments. Over the period from 1974 to 1984, an average of two fifths of total debts of the three countries was used to finance consumption.

From 1990 onwards, the external debts of Algeria experienced two different trends. First, from 1990 to 1995, external debt increased from US$25bn to US$33bn, reflecting an increase in the ratio of debt to GDP from forty-four percent to seventy percent[52]. In 1994, Algeria was in a situation of not being able to repay its external debts, and as a consequence, had to negotiate payments rescheduling with the main borrowers[53] and had to implement a structural reform programme assisted by the IMF. Second, from 1996 to

[52] Similarly, the cost of debt servicing increased up to 86% in 1993 and 93% in 1994.
[53] In 1994 and 1995, Club of Paris agreed to reschedule US$15bn of Algeria's debts.

2000, Algeria's external debts fell from US$33.7bn to US$25bn. The price increase in energy prices resulted in a proportional increase in exports revenues, which helped Algeria to service its debts and achieve a historically high level of reserves to debt service ratio in 2000[54]

In Morocco, external debts have fallen during the nineties from approximately US$24bn in 1990 to US$16bn in 2000. Similarly, the external debt to GDP ratio declined from ninety-percent in 1990 to fifty-five percent in 2000. However, the external debt to GDP ratio is still high in Morocco compared to Algeria (45%) and Tunisia (50%). Morocco signed external debts payments rescheduling agreements with the main borrowers (Club de Paris) twice: in the early eighties and early nineties. Vermeron (2002) mentions that Club de Paris owns nearly half of Morocco's external debts, whom France is the main lender.

In dollar terms, Tunisia has the lowest level of external indebtness among the three countries under study, and these amounted to US$10bn in 2000, after being US$5bn in 1991. However, the level of debt to GDP remained stable, on average, at approximately sixty percent Table 2–7 summaries selected indicators of external indebtness of Algeria, Morocco and Tunisia.

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[54] Reserve to debt service ratio stood at 284% in 2000.

Table 2–7: Selected External debt indictors in Algeria, Morocco and Tunisia from 1990 to 2000

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Algeria											
Total External debt*	27.88	28.20	27.08	26.02	29.97	32.78	33.42	30.89	33.68	28.00	25.00
Total debt/GDP	44.9	61.7	56.6	52.3	41.4	76.7	71.9	65.2	64.3	59.4	46.6
Debt service ratio	31.6	32.5	34.4	34.8	17.0	12.8	12.8	14.3	16.7	18.5	16.7
Med&long-term debt/ total debts	95.4	94.4	95.6	96.2	94.0	94.7	92.9	92.7	92.8	92.5	92.2
Reserves/ debt service	2.7	5.7	5.7	5.9	9.5	6.5	13.6	28.0	24.0	17.5	248.9
Bilateral debts/debts	57.5	58.5	59.1	63.9	24.4	35.0	41.4	46.5	49.0	50.8	52.2
Morocco											
Total External debt*	24.11	22.22	22.03	20.78	21.71	22.44	21.17	20.68	19.30	17.50	16.1
Total debt/GDP	93.4	79.9	77.4	77.5	71.5	68.1	57.8	61.9	54.2	50.1	48.3
Debt service ratio	8.4	9.8	10.0	11.9	11.9	12.3	13.3	14.1	14.03	16.97	15.56
Med&long-term debt/ total debts			97.0	98.0	99.0	99.3	99.3				
Reserves/ debt service	8.9	14.9	17.0	17.7	20.2	16.3	17.9	21.0	23.2	32.9	
Bilateral debts/debts			55.0	54.0	54.0	53.5	50.1				
Club de Paris			50.0	49.0	49.0	48.6	45.9				
Tunisia											
Total External debt*	7.52	5.38	8.50	8.85	9.97	11.15	11.41	11.10	11.31	12.0	10.0
Total debt/GDP	61.1	41.4	54.7	60.6	62.5	62.2	59.8	60.9	55.4	59.7	45.6
Debt service ratio	20.2	26.8	14.4	13.8	14.3	14.9	15.3	14.3	14.3	14.3	19.8
Med&long-term debt/ total debts					85.6	54.9	51.8	52.8	48.7		
Reserves/ debt service	11.9	11.1	11.8	11.5	18.2	18.0	20.9	21.2	19.5	23.8	
Bilateral debts/debts											

Source: IMF, Selected Statistics from Country Reports 2001 and 2003. Ministry of Privatisation and Finance in Morocco, 2003.

* In billion US Dollars, all other indicators in Percent.

Table 2–7 shows that in terms of duration, medium and long-term debts represented more than ninety percent of Algeria and Morocco's external debts, whereas, in Tunisia, medium and long-term debt were approximately less than half of total external debt. Bilateral debts constitute around half of the total debts of the three countries, in which Club de Paris account for more than a quarter. The French government and banks are the main owners of these countries' external debts, totalling around a quarter. Overall, the stabilisation programmes implemented in the 1990s to correct the macro-economic distortion seem to have succeeded in improving external debt indicators for the three countries under study.

2-5-5 Exchange Rate Policy

This section of the chapter reviews the exchange rate policy and its implications for the economies of Algeria, Morocco and Tunisia, over the nineties. The exchange rate policy in Morocco and Tunisia were designed to maintain a stable exchange rate, whereas in Algeria, the exchange rate policy was used to devalue the Algeria Dinar to shorten the gap between the administrative nominal exchange and the market exchange rate[55].

As a part of the global economic reform programmes, the three countries substantially reformed their foreign exchange systems in the late eighties and early nineties, by gradually liberalising foreign exchange markets and establishing current account convertibility. However, there are still significant restrictions imposed, in general, on outflows rather than on inflows. Reforms have permitted non-residents to hold accounts in foreign and domestic currencies, but residents' accounts are subject to more regulation than non-residents' accounts and are not fully convertible into foreign exchange.

In the three countries, the exchange rate used to be weighted against a basket of currencies according to the countries' main trade partners, namely, the Euro-zone. Domac and Shabsign (1999) mention that the weights of the basket were reviewed regularly in order to consider the change in foreign trade partners and the structure of currencies in external settlements. The governments in the three countries discontinued the determination of exchange rates administratively, since the creation of the domestic inter-bank market in the mid-1990s. The exchange rates are liberalised and freely

[55] Between 1990 and 1994, the Dinar declined by 200% against the US dollar in nominal terms. There were major devaluation of 22% in Sep. 1992, and 40% in Apr. 1994, due to the agreements with the IMF. The government was committed to pay DA168bn (11% of GDP) as a compensation for foreign exchange losses occurred on past external borrowing contracted mostly on behalf of the State. More devaluation measures in three countries are reported in the sector of financial liberalisation in chapter 3.

convertible in the foreign exchange market, but the central banks still can intervene by setting ceilings on the buy and sell rate differential.

Karam (2001), however, mentions that the authorities have adopted a pegged-exchange rate policy in Morocco and a managed floating exchange rate policy-based regime in Algeria and Tunisia. The pegged exchange rate regime states that the Moroccan Dirham is determined daily in the foreign exchange market based on variations in the value of the currencies of the country's principal trading partners. In Algeria and Tunisia, although the pegged exchange rate regime is used, they also use the managed floating regime; with which the central bank quotes regularly the exchange rate applied in foreign exchange interventions, according to demand and supply conditions in the inter-bank markets.

2-5-6 The Public and Private Sectors

2-5-6-1 The Public Sector

As noted earlier, the strategy of development adopted in the immediate period of the post-colonial era had the objective of constructing substantial government-owned economic sectors.

Algeria has a more deep-seated government-owned sector than Morocco and Tunisia due to the disciplined adoption of the centrally planned strategy of development in the sixties and seventies. In 1989, the public sector was responsible for creating approximately 54% and 40% of added value in the productive sectors including and excluding hydrocarbons, respectively, as well as paying more than three quarters of the country's wages (IMF, 2001). The economic and financial liberalisation programmes launched in the mid-nineties, which are still underway, aimed at the gradual disengagement of the government from owning and managing productive activities. The privatisation programme has converted more than one thousand government-owned firms to the private sector (and there were more public firms liquidated). This measure has resulted in the reduction of public sector personnel by 360,000. During the major developments, by 2000, the public sector in Algeria still paid half of the country's wages. The government-owned sector, also, still remains dominant in the hydrocarbon (100%) and financial sectors (more than 95% ownership).

In Morocco, the public sector is less prevalent than in Algeria. During the 1970s, the government development and Morroconisation strategy did not exclude private and foreign capital from operating in "non-strategic "sectors. In addition, the privatisation process started in the eighties has reduced the presence of the state in the capital of firms. For instance, in 1988, the public sector employed approximately one-fifth of country's total labour and contributed to one-fifth of the country's GDP. According to Jiyad (1995), the presence of the State was reduced, but is still more dominant in the industrial and energy sector (60%) than in services (55%) and agriculture (less than 5%). In contrast to Algeria and Tunisia, Hamdouche (1997) states that the government-owned sector in Morocco has been substantially smaller than the private sector since the early eighties. Hamdouche (1997) reports that the government-owned sector accounted for less than half of the country's GDP and paid about one tenth of total salaries and wages.

In Tunisia, the size of the public sector was reviewed in late 1980s as new laws were introduced and aimed at reducing state involvement. Jiyad (1995) notes that, in 1989, the government passed a law that deemed any company as public or government-owned if the State held at least half of its capital[56]. Similar to Algeria and Morocco, the liberalisation reforms and privatisation process have reduced the size of the public sector in the economy. For instance, in 1988, the Tunisian public sector enterprises absorbed 12.5% of the labour force, contributed 13.4% to GNP, owned 28% of total domestic investments, and participated in 26% of foreign trade. By the end of 2000, these public sector enterprises paid less than 10% of the country's wages and salaries, accounted for less than 10% of GNP, and less than 20% of foreign trade.

2-5-6-1 The Private Sector

The privatisation of the government-owned sector in the three countries under study has been a significant component in the programmes of financial and economic liberalisation launched since the early eighties. As the process of privatisation has been well-developed in Morocco and Tunisia, less progress has been made in Algeria.

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[56] According to Law No. 9 of 1989, a form is considered public if the government owned at least 50% of its capital. This replaced Law No. 27 of 1985, which consider every company where the government owned at least 34% public. Between 1964 and 1985), a form was considered public if the government owned more at least 10% of its capital.

Jiyad (1995) discusses the arguments in favour of privatisation in North Africa and Middle East countries (MENA). His findings include that state-owned enterprises are more likely to be inefficient, mis-managed, loss-making, multi-objective, and politicised. In contrast, private enterprises are more likely to be efficient, well-managed, profit-motivated and market-driven. Most studies in favour of privatisation, such as Nvong (1994), discern three main arguments. First, "the efficiency argument" suggests that private-owned enterprises are efficient and more likely to produce better results and higher profits than state-owned enterprises. Second, "the management and ownership argument" asserts that managers need to have a share in the capital of the enterprises they manage in order to be more motivated to avoid inefficiencies. Finally, "the fiscal distortion argument" claims that the interventionist role of the government in enterprises ownership and management would allocate resources inefficiently, reflected in substantial budgetary deficits.

The privatisation of the public sector in Algeria, Morocco and Tunisia reflects a failure of the measures undertaken in the era of nationalisation in the sixties and seventies. Currently, the governments in the three countries recognise that private ownership is preferred and all are committed to the process of State disengagement from the economy. The laws and constitutions allow private and foreign capital to own and manage properties in almost all economic sectors. The creation of new stock exchanges[57] has significantly helped to float capital and boost the ownership of non-government capital in quoted companies, particularly in Morocco and Tunisia.

Privatisation programmes in Algeria, Morocco and Tunisia tend to have a gradual character and do not typically distinguish between national private and foreign capital.[58] At the beginning of the process, privatisation laws were designed to privatise and liquidise small and non-performing enterprises, such as public local enterprises in Algeria. Enterprises in non-strategic sectors such as tourism and breweries were most concerned with the transfer of property to private investors at this stage of the process.

[57] Stock exchanges are more active and developed in Morocco and Tunisia than in Algeria. Stock exchanges existed in Morocco and Tunisia since early sixties but had been dormant before the nineties. The Algiers Stock exchange was created in late nineties. See next chapter.
[58] According to Belghazi (2000), over the 1993-1996 privatisation programme in Morocco, half of the companies were transferred to foreign investors

Then, privatisation laws were amended to allow "profitable" enterprises in "priority or strategic" sectors to be privatised such as in the banking and telecommunications sectors[59].

In Algeria, the process of privatisation started in 1994 as first conditioned by the one-year Stand-By Agreement with the IMF. The government started by passing the law of privatisation in 1995, which allows full private ownership in most public enterprises. The government liquidated approximately one thousand enterprises of a small and local character, in sectors such as in housing, construction and retail, and later managed to fully privatise hotels, breweries and brick enterprises[60]. By 2001, the government put 88 firms for privatisation, and only one company attracted full foreign capital,- the country's largest steel firm, SIDER[61]. Naas (2003) notes that amendments made to the Investments Law in 1994 abolished the former article stipulating the outlawing of any long-term credits allocated to the private sector, and limiting long and medium loans to be up to 2-3-% of total investment expenses. This change aimed at promoting greater private sector funding of industry. However, despite these attempts to improve the role of private capital, the results have been modest. The Algiers Stock Exchange created in 1999, has failed to attract substantial investment as only three shares were floated by 2004[62]. The share of the government is still significant in sectors such as the financial sector, hydrocarbon-related activities, and also in the state airline *Air Algerie*, although private ownership significantly dominates retail trade, road transport and agricultural industries.

In Morocco, Hamdouche (1997) mentions that the privatisation programme targeted sectors where private capital (foreign or Moroccan) held a minority position, particularly in sectors such as manufacturing, transport, communications and banking. As of the late nineties, the government has sold an equivalent of US$1.5bn of its holdings to private

[59] The Egyptian-Base Mobile Company ORASCOM won the contract of setting up first generation of mobile Phones in Algeria in 2001. The second contract took place in late 2003 and was won by the Kuwait-base Al-Watania.

[60] During 1997-1998, the government offered 88 companies for privatisation and 350 subsidies (20 hotels, 20 brick factories, and 4 breweries). In 1998, the government privatised 1200 public pharmacies.

[61] The Indian company ISPAT bought SIDER. Also, in 1999, the German giant HENKEL form a joint venture with ENAD to manufacture soap and detergent.

[62] These share are: ERIAD-Sétif (Food processing), SAIDAL (pharmaceutical), and El-Aurassi Hotel. Only 20% of their capitals are floated on Algiers Stock Exchange.

and foreign capital[63]. The programme of privatisation in Morocco has attracted foreign ownership. For instance, in 1997, foreign capital purchased an equivalent of US$1bn of firms listed on privatisation programmes[33]. Also, according to the IMF (2003), as a result of the liberalisation the telecommunication sector in 1996, the government privatised its mobile phone industry for US$1.1bn in 1999, and also a third of Maroc Telecom for US$2.1bn to Vivendi (equivalent to 5% of GDP).

In Tunisia, the government privatised 165 public enterprises over the period from 1987 to April 2003 (tounisinfo.com). The government participation in public sector production businesses was reduced from 48% at the end of the 1980's to about 42% by 2003 as a result of the privatisation process[64]. By 1989, the government has privatised forty-five enterprises mainly in tourism, small manufacturing and construction for total receipts of US$90m. Most of the enterprises privatised in early phases of the privatisation programmes in Tunisia were unprofitable and/or relatively small, and they were directly sold to private parties rather to the public via the "*Bourse de Tunis*". Some were simply liquidised and their assets sold to private purchasers. The privatisation programme was advanced during the period 1997-2001, in which half of the total value of privatised companies was collected. Services, including tourism and banking, and manufacturing industries, were mostly concerned with the privatisation programme. Foreign capital accounted for approximately three quarters of the receipts of privatisation, of which more than nine-tenths were in the construction and financial industries (Tunisiainfo.com).

2-5-7 Employment and Unemployment

Another common indicator of economic performance relates to the employment prospects within a country. Overall, unemployment rates in the three countries under study have been higher than in MENA and in other Mediterranean countries. Unemployment rates in Morocco and Algeria are similar, but higher than in Tunisia. In 2000, the level of unemployment reached 15% in Tunisia, and as high as 28% in Algeria

[63] As of mid-1998, the government sold some or all of its shares in 52 entities out of 114 programmed, in which 18 were hotels (www.north-africa.com, 1999).

[64] Tunisia is trying to reach the level of industrialized countries where government ownership share of institutions does not exceed 7%, while in Tunisia it is more than 20% (http://www.arabicnews.com/ansub/Daily/Day/971205/1997120502.html)

and Morocco, higher than the rate average of MENA countries, 25% (IMF, 2001). The IMF (2001) reports that more than a quarter of Algeria and Morocco's population are unemployed, which are mostly in urban areas. Akesbi (1999) and Vermeren (2002) found that, in Morocco, the unemployment rate is higher for educated individuals compared to those with no education. In addition, in all three countries, populations tend to be young with around sixty percent of the total populations being less than thirty-years old. This category of the population tends to be most affected by high unemployment, specifically in Morocco and Algeria. Akesbi (1999) reports that, in Morocco, unemployment among the 20-30 year-olds is about 25%, whereas it is about 10% for those more than fifty years of age. Akesbi (1999) discerns that quarter of a million job seekers come onto the labour market every year, which are mostly less than twenty years of age.

Akesbi (1999) states a number of factors that help explain the significance of the ongoing imbalances between the supply and demand of labour in Algeria, Morocco and Tunisia. These imbalances primarily relate to various demographic characteristics, the rural exodus, and the relatively low rates of investment and economic growth. Jiyad (1995) adds other factors including programmes of privatisation, liquidation, and the restructuring of public enterprises. These programmes involved dismissing unnecessary employees, and consequently, increased the number of unemployed[65]. Furthermore, Akesbi (1999) observes that unemployment mostly affects populations in urban areas more than in rural area. Nowadays, around half of the three countries' populations are living in urban areas compared to less than forty percent in the eighties. In Algeria, the exodus driven by the threat of terrorism and crime in rural areas has led to the increase in the proportion of population living in urban areas. According to Akesbi (1999), this rural exodus has created a mismatch between the urban population and employment supply.

An analysis of employment structure shows that an approximate average of thirty percent of the active population in the three countries are employed in the distributive sector (which includes hospitality, retail and transport industries). The agricultural sector employs around forty percent of total employed in Morocco and Tunisia, whereas it

[65] For instance, over the period 1994-2000, the Algerian government has made mire than 450,000 public sector employees redundant. However, the state is still the biggest employer in Algeria (as privatisation is still underway), whereas the private sector is the biggest employer in Morocco and Tunisia.

employs less than fifteen percent of the employed population in Algeria. The industrial and construction sector, including the hydrocarbons, is the biggest employer in Algeria with nearly half of the employed population. In Morocco and Tunisia, this sector employs around thirty percent of total employed (IMF statistics, 2001).

2-6 Conclusion

This chapter reviews the main economic characteristics of Algeria, Morocco and Tunisia over the post-colonialism era. In the 1960s and 1970s, the three countries followed economic policies based on the principle of "State interventionism". These policies generated a situation where the State monopolised the management and ownership of all or the main economic sectors. The chapter shows that the three countries followed the same pattern in the postcolonial period: local economies dependent on the metropolitan economy, central planning model and then economic liberalisation. While Algeria strongly adopted the "State Developmentalist" model, Morocco and Tunisia encouraged the interventionist role of the State in strategic sectors, but did not exclude the participation of the private sector from non-strategic sectors. Tunisia and Morocco motivated the private and foreign sector to invest in export-substitute industries.

While the three countries enjoyed higher levels of economic growth due to the higher prices of hydrocarbon and phosphate in the seventies, by the 1980s, this approach to economic management of the respective economies by the State had illustrated its disadvantages, as reflected in declines in economic growth, falls in export revenues, and increased external indebtness. Choski and Parageorgiou (1986) discern that oil crises and interest rate shocks altogether with debt problems in Latin America and Africa in the eighties, exerted increasing pressures on policy-makers in developing and centrally-planned countries to re-evaluate past growth and development strategies, and encouraged them to move their economies towards more market-based systems.

In the late 1980s and by the mid-1990s, having the assistance of the IMF, Algeria, Morocco and Tunisia launched structural reform programmes aimed at the liberalisation of economic activities. This included the reduction of State involvement in the economy and increasing the role of the private sector encouraging domestic and foreign capital. In addition, the three countries suffered from the heavy burden of external debts owing to extravagant developments in the early decades of independence. The three countries were forced to reschedule their debts under International Monetary Fund arrangements.

The chapter has also outlined the main structural characteristics of the Algerian, Moroccan and Tunisian economies. In terms of their economic structures, while heavy industry and hydrocarbons are more important in Algeria, light manufacturing, services and agricultural sectors are more prevalent in Morocco and Tunisia. In terms of their external trade, the three countries suffer from structural concentrations and imbalances in exports. For instance, nearly 95% of Algeria's export revenues are from the hydrocarbon industry, whereas more than 60% of Morocco and Tunisia's exports are from agriculture (agriculture-related) and light manufacturing products, such as textiles and shoes. Imports of the countries under study are mainly consumer goods and technology products.

The following chapter attempts to highlight the main features of Algeria, Morocco and Tunisia's financial sectors. Particular attention will be paid to discussing various financial and monetary reforms.

Chapter 3 Structural Characteristics of the Algerian, Moroccan and Tunisian Banking Systems

3-1 Introduction

The preceding chapter examined the structural characteristics of Algeria, Morocco, and Tunisia's economies, and noted that economic growth in Algeria is strongly related to world energy prices, whereas growth in Morocco and Tunisia is more dependent on climatic conditions (e.g. the performance of the agricultural sector), services (e.g. hospitality sector) and export-oriented light manufacturing. The three countries are also affected by the performance of the EU economy, as this is their main external trade partner. In addition, the previous chapter examined the economic performance of the three countries over the post-colonial era. The three countries adopted the centrally planning model and built significant government-owned sectors throughout the sixties and seventies. In the 1980s and 1990s, driven by the imbalances in their macro-economies, the three countries implemented a programme of economic and financial reforms in order to correct economic distortions and towards more market-based economies.

The present chapter focuses on the monetary, financial and banking features of the three countries under study. The chapter reviews the main developments in the banking system since independence, including the role of the monetary policy and financial institutions in the Statist economies before financial liberalisation. Over this era, interest rates were administratively determined, and the supply of credit and money was controlled directly by the State through the old French style *encadrement system*. Having no autonomy, every bank was forced to lend to a (public-owned) specific economic sector compatible with its own pre-defined specialisation. The chapter will also assess the main financial liberalisation measures that have been undertaken in the three countries. Financial liberalisation measures include the abandonment of the aforementioned interventionist practices by relaxing the interventions of the state in the financial system and the transfer of the management of some of these to the central bank. Interest rates and credit allocation are currently freely set in the market and private and foreign capital is permitted in the local banking markets. In addition, the chapter outlines the main features and structures of banking and financial systems in the three countries under study.

This chapter is divided into four sections. The first section reviews the main monetary and banking developments over the period pre-liberalisation. Table A2–1, Table A2–2, Table A2–3, and Table A2–5 in Appendix A2 contain selected financial and monetary indicators in the three countries under study. The second section reviews financial liberalisation and reform measures that have being implemented in the three countries. The third section examines the main substantial characteristics of the banking systems including market concentration, ownership and size. The final section evaluates the major features of the banking sectors performance and condition using various balance sheet and profitability indicators. Table A2–5 (Algeria), Table A2–6 (Morocco) and Table A2–7 (Tunisia) in Appendix A2 contain information on balance sheet structures on the three banking systems.

3-2 Monetary and Financial Policy in the Pre-Reform Period

This section of the chapter reviews the monetary and financial policies that were undertaken during the period prior to financial liberalisation.

3-2-1 Algeria

Goumiri (1993) and Naas (2003) analyse the main characteristics of the monetary policy of the economic and financial authorities and the emergence of the banking sector in Algeria over the period from the post-colonial to the liberalisation period. Over the period 1962-1985, they categorise the evolution of the Algerian banking sector into three major phases: the sovereignty phase (1962-1963), the nationalisation and socialisation phase (1966-1980), and the organic restructuring phase (1982-1985). These phases were compatible with the dominance of the centrally planned system characterised by substantial public, priority and strategic sectors, administratively designed investment and development plans, and full State intervention in the process of development and industrialisation. In the late 1980s, the banking sector was gradually oriented towards more market-based system.

First, the phase of sovereignty started just after independence in 1962. This phase witnessed the creation of four major financial institutions: the Treasury (August 1962), the Central Bank (December 1962), the Caisse Algeriénne de Développement[66] (CAD, Mai 1963), and the Caisse Nationale d'Epargne et de Prévoyance (CNEP, August 1963). First, the Treasury was in charge of allocating financial resources to investments, particularly those in favour of the agricultural sector. Second, the creation of the Banque Centrale d'Algérie established the Algerian Dinar as the country moved out of the Franc Zone. The central bank was granted traditional functions including money issue, credit control and reserves and State external debt management. In addition to these functions, in 1964, the central bank was in charge of granting loans and advances in favour of the State-managed agricultural sector. Finally, the CAD and CNEP were created to collect savings and finance planned investments, as well as to play the role of a payment instruments provider.

Second, the phase of "Algerianisation and socialisation" started in 1966, and this consisted of the construction of the core of the Algerian commercial banking system. Naas (2003) indicates that the government needed the creation of its commercial banking fabric, mainly in order to channel more financing into its socialist plans. The government, headed by President Boumediéne, nationalised foreign banks that had operated in the country since the colonial era. Benhalima (1987) looks at the nationalisation process that created the major three Algerian commercial banks, which were Banque Nationale d'Algérie (BNA[67], June 1966), Crédit Populaire d'Algérie (CPA, December, 1966), and Banque Extérieure d'Algérie (BEA, October 1967). BNA was principally (and exclusively since 1968) in charge of lending money to the agricultural sector, whereas CPA and BEA were primarily in charge of lending money to other sectors, including hotels, trade and construction, and to export and import-oriented industries.

[66] The CAD was transferred into a real development bank under the name of Banque Algerienne de Developpment (BAD) according to Ordonnance No 72-66 of 7th of June 1972.
[67] Naas (2003, pp45-50) mentions that deposits at BNA, CPA and BEA represented approximately 70%, 10% and 20% of total commercial bank deposits, respectively, by the end of the sixties.

The financial policy applied along with the nationalisation and socialisation process was passive, as reflected by the central planning and administrative regulation in place. The government kept prices constant for prolonged periods and heavily subsidised basic commodities, which resulted in generating repressed inflation, and excess in the consumer goods market. Also, the financial policy encouraged the government to allocate financing and investment centrally using administrative schemes or periodic development plans. The Treasury used the Algerian Bank for Development to allocate investment and finance provided externally through hydrocarbon exports revenues and substantial external borrowings.

Furthermore, Goumiri (1993) and Naas (2003) state that, in the phase of nationalisation and socialisation, the Algerian government imposed four major principles on its financial and banking institutions. These principles were adopted to ensure the administratively planned exploitation of the banking sector to channel financial resources towards State planned investments rather than autonomously shaping investing and financing decisions. These principles are unique banking domiciliation, bank specialisation, self-financing outlawing, and the illegality of inter-enterprise lending principle.

First, the principle of unique banking domiciliation, which was introduced in the Budget Law of 1970, reflects the mono-bank principle. According to this principle, enterprises were obliged to concentrate their banking accounts and their banking operations at one bank only[68]. Naas (2003) finds that, besides the absence of competition, this principle resulted in creating liquidity and use-resources unbalances between banks. For example, the BEA, which domiciliated SONATRACH (the state oil company), benefited from extra liquidity, whereas the BNA, which financed the agricultural sector, was continuously in need of extra funding.

Second, the bank specialisation principle, as a result of mono-banking principle, stated that banks were allowed to open banking accounts[69] to enterprises that were operating in an economic sector that matched their sectoral specialisation. For instance, BNA, then

[68] The principle was legalised by the budget law of 1970 published in the Algerian Official Journal.
[69] Every government-owned enterprise disposed two accounts: exploitation account and development account. The exploitation account contains the revenues, payment and short-term loans in order to finance working capital needs. The development account records medium and long-term loans.

BADR, specialised in the agricultural sector, and BEA primarily specialised in lending money to substantial industrial firms such as in hydrocarbons and steel, CPA was in charge of lending to industries in the service and construction sectors.

Third, the principle of outlawing self-financing prohibited enterprises from engaging in profit accumulation and self-financing of their investments, unless the planning authorities (Ministry of Planning) approved them. Banks did not have autonomy to decide upon their investment and financing decisions. Every investment required the approval of the Ministry of Planning, then the approval of Comité directeur de la Banque Algérienne de Dévéloppment (BAD) to allocate financial resources, the final approval came from the Ministry of Finance.

Finally, the illegality of inter-enterprise lending principle outlawed profit and net cash accumulation and their use for inter-enterprise financial operations. Instead, following the principle of financial resource centralisation at the Treasury, enterprises were required to centralise their unexploited credits, loans and profits at their mono-bank, which, in turn, reported to the Treasury and Ministry of Finance to decide upon their future exploitation according to the objectives of the various state plans.

Even though the Central bank was heavily involved in the economy; Goumiri (1993) and Benbitour (1998) recognise that the Treasury was the most important institution in the financial system of Algeria over the period of central planning. The Treasury managed the government revenues and payments, and allocated all the financial resources of the government to the financial and banking institutions. The Treasury was responsible for lending more than two-thirds of total investments between 1970 and 1980. The banking and financial system had a limited intermediary role and was regarded as a tool to be used to finance planned investments.

The third phase of the Algerian banking system's evolution was the organic restructuring phase that started in 1984. This phase was a part of the major government-owned enterprises organic restructuring operation launched in 1982 in almost all sectors of the economy. The banking sector witnessed the creation of two new banks: Banque de l'Agriculture et du Dévéloppment Rural (BADR, 1984) and Banque du Dévéloppment Local (BDL, 1985). These two banks were established by occupying a number of structures and branches belonging to the BNA and CPA, respectively. Following the principle of banking specialisation, BADR was required to lend money to the agricultural sector and agro-industrial industries, whereas the BDL was forced to lend money to local government-owned enterprises, which were operating under the authority of local government departments.

Thus, from the 1960s throughout the 1980s, the Algerian financial system was compulsorily exploited by the government to bridge government finance and government investment, with the objective of building a large government-owned sector. In the 1990s, the Algerian government opted for financial reforms resulted in liveralising the financial sector.

3-2-2 Morocco

When Morocco obtained its independence from France in 1956, the Moroccan banking system consisted of structures that were primarily branches of French banks headquartered either in Paris or Algiers.

The new government of Morocco focused on establishing a banking system that would serve its economic and political objectives, within the framework of reclaiming sovereignty over the economic and financial sectors. Over the period 1956-1959, the Central Bank of Morocco[70] was created along with the new national currency, the *Moroccan Dirham*. The sovereignty-reclaiming programme also required existing banking structures to apply for new licensing agreements from the newly independent government. This measure resulted mainly in a restructuring of the financial sector through the reduction in the number of approved banks from sixty-nine in 1954 to twenty-six by 1961[71].

The phase of bank creation started in 1959, when the government created its first owned bank, Banque Marocaine du Commerce Extérieur (BMCE). This bank was required to

[70] Banque du Maroc was established by the Dahir n° 1-59-233 of 30 June 1959 to replace the Banque d'Etat du Maroc, and to ensure the functions of a Central Bank. It was created as a state-owned institution with legal personality and financial autonomy, entrusted with the privilege of issuing banknotes and coins, and the mission of safeguarding the stability of the currency as well as preserving the soundness of the banking system. On March 1987, the Banque du Maroc was replaced by Bank Al-Maghrib.

[71] Other reason of reduction in the number of banks was mergers.

provide, as a monopolist, foreign trade financing to Moroccan companies. Other development banks were created including Caisse de Dépôt et de Gestion (CDG), Fonds d'Equipement Communal (FEC), Banque Nationale pour le Dévéloppement Economique (BNDE), and Caisse d'Epargne Nationale (CEN). The setting up of the Moroccan banking system continued between 1961 and 1967, as new banks were created. This included Credit Agricole (CA), Crédit Populaire (CP) and Crédit Immobilier and Hôtelier (CIH)[72]. Achy (2000) notes that, in the sixties, the primary role of the banking system was to collect savings, finance government budgets, pubic enterprises and priority and strategic sectors through the mandatory holding of government securities, and bonds issued by development banks on behalf of the government.

The second significant phase of the evolution of the Moroccan banking system was launched with the Royal order n° 1-67-66 of 21st April 1967 enacting law relating to the banking industry and credit sector. The main contributions of this law consisted of a more precise definition of a bank's activity, the demarcation of duties of Central Authorities as well as the establishment of a new regulatory structure. The articles of the order were applied to money deposit banking, and were extended to the Crédit Populaire in 1970. In 1986, the regulations of title III of the enacting law relating to bank and credit control were extended to the Banque Nationale pour le Développement Economique and to the Crédit Immobilier et Hôtelier, which were, in other aspects, allowed to collect deposits. In 1987, La Caisse Nationale du Crédit Agricole was permitted to finance other activities in rural areas.

In addition, and in order to promote investment projects initiated by Moroccans residing abroad, two institutions were created in 1989. These were the Bank Al-Amal, which was charged, in particular, with granting participative loans or subordinated loans, and Dar Ad-Damane, which aimed to offer guarantee services on the loans authorised by the Bank Al-Amal.

In 1973, the process of *Morocconisation* was launched and it did not exclude the banking sector. Hamdouche (1997) notes that the nationalisation process that had taken place, unlike in Algeria, permitted the Moroccan private sector to invest in banking.

[72] Source: Bank Al-Maghrib (Moroccan central bank) Internet site, 2003.

Hamdouche (197) also conforms that the economic strategy adopted in the 1960s did not deny the importance of private capital in the Moroccan economy.

Zamiti (1998) discusses the credit policy in Morocco over the period 1976-1990. The policy included dividing financial institutions into deposit money banks and specialised financial institutions. Deposits money banks were allowed to open branches and collect deposits, however, specialised financial institutions were not permitted to deal with the public and open branches. Specialised banks were required to provide finance to projects of a development character and with governmental clients. As in Algeria, the French style systems "l'encadrement du crédit" was adopted with the aim of controlling the supply of funds, and ensure these were allocated according to government expectations outlined in the periodic plans. The government coerced its commercial banking structure to invest in government bonds, which were either issued by the Treasury or by government-owned specialised development banks on behalf of the government. In the early 1980s, banks were required to retain thirty percent of their deposits as treasury bonds. In addition, commercial banks were also required to hold fifteen percent of their deposits as bonds issued by specialised banks[73].

As part of the structural adjustment reform programme, which was designed with the assistance of the IMF in the mid-1980s, the Moroccan government implemented measures with the objective of liberalising the financial and banking industry. One particular measure was the adoption of universal banking. Specialised financial institutions became able to collect deposits and savings from the public and open branches across the kingdom.

The financial sector in Morocco underwent a process of profound financial liberalisation in the early nineties, as part of the structural adjustment reform programme. The liberalisation measures included the elimination of credit ceilings, the deregulation of interest rates, the gradual removing of mandatory holdings of government securities, and the strengthening of prudential regulation of banks in accordance with international

[73] Banks were required to hold 6% of deposits as bonds issued by the Crédit Immobilier et Hôtelier (CIH), 5.5% of deposits as bonds issued by Banque Nationale pour le Développement Economique (BNDE), AND 3.5% of deposits as bonds issued by Caisse Nationale de Crédit Agricole (CNCA).

standards. Financial liberalisation was reflected in the new Banking law of 1993[74] relating to credit institutions' activity and their supervision, which represented a significant change in the Moroccan banking system. The new law allowed for the unification of the legal framework applicable to credit institutions including multipurpose deposits banks[75], specialised financing institutions, and financing companies[76], as well as the strengthening of the central bank authority, Bank al-Maghrib, over supervision functions. For instance, Bank Al-Maghrib required financial and banking institutions that received funds from the public to undertake a compulsory annual audit and publishing of their financial statements. The Law also imposed measures to protect customers and depositors such as the establishment of a Depositors Guarantee Fund as well as a support mechanism for credit institutions in difficulty.

3-2-3 Tunisia

As in Morocco, Pfeifer (1996) notes that prior to independence, banking structures operating in Tunisia were branches and affiliates of banks based in France or Algiers. These banking structures primarily served the financial needs of the French settlers and French-friendly community in Tunisia. Shortly after independence in 1956, the new government headed by President Bourguiba, decided to nationalise all banking structures and to link these to the public sector. In 1958, Banque Centrale de Tunisie[77] was established, and a month later, the currency unit the Tunisian Dinar[78]was created. The central bank was primarily attributed the duties of money issue and money supply to the public-owned enterprises. At the same time, the government terminated the foreign exchange system under which the Tunisian Dinar was pegged to the French Franc.

Hall (2001) notes that since independence, the State realised the non-existence of a strong private sector, and has pursued an economic development strategy based on the interventionist role of the government and its indisputable control and ownership over "strategic" sectors including foreign exchange and the financial sector. However, the

[74] Dahir enacting Law No. 1-93-147 of July 6th, 1993.
[75] The Law calls this banks "registered banks".
[76] including consumer credit companies, leasing companies, real estate credit companies, factoring companies, suretyship companies, and management of payment companies
[77] Law No. 58-90 of 19th September 1958.
[78] Law No. 58-109 of 18th October 1958.

nationalisation process was not accomplished until 1966. By this year, the process of "*Tunisification*" targeted seven banks out of the thirteen operating by then. The remaining six remained under French jurisdiction until 1966[79], when the government headed by Ben Salah nationalised all these banks.

In the 1960s and 1970s, the Tunisian government restructured the financial and banking sector by establishing new banking and financial government-owned firms. The primary role of the newly established nationalised banking sector was to collect savings and channel these to the treasury and government-owned enterprises. That is, the government exploited the structure of the banking industry within the framework of State intervention and regulation. Financial regulation in Tunisia consisted of the administrative allocation of credit, and the central determination of interest rates, in addition to the prohibition of foreign banks from operating in local markets. The financial regulation also included the centralisation of bank credit decision-making[80]. Banks were compelled to hold up to one fifth of their assets in government bonds and to allocate a fixed percentage of their deposits for lending at preferential interest rates to priority sectors.

3-3 Financial Liberalisation in Algeria, Morocco and Tunisia

This section of the chapter discusses the main financial liberalisation measures implemented in the reform period, in the 1980s and 1990s. Financial liberalisation in Algeria, Morocco and Tunisia involved the creation of monetary and financial markets, the adoption of indirect monetary instruments, the deregulation of interest rates, the granting of autonomy to banks upon their credit allocation decision, and the dismantling of entry barriers by allowing private and foreign capital to operate in the respective banking sectors.

According to Enders et al. (1998), financial sector reforms in Algeria, Morocco and Tunisia were part of a structural adjustment plan launched in the 1980s and 1990s. The

[79] For instance, the property Savings Bank of Algeria and Tunisia, based in Algiers, now Amen Bank, remained subject to French jurisdiction until 1966. By this year, most of banks working in Algeria were nationalised.

[80] Banks were required to obtain the approval of the central bank for credits exceeding TD100,000.

primary objective of the financial reforms was to move towards the use of indirect instruments of monetary control, the adoption of internationally accepted methods of supervision and prudential regulation, and the modernisation of the legal and institutional structures of the respective banking systems. Another objective of the financial liberalisation implemented in the three countries under study was to break down financial repression practices, as reflected by both the administratively determined interest rates and the quantitative controls on credit allocation based on the *Encadrement du Crédit* system. In addition, the financial liberalisation programme envisioned reducing the dependence of the economy on local banking capital and aimed to encourage foreign capital through the chartering and licensing of new foreign-owned banks. Ben Naceur (2003) observes that that financial reforms were articulated around five areas; liberalization of interest rates and credit allocation, introduction of new indirect monetary policy, strengthening prudential regulation, opening the financial sector to foreign financial institutions and promotion of the equity market.

3-3-1 Interest Rates Liberalisation

Enders et al. (1997 and 2000) reviews the steps of interest rates liberalisation in Algeria, Morocco and Tunisia, and notes that the process of deregulation in the three countries was gradual. Overall, as Table 3–1 indicates, interest rates in Algeria, Morocco and Tunisia maintained a decreasing trend from the mid-1990s. Table 3–1 reports deposit, lending and money market rates in the three countries under study, from 1990 to 2002.

In Algeria, the passing of the Money and Credit Law (April 1990) terminated the determination of interest rates by the Treasury. According to this law, the central bank is now responsible for the monetary policy of the country, and therefore, interest rates determination. In 1990, the measures relating to discriminatory and preferential interest rates for certain sectors, considered as priority, were abolished. Interest rates for the private and public sector became unified and commercial paper from both sectors became subject to the same eligibility criteria of refinancing. Also, in 1990, controls on deposits interest rates were discontinued and became fully deregulated. In 1994, the central bank replaced ceilings on lending rates by limits on banking spreads. However, in 1995, limits on banking spreads were annulled. Eltony (2002) reports, in Algeria, real deposit rates were negative before 1999, and reached the highest level in 1992, at -15%. In 1999 and 2000, these rates became positive, at 5.5% and 4%, respectively. Interest rates increased over 1990-1995, but declined thereafter.

In Morocco, Inders et al. (1997) reports that the first attempt to deregulate interest rates was in the mid-eighties, when interest rate subsidies for priority sectors were eliminated. Between 1989 and 1991, interest rates on lending and for time deposits were further liberalised, and ceilings on lending rates for all types of credits, except for export and small and medium-sized companies, were replaced by limits on banking spreads. In 1996, the process of interest rate liberalisation was continued by terminating the use of limits on banking spreads, and all the remaining aspects of control on lending and deposits rates. For instance, lending interest rates became freely negotiated between banks and their clients[81]. Also, credits of less than one year must have fixed interest whereas credit of more than one year can have either fixed or variable interest rates indexed to the money market rate. In Morocco, Achy (2002) notes that, before implementing the financial liberalisation in the mid-eighties, interest rates were administratively set and were negative in real terms, due to high inflation rates. For instance, real interest rates were –7% in 1980, but increased to 4.9% by 1987. In the 1990s, although inflation picked up, nominal interest rates were sufficiently high, between 14% and 16%, and real interest rates maintained their positive sign, but a steady decline of nominal interest rates, has been accruing since 1995.

In Tunisia, Inders et al. (1997, 2000) state that the creation of the money market in 1987 was the first step to the gradual process of interest rate liberalisation. Interest rates on special savings accounts became pegged to the money market rate (MMR) in the proceeding month. The liberalisation processed was furthered by deregulating interest rates on term deposits of at least three months. In the late eighties and early nineties, lending rates, except for those to priority sectors, were allowed to be freely moving with a spread of three percent above the money market rate. Over 1994-1996, the gradual liberalisation of interest rates was completed by lifting all controls on lending rates for both priority and non-priority sectors. However, Boughrara (2002) mentions that, even

[81] Bank Al-Maghrib Circular of February 15th, 1996 related to interest rates.

though interest rates have been liberalised in Tunisia, a number of deposit rates remained regulated. For instance, interest rates on sight deposits (up to three months) must not exceed a ceiling of 2%, interest rates on special savings deposits[82] are set at 2% below the money market rate, and savings accounts dedicated to housing financing had a fixed rate of 5.25%. Table 3–1 shows the evolution of interest rates in the three countries over the period 1990 to 2002.

Table 3–1: Selected Interest Rates in Algeria, Morocco and Tunisia, in Percent from 1990 to 2002

Rates	Deposits Rates			Lending Rates**			Money Market Rates*		
Countries	Algeria	Morocco	Tunisia ***	Algeria	Morocco	Tunisia	Algeria **	Morocco	Tunisia
1990	8.00	8.50	9.63	13.75-20.00	9.00	-	-	8.31	11.8125
1991	8.00	8.50	9.63	15.00-20.00	9.00	-	-	10.00	11.8125
1992	8.00	-	9.63	15.00-20.00	11.04-15.59	-	-	8.80	11.3125
1993	8.00	-	7.38	15.00-20.00	10.0-14.0	-	-	7.04	8.8125
1994	12.00	7.17	6.88	17.63-22.63	10.00	-	19.80	12.29	8.8125
1995	-	-	6.88	22.83	10.0-12.50	-	19.4-23.0	10.06	8.8125
1996	14.50	7.00	6.13	19.00	8.00-15.00	-	18.47	8.42	7.8125
1997	9.75	-	5.00	12.50	8.00-13.75	-	11.80	7.89	6.875
1998	8.50	7.30	5.00	11.00	13.50	-	10.40	6.30	6.875
1999	7.50	6.40	3.88	10.00	13.50	-	10.43	5.64	5.875
2000	7.50	5.20	3.88	10.00	13.30	-	6.77	5.41	5.8750
2001	6.25	5.00	4.00	9.50	13.30	-	3.35	4.44	6.04
2002	5.25	4.5	4.00	8.50	13.10	-	4.20	2.99	5.93

Source: Various including IMF statistics Book (2000 and 2004)
*End of Period rates/ ** Lending rate in Tunisia were set within a spread of 3% of the money market rate.
**Naas (2003), Pp. 237.
*** This rate is called savings remuneration rate, source: Central Bank of Tunisia (2004)

Table 3–1 indicates that in Algeria, interest rates were stable over the period 1990-93, but increased from 1994 to 1996 to the stabilisation programme interest rates reached all time

[82] Special saving deposits accounted before 40% of total deposits of the public in the banking sector at the end of 1998.

low level of 4.20% in terms of the money market rate. In Morocco, money market rates increased over the period 1996 to 2002, but were developing irregularly over the period 1990 to 1995. In Tunisia, money market rates decreased from a high level of 11.81% in 1990-92 to 5.93% by 2002. Therefore, interest rate liberalisation has resulted in a general decline in nominal interest rates in Algeria, Morocco and Tunisia.

3-3-2 Credit Allocation Liberalisation

As discussed earlier, in the pre-liberalisation period, Algeria, Morocco and Tunisia controlled the money supply and influenced banking sector liquidity and credit allocation by the adoption of the French style "*l'encadrement du Crédit*". During the mid-nineties, the three countries under study had deregulated credit allocation and gave greater autonomy to government-owned banks in the credit allocation process. Besson (1993) asserts that the "*encadrement du Crédit*" was effectively a form of credit ceilings and directed credits, which consisted of fixing, for every bank, a monthly progression of norms and ceilings on credits. Any supply that exceeded the set norms generated certain sanctions. For the case of Algeria, Morocco and Tunisia, "*encadrement du Crédit*" involved the requirement of banks to use the money channelled from the Treasury to provide state-owned banks and priority sectors with credits. The process of financial sector liberalisation required the abandonment of the "*encadrement du Crédit*" principle.

In Algeria, the gradual reduction in directed credits was initiated in 1987, when the Treasury decided to withdraw from directed investment in State-owned enterprises. The emergence of the Law of Money and Credit in 1990 resulted in the dissociation of the Treasury from monetary policy responsibilities, which were transferred to the central bank. Also, this law terminated the adoption of the unique banking domiciliation and specialisation principles, under which banking transactions of a government-owned enterprise were forced to be lodged with specific banks, which were uniquely involved in financing projects in the sector in which the enterprise operated. Consequently, all economic sectors were opened to all banks, including specialised banks. In addition, Iradian et al. (2000) indicates that in 1994-1995, the central bank of Algeria introduced remunerated reserve requirements for commercial banks. Iradian et al. (1997) also indicates that Algerian banks have been granted greater autonomy, particularly concerning the forced allocation of credit to high-risk state-owned firms and the holding of treasury bills. The mandatory holding of treasury bills was phased out in 1994, however, commercial banks still hold significant amounts of treasury paper from past re-capitalisation exercises[83]. Abed and Fisher (2003) report that, by the period 2000-2002, the Treasury identified the remaining non-performing loans of banks, and re-capitalised three government-owned banks through infusions of cash and the issuance of treasury securities.

In Morocco, Enders et al. (1997, 2000) reviews the abandonment of credit rationing. In 1991-1993, the obligatory holdings of bonds and paper issued by specialised governmental banks[84] were gradually reduced from a peak of 15%. In 1994, while the requirement of holding bonds issued by BNDE and CIA was discontinued, the requirement to hold bonds issued by CNCAQ was still in place, and was equivalent to 2% of deposits. In addition, the requirement for compulsory holdings by commercial banks of government paper was reduced from 35% of short-term deposits in 1986 to 10% of short-term liabilities by 1994. Further, all the preferential access to refinancing and credit provided to smaller and for-export related companies was terminated by 1996.

In Tunisia, Enders et al. (1997, 2000) discerns that the deregulation of credits started in 1988, when the central bank terminated the procedure by which banks had to obtain central bank authorisation for credits and loans decisions. In 1990, the central bank discontinued the requirement on banks to supply loans and credit to certain government-owned enterprises and economic sectors at preferential interest rates. In 1994, the deregulation of credits continued as banks were no longer obliged to hold treasury bills, and in 1996, obligatory sectoral lending ratios were voided.

3-3-3 Dismantling of Entry Barriers and Privatisation

One predominant measure initiated by the financial liberalisation programme in Algeria, Morocco and Tunisia, was the dismantling of entry barriers and the disengagement of the State from the financial sector, in terms of ownership and management. This measure has

[83] Commercial banks held US$14bn and US$18bn of re-capitalisation equivalent paper in 1995 and 1997, respectively.
[84] These banks are Banque Nationale pour le Dévéloppement Economique (BNDE), Crédit Immobilier et Agricole (CIA), and Caisse Nationale du Crédit Agricole (CNCA).

been implemented through the process of privatisation and the lifting of constraints on private and foreign capital to invest in local markets, aimed at increasing competition in the financial sector and improving the performance of banks. In the three countries under study, privatisation has been processed by permitting national and foreign investors to set up financial and banking firms, and also, in the case of Morocco and Tunisia, through transferring government-owned banks to the private sector using the capital market or by negotiating sales to private institutions.

Clarke and Cull (1998) discuss the relationship between bank government-ownership and banks' incentive. Primarily, as banks collect private saving and convert these into investments, banks will have stronger incentives to gather information about the credit-worthiness of potential borrowers. The gathered information will then be examined to determine how and at what terms credit is allocated, in order to ensure that money is directed towards the most productive purposes. In the case of state owned banks political and non-market pressures distort banks' incentives, which can be reflected by allocating credit on non-commercial lending criteria and to non-productive purposes. Clarke and Cull (1998) conclude that privatisation and maintaining the position of the state from the ownership of banking structures might generate large effects on financial sector performance.

In Algeria, the new law of Money and Credit of 1990 permitted private and foreign banks to set up. Since 1994, the privatisation of the financial sector has developed by allowing private and foreign banks to operate in the local market. No major transfer of management and ownership concerning public banks has been made to date[85]. As a result of the indicated Law, in 2003, there are more than fifteen non-government commercial banks (three private-owned and eight foreign-owned) and six government-owned commercial banks (Naas, 2003). The recently established private and foreign banks tend to be small and have limited networks[86]. The entry of new foreign and private banks has intensified since 1997, as the Bank of Algeria authorised more than twenty new banks

[85] The Algerian government has not started privatising its owned banks (now 2003). The government plans to open the 50% capital of CPA for foreign and private investors in 2005.

[86] The first joint-venture bank, which was licensed in 1994, is Al-Baraka Bank. This bank is owned equally between the Saudi-based private bank, Al-Baraka Group, and the Algerian government-owned bank BADR. The investment bank, Union Bank, was the first bank fully owned by Algerian private investors

with different forms of ownership; fully foreign, fully national private, and national private-foreign.

One major obstacle that has significantly hindered the rapid privatisation of large government-owned banking firms is their under-capitalisation, which was caused by the large amounts of non-performing loans granted to government-owned enterprises. The government has implemented re-capitalisation processes in the nineties either in the form of cash or bond-loan swaps. Iradian et al (2000) reports that the first major re-capitalisation operation occurred in 1992-1993, when the Treasury substituted government bonds for non-performing assets given by public banks to public enterprises. As a first step, this operation was substantial as the government bonds accounted for approximately a quarter of GDP (these bonds were paid off by 1996). The second major re-capitalisation operation in the form of bond-loan swaps occurred in 1997, in favour of three main public banks (BADR, BNA, and CNEP[87]). The cost of this operation was about 8.5% of GDP. Overall, the process of State-owned banks recapitalisation has cost the government over US$18 billion (Marks and Mussadeq, 2003).

In Morocco, in 1989, the government voided the procedures of the *Morocconisation decree* of 1973, which imposed a 49% limit on foreign ownership in strategic sectors, including the financial sector. The new Banking Law of 1993 allowed private and foreign capital to invest and create banking and financial institutions. Morocco has used main stock exchange- the *Bourse de Casablanca*- to process the privatisation of its banking sector. Currently, there are seven commercial banks listed in the market representing a third of total market capitalisation. The privatisation of banks started over 1995-1997[88], and as of the end of 2000, there were only three major government-owned banks[89]. A new law approved in 2000 allowed Morocco's largest bank (Banque Centrale Populaire) to float about a fifth of its shares on the *Bourse de Casablanca*.

[87] BADR and BNA increased their lending and loan concentration in the food and pharmaceutical importing agencies. These agencies suffered large losses originated from the 1994 devaluation of Dinar. Iradian et al. (2000) reports that between 1991-1997, public banks receive an equivalent of 11% of GDP to compensate them for foreign exchange losses incurred on past external borrowing contracted on the behalf of the government. CNEP bank accumulated large amounts of non-performing to he housing and construction sector.

[88] The first bank to be privatised was 1995 (Casablanca Bourse Fact Book, 2002).

[89] These are: Banque Centrale Populaire (BCP), Crédit Immobilier et Hôtelier (CIH), and Banque Nationale pour le Dévéloppement Economique (BNDE).

In Tunisia, financial liberalisation abolished entry restrictions on non-government owned banks allowing them to enter the market. This has been done by opening banks' capital to foreign and private participation, by permitting foreign and private capital to open branches and operate onshore, and by allowing offshore banks to collect deposits in Tunisia Dinar from residents, but with some restrictions. The Central Bank of Tunisian (2003b) states that the programme to restructure the banking system and enhance the presence of foreign capital continued in 2002 with the privatisation of the International Banking Union (UIB) and transformation of joint-venture development banks into full service banks. The transaction for privatising the UIB was finalised in November 2002 with the sale of 3,640,000 public shares, representing 52% of its capital to the French bank *"la Société Générale"* for 102.7 MTD. This transaction, in the context of the State's privatisation programme, is a major event in that it is the first sale of a controlling stake in a Tunisian bank to foreign interests.

3-3-4 The Creation of Financial Markets

The establishment and development of stock exchanges in Algeria, Morocco and Tunisia can be regarded as a major step in the course of moving towards market-based financing of the economy and reducing the dependence of enterprises on banking lending. The *Bourse de Casablanca* is the oldest in the region, established in 1929, followed by *Bourse de Tunis*, 1969, and then more recently *Bourse d'Alger* in 1999. While only three shares are listed on the Algiers exchange, the market capitalisation and number of listed companies in Casablanca and Tunis increased considerably due to privatisation programmes executed in the 1990s. However, all three stock exchanges are still small and have not developed in line with the respective banking systems. Demirugüç-Kunt and Huizinga (1998) discern that larger stock market capitalisation to GDP ratios appear to be related to increased bank margins, reflecting possible complementarily between debt and equity. The same study also finds that a larger market capitalisation to bank assets ratio, however, is related negatively to margins, suggesting that relatively well-developed stock markets can substitute for bank finance.

Eltony (2000) states that the development of capital markets requires a sound regulatory framework and a number of structural reforms. These, in particular, relate to the establishment of an effective privatisation programme, a sound macro-economic environment in favour of increasing the share of private ownership in the economy, the strengthening of market forces through improved information flows, accounting standards, property rights, pricing efficiency, and tax reforms.

In Algeria, the Algiers Stock Exchange (ASC) is the smallest in the region with only three still-dominantly government-owned listed shares[90]. Currently, there is no financial and banking firm quoted on the market. The capitalisation of the market represents less than 1% of total GDP.

In Morocco, the Casablanca Stock Exchange (CSE) is the largest in the region with a market capitalisation of DH115bn (US$14bn) and fifty-eight listed companies, in 2000, accounting for about two-fifths of Morocco's GDP. The CSC witnessed considerable development in the nineties, as market capitalisation increased from DH7.8bn in 1993 to DH145bn by 2000, and market capitalisation to GDP ratio from 5% in 1990 to 40% in 2000. Since 1993, the programme of privatisation contributed conspicuously to the development of the Casablanca exchange. The number of listed firms increased from 44 in 1995 to 58 in 2000. In terms of market concentration, the share of the first ten securities quoted as a proportion of total market capitalisation declined from 88% in 1994 to 65% percent in 2000. Financial sector firms account for about half of total market capitalisation. The capitalisation of the seven quoted commercial banks' represent a third of total market capitalisation.

In Tunisia, the Tunis Stock Exchange (TSE) capitalisation stood at DT3.9bn (US$2.6bn) in 2000 with forty-four quoted companies, representing around fourteen percent of the country's GDP. Similarly, the number of quoted firms increased from thirteen in 1990 to forty-six in 2002. Over the period 1990-2000, the capitalisation of the Tunis market increased nearly eight times. However, over 2000-2002, the capitalisation of the market decreased from 3.8 to 2.8 billion Tunisian Dinar. Interestingly, foreign capital is strongly present in Tunis in an estimated at 60%t of quoted forms, holding around a fifth of total market capitalisation. Currently, there are a number of leasing firms, three insurance

[90] Only 20% of these shares ate floated on the Algiers Stock Exchange. These companies are Eriad-Setif (agro-industrial), Saidal (pharmaceutical), and Al-Aurassi Hotel.

companies and fourteen commercial and development banks listed on the Tunis exchange that account for around half of total market capitalisation.

Despite these developments, Eltony (2000) notes that the exchanges in Morocco and Tunisia are relatively underdeveloped compared to other MENA exchanges, such as in Egypt and Jordan. First, the number of listed shares in Cairo and Amman is greater than that in Morocco and Tunisia. Second, as of the end of 2000, the capitalisation of the Casablanca and Tunis stock exchanges reached US$14bn and US$2.6bn, respectively, compared to US$21 and US$5bn in Cairo and Amman, respectively. Also, in 2000, the ratio of market capitalisation to GDP was higher in Morocco (40%) than in Egypt (23%) and Tunisia (13%), but lower than that of Jordan (70%). Nevertheless, share dealings on the Casablanca and Tunis exchanges were greater than in Cairo and Amman exchanges. For instance, in 2000, the value of shares traded in Casablanca and Tunis amounted to US$1.8bn, compared to US$0.7bn for Egypt and US$0.9bn for Jordan.

3-4 Banking Regulation in Algeria, Morocco and Tunisia

The banking system in Algeria, Morocco and Tunisia consists of the central banks, commercial banks, and other financial institutions. As noted earlier, the regulatory framework for the financial and banking system is more market-oriented than in the period prior to liberalisation. In the three countries, banking sector reforms have deregulated barriers to entry and reduced the differences between commercial banks and development, investment and other specialised banks. The current legislation that regulates the financial systems is, the Law No. 14 of April 1990 relating to Money and Credit in Algeria, the Dahir of 6th of July 1993 relating to Banking Law in Morocco, and Banking Law of 1994 and 2001, modifying the banking law of 1967 in Tunisia. These laws have contributed to the development process by liberalising sector practices and regulation. Also, they have unified the legal basis of universal banking by reducing the compartmentalisation of activities between commercial banks and other financial institutions. Also, in the three countries, credit institutions are required to provide information about their activities to the central bank on a regular basis.

According to the current legislations, the central banks of the three countries[91] are the monetary authorities responsible for monetary, debt and exchange rate policies. The central banks were created just after independence, and currently they operate with various degrees of autonomy and independence from their respective executive political authorities, including the Ministry of Finance. For instance, in the three countries, the central banks are still working under the supervision of the political authorities, as heads of state nominate the governors and executive boards. Also, in the three countries central bank policies have to be coordinated with the macroeconomic and financial plans of the government and Ministry of Finance. The lack of political and economic independence of these central banks could result in monetary policy being conducted under political pressure pressures, resulting in higher levels of inflation. Alesina and Summers (1993) suggest that monetary discipline associated with full central bank independence is likely to reduce the level and variability of inflation.

In the three countries, the central banks have the privilege of regulating and supervising the financial and banking sector, play the role of financial and economic advisers to the government, manage internal and external debts, use a variety of indirect instruments to regulate credit and interest rates, and supervise the foreign exchange market. However, one difference between the central banks in the three countries is the banking licensing privilege. While the Banque d'Algerie sets the conditions for financial institutions' establishment and supervises their activities, Bank Al-Maghrib and Banque Centrale de Tunisie are denied this privilege as the Ministry Finance in the respective countries is responsible for chartering new banks.

The new banking laws in the three countries allow credit institutions to expand their activities into previously prohibited activities such as lending in foreign exchange. Also the banking laws facilitate money market interventions by the central bank via the buying and selling of government bonds between the central bank and credit institutions. Besides, the new banking laws introduce important measures such as the ending of bank specialisation and the greater protection for banks' clients and depositors. There is a

[91] Banque d'Algérie in Algeria, Bank Al-Maghrib and Banque Centrale de Tunisie

unified legal basis for universal banking, reflecting that there is no longer a major separation between commercial banks and other financial institutions.

3-5 Banking Regulations in Algeria, Morocco and Tunisia[92]

This part of the section briefly reviews banking sector regulation in Algeria, Morocco and Tunisia. Banking regulations are significant as, for instance, the minimum capital and supervisory norms provide banking users with confidence about the safety of the systems. Banking conditions in the three countries are being progressively updated to reflect the shift towards internationally-accepted norms.

3-5-1 Minimum required Capital

The central banks in Algeria, Morocco and Tunisia determine the amounts of the subscribed and paid-up capital of banks. They also decide upon the amounts of capital required to enable banking and financial firms to meet capital adequacy requirements. The minimum levels of bank capital are imposed on both already established and newly established banks, on government-owned and private owned banks, and on domestic-owned and foreign-owned banks. Currently, the minimum capital applied to create a bank in Algeria, Morocco and Tunisia is DA500mn, DH100mn, and DT10mn for commercial banks, respectively, and DA100mn, DM100mn, and DT3mn for other non-commercial banks respectively[93].

3-5-2 Capital Adequacy Ratio (Solvency Ratio)

Minimum capital adequacy indicators have gradually been updated to be compliant with the principles of the *Basle Accord.* Currently, all agreed banks are compliant with the minimum eight percent level. In the three countries, the large amounts of non-performing loans were a major obstacle to meet the eight percent international minimum level.

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[92] For more details on banking regulation in Tunisia, See Smida (2003).

[93] The minimum required capital for banks operating in the three countries is set in the respective banking laws. In Algeria, the authorities are planning an increase in minimum required capital due to the repercussions of El-Khalifa Bank collapse.

In Algeria, it was planned to set minimum capital adequacy ratio at four percent in 1992, five percent in 1993 and then eight percent in 1995[94]. However, banks suffered from major under-capitalisation, which forced the Bank of Algeria to postpone the compliance with the eight percent ratio until 1999. In Morocco, the minimum solvency ratio has been set at eight percent since 1997[95]. In Tunisia, the central bank set the minimum capital adequacy ratio at five percent over 1992-2000[23], but increased this to the international minimum level of eight percent in 2001[24].

In Algeria, Iradian et al (2000) states that the government has re-capitalised its banks in order to bring their capital adequacy ratios in line with international standards. The capitalisation operations cost is estimated at 45% of GDP, over 1990-1999. Public-owned banks received a large influx of funds in the form of cash or debt-takeover procedure.

3-5-3 Liquidity Ratios

The central banks in the three countries impose various liquidity requirements on commercial banks and other financial institutions. The main purpose of this procedure is to ensure that banks could meet the liquidity requests of their customers, and could achieve balances between assets and liabilities in terms of liquidity and maturity. For instance, the liquidity ratio (calculated as current assets to current liabilities ratio), is currently 100% in the three countries.

3-5-4 Provision for Bad Loans

The central banks in Algeria, Morocco and Tunisia have the privilege of setting the level of provisions for each category of assets in terms of risk. Provisioning is strongly related to the soundness of the banks, so any increase in assets provisioning would improve the banks' soundness but reduces their profitability. The banking laws in the three countries define four categories of assets. First, standard assets, which represent good loans, have provisions required at one percent of the value of these assets. Second, substandard loans have provisions of a fifth of the value of these assets. Third, doubtful Assets have

[94] Banking Instruction No. 34-91 of 14the November 1991.
[95] Arrêté No. 175-97 of 22nd January 1997 pursuant to Law 1-93-147.
[23] Circulaire No. 91024 of 17th December 1991.
[24] Circulaire No. 2001-04 of 16th February 2001, and Circulaire N0. 2001-12 of 4th May 2001.

allocated provisions of half of the value of these assets. Finally, non-performing assets have provisions of a hundred percent.

3-5-5 Restrictions on Large Exposures (Assets Concentration)

The central banks in Algeria, Morocco and Tunisia impose some measures to reduce the extent of bank exposures to a specific category of bank customers. These measures include credit and loan ceilings.

In Algeria, the ratio used to define credit concentration is loans to the client or borrower's equity. Since 1995, the banking legislation[25] sets this ratio at a maximum level of twenty-five percent, compared to thirty percent in 1993 and forty percent in 1992. In Morocco, a bank exposure to credit concentration is calculated as loans to the client's net capital[26]. This ratio is currently set at a minimum of ten percent since 1997, after being seven percent. Banks are also required to list all risks and information about loans that exceed five percent of the client's net capital. In Tunisia, the legislation[27] states that any amount of credit or loans granted to only one borrower must not exceed a quarter of the borrower's equity. Shareholders, mangers and executives are allowed to borrow up to three times of their capital.

3-5-6 Deposits' Guarantee System

Financial legislation in the three countries under study envisioned enforcing banking safety by creating a deposits' guarantee mechanism that protects and insures banking customers' deposits. This mechanism offers bank depositors aspects of guarantees that make their deposits safe. This should encourage depositors to have greater confidence in the banking system and therefore encourage savings. Demirguc-Kunt and Detragiache (1998) state that when bank deposits are not insured, a deterioration in the quality of bank's assets may result in pushing depositors to rashly and suddenly withdraw their funds before the bank declares bankruptcy, which also may lead to a liquidity crisis.

[25] Instruction No. 34-91 of 14th November 1992 and Instruction No. 74-94 of 29th November 1994.
[26] Arrêté No. 34-91 of 22nd January pursuant to Law 1-93-147.
[27] Circulaire No 91024 of 17th December 1991 modified by Circulaire No. 2001-04 of 16th February and Circulaire No. 2001-13 of 4th May 2001.

However, Demirguc-Kunt and Detragiache (1998) assert that when depositors are insured against the risk of bank insolvency, the likelihood of a depositors withdraw run is reduced.

In the three countries, the depositors' guarantee systems are separate legal entities with an independent budget and subject to the central bank's supervision. Also, in the three countries the maximum total amount of deposits insured by the system is not related to economic indicators. In Algeria, the system offers insurance to deposit amounts up to DA600th[28]. In Morocco, the system of deposits guarantee insures deposits up to DM50th, and requires banks to contribute to the financing of the system with 0.25% of the deposits they hold. In Tunisia, the system of deposits guarantee is introduced in the form of a joint mechanism in which all banks must participate. The system intervenes as a response to any demand from the central bank to reimburse depositors relating to banks encountering difficulties[29].

3-6 Banking Structures in Algeria, Morocco and Tunisia

This section analyses the banking structures in Algeria, Morocco and Tunisia in terms of their size, branch banking network, penetration, and banking sector ownership. These characteristics reflect the indicators of the market structure in the three countries under study. Table A2–8 (Algeria),

Table A2–9 (Morocco) and (Tunisia) in Appendix A2 contain information on a number of banking and financial forms operating in the three banking systems under study.

In Algeria, the banking sector is categorised into commercial banks, financial establishments with general vocation, financial establishments with specific vocation, and bureaux de liaison. In Morocco, the credit institutions are divided into banks approved as money deposit multi-purpose banks or registered banks, specialised banks, and financing companies including consumer credits companies, real estate loan companies, mean of payment management companies, leasing companies and factoring companies. These categories of banks are overseen by the central bank. In Tunisia, the

[28] Règlement No. 97-04 of 31st December 1997.
[29] Law No. 2001-65 of 10th July 2001.

central bank oversees two sectors which are the banking sector and the non-banking specialised financial establishments. The banking system includes deposit banks, development banks, merchant banks, and offshore banks. The other sector includes leasing agencies, factoring companies and representation agencies. As in other financial systems, the banking sector including commercial banks and specialised banks are the most important types of bans, accounting for the majority of total banking assets in the three countries.

3-6-1 Banking Sector Size

In the three countries under study, commercial banks represent the core of the financial system. Table 3–2 shows the size characteristics of commercial banks in absolute terms and as a proportion of GDP over the period 1990-2001.

Table 3–2: Comparative size characterises commercial banking in Algeria, Morocco and Tunisia

Indicators	Assets Size of Commercial Banking Sector (in billion of Dollar)			Size of Commercial Banking Sector to GDP (%)		
Countries	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia
2001	29.472	30.372	13.939	51.34	90.69	69.55
2000	28.887	30.683	13.480	47.89	93.25	69.26
1999	27.772	29.085	12.156	57.57	83.10	58.44
1998	26.720	29.608	13.053	55.85	83.01	65.82
1997	25.490	25.843	11.098	53.25	77.34	58.73
1996	24.831	20.103	11.010	53.00	54.87	56.20
1995	23.376	19.451	10.853	56.66	58.97	60.20
1994	24.510	17.236	9.967	58.40	56.79	63.76
1993	35.641	14.046	8.786	71.62	52.41	60.14
1992	33.118	13.691	9.062	69.18	48.12	58.48
1991	33.703	14.026	9.151	73.72	50.39	70.34
1990	52.711	11.530	8.860	84.92	44.64	63.19
Indicators	**Size of Financial Sector (in billion of Dollar)**			**Size of Financial Sector to GDP (%)**		
Countries	**Algeria**	**Morocco**	**Tunisia**	**Algeria**	**Morocco**	**Tunisia**
2001	32.431	37.533	14.118	59.31	112.07	70.44
2000	27.326	35.853	13.661	50.44	108.97	70.19
1999	25.440	34.923	12.431	52.73	99.78	59.77
1998	26.907	35.531	13.316	56.24	99.62	67.15
1997	25.169	31.296	11.092	52.58	93.66	58.70
1996	21.204	24.181	10.913	45.26	66.00	55.71
1995	19.042	23.643	11.140	46.15	71.67	61.79
1994	19.462	20.699	10.048	46.37	68.20	64.28
1993	31.824	17.387	8.702	63.95	64.88	59.57
1992	29.073	16.599	9.099	60.73	58.34	58.71
1991	23.842	16.169	9.085	52.15	58.09	69.83

Source: Arab Monetary Fund (2001)

Table 3–2 shows that, in 2001, the banking sector of Morocco is larger than in Algeria and Tunisia. Commercial banks' assets represent more than ninety-five percent, ninety-three percent, and sixty-five percent of Algeria, Morocco and Tunisia's total banking assets, respectively (Various sources). Commercial banks' assets represent between seventy percent, seventy percent, and sixty percent of the three countries' GDP, respectively. The size of the banking sectors in the three countries has significantly increased due to the entry of new banks into the system, the growth of activities of banks, and the conversion of non-commercial banks into commercial banks[30]. According to the respective banking laws, the main activities of commercial banks consist of collecting deposits of any term and form, from different economic agents, providing various firms of loans and credit of any maturity and ensuring the normal work of payment and exchange.

It is important to note that banks operating within the rules of "Islamic Sharia" are operating in Algeria and Tunisia, but there is none in Morocco. Only two "Islamic" banking firms are operating, one in Algeria, and one in Tunisia. The investment Islamic bank "Beit Ettamouil Saoudi Tounsi was created in the early 1980s, while the Algerian money deposit bank Al-Baraka bank was established in 1991. Both of these banks hold less than one percent of total bank deposits and assets in the respective countries. In Morocco, plans are underway to create an equally-owned Moroccan-Qatari Islamic bank[96].

3-6-2 Branch Banking Network and Penetration

Overall, the number of banks and banking branches has considerably increased in the three countries over the period 1990-2002. This is primarily due to the expansion of the existing banks, and the entry of new banks.

Table 3–3 exhibits the main banking characteristics of Algeria, Morocco and Tunisia according to bank number, network and penetration, over the period 1990-2002.

[30] For instance, the saving bank CNEP in Algeria was a saving bank, but was converted into a commercial bank in 1997. Similarly, the Crédit Immobilier and Hôtelier (CIH) was specialised bank before 1993, but converted to a commercial bank. Also, in Tunisia, two commercial banks absorbed a number of non-commercial banks in 1999. First, the Union International de Banques (UIB) absorbed Tuniso-Emirates Investment Bank. Second, Société Tunisiénne de Banques (STB) took over Banque Economique pour le Dévéloppment en Tunisie (BEDT) and the Banque Nationale pour le Dévéloppment Touristiques (BNDT).

[96] Source: www.bladi.net/article-2181.html

Table 3–3: Comparative commercial banking characterises in Algeria, Morocco and Tunisia

Indicators	Number of Commercial banks			Number of branches			Penetration measures as Branches Number to Population		
Countries	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia
2002	26	18	14	1197**	1878	868	25,898	15,484	11,150
2001	26*	19	14	1129	1814	868	27,150	16,143	11,145
2000	21	21	14	1077	1703	857	27,316	16,801	11,155
1999	17	21	14	1064	1618	828	28,000	17,460	11,401
1998	12	21	14	1061	1523	817	27,787	18,240	11,420
1997	8	20	13	1043	1450	792	27,289	18,834	11,641
1996	7	16	13	1008	1414	786	27,877	18,989	11,565
1995	7	15	13	963	1386	770	28,858	19,040	11,636
1994	6	14	13	954	-	753	28,595	-	11,660
1993	6	14	13	-	-	738	-	-	11,653
1992	5	14	12	-	-	701	-	-	12,026
1991	5	14	12	-	-	674	-	-	12,255
1990	5	14	12	-	-	626	-	27000	12,939

- * Naas (2003), p280.
- ** Lazare et al., (2004), p67.
- Various.
- Central banks.
- Tunisia: Banking Profession Association.

Table 3–3 shows that the number of banks and bank branches has increased significantly in the last few years and that the number the commercial banks (the most significant bank type in the three countries), is higher in Algeria, than in Morocco and Tunisia. However, the number of bank branches appears to be higher in Morocco than in Algeria and Tunisia. Besides, the Tunisian commercial banking sector seems to have more branches per capita than in Morocco and Algeria. Overall, even though the number of banks and branches has increased in the three countries under study, the Algeria and Moroccan banking systems still display a relatively low penetration rate compared to Tunisia.

In Algeria, Table 3–3 shows that the number of bank branches has doubled over the period 1995-2002, from less than 650 to more than 1120 branches by 2000-2002. The table also shows that the density of banking branches is far lower in Algeria, compared to Morocco and Tunisia. Banking density is more than 27 thousand inhabitants per branch. The increase in the number of banking firms reflects the entry of private and foreign-owned banks, but also the expansion of government-owned banks. In Algeria, as of early 2004, there are 21 commercial banks, of which 14 are non- fully government-owned banks.

In Morocco, Table 3–3 indicates that the number of branches rose from less than 1000 in 1990 to about 1800 in 2000-2002. Similarly, the average value of assets per branch increased from DH174mn in 1990 to about DH230mn in 2000-2002. Table 3.3 shows that banking density in Morocco has fallen over 1990-2002, with less than 20 thousand inhabitants per branch. Achy (2002) notes that the banking system in Morocco is rather limited. Only an estimated fifth of the Moroccan population has access to banking services, and less than two-fifths of the labour force has a bank account. Similarly, Vermeren (2002) and Ingves and Abed (2003) mention that, as in 2000-2002, only 17-15% of Moroccans has banking accounts. Branch concentration shows that the industry is dominated by six banks, three of them local and three of them subsidiaries of the major French banks.

In Tunisia, the aforementioned table shows that the commercial banks' network has significantly increased in recent years, from less than 600 in 1990, to more than 8000 by 2000-2002. This expansion has increased the availability of banking services to the population as the ratio of inhabitants per branch has fallen from more than 14 thousand in 1990 to less than 12 thousand by 2000-2002. Ingves and Abed (2003) point out that the number of bank accounts to population in Tunisia is 40%, compared to 15% in Morocco.

3-6-3 Banking Concentration

Another indicator of market structure relates to the level of concentration in the banking sector. Concentration is usually calculated as the fraction of assets, deposits, credits and branches, held by the three, four or five largest banks. For instance, Altunbas, Molyneux and Gardener (1996) use three and five-firm deposits and assets concentration ratios to examine the structure of European banking systems Goddard, Molyneux and Wilson (2002) note that there have been many studies that examine the relationship between bank structure characteristics and performance of banking systems to test two hypotheses. First, the trad*itional structure-conduct-performance (SCP) hypothesis* suggests that if a small number of banks dominate a banking sector, then it is easier and (less costly) for them to collude. Collusion may result in higher rates charged on loans, less interest being paid on deposits, and higher fees being charged. Berger and Hannan (1989) state that the SCP theory suggests that higher concentration leads to higher prices, and consequently to higher financial returns. Second, the *efficiency hypothesis* suggests that larger market concentration may be the result of better efficiency and lower costs. Berger (1995) notes that the efficiency hypothesis investigates the relationship between banking concentration from the firm-level efficiency, and that concentrated markets evolve because some banks get bigger because they have inherent efficiency advantages. It is a matter of empirical investigation to examine whether the SCP paradigm or the efficiency hypothesis holds in any particular banking system. Demirugüç-Kunt and Huizinga (1998) found that banks in countries with a more competitive banking sector have smaller net interest margins and lower financial returns. They also found that bank concentration positively affects bank profitability, and larger banks tend to have higher margins.

In Algeria, by 2000-2002, in terms of branch concentration, more than sixty percent of total branches were owned by four banks, BADR, CNEP, and BDL and BNA. In addition, the country's five largest banks own an estimated three quarters of banking sector's assets. The three-firm concentration ratio (BADR, CNEP, BDL) is around half of total banking sector assets.

In Morocco, the banking system is characterised by the predominance of the three leading banking groups (BCM, BMCE, Banque Populaire), which have approximately two-thirds share of total banking sector assets. The CPM, BCM and BMCE[31] have the largest banking networks in Morocco. By 2000-2002, these three banks have more than 312, 181, and 169 branches, respectively. In addition, most branches are located in urban area: the six largest cities account for approximately half of the banking network. Chaput et al. (2000) mentions that a third and a tenth of total banking branches are located in Casablanca and Rabat, respectively. In Morocco, the four leading banks control about three quarters of the country's deposits, and two-thirds of all loans. In addition, the three

[31] By October 2000, the BMCE opened 13 branches abroad. The largest bank in Morocco, BCM, owns about 16% of total bank branches

largest banks in terms of stock market capitalisation are BCM[32], BMCE, and Wafabank[33]. These banks account for about three quarters of total banking market capitalisation and a fifth of total market capitalisation.

In Tunisia, the three-firm and five-firm asset concentration ratios were about 55% and 75% by 2000-2002. The largest five banks own more than half of the country's bank branches. The eleven commercial banks quoted on the Tunis stock exchange represent about a quarter of total market capitalisation. The Société Tunisiénne de Banques (STB) is the largest bank in terms of market capitalisation and accounts for about a quarter of total banking market capitalisation and six percent of total stock market capitalisation. The three largest Tunisian banks in terms of market capitalisation represent about 60% and 15% of total banking capitalisation and total stock market capitalisation, respectively[34].

3-6-4 Bank Ownership

In the three countries under study, and similar to a number of MENA countries, three main agents own banking institutions, these are; the government, domestic private capital and foreign capital. Lee (2002) discusses bank ownership in MENA countries, and finds that domestically owned capital (private and public) accounts for about eighty-four percent of total bank equity capital, whereas foreign investors own the remaining. The private sector is the main owner with approximately three-fifths of total equity capital, then the government with about a quarter of equity capital. Lee (2002) elaborates that in countries such as Iran (100%), Syria (100%), Libya (100%) and Algeria (95%), state bank ownership is dominant. In countries such as Lebanon (25%) and Morocco (23%), foreign capital appears to be more significant and is above the average of foreign equity capital of MENA countries (16%). Saudi Arabia has the lowest level of foreign capital ownership in the banking sector at about 1.1%, then Algeria at 2%. Similarly, Henry and Boone (2001) examine the ownership concentration issue in banking industries in MENA

[32] The BCM has a market share of 17% in deposits and loans, and 25% of international transactions.
[33] The BMCE and Wafabank are the second and third largest quoted banks with 22% and 15% of total banking market capitalisation, and 6.4% and 4.4% of total market capitalisation, respectively.
[34] The Banque du Sud (BS) and Amen Bank (AB0 are the second and third largest banks in terms of market capitalisation. Each of them account for about 16% of total banking capitalisation and about 3.6% of total market capitalisation.

countries. They find a significant relationship between high bank concentration (HHO) and high government ownership, particularly in the case of Algeria, as well as other countries such as Libya and Syria. The aforementioned authors find that Tunisia and Morocco has relatively lower government ownership-concentration relations than in Algeria.

In Algeria, as of the end of 2002, the banking sector comprised six major state-owned banks[35], a number of small private commercial and investment banks, a few foreign branches[36], and other types of financial institutions such as leasing companies. Lee (2002) and Iradian et al. (2000) report that the public banks dominate the banking sector in Algeria with approximately 95% of total assets and 90% of bank branches. Marks and Drummond (2003) mention that foreign-owned banks operating in Algeria "siphon off 13% of national savings, but only provide 5% of the credits flowing into the economy". The government has not yet operationally opened the capital of government-owned banks for privatisation, as it is still in the process of re-capitalising them. Even though the presence of private and foreign banks is increasing, it is still considered insignificant compared to Morocco and Tunisia. Private and foreign-owned banks own approximately 5% of total assets, deposits and capital of total banking sector.

Drummond (2002) and Marks and Mossadeq (2003) mention that the French bank, Société Générale, started negotiations to purchase up to a third of the third-largest public-owned bank, Credit Populaire d'Algerie, CPA, -- described as the least bad state-owned bank--, but nothing had been achieved by mid 2004. In the meanwhile, Société Générale is in the process of upgrading its existing small branch network to four in the country's four major cities. BNP Paribas has upgraded to a full branch while Credit Agricole Indosuez has a representative office. The HSBC has a representative office through its British Arab Commercial Bank subsidiary, and Citibank has a full branch in Algiers.

In Morocco, the presence of government ownership in the banking sector has fallen over the 1990-2002 period, to a third of total banking assets, and a quarter of total banking

[35] These banks are Banque de Dévéloppement Local (BDL), Banque Extérieure d'Algérie (BEA), Banque Nationale d'Algérie (BNA), Crédit Populaire d'Algérie (CPA), Banque Algérienne du Dévéloppment rural (BADR), and Caisse Nationale d'Epargne et de Prévoyance (CNEP). CNEP bank was converted into a commercial bank in 1997, after previously acting as the main public saving and housing loan institution.

[36] Including Citibank, Société Générale, and Barclays.

equity capital. Currently, the government still has majority shares in only four banks, which used to be specialised banks[37]. Ingrives and Abed (2003) report that government-owned institutions still held approximately 43% of total banking assets by the end of 2001. The presence of foreign and private capital in the Moroccan banking system has increased and reached about a quarter of total banking assets and equity capital by the late 1990s. Unlike in Algeria, foreign banks benefited from the Moroccan bank privatisation programmes launched in the early nineties onwards. Chaput et al. (2000) notes that in Morocco, there is an oligopoly run by a number of Moroccan capitalists (families) in collaboration with foreign partners, who hold about a quarter of bank's capital. A number of international banks, such as Société Générale, bought and gradually increased their stakes in the capital in a number of major Moroccan banks. French banks are the main shareholders and management position holders in BMCE, and CM and SGMB[38].

Société Générale has its own-branded subsidiary in Morocco with about 150 branches. BNP Paribas and Credit Lyonnais also operate subsidiaries under different brands in alliance with powerful local families: Banque Marocaine du Commerce et de l'Industrie (BMCI) in the case of BNP-Paribas and Credit du Maroc in the case of Credit Lyonnais. The German-based bank Commerzbank has also stakes in Banque Marocaine du Commerce Exterieur, while the Spanish banks (Santander Central Hispano) has a stake in Banque Commerciale du Maroc[97], Banco Bilbao Vizcaya Argentaria also has a minority position in Wafabank, alongside Credit Agricole Indosuez. The American bank Citibank also has a branch in Morocco[98]. Thus, it can be noted that French banks that are

[37] These banks are Banque Nationale pour le Dévéloppment Economique (BNDE), Crédit Immobilier et Hôtelier (CIH), Caisse Nationale de Cooperation Agricole (CNCA), and Banque Centrale Populaire (BCP). Vermeren (2002) mentions that in 1999, there was the "CIH gate", the biggest financial scandal Morocco ever had since independence involving nearly 11 billions of dirham (1,5 times the country' bill of hydrocarbon imports).

[38] For instance, Banque Nationale de Paris (BNP) owned 56% of capital of Banque Morocaine du Commerce et de l'Industrie (BMCI), Crédit Lyonnais owns 51% of capital of Crédit du Maroc (CM), Société Générale owns 51% o capital of Société Générale Marocaine des Banques (SGMB). Foreign shareholders own 25.2%, 14.5% and 16.6% of capital of Banque Commerciale du Maroc (BCM), Banque Marocaine du Commerce Extérieur (BMCE), and Wafabank, respectively.

[97] The latter is known in Morocco as the bank of the royal family.

[98] This information is by James Drummond (2002)," Northern lights: with a French-speaking population of 70 million, it is little wonder that Algeria Morocco and Tunisia are attractive to French banks. (Middle East & Africa: Maghreb)", published in the Banker magazine on Sep 2002.

in a position of building up controlling interests in Moroccan banks, similar to their non-financial French companies counterparts in other sectors of the Moroccan economy, whereas other international banks mainly in minority positions.

Besides, it has been reported[99] that Banque Commerciale du Maroc (BCM) and Wafabank have agreed to merge into one entity effectively from the first half of 2004. This deal is a takeover bid for 100% of Wafabank's capital, following BCM purchasing 36.4% of capital share in Wafabank for about two billion Moroccan Dirhams, US$218mn in late November 2003. This merger will create a new entity VCM-Wafabank and this will become the largest bank in Morocco in terms of assets, deposits and branches.

In Tunisia, Chabrier and Ingves (2002) note that although the share of government ownership in the banking sector has fallen over 1990-2002, it still has a considerable presence. The Tunisian government still has majority stakes in three of the largest commercial banks and owns approximately half of development banks' capital[39]. This represents approximately a third of total banking sector assets. The aforementioned authors note that government-owned banks in Tunisia tend to be characterised by greater exposure to credit risk due to their previous policies of directed lending to strategic sectors. In addition, the economic and financial liberalisation programme provides the primary explanation for the increasing presence of private and foreign capital in the Tunisian banking sector. Chabrier and Ingves (2002) report that domestic private capital owns about half of total commercial banking sector assets. Amen Bank is the first Tunisian bank entirely created and owned by domestic private capital. They also report that foreign capital own approximately half of total assets and capital of development banks, and about a third of total commercial banks assets and capital. Middle-east based banks are present through Arab Bank and Bahrain-based Arab Banking Corporation, which is offshore. French banks include BNP Paribas, which has an affiliate in Union Bancaire pour le Commerce et l'Industrie (UBCI), while Société Générale owned 52% in the Union Internationale de Banque (UIB). Société Générale also has a representative office in Tunis.

[99] www.menareport.com (2nd December 2003).

[39] Private shareholders own nearly 6% of total capital of development banks. What remains is equally shared between the Tunisian government and a number of oil-exporting Gulf and Libyan governments.

One observation about foreign and private capital in the three countries under study is the manner it enters the banking [100]industry. In Algeria, private and foreign capital chose to establish their own operations rather than waiting for the launching of the bank privatisation process. In Morocco and Tunisia, foreign capital mostly preferred to purchase stakes in existing banks rather then establish new operations. Iradian et al. (1997) presents two main explanations that may support this inclination in Morocco and Tunisia. First, the number of banks might seem sufficient to satisfy the demand for banking services in the short-term. Second, there is potential for raising efficiency in domestic banks through the use of modern technology and improved management.

Thus, while the government ownership sector is still significantly predominant in the Algerian banking system, private and foreign ownership of the banking sector outsize government ownership in Morocco and Tunisia. Drummond (2002) and Marks and Mossadeq (2003) notice the remarkable presence of French-owned capital in Algeria, Morocco and Tunisia. Drummond (2002) states that "Algeria, Morocco and Tunisia offer the attraction of a large under-banked French-speaking population". We expect Tunisian and Moroccan banks to have more independence in terms of making loan decisions than Algerian banks. Also, based on studies that find a positive relationship between and private and foreign bank ownership, we might expect that banks in Morocco and Tunisia tend to be more efficient than in Algeria.

3-7 Balance Sheet structure

This part of the chapter examines the assets and liabilities characteristics of the Algerian, Moroccan and Tunisian banking systems[40].

Lee (2002) studies the average balance sheet structure of the banking systems of Algeria, Morocco and Tunisia with other MENA countries over the period 1989-2001. He reports significant increases in the size of assets, deposits, capital, and credits for all the countries under study. In three countries under study, the balance sheet structure appears to accommodate mainly credits to the economy, credits to the government, security

[40] The balance sheet structure analysis is based on balance sheet statements provided by the Arab Monetary Fund (2002).

portfolios, and credits to the central bank, on the assets side, and short, time and saving deposits, and other funds on the liabilities side.

On the assets structure, Lee (2002) finds that Algerian banks have fewer credits to the economy in their assets than in Morocco and Tunisia, with an average of 46%, 53%, and 85% of total assets, respectively. Credits to the economy by the banking system were around a third of GDP compared to a half in Morocco and Tunisia. Chaput et al. (2000) reports that the level of bank credits to the economy to GDP ratio remains low in the three countries under study, compared to other more developed markets such as Singapore, where credits were 110% of GDP in 1999. Lee (2002) also finds that Tunisian banks allocate fewer credits to the government than in Algeria and Morocco, with approximately, on average, 6%, 15%, and 30%, respectively. This reflects that the government budget in Tunisia and Algeria experienced relatively more favourable balance than in Morocco[41]. In addition, the portfolio of securities investments account for approximately 30%, 25% and 12% of total banking assets in the three countries, respectively. Although Algerian banks have invested in the three shares listed on Algiers Stock Exchange; the majority of their securities portfolio represents the stakes of Algerian banks in other government-owned enterprises. The portfolio of securities of Moroccan and Tunisia banks is securities investments made via the stock exchange.

Lee (2002) asserts that, overall; bank credits to the economy tend to be of low maturity. There are three main factors that can explain this. First, banks may seem unable to transform efficiently and profitably their short-term liquid deposits into medium and long-term illiquid assets. Second, bank may seem to suffer from the lack of accurate and reliable information on enterprises and projects that stimulate them to extend credits for longer terms. Third, banks might have realised the existence of legal and regulatory weaknesses that prevent them from playing fully their role in financing projects, such as long legal process to re-collect overdue loans, and long delays in judicial procedures.

[41] Over the period 1990-2001, the budget balance to GDP ratio was, on average, 1.1% in Algeria, -3.8% in Morocco, and -2.5% in Tunisia. In Algeria, the importance of the credits to government to assets ratio is due to the purchase of stock of non-performing loans of government liquidised or restructured bank enterprises.

On the liabilities side, Lee (2002) reports that, on average over 1990-2002, Moroccan banks have received more short-term demand deposits than savings deposits, with 50% and 25% of total liabilities and equity, respectively. On contrast, he reports that Tunisian banks are less dependent on demand deposits (20%) than time deposits (40%)[42] in their sources of funding. Algerian banks have approximately the same level of short-term deposits and time deposits, with each at quarter of liabilities and equity. Finally, capital accounts show, that, over 1990-1999, Algerian banks had equity to assets ratios of less than four percent, but this improved from 1999 onwards to about six percent, due to the various operations of re-capitalisation, compared to twelve percent in Morocco and fourteen percent in Tunisia.

3-7-1 Algeria

Table 3–4 shows the balance sheet structure of the Algerian banking system from 1990 to 2001. (See Table A2–5 in Appendix A2 which shows the total balance sheet of Algerian bank as a proportion of total assets).

[42] Short-term demand deposits and Time and savings deposits are those deposits made in local currency by residents.

Table 3–4: Algeria: Structure of Bank Balance sheet in Algeria from 1990 to 2002 in Billion Algerian Dinar.

Ratios	Assets						
Year	Cash	Deposits at Central Banks	External Assets	Credits to the Government	Credits to the Economy	Portfolio & Others	Total Assets
1990	0.999	1.981	9.032	44.831	246.978	168.337	472.158
1991	0.541	2.540	23.218	32.143	325.847	336.337	720.965
1992	0.555	5.293	20.821	28.334	412.269	287.183	754.455
1993	0.715	36.973	16.470	300.514	220.207	284.880	859.759
1994	1.367	5.522	44.877	204.633	305.808	489.411	1,051.318
1995	2.549	2.865	33.295	155.644	564.618	460.686	1,219.657
1996	2.626	10.135	32.383	141.428	776.814	431.743	1,395.129
1997	4.061	14.698	23.108	273.147	741.204	432.774	1,488.992
1998	5.647	10.154	27.501	410.385	730.826	428.090	1,612.603
1999	4.616	8.676	27.892	259.486	934.505	489.847	1,925.022
2000	6.552	36.020	28.315	600.377	775.573	508.097	1,954.934
2001	7.363	174.267	32.919	589.791	818221	561.973	2,184.534

Ratios	Liabilities							
Year	Demand deposits	Time & Savings deposits	External Liabilities	Credits from the Central Bank	Credits from the Government	Equity	Others	Total Assets
1990	105.546	72.923	3.714	66.325	0.871	18.640	204.139	472.158
1991	133.112	90.277	9.400	95.455	2.462	25.974	364.285	720.965
1992	140.841	146.183	13.386	78.657	5.876	26.131	343.381	754.455
1993	188.930	180.520	12.940	29.390	90.195	35.593	322.191	859.759
1994	196.452	247.680	35.138	50.686	38.816	37.584	445.262	1,051.318
1995	210.775	280.455	22.576	189.290	44.529	53.012	419.020	1,219.657
1996	234.029	325.958	20.793	259.125	97.531	53.758	403.935	1,395.129
1997	254.833	409.948	14.532	219.063	84.359	55.871	450.386	1,488.992
1998	334.520	474.194	25.480	226.252	55.740	66.319	430.098	1,612.603
1999	352.707	578.574	30.870	310.802	56.660	70.960	524.449	1,925.022
2000	460.267	617.873	26.661	170.538	33.507	86.388	559.700	1,954.934
2001	528.649	840.015	36.489	0	26.896	122.374	630.111	2,184.534

Source: AMF Report, 2002.

Table 3–4 shows that, in Algeria, the assets of the commercial banking sector increased about five times in nominal terms, from around DA470bn in 1990 to more than DA2100bn in 2001, possibly due to the increase of bank activities and establishment of new banks. Similarly, credits to the economy grew by nearly five times over the same period, including credits to government-owned enterprises. The share of credits to the economy to GDP considerably decreased from around 60% in (1990-1995) to 40% in (1995-2001). However, this decrease is potentially due to the abolition of directed and forced lending by banks to the government-owned enterprises, of which large numbers were liquidated, and the relative "*borrowing weakness*" of the private sector.

Over 1990-1999, public enterprises benefited from around four fifths of total credits, while the private sector borrowed around one fifth of total credits, the latter of which increased from 18-19% in 1998-99 to around one third in 2000-2002 (Naas, 2003). The low levels of credits to the private sector indicate the relatively weak role of the private sector in economy. The relatively low levels of credits to the private sector may also reflect the dominance of the public sector in Algeria, and the limitations of the privatisation programme. In terms of maturity, credits allocated by Algerian banks to enterprises were mainly short-term. This implies that Algerian banks provide working capital funds for enterprises rather than long-term investment finance. It also suggests that perhaps Algerian enterprises are facing difficulties in accessing to investments and long-term loans. Naas (2003) examines the structure of bank credits to the economy during the period 1998-2001. Over this period, he finds that short-term credits (56-61%) outsized long and medium-term credits (44-39%).

In addition, Table 3–4 shows that the share of credits to the government in total banking assets has decreased from 9.5% in 1990 to 3.8% in 1992, then from 35% in 1993 to 10% in 1996, and to less than 15% in 2001. Due to the fact that, on average, the government budget balance showed surplus, the fluctuations in the share of credits to the government in the assets structure of banks reflect the situation of non-performing loans and foreign exchange losses. As discussed earlier, the government purchased, in the form of bond-debt swaps accumulated stocks of non-performing loans of public enterprises, which were either liquidated or restructured. Also, in the same form of debt takeover, the government refunded banks the foreign exchange losses they occurred due to the major

Dinar devaluations in 1991 and 1994. One consequence of this debt takeover was bringing the capital ratios in line with international standards starting from 1999, and cleaning up the portfolio of credits to prepare, perhaps, banks for privatisation.

On the liabilities side, in Algeria, total banking sector deposits increased more than five times over the 1990-2001 period. The deposits to total assets ratio rose from less than 40% in 1990-1993 to around 40% over 1993 to 1998, then to greater than 50% over the 1999-2001 period. One explanation for this increase may be the deregulation of interest rates since 1992 and inflation management, which decreased nominal interest rates and brought real interest rates to positive levels.

The other item figuring on the liabilities side of Algerian banks is credits from the central bank. The importance of this item indicates the degree to which commercial banks rely on the control of the money authorities. It also provides some indication of the policy applied by the central bank on the banking sector. Overall, banks borrowed less than 5% of their assets from the central bank, except for two occasions, in 1993 (10%) and 1996 (7%). It seems that Algerian banks are not significantly dependent on central bank funding. Also, as the central bank of Algeria has substituted direct monetary control with market-based indirect monetary policies. This has probably helped reduce the size of central bank funding in bank's balance sheets.

In Algeria, over 1990-1999, the equity to assets ratio stood at less than four percent, and was even sometimes negative for some banks such as BDL. One main explanation for this under-capitalisation was the large amounts of accumulated non-performing assets of government-owned enterprises. This ratio improved after 1999, due to the repeated purchase of non-performing loans by the government (due on its enterprises) and cash inflows from the government to the banking sector.

Overall, there a number of main observations inspired from Table 3–4 that can be made about the balance sheet structure of Algerian banks over 1990-2001. First, non-performing loans appear to be the main cause of the under-capitalisation of banks during this period, due to the former directed lending to public enterprises and sectoral credit specialisation. Second, bank deposits increased due to the positive rates of interest rates. Third, credits to the public sector still appear to be significant due to the weakness of the private sector. Fourth, it seems that banks are not financing long-term investment and are, instead, concentrating on financing the working capital of enterprises, mainly, in the industrial sector. Fifth, Algerian banks' compliance with the capital adequacy ratios appears to be dependent on the large share of claims on the government in their balance sheets and the implicit government guarantee on non-performing loans to government-owned enterprises[101]. Finally, the primary factors shaping Algeria's non-performing loans include the extensive administratively controlled policy of planned lending within the period prior to liberalisation, low financial performance of the government-owned enterprises, and lax internal credit risk controls of the government-owned banks.

3-7-2 Morocco

Table 3–5 shows the balance sheet structure of the Moroccan banking System from 1990 to 2001. (See Table A2–6 in Appendix A2 which shows the total balance sheet of Moroccan banks as a proportion of total assets).

[101]Ms Mentouri, one of the government's reformists, minister delegate for banking reform, noted that State banks had received over $18bn from the state to re-capitalise over the period 1991-2000 (

Table 3–5: Morocco: Structure of Bank Balance sheet in Morocco from 1990 to 2002 in Billion Moroccan Durham

Ratios	Assets							
Year	Cash	Deposits at Central Bank	External Assets	Credits to the Government	Credits to the Economy	Portfolio	Others	Total Assets
1990	1.016	6.812	6.281	29.766	34.095	1.101	15.955	95.026
1991	0.945	11.460	5.621	28.293	48.500	1.011	18.479	114.309
1992	0.962	6.275	5.408	39.545	56.581	0.994	14.129	123.894
1993	1.090	7.682	5.002	44.652	62.351	0.355	14.425	135.557
1994	1.061	7.344	6.765	50.746	70.408	1.409	16.703	154.436
1995	1.086	8.059	5.533	49.633	81.777	1.637	17.005	164.730
1996	1.443	8.112	5.855	50.048	90.545	0.627	20.276	176.906
1997	1.6299	9.654	3.703	58.616	151.203	25.580	-	251.038
1998	2.698	10.682	4.592	58.614	167.602	29.834	-	274.022
1999	5.242	11.858	4.812	54.917	183.531	33.017	-	293.377
2000	5.640	13.340	6.356	61.729	204.446	34.312	-	325.823
2001	8.542	20.528	5.805	72.318	207.013	22.801	14.095	351102
2002	6.447	23.33	8.532	75.179	214.284	24.580	15.16	367512
Ratios	Liabilities							
Year	Demand deposits	Time & Savings deposits	External Liabilities	Credits from the Central Bank	Credits from other banks	Non-Residents Deposits	Equity	Other	Total Assets
1990	54.171	24.143	1.819	5.862	0.312	1.507	6.491	2.540	95.026
1991	61.757	30.383	2.179	8.398	0.339	1.804	8.376	3.216	114.309
1992	66.636	36.425	3.205	2.566	0.499	2.706	10.382	4.680	123.894
1993	70.033	42.687	3.729	0.965	0.465	3.264	12.973	5.170	135.557
1994	79.099	45.958	6.020	1.108	0.713	5.307	14.832	7.419	154.436
1995	84.606	50.552	3.745	1.232	0.831	2.914	16.285	8.310	164.730
1996	87.323	54.692	4.579	2.508	1.488	3.091	17.950	9.584	176..906
1997	116.054	64.121	3.409	1.209	2.203	1.206	38.743	27.502	251.038
1998	126.767	65.114	4.276	3.381	3.194	1.082	44.973	29.511	274.022
1999	140.895	69.389	4.605	1.346	3.289	1.316	47.759	29.383	293.377
2000	156.545	76.281	4.322	7.161	3.891	0.431	53.736	27.751	325.823
2001	166.238	98.497	12.035	0.007	12.876	0.641	54.611	6.197	351102
2002	183.704	94.3	11.659	0.001	15.258	0.527	57.198	4.865	367512

Source: AMF Report, 2002.

Table 3–5 points out that, in Morocco, the assets size of the banking sector increased by three times, in nominal terms, over 1990-2001, from around DH95bn in 1990, to more than DH340bn in 2001. Credits to the economy, which are the main component on the assets structure of banks, outgrew total assets by nearly seven times, particularly from 1996-1997, to be more than DA210bn by 2001. As a share of total banking sector assets, credits to the economy increased from around one third in the early nineties to two-thirds by 2000-2001. The growing importance of credits to the economy can also be expressed by the behaviour of domestic credits to GDP. This ratio ranged between 45-60% in 1991-96, and increased to more than 80% over 1997-2001. The strong trend in domestic credit growth is mainly related to growth in commercial bank lending to the private sector.

The growing importance of the private sector also expressed by the ratio of credits to private sector to GDP. As a share of GDP, credits to privately-owned businesses rose from less than 30% over the 1990-1996 period to more than half of GDP during 1998-2001(see Table A2–4 in Appendix A2). Credit deregulation and privatisation programmes started significantly in 1993, both seem to explain the behaviour of increased commercial bank lending to the private sector. Chaput et al. (2000) report that Moroccan banks' balance sheets are characterised by short-term assets matched by short-term deposits, as long-term loans represent only one tenth of banking credits.

The second main component figuring on the assets side of Moroccan banks' balance sheet are credits to the government. Over the period 1996-2001, credits to the government to total bank assets were around thirty percent, and mainly in the form of Treasury securities. This level is higher than in Tunisia, even though the mandatory holding of government papers has been annulled. The behaviour of credits to the government is strongly associated with the government budget balance. If the government budget records a deficit, more credits will appear on the assets side of banks. During the period 1990-2001, the Moroccan government suffered from a sustainable budget deficit averaging at 2.5% of GDP, which mainly explains the relatively high levels of credit to the government over this period.

The share of portfolio investments (securities) in total bank assets experienced significant increases from less than 1% before 1997, to around one tenth of the balance sheet by

1997-2001. This increase is considerably related to the conspicuous importance of the stock exchange derived from the privatisation programme. The market capitalisation of Casablanca stock exchange increased from 23% of GDP in 1996, to within 42-32% over the period 1997-2000[43].

Reserves at the central bank were relatively stable over the 1990s, at around 5% of total banking sector assets. Similar to the Banque d'Algérie, Bank Al-Maghrib uses indirect market-based monetary instruments in the money market to oversee the supply of money. It appears that the Bank Al-Maghrib has not made significant changes to impose high rates on reserve requirements as this explains their stable levels.

In terms of assets quality, the Moroccan banking sector is relatively more exposed to credit shocks more than their Algerian (and Tunisian) counterparts. More than half of Moroccan bank lending are allocated to activities that tend be highly cyclical in nature such as tourism, agricultural and agro-industrial industries and the textile sector. That is, the asset quality of banks is strongly related to the health and performance of the country's leading borrowing sectors, including agriculture, tourism and textile and agro-related businesses. In addition, Bank Al-Maghrib (2001) reports that the level of overdue loans in the banking sector increased to 15% of total bank lending by 1999-2000, representing 5% of GDP, compared to 12.6% in 1998, and 8% in 1992. The former specialised banks, BNDE, CIH and BNCA, accounted for a large share of these overdue loans. Over the period 1997-2002, Ingrives and Abed (2003) report that the ex-specialised banks held approximately 23.8% to 36.4% of non-performing loans to total loans compared to 12% to 18% for other banks. In 1998, approximately, 90% of overdue loans of the former specialised banks were considered unrecoverable, according to the new classification rules introduced in 1993 and supposed to be implemented by the end 1996. However, the former specialised banks did not strongly comply with the new classification procedures by that date.

On the liabilities side, it seems that demand and time deposits dominate banking sector funding in Moroccan banking. Over the period 1900-2001, these two components

[43] According to the Casablanca Stock Exchange Fact Book 2002, (page 20), the capitalisation of the CSE was DH75bn in 1996, DH118bn in 1997 and DH145bn in 1998.

represented, on average, more than two thirds of total liabilities and capital. Deposits grew by more than threefold over the period 1990-2001, in particular from 1997 onwards. From 1997, real interest rates increased and banks actually might have sought to raise deposit finance to help fund stock market investments.

Most Moroccan banks, apart from the former specialised banks, managed to bring their capital ratios in line with the BIS international standards. The capital equity share of total assets of banks has been higher than the minimum international rate of 8%, since 1992. The equity to assets ratio increased from seven percent in 1990-1991 to within 8-10% in 1992-1995 and to more than 12% over 1996-2001, particularly greater than 16% since 1998. Lee (2002) notes that capital adequacy ratio of Moroccan banks stood at an average rate of 12% over 1990-2001, whereas the central bank reports (2000, 2001 and 2002) state capital adequacy ratio between 11.1 and 12.6% over the 2000-2002 period.

Over the 1990-2001 period, the balance sheet structure of Moroccan banks was characterised by five main features. First, credits to the economy represented the prime item on the assets side, of which more than 75% was borrowed by private enterprises. Second, bank credits are allocated to sectors that tend to be cyclical in nature such as the agricultural and tourism sectors. Third, banks have devoted a growing proportion of their funds to investment in the stock market. Fourth, banks have experienced substantial deposits growth due to positively high real interest rate in recent years. Finally, Moroccan banks are complying with the standard BIS 8% international capital adequacy ratio requirement.

3-7-3 Tunisia

Table 3–6 shows the balance sheet structure of the Tunisian banking system from 1990 to 2001. (See Table A2–7 in Appendix A2 which shows the total balance sheet of Tunisian banks as a proportion of total assets).

Table 3–6: Tunisia: Structure of Bank Balance sheet in Tunisia from 1990 to 2001 in Billion Tunisian Dinar.

Ratios	Assets							
Year	Cash	Deposits at Central Banks	External Assets	Credits to the Government	Credits to the Economy	Portfolio	Others	Total Assets
1990	44.029	73.623	221.329	762.406	5,160.876	140.269	1397.086	7,781.621
1991	42.714	87.559	189.844	792.925	5,648.587	198.665	1503.929	8,464.123
1992	39.797	96.776	211.521	536.613	6,494.843	256.438	2018.211	9,654.199
1993	50.738	130.368	275.757	535.911	7,054.548	274.756	2399.801	10,721.879
1994	56.620	237.104	326.869	544.023	7,681.393	304.816	2559.038	11,709.863
1995	55.724	219.278	306.534	341.103	8,463.401	334.933	2838.667	12,559.640
1996	83.722	675.849	533.206	291.296	8,776.006	344.661	3527.645	14,232.358
1997	78.000	738.418	675.310	632.224	9,760.767	420.182	3622.774	15,977.679
1998	83.913	271.716	271.697	682.224	10,649.749	487.034	4611.855	17,371.307
1999	95.688	757.716	777.891	556.073	11,732.749	568.862	4706.335	19,581.046
2000	118.191	321.449	927.965	1,561.303	14,683.732	758.386	5512.560	23,911.576
2001*	144.446	604.934	807.507	1,486.887	16,241.305	797.120	6,195.307	26,277.506
2002*	138.727	530.070	957.253	1,558.762	17,122.207	1,019.805	5,688.381	27,015.205
Ratios	**Liabilities**							
Year	**Monetary deposits**	**Quasi-Monetary deposits**	**External Liabilities**	**Credits from the Central Bank**	**Special Resources**	**Equity**	**Others**	**Total Assets**
1990	1,536.697	2,891.559	377.902	564.280	668.102	591.837	1151.244	7,781.621
1991	1,401.236	3,195.569	424.452	696.313	736.285	710.073	1300.195	8,464.123
1992	1,516.184	3,489.746	532.895	679.094	784.837	887.669	1763.774	9,654.199
1993	1,622.856	2,766.543	613.852	788.323	824.454	1,053.390	2052.461	10,721.879
1994	1,892.933	3,991.165	780.358	605.556	933.730	1,254.435	2260.686	11,709.863
1995	2,024.104	4,165.537	816.498	690.882	838.636	1,671.550	2352.433	12,559.640
1996	2,288.219	4,735.828	1,076.138	170.862	856.375	1,913.972	3187.964	14,232.358
1997	2,724.138	5,654.754	1,213.727	131.189	903.645	2,150.449	3199.777	15,977.679
1998	2,937.003	5,870.984	1,260.459	126.917	919.370	2,361.021	2895.553	17,371.307
1999	3,249.521	7,121.590	1,683.701	112.830	935.717	2,577.180	3900.507	19,581.046
2000	3,585.364	8,372.276	1,839.446	469.695	1,787.909	2,935.236	4921.650	23,911.576
2001*	3,959.325	9,292.966	1,826.848	869.957	2,003.697	2,880.967	5,443.746	26,277.506
2002*	3,696.699	10,118.780	2,006.096	504.091	2,353.680	3,075.831	5,260.028	27,015.205

Source: AMF, 2001.

Source: Banque Centrale de Tunisie, Statistiques Financieres, No. 136, Sep. 2001.
* Source: Banque Centrale de Tunisie, Statistiques Financieres, No. 144, Sep. 2003

Table 3–6 indicates that, over the period 1990-2001, banking sector assets in Tunisia increased by threefold in nominal terms, from DT7.8 in 1990, to more than DT24bn in 2001. Similar to Morocco, credits to the economy constituted the main part of banking sector assets with an average of 60% of assets and half of GDP, over the period. Due to the programme of privatisation and the encouragement of the role of private ownership and investment, bank credits to government-owned enterprises represented only a small share of total credits to the economy amounting to around 7% of total credits and 5% of GDP. In contrast, credits to the private sector have grown during the nineties reaching an average of 45-50% of GDP and more than 90% of total credits to the economy. Compared to Algeria, bank credits to government-owned enterprises in Tunisia (and Morocco) are the lowest, suggesting an advanced privatisation process.

In terms of maturity and activity, Banque Centrale de Tunisie (2001) states that Tunisian bank lending appears to be largely short-term, and similar to Morocco, heavily concentrated in cyclical sectors such as in services (including tourism), and industries that belong to the export-oriented sectors, which face fierce competition in foreign markets such as in textiles (Chabrier and Ingrives, 2002). Over the period 1990-2001, on average, short-term credits accounted for around three fifths of total credits. Also, on average, services sectors accounted for 60% of total bank credit to the economy. Credits to the agricultural sector were mainly medium and long-term with 90% of total medium and long-term credits, whereas the remaining 10% were allocated to other sectors including the services and light industrial sectors. Overall, banks lending to the agricultural sector to total credits fell over 1990-2001. Inders et al. (1998) explains that agriculture in Tunisia has received less bank lending due to the annulment of the preferential treatment for refinancing, and the termination of compulsory lending to the sector since 1996. Also, the decrease in bank lending to the agricultural activities has been driven by relative high risk and volatility of the sector itself. The largest borrower of bank loans is the services sector, from around 40% in 1999 to 60% of total credits in 2000-2001. This increase has been driven predominantly by the development of the tourism industry.

The share of the industrial sector in total bank lending fell from 50% in 1990 to less than 40% in 2000-2001. As most of these credits were allocated to the ex-government-owned enterprises, the programme of enterprise privatisation and bank privatisation allowed for the reduction of these. The IMF (1997) states that loans to government-owned enterprises were most responsible for bank non-performing assets and this represented up to a third of total credits to the economy over the 1990 to 1997 period. The decisions of lending to government-owned enterprises can be considered as being the main cause of the high level of non-performing loans.

Whereas in Algeria and Morocco, the governments opted for bond-debt swap policies in dealing with non-performing loans (mainly to public enterprises); the Tunisian government followed another approach. Chabrier and Ingves (2002) state that, in 1997, the government allowed the creation of private asset management companies (AMCs) charged with the purchase and collection of non-performing loans. These companies were subsidiaries of the respective banks, playing the role of an in-house non-performing loans recovery company. Measures taken by these structures include converting all the non-performing loan assets of ex-government-owned banks that have been liquidated or privatised into non-interest bearing claims on the government with a 25-year re-payment period (more than 60% of non-performing claims were on government-owned companies). The approval of this measure has improved the relative performance and soundness of the banking system. Chabrier and Ingves (2002), however, report that the level of non-performing loans still amount to a fifth of total credits, with only two fifths of total provisioning by 1999-2001,

Credits to the government represented an average of 6% of total Tunisian bank assets over 1990-2001. As in Morocco, the magnitude of credit to the government is significantly positively related to the level of the government budget balance, which witnessed a deficit of 3.3% of GDP over 1990-2001. Also, Enders at al. (2000) reports that the increase in bank credits to the government from 1997 onwards, was due to the government purchase of a stock of non-performing loans from the agricultural-oriented bank Banque Nationale de l'Agriculture (BNA), the largest public bank in Tunisia (in 1997). Whereas as explained by Enders et al. (1998, 2000), the decrease in bank credits to the government over the period 1990 to 1996, was due to the abolishment of forced holdings of government securities and the reduced budget deficit. Prior to major reforms in the late 1980s, the government financed its deficits by requiring banks to hold government paper (IMF, 1996). In 1989, this requirement was discontinued and, instead, the government introduced a new procedure through which banks were forced to finance government deficits by holding treasury bills at market conditions (Tunisia, 2001b). By 1995, government credit allocation gradually disappeared that allowed banks to have greater autonomy in their lending activities (IMF, 1996). Moreover, bank deposits at the central bank have declined and remained relatively low during the period 1991-2001. In addition, Tunisian banks invested an estimated of quarter of their assets in securities.

Deposits from households and enterprises constitute the main part of Tunisian banking sector liabilities side. Over the period 1990-2001, this item accounted for an average of half of total assets. This ratio implies that deposits from households and enterprises accounted for than three quarters of total bank lending.

The capital adequacy ratio was less than 8% in 1990-1996, but increased to over 10% after 1996. According to Inders et al. (1998), the increase in equity and capital has been promoted by the new prudential regulations introduced in 1991, and by the re-capitalisation of a number of under-capitalised public banks in order to meet the required 8% capital adequacy ratio requirement. Further measures were implemented in 2001[44] to accentuate the importance of banks in meeting international standards. The greater focus on prudential supervision during the 1990s has helped strengthen the capital adequacy of the Tunisian banking system, in particular over 1997-2001. For instance, the capital adequacy ratio of Tunisian banks has increased from 5% in 1996 to 12% by 2000 (Sfar, 2001). The improvement in Tunisian banks' soundness may be also explained by the decline in non-performing asserts from 28-25% between 1993 and 1995 to less than 20% over the period 1999-2001. In addition, Chabrier and Ingves (2002) believe that the significant exposure to credit risk suggests that the level of risk-weighted capital is sensitive to credit risk shock. Chabrier and Ingves (2002) estimate the capital adequacy of Tunisia banks at 11% in 2000-2001. However, the aforementioned authors think that this level of capital adequacy is over-estimated. They detect that regulation in Tunisia

[44] Central Bank circular No. 2001-04.

does not require the provisioning of loans backed up by real estate collateral. As a consequence, they argue that the weighted capital ratio at 11% does not reflect this, and for example, if 100% collateral was unrecoverable, it would result in a reduction of the risk weighted capital ratio from 11% to 0.5%. This ratio would decline to 6% if only half of the collateral was unrecoverable. Overall, however, Chabrier and Ingrives (2002) do recognise that loan provisioning of Tunisian banks has improved.

In general, the balance sheet structure of Tunisian banks are characterised by four main features. First, credits to the economy and credits to the private sector appear to be the main constituent on the assets side. Second, even though non-performing loans are decreasing, these are still substantial accounting for 20% of total loans. Third, a large proportion of bank loans tends to be short term and concentrated in sectors that are cyclical in nature and face fierce competition from foreign markets. Fourth, approximately half of Tunisian banks' liabilities and capital consist of interest-bearing deposits from households and enterprises. Finally, Tunisian banks have met the internationally adopted minimum capital adequacy ratios in the late 1990s.

3-8 Efficiency and Profitability of Banks in Algeria, Morocco and Tunisia[45]

Overall, our ratio analyses of the profitability and efficiency of the banking systems under study suggest that Algerian banks are not as profitable and efficient as banks in Morocco and Tunisia. Algerian banks have tended to suffer from low rates of returns on their assets as well as higher levels of costs to income ratios compared with Moroccan and Tunisian banks.

Studies that have investigated the profitability and solvency of the banking sector in Algeria have typically found poor performance and soundness according to the international and regional comparison over the period 1990-2001. Chabrier and Kapur (2000) found that the return on assets of Algerian banks was very low, compared to banks in Morocco and Tunisia, at less than half a percent. The aforementioned study

[45] Due to the difficulty of collecting detailed information about profitability and efficiency indicators on banking sectors in the three countries used study over the period of investigation, the thesis uses the analyses of authors who examined these themes.

refers to the characteristics of Algerian banks' balance sheet structure to present potential causes for this low level of returns. Algerian banks sustained relatively high levels of non-performing claims on loss-making government-owned enterprises. Due to the influence of (past) governments on banks[46], and despite the autonomy of decision-making granted to bank managers regarding credit allocation, Algerian banks had to continue providing funds to public enterprises to support their working capital, especially wages and salaries. Banks might have liquidity constraints created by the large amounts of government bonds swapped within the framework of the bank-recapitalisation programme, currency devaluation losses, and non-performing claims on government-owned enterprises. These bonds might have also yielded lower interest income than expected. In addition, Algerian banks have found it difficult to enlarge their net interest revenue or interest spread. Over the period 1990-2001, the fall in deposit interest rates was larger than the decrease in lending rates, thus lower profitability in lending business (particularly in sectors outside the upstream hydrocarbon sector).

In Morocco, Chaput et al. (2000) and Ingvis and Abed (2003) study the profitability of Moroccan banks in recent years. Unlike in Algeria, Moroccan banks experienced relatively large (but overall stable) net interest revenues of up to eight percent despite the larger decrease of lending interest rates compared to deposits interest rates. Banks benefited from the abolishment of mandatory credits for priority sectors over the period 1990-1995. Also banks benefited from the discontinuation of the forced holding of government securities at administratively low-interest rates, and subsequently, banks have substituted these securities for debt instruments yielding market interest rates (as well as Treasury bills). Chaput et al. (2000) reports that Moroccan banks income from treasury securities increased by half between 1993 and 1998. In addition, Chaput et al. (2000) notes that large and relatively stable Moroccan banks' net interest margins imply that financial liberalisation measures did not significantly influence the degree of competition among banks. High levels of interest spread may reflect the fact that the Moroccan banking sector is still highly concentrated, and banks are not competing on interest rate business.

[46] In Algeria, the chief executives of government-owned banks are still nominated by political authorities

In Tunisia, Chabrier and Ingrives (2002) report that Tunisia's commercial banks increased their ROA from 0.6-0.8% in 1996-1997 to an average of 1.2% over 1998-2001. However, ROE decreased from 28% in 1990 to 14% by 1999-2001. The aforementioned study suggests that the level of profitability of Tunisian banks is relatively high. One potential explanation of this phenomenon is a large interest spread driven by the possible absence of competition (possibly due to the high levels of industry concentration). In terms of costs, the operating costs to average assets ratio experienced a relatively stable trend at approximately 2.3% over the 1990-2002, compared to 2.2% in Morocco and 2% in the Euro area (Chabrier and Ingrives, 2002).

Inders et al. (1998) comments that Tunisian banks were experiencing ROA rates in the range of those experienced in the OECD countries, with private-owned banks persistently outperforming government-owned banks. The aforementioned study suggests that the high level of ROA was driven mainly by the large net interest revenues. Tunisian banks were lending, on average, 2.7% above the money market rate while deposits were remunerated at approximately 0.5% below the money market rate.

In addition, Ben Naceur (2003) investigates the determinants of the profitability of the banking sector (ten deposit banks) in Tunisia using data representing the period 1980-2000. Two measures of performance are used; Net Interest Margin and ROA. Also, five banks' characteristics indicators are used as potential internal determinants of performance. They comprise the ratio of overhead to total assets (OVERHEAD), the ratio of equity capital to total assets (CAP), the ratio of bank's loans to total assets (BLOAN), the ratio of non-interest bearing assets to total assets (NIBA) and the log of bank assets (LNSIZE). Also, two macro-economic variables are used: inflation (INF) and GDP per capita growth (GROWTH). The study also examines how the performance of the banking sector is related to the relative development of the banks and stock markets. Ben Naceur (2003) finds that proportion of loans to assets has had a positive and significant impact on banks' interest margins. He also finds that size has mostly negative and significant coefficients on the level of net interest margins. This latter result may simply reflect scale inefficiencies. In addition, banking market concentration is found to be less beneficial to the Tunisian commercial banks than competition. Ben Naceur (2003) suggests that banks to improve their performance, they need to reduce the proportion of non-interest bearing assets of large banks can achieve optimal levels. At their national level, Ben Naceur (2003) recognises that concentration should be reduced to spur competition, and equity market should be developed as in order to improve bank performance and stock market developments have been found to be complementary.

Thus, according to studies that have investigated the profitability and cost behaviour of banks in Algeria, Morocco and Tunisia, it appears that Moroccan and Tunisia banks are more profitable and efficient than banks in Algeria. This evidence suggests that standard accounting measures imply that Algerian banks are likely to be more profit and cost inefficient than those located in the two neighbouring countries under study.

3-9 Conclusion

During the period prior to the implementation of financial liberalisation in the late 1980s and early 1990s, the financial and monetary authorities in Algeria, Morocco and Tunisia relied predominantly on three instruments to regulate the financial sector. First, there was a State monopoly over the banking sector in terms of ownership and management. Private and foreign capital was not allowed to establish banking structures in the local banking market due to its "*strategic character*". Second, there were quantitative controls on credits within the framework of the French style scheme known as "*l'encadrement du Crédit*". According to this scheme, financial intermediaries were obliged to maintain a pre-determined proportion of their lending portfolios to assigned pre-defined sectors deemed as 'strategic' or 'priority' by the respective governments. Substantial directed lending took place to sectors such as agriculture, export-oriented (Morocco and Tunisia) and public enterprises or import-oriented sectors (Algeria), even if these sectors were unprofitable or loss-making. Finally, borrowing and lending interest rates were administratively determined, and usually fixed for long periods. The implementation of these measures resulted in financial repression.

The financial and banking systems of Algeria, Morocco and Tunisia witnessed substantial liberalisation reforms that have helped re-shape the structure of their respective systems and relaxed aspects of financial repression that were evident throughout the 1970s and 1980s. As part of the reform process, first, the monetary authorities changed monetary policy practices and introduced indirect market-based instruments such as open market operations and reserve requirements. Second, lending and borrowing rates have been gradually deregulated and are allowed to respond to internal. Third, the *encadrement du crédit* style has been discontinued and banks are (in theory at least) given autonomy in their credit allocation decision making, and are encouraged to consider only market criteria when approving lending. Fourth, various specialisations and entry barriers have been dismantled to allow private and foreign ownership to operate in the banking systems with the respective States have made commitments to privatise their banks. Finally, internationally-accepted banking supervision norms have been introduced and banks are required to meet these levels.

The results of financial liberalisation measures on the balance sheet structure of the respective banking systems can be identified in certain aspects. First, both private and foreign banks currently operate in local banking markets. Second, bank lending to private enterprises has grown while credits to government-owned enterprises have fallen. Third, interest rates have become more market based. Fourth, banks are now meeting the internationally-accepted BIS capital adequacy level of 8%, especially in Morocco and Tunisia. In general, however, the structure of the local banking systems still show high levels of concentration and non-performing assets are still relatively high. Credits are concentrated in certain sectors that are relatively short-term. Credit concentration also occurs in sectors that are cyclical in nature or face fierce competition from international markets. Banks also still enjoy stable and relatively large interest margins due to low levels of competition in the respective operating environments. Algerian banks appear to be less profitable and cost efficient than their Moroccan and Tunisian counterparts. These findings we wish to investigate in a more formal fashion in the following chapters.

Chapter 4 The Theory and Empirics of Cost and Profit Efficiency Measurement in Banking

4-1 Introduction

The present chapter introduces the theoretical framework related to the investigation of cost and profit efficiency in banking. The chapter provides a description of the concept of bank efficiency and its types including productive X-efficiency and scale and scope economies. Also, the present chapter covers the description of the major statistical frontier approaches that have been extensively used to measure efficiency, namely, the parametric and the non-parametric approaches (Bauer et al., 1997).

These two approaches provide quantitative measures of relative firm-level performance as they estimate best practice according to a variety of assumptions, including input and output choice. In banking, the efficiency estimates derived using the two families of approaches are indicative of a banking institution's performance relative to the best practice banking institutions that lie on (or are close to) the frontier. While the parametric approach requires the estimation of a cost or profit function, the non-parametric approach does not require the specification of a functional form; instead, it employs linear programming techniques to envelop the observed dataset so as to produce a linear frontier. Empirical studies have extensively applied these two approaches to investigate the efficiency characteristics of banking and financial systems across various countries with different economic and financial features.

This chapter is divided into three main sections. The first section outlines the notion of efficiency, its main types. Also, the section discusses the concepts of economies of scale, economies of scope, and productive X-efficiency. These concepts will be referred to later in the empirical chapter of the thesis where efficiency levels in the banking sectors of Algeria, Morocco, and Tunisia are analysed. The second section reviews the parametric and non-parametric estimation techniques. The third section presents the three main mathematical functional forms that are broadly employed to derive efficiency and productive levels estimates including, as noted by Berger and Mester (1997), the cost, standard profit, and alternative profit functional forms. The empirical analysis conducted in later chapters utilises cost and alternative profit features to measure the efficiency levels in the banking sectors of Algeria, Morocco and Tunisia.

4-2 Efficiency Definition and Measurement

4-2-1 Efficiency Definition

Berger and Humphrey (1997) note that the concept of X-efficiency or productive efficiency is related to the process of evaluating the relative change in performance based on comparing an entity, a firm or Decision Making Unit (DMU), to the best practice (other entities, firms, or DMUs), in terms of a variable or scores of variables. The efficiency of a firm is defined relative to the best practice firms observed in the industry and requires the estimation of a production, cost or profit frontier. That is, productive or X-efficiency is derived as the distance an individual (banking) DMU is from the 'optimal' or 'best practice' DMU existing on a (cost or profit) production function, in which the 'best practice' DMU firms is defined with reference to all the DMUs in the dataset.

A production frontier is a relationship that describes the maximum output that an efficient firm can produce using a combination of inputs over time. Similarly, Oster and Antiosh (1995) relate the concept of efficiency in banking to how well a bank utilises its resources relative to the existing production possibilities frontier or best practice. That is, how a banking institution simultaneously minimises costs and maximises revenues, based on an existing level of production technology. Bank efficiency analysis can be considered similar to an intra-industry comparison that involves both technological and relative pricing.

Bank cost and profit efficiency studies have used both parametric and non-parametric approaches to quantify the maximum outputs that an efficient "best practice" banking firm can produce from any given combinations of defined inputs over a specified period of time. Frontier efficiency approaches estimate the deviations in performance from that of "best-practice" banking firms that lie on or are closer to the frontier. That is, these approaches measure how well a banking firm performs compared to the predicted performance of the best practice banking firms in the industry experiencing the same market conditions.

4-2-2 Farrell's Study (1957)

A seminal study on the concept of efficiency and how it can be measured was by Farrell (1957). As noted by Kumbhakar and Lovell (2000), Farrell (1957) was the first to outline the operational procedure to measure technical and allocative efficiency. Farrell (1957) employs two inputs and a single output example to illustrate how technical efficiency can be measured. The procedure of efficiency estimates takes the following steps. First, assume that there are five decision making units (A, B, C, D, and E) that produce a single output, y, and use only two inputs, x_1, and x_2. Second, a reference point or firm can be defined, and used as a benchmark to estimate the efficiency levels of every DMU. The reference firm is obtained by lying up the actual observations closest to the axis, and then these observations are enveloped to construct the best practice frontier, QQ'. Figure 4-1 displays both combinations of inputs/outputs and the efficient frontier of the concerned firms.

Figure 4-1: Distance Measure of technical Efficiency

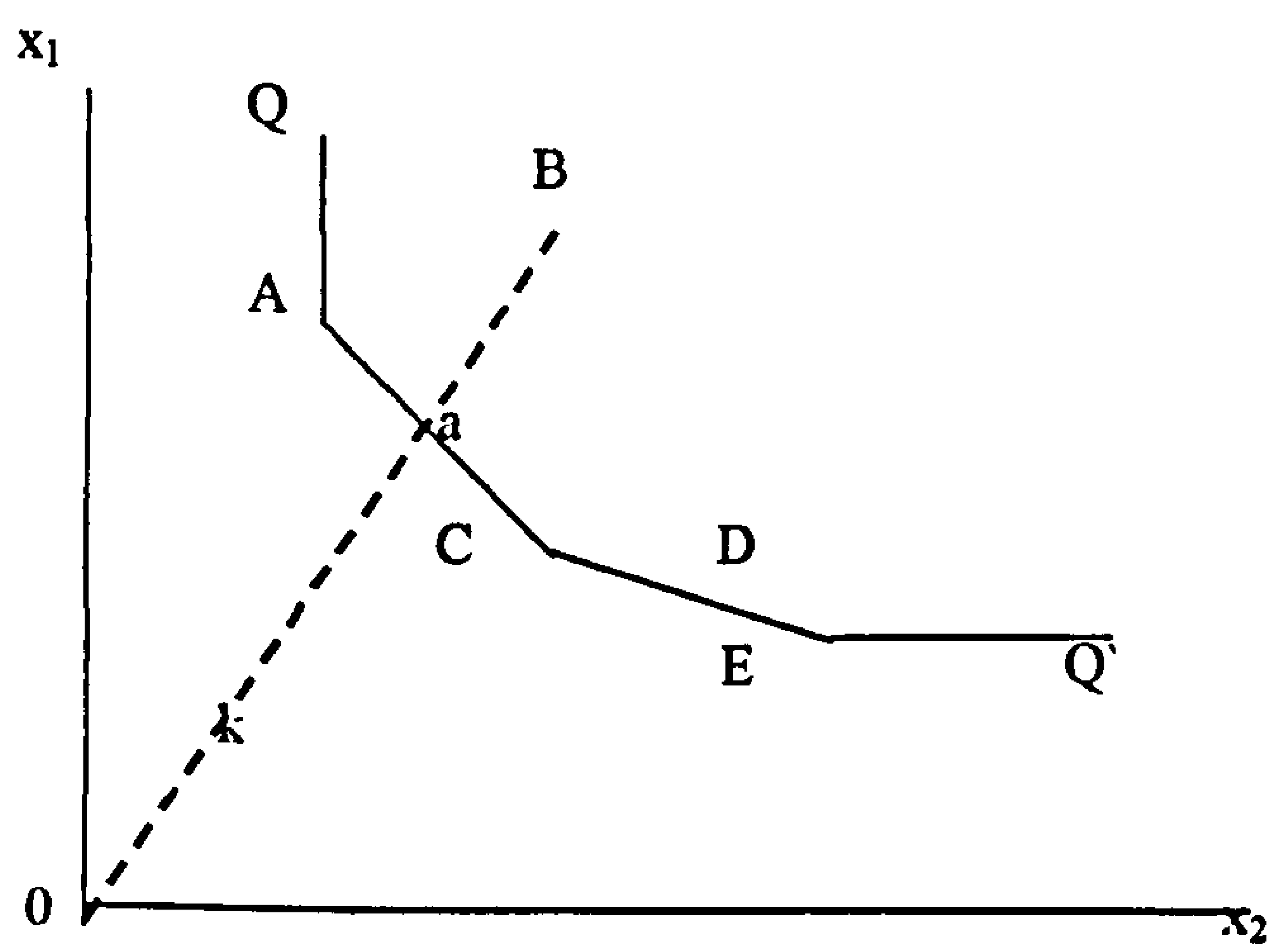


Figure 4-1 shows that the DMU A, C and E are the most efficient firms as they lie on the best practice frontier curve, QQ', which gives them the privilege of serving as a benchmark norm for other firms. A firm operating at the point k, or any position under QQ' is not technically feasible. Similarly, firms on points above the curve QQ' are technically inefficient. For instance, the firm B produces the same amount of outputs as the best practice firms but uses extra units of inputs. If a firm operated at the best practice level, it should lie on QQ' at point a. Farrell (1957) suggests that the assessment of technical inefficiency for firm B is possible by measuring the ratio of 0A to 0B. As a distance measure, the ratio of 0A to 0B represents the ratio of inputs technically necessary to the inputs actually used to produce one unit of output, given the actual input mix.

4-2-3 Efficiency Types: Allocative and Technical

4-2-3-1 Efficiency Decomposition

Efficiency frontier studies investigate efficiencies as defined as the relationship between the level of production of outputs and either cost input minimisation or profit maximisation in certain regulatory competitive and technological environments. As noted earlier, frontier approaches measure the deviation of a bank's costs or profits from the efficiency or best practice frontier, which depicts the maximum attainable output for a given level of outputs. According to Kwan and Eisenbeis (1996), firms that lie off the frontier are known as inefficient or X-inefficient, a term introduced by Leinbenstein (1966), who noted that, for a variety of reasons, people and organisations normally work neither as hard nor effectively as they could.

X-efficiency, as defined by Evanoff (1999) as the suboptimal use of inputs, can be decomposed into two major components, namely, allocative efficiency and technical efficiency. Technical efficiency (TE) can be also decomposed into pure technical efficiency (PTE) and scale efficiency (SE). The decomposition of technical efficiency helps investigate the source of inefficiencies and determines the position of banks in terms of operating at the most productive scale size (MPSS), increasing return to scale (IRS) or decreasing returns to scale (DRS)[102].

Farrell (1957) distinguished between two components of the economic, cost or profit efficiency of a decision-making unit (DMU); technical efficiency and allocative efficiency. First, technical efficiency reflects the ability of the DMU to obtain maximum output from a given set of inputs. Second, allocative efficiency indicates the ability of the DMU to employ inputs in optimal proportions, given their respective prices and a given production technology. Leinbenstein (1966) states that errors, lags between the choice of the production plan and its implementation, human inactivity, distorted communication, and uncertainty cause deviations from the efficient frontier, which are called X-inefficiencies.

Allocative efficiency and technical efficiency both measure the deviation from the efficient frontier where the best practice banking firms operate, which are characterised as minimum costs or maximum profit input usage in the industry. Berger, Hunter and Timme (1993) indicate that X-inefficiencies in banking account for approximately twenty percent or more of total banking costs, while scale and scope efficiencies, when they can be accurately estimated, are usually found to account for up to five percent of total banking costs. Similarly, Berger and Humphrey (1997) survey the efficiency literature in banking and found that cost X-inefficiencies are within the range of twenty to thirty percent, and they tend to dominate the effects of scale and scope economics, which are found to be within the range from five to ten percent.

De Young (1997) explores the efficiency frontier analysis approaches and their advantages over classical accounting ratios. Cost and profit frontier analysis does not require the construction of peer groups of banks with similar characteristics, but uses, in lieu, statistical technique to select the best practice banks. De Young (1997) observes that bank efficiency is a complicated phenomenon and this requires the use of sophisticated analytical tools to solve optimisation problems. On the other hand, accounting ratio analysis does not control for input mix and output mix and other factors that may explain differences in firm-level efficiency. Efficiency frontier analysis allows

[102] This tends to be done using the DEA approach.

users to estimate bank inefficiencies for any size of sample that may include thousands of observations, solving, as a consequence, the problems related to peer group selection.

4-2-3-2 Allocative Efficiency

Allocative inefficiencies, as defined by Berger, Hunter and Timme (1993), consist of the increase in costs or losses of profit from making poor choices of inputs and outputs, including poor production plans. A banking firm might produce too much of one type of loan but too little of another based on misperceptions of their relative returns. For instance, a bank might conduct a poor assessment of the relative credit risks, or it may not embrace the benefits of diversification, or a bank might incorrectly assess the effects of interest rate changes in the value of fixed-rate investments. Lovell (1993) defines allocative efficiencies as the ability of the banking firm to avoid waste by either producing as much output within the optimal usage of inputs.

According to Evanoff (1999), allocative inefficiency occurs when inputs are employed in suboptimal proportions, due mainly and typically to regulations. Regulation may require banks to use inputs in pre-defined proportions, such as the requirement of using more capital than deposits, or visa versa, in certain funding operations. These required proportions would most likely result in a production or intermediation process that would be less efficient than the unrestricted process. In addition, Evanoff (1999) highlights the role of regulations that frequently results in unintentionally inefficient bank behaviour. For instance, price restrictions aiming at providing banks with an inexpensive source of funding may result in significant bank expenses to avoid the restrictions. In addition, bank entry regulations may result in low-quality bank services, as entry barriers may restrict the mechanism that make poor quality banks be driven out of the market by efficient banks. Thus, regulation is a major reason for the existence of allocative inefficiency.

4-2-3-3 Technical Efficiency

Technical inefficiencies, as defined by Berger, Hunter and Timme (1993), consist of the increase in cost or losses in profits from failing to meet plans designed at the choice-making level. Technical inefficiencies could occur if a bank produces fewer outputs or uses more inputs than hypothetically a fully efficient bank. For instance, a technically inefficient banking firm is associated with the characteristic of making fewer loans than would be the case for a technically efficient banks that has the same objectives. Evanoff (1999) relate technical inefficiency to the underutilisation or mismanagement of inputs.

Technical efficiency can be decomposed into pure technical efficiency and scale efficiency. First, according to Webster, Kennedy and Johnson (1998), pure technical efficiency measures the proportional reduction in inputs that could be achieved if the firm operated on the variable returns to scale frontier. If the firm is able to achieve this, then further input reductions could be achieved by operating at the constant returns to scale. Evanoff (1999) notes that pure technical efficiency occurs when more of each input is used than should be required to produce a given level of output. This implies that banks employ the proper mix of inputs but mismanage them. Second, according to Oster and Antiosh, (1995), scale efficiency refers to banks or branches achieving an optimum size for producing financial services and thereby, ensuring operations at the minimum point of the average cost curve. Scale efficiencies reflect a situation where a firm can produce its current level of output with fewer inputs assuming constant returns to scale, which refers to the ability to avoid waste by operating at the most productive scale.

4-3 Scale and Scope Economies[103]

4-3-1 Scale Economies for a Single Output form

De Young (1997) defines scale economies as cost savings from spreading fixed costs over larger quantities of outputs and from making better use of specialised labour and capital inputs. They reflect how costs are affected when output expands, by referring to the relationship between a firm's per unit average production cost and production quantities.

Economies of scale are calculated as the ratio of the proportional change in costs relative to the proportional change in outputs. If the proportional change in costs is equal to the proportional change in outputs, a bank is said to be operating at constant returns to scale.

[103] Frequently attributed to Schumpeter (1942), the association of form size with scale and scope economies, market power, and the ability to aggregate inputs is widely asserted to confer performance advantages on large forms.

If the proportional change in costs exceeds the proportional change in outputs, a bank is said to be operating at decreasing returns to scale. Thus, scale diseconomies occur when average production costs start to rise with outputs beyond certain quantities of production. Scale diseconomies may arise because it may be more costly to manage a very large firm, or because the managers of a large firm become entrenched and therefore concerned more about maximising their own welfare than that of shareholders.

Berger and Humphrey (1994) and Clarke (1996) review surveys by Mester (1987), Clarke (1988), Humphrey (1990), Berger, Hunter and Timme (1993) to conclude that scale economies in banking are represented by an average cost curve that tends to have a relatively flat U-shape with medium-sized banks being slightly more scale efficient than either large or small banks. Only small banks appear to have the potential for scale efficiency gains, but the measured scale economies are in the order of up to five percent. William, Gilbert and Yeager (2001) note that hypothetical or actual cost and profit efficiency gains can be obtained through greater geographic or industry diversification. They refer to Boyd and Graham (1998) who found significant cost and profit efficiency gains after small-bank mergers. If the average cost curve is U-shaped[104], it implies that there is an optimal scale of production at which the peer unit average production cost is minimised.

Thus, for a single output bank, scale economies are related to the relationship between the behaviour of both total costs and output. De Young (1997) states that banking deregulation allows banks to grow bigger by acquiring and merging with other banks and entering new geographic markets, which will be reflected in reducing unit costs. That is, consolidation and market and geographic diversification may hypothetically result in reducing per unit cost by capturing scale economies.

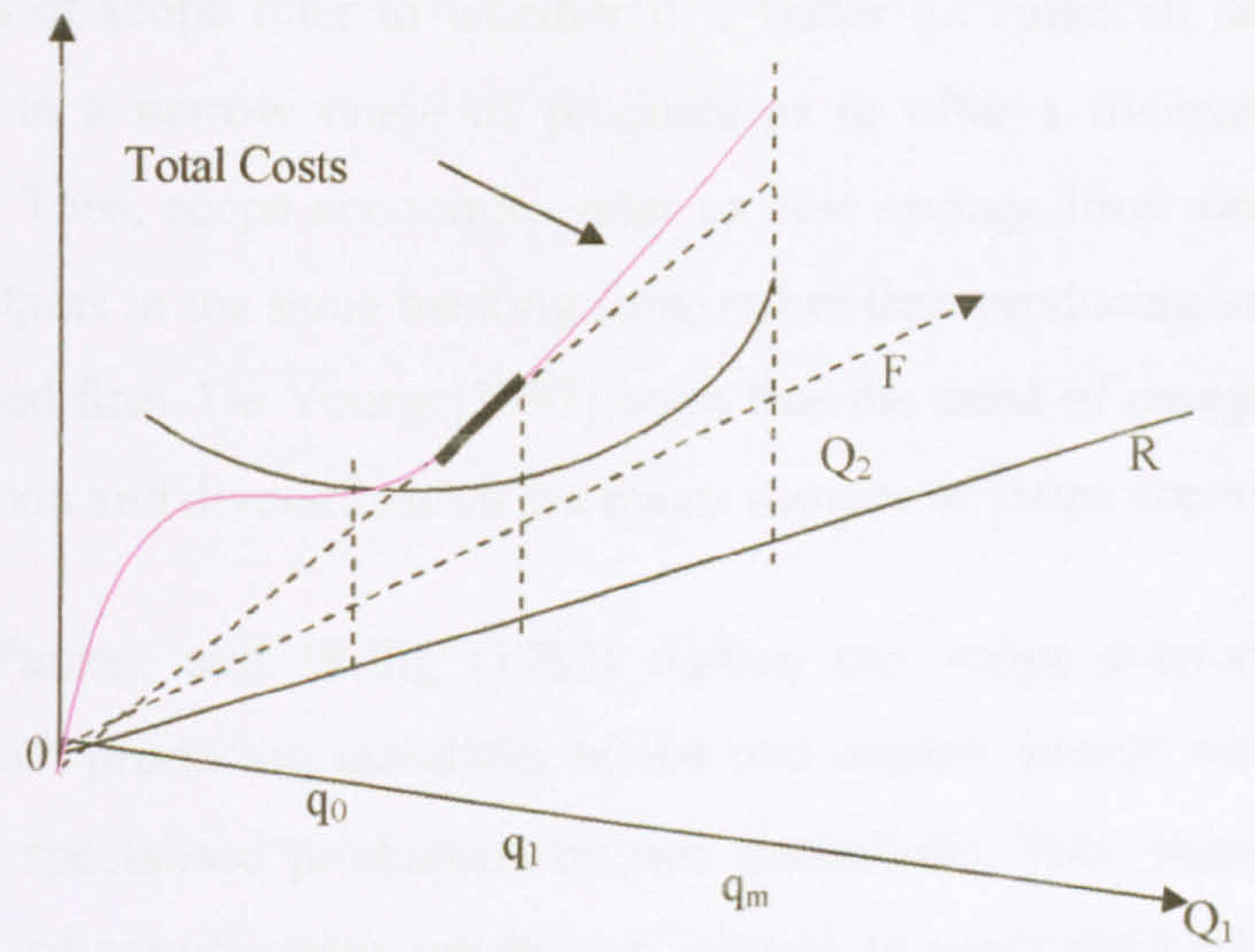
4-3-2 Scale Economies for a Multi-Output form

Even though scale economies for a multi-product form are based on the same concept as in the case of a single output firm[105], there are some complications in terms of measurement. Baumol, Panzar, and Willig (1982) note that measuring scale economies in

[104] Due to economies of scale at a low output level and diseconomies of scale at a high output level.
[105] In both cases, scale economies reflect the behaviour of total costs and output(s).

the case of single-output firms tend to be relatively simple and can be undertaken by measuring total cost change to the total output change ratio. However, the aforementioned authors recognise that in the case of multi-product firms, measuring scale economies tends to be more complicated, as changes in all outputs produced by a bank have to be included. Baumol, Panzar, and Willig (1982) suggest the concept of Ray Average Cost (RAC) or Ray Economies of Scale (RES) to overcome scale economies measuring complications that occur in the case of multi-product firms. The RAC or RES concept is illustrated in Figure 4-2, which present scale economies for a firm with multi-outputs.

Figure 4-2 Scale Economies for a Multi-output form[106]



As Figure 4-2 shows, and taking an example of two outputs, a bank's ray economy of scale is calculated as the sum of the cost elasticities of output for its three output services:

$$R = \sum_{j=1}^{2} \frac{\ell \ln TC}{\ell \ln q_j} \tag{4.1}$$

Since the derivatives are functions of the observed bank inputs and outputs and not merely of the estimated parameters, each ray economy of scale is applicable only to a

[106] Source: Molyneux, Altunbas and Gardener (1996), p 141.

given bank at a given mix of output. A ray economy of scale measures the total elasticity of production of the bank, showing whether costs will increase by more or less than one percent for each percent increase in production of all three services. Elasticity's greater than unity imply diseconomies of scale and values less than unity imply economies of scale; whereas unity denotes constant returns to scale.

4-3-3 Scope Economies

William, Gilbert and Yeager (2001) mention that economies of scope are present if cost savings or performance benefits are realised when two or more activities are conducted jointly in comparison to when these activities are conducted separately. In the standard analysis of production, scope economies result when activities can share productive inputs at little or no additional cost. Similarly, Cummins, Weiss, and Zi (2003) note that economies of scope refer to whether it is better for financial services organisations to specialise in a narrow range of products or to offer a diversity of products to their customers Thus, scope economies refer to cost savings from simultaneously producing several outputs in the same banking firm, rather than producing each output separately in a specialised firm. De Young (1997) notes that the trend of deregulation and product de-specialisation and diversification are major sources of scope economies in banking.

Baumol, Panzar, and Willig (1982) outline that scope economies quantify the cost savings from producing quantities of the two outputs jointly within a single institution relative to specialised production by two institutions. This measure thus represents the economies of simultaneous production relative to specialised production. According to Pulley and Braunstein (1992) and Pulley and Humphrey (1993), economies of scope are measured by evaluating the cost of specialised versus joint production firms. Mathematically, scope economies can be calculated as follows;

$$SCOPE=[(C(q_1, 0,\ldots\ldots,0;r) + (C(0,q_2, 0,\ldots\ldots,0;r) + C(0,\ldots\ldots0,q_m;r) - (q_1 + q_2 \ldots\ldots + q_m;r)/ C(q_1 + q_2 + \ldots\ldots + q_m;r) \quad (4.2)$$

Where C( ) refers to the cost function, q_i, (i= 1, 2, ...m) refers to outputs, and r is a vector of *n* input prices.

Cummins, Weiss, and Zi (2003) state two major hypotheses about economies of scope. These are the *conglomeration hypothesis*, which holds that operating a diversity of business can add value by exploiting cost and revenue scope economies, and the *strategic focus hypothesis*, which holds that firms can best add value by focusing on core businesses.

According to the *conglomeration hypothesis*, scope economies can originate from cost complementarities, including the sharing of inputs such as brand names, customer lists, and managerial expertise. Other potential sources of cost economies of scope include earnings diversification, which permits the banking firm to operate with higher leverage ratios, more efficient use of capital through internal capital markets, and other factors. Economies of scope also can arise due to revenue complementarities, resulting from the creation of "one-stop banking" opportunities for consumers that reduce search costs and enhance consumer value and product quality.

The *strategic focus hypothesis* holds that conglomeration is likely to destroy firm value by introducing cost and/or revenue diseconomies. Operating a conglomerate rather than a focused firm may increase management and coordination costs, exacerbate principal-agent conflicts, and create costly cross-subsidization among subsidiaries due to inefficient internal capital markets. On the revenue side, conglomeration may destroy firm value if specialised firms develop superior expertise that is valued by consumers or if specialisation facilitates the reduction of informational asymmetries that can foster adverse selection. The development of electronic (internet) market channels also may have reduced the value to consumers of financial supermarkets. Because scope economies are most likely to exist for closely related products focusing on a single, broadly defined industry enables us to provide a strong test for the existence of both production and consumption scope economies.

Berger, Hanweck and Humphrey (1987) identify four major sources of scope economies, which relate to the spreading of fixed costs, information economies, risk reduction, and consumer cost economies. Pulley and Humphrey (1993) also identify two main sources of scope economies in banking, which are related to cost spreading and cost complementarities. First, economies of scope can arise by spreading fixed costs over an extended product mix. For instance, a bank may produce deposits and loan services jointly rather than separately. Also, a bank may use the same inputs, including computers, accounting information, branches and labour to produce new loans and products. Second, banks can realize economies of scope through cost complementarities among different products. For instance, if a bank can predict a customer's qualities based on his-her history regarding depositing funds, this will be an advantage in evaluating his/her creditworthiness. As a consequence, the bank can lower credit losses and, at the same time, can lower marketing costs through cross-selling new products to the same customer. Third, Berger, Hanweck and Humphrey (1987) state that economies of scope can arise from the consumption concept of "one-stop shopping or banking". Customers can reduce their transaction, transportation, and search by utilizing the same system for different products. This concept lies behind the concept of universal banking as it offers bank customers the advantage of opening a universal account with different product access.

4-3-4 Problems Relating to the Computation of Scale Scope Economies

In their review of the scale and scope efficiency literature, Berger, Hunter and Timme (1993) observe that, in banking, the average cost curve has a relatively flat U-shape, with medium-sized firms being slightly more scale efficient than either very large or very small banks. They also note that scale and scope economies studies vary with regards to the location of the bottom of the average cost U curve, which is the most efficient point indicating optimal firm size.

Berger, Hunter and Timme (1993) and McAllister and McManus (1993) note that there is no consensus as to the optimal bank size in the empirical literature. This is the consequence of the fact that studies investigating bank scale and scope economies, vary in terms of their examined sample and size. For instance, taking the US case, Berger, Demsetz, and Strahan (1999) find that efficient scale banking organisations tend to be medium sized within the range of $100 million to $25 billion of assets. However, Wheelock and Wilson (2001) apply the parametric and non-parametric approaches for the period 1985-94, and locate the maximum efficient scale banks within the range size of \$300 million and \$500 million of assets. Banks below this range face increasing returns to scale, while banks in or above the range face constant or decreasing returns to scale.

In addition, Berger, Hunter and Timme (1993) and McAllister and McManus (1993) note that there is no consensus in terms of methodological approaches used to estimate scale and scope economies, due to the fact that studies investigating scale and scope use different methodological approaches to evaluate the concerned economies as there is also limited sufficient information on specialised banking firms. Some functional forms that have been used to model the cost characteristics of the banking industry may not be capable of incorporating the technologies of both large and small banks. For instance, the aforementioned authors note that the use of a translog cost function specification to estimate scale and scope economies may be a poor approximation when applied to banks of all sizes. The cost translog functional form forces large and small banks to lie in a symmetric U-shaped average cost curve and disallows other possibilities, including an average cost curve that falls up to some output point and remains constant thereafter. To overcome this problem, it is suggested that more researchers use flexible functional forms such as the Fourier Flexible functional form (Berger, Hunter and Timme, 1993), or use non-parametric methods (McAllister and McManus, 1993), or replace the cost function by a profit function (Hunter and Timme, 1995), and focus on X-efficiency measurement rather than scale and scope economies.

4-4 Efficiency Concepts: Cost, Standard Profit and Alternative Profit

Berger and Humphrey (1997) and Berger and Mester (1997) identify three concepts that offer a definitional framework for the examination of cost and profit efficiency in banking. These are cost efficiency, standard profit efficiency, and alternative or non-standard profit efficiency. These concepts are believed to be founded on economic optimisation in reaction to market prices and competition, as banking firms prefer to represent the best practice in the industry, in terms of maximising profits or minimising costs. Cost efficiency studies in banking appear to be more widespread than profit/revenue efficiency studies. The majority of studies surveyed by Berger and Humphrey (1997) examined cost efficiency. This survey which covered 130 bank efficiency studies in 21 countries, reviewed only 14 papers that examines revenue and/or profits efficiency.

Economies of scale and scope are different from X-efficiency. The measurement of economies of scale and economies of product mix involves the consideration of the characteristics of a function or frontier. Productive efficiency measurement differs from the measurement of economies of scale and product mix in that inefficiency of an individual institution is viewed as a distance from the best practice function or frontier.

4-4-1 Cost Efficiency

Cost efficiency measures the closeness of a bank's cost to the best-practice bank's cost. Mathematically, cost efficiency is represented in a form of a selected cost function[107] that relates the variable costs to the prices of variable inputs, the quantities of variable outputs, and any fixed netputs, (including control and environmental variables), and random error, which may temporarily give banks high or low costs. In addition, the cost function includes an inefficiency factor that incorporates both allocative inefficiency (price component) and technical inefficiency (physical component). While allocative inefficiency occurs from a bank failing to react optimally to the relative price of inputs, technical inefficiencies arise from employing too much of the inputs to produce a certain mix of outputs.

Berger and Mester (1997) note that the cost efficiency ratio is a useful indicator to measure bank efficiency. This ratio is calculated as the proportion of costs or resources that are used efficiently, and range over [1, 0]. It assigns one for a best practice within the observed data and zero for the most cost inefficient within the same dataset. A bank with a cost efficiency ratio of 0.70 is seventy percent efficient or equivalently wastes thirty percent of its costs relative to a best practice experiencing the same regulatory conditions.

[107] This is the case of parametric approaches.

Hence, the cost efficiency of a bank is defined as the estimated cost required to producing the bank's output vector if this bank was as efficient as the best practice bank in the sample facing the same set of variables divided by the actual costs of the bank, adjusted for random error (Berger and Mester, 1997).

4-4-2 Standard Profit Efficiency

Standard profit efficiency provides a measure of how close a bank is to producing the maximum possible profits as a best practice firm on the frontier, given a particular level of inputs and output prices and other exogenous variables. Standard profit efficiency estimates are derived from a profit function that specifies variable profits and takes variable output prices as given. The profit function uses a measure of the variable profit as a dependent variable, which allows for consideration of revenues that can be earned by varying outputs as well as inputs. The consideration of exogenous output prices allows for inefficiencies in the choice of outputs when responding to these prices or to any other arguments of the profit function.

The standard profit efficiency measure is represented in terms of a ratio that predicts actual profits to the predicted maximum profit that could be earned if the bank was as efficient as the best practice bank in the sample, net of random error. A bank with a ratio equal to one is considered as the best practice bank. A bank with a 0.70 ratio indicates that because of excessive costs or deficient revenues, or both, the bank is losing about thirty percent of the profit if could be earning.

Berger and Mester (1997) consider that the profit efficiency concept dominates over the cost efficiency concept for evaluating the overall performance of banks according to the argument that profit efficiency is founded in the more accepted economic objective of profit maximisation. The latter requires that managerial duties should equally concentrate on raising the marginal dollar of revenues and reducing a marginal dollar of costs. For example, a bank that spends one dollar to generate two dollars of revenues, all else held equal, would appropriately be measured as being more profit efficient, but might inappropriately be measured as being less cost efficient. In addition, profit efficiency is based on a comparison with the best practice point of profit maximisation with the sample of observations. In contract, cost efficiency evaluates performance by holding output constant at its current level, which generally may not correspond to an optimum. A bank that is relatively cost efficient at its current output may or may not be cost efficient at its optimal output level, which typically involves a different scale and mix of output.

Berger and Mester (1997) conclude that the standard profit efficiency measure may take better account of cost inefficiency than the cost efficiency measure itself, due to the fact that it captures cost inefficiency deviations from the optimal point. However, the use of the standard profit function assumes that output markets are perfectly competitive so that banks are price-takers in both output and input markets as is specified as a function of input and output prices. In contrast, the alternative profit function, discussed below, assumes that banks can have some power in determining output prices.

4-4-3 Alternative Profit Efficiency

Alternative profit efficiency measures how close a bank comes to earning maximum profits given its output level rather than its output prices. It is measured as the ratio of predicted actual profits to the predicted maximum profits for a best practice bank. The alternative profit measure uses the same dependent variable as the standard efficiency measure and the same exogenous, explanatory and independent variables as the cost function. That is, the alternative profit efficiency function employs output quantities rather than output prices as in the standard profit efficiency function[108] (Berger and Mester, 1997).

Berger and Mester (1993) state four major situations in which the alternative profit efficiency function specification is preferred over the standard profit specification. These are; first, when there are differences in the quality of banking services; second, when markets are not perfectly competitive so banks might have relative market power in pricing their outputs; third, when outputs are not continuous variables, so that banks can not achieve every output scale and products mix; and finally, when output price information is not available.

[108] This is the case of parametric approaches.

4-5 Approaches to Measure Bank Efficiency: Parametric and Non-Parametric Approaches

The bank cost and profit efficiency literature has used two major families of methodological approaches to estimate banking efficiency scores. These are the parametric and non-parametric approaches. The parametric (or econometric) approaches derive efficiency estimates from an assumed functional specification based on the three concepts of efficiency elaborated by Berger and Mester (1997) (cost, standard and alternative profit efficiency). The non-parametric approach, mainly Data Envelopment Analysis (DEA), is a linear programming technique that can be used to measure efficiency distances between a bank observation and the best practice banks within an examined sample.

According to Mustafa (1999), the main difference between parametric and non-parametric approaches relate to varying assumptions about random noise and the structure of the production technology. The parametric approach attempts to distinguish between the effects of noise from the effects of inefficiency. The parametric model requires the specification of functional forms and it confounds the effects of mis-specification of functional form with inefficiency. In contrast, the non-parametric approach uses a linear programming technique that assembles noise and inefficiency together and calls this combination "inefficiency". Lee and Holland (1999) state that the non-parametric approach estimates efficiency relative to other observed units in the sample without specifying a functional form, and therefore, avoids making errors of specification associated with functional forms.

Bauer et al. (1997) identify four major statistical approaches to modelling bank efficiency. This includes one non-parametric approach, represented by Data Envelopment Analysis, and three parametric approaches, which are the Stochastic Frontier Approach, the Thick Frontier parametric Approach, and the Distribution-Free Approach.

Bauer et al (1997) proposes consistency tests that comprise undertaking a number of consistency conditions and making efficiency measures derived from any of the parametric or non-parametric approaches subject to these consistency conditions. For example, this can be carried out by conducting a simple rank correlation to check whether efficiency estimates are consistent across different methodologies.

4-5-1 Parametric Approaches

The parametric approach is an econometric (stochastic) approach that has been extensively used in studies that investigate bank cost and profit efficiency[109]. The econometric approach specifies a cost or profit functional form resulting in a structure being imposed on the shape of the frontier. As noted above, the family of parametric approaches include the stochastic frontier approach, the thick frontier approach, and the distribution-free approach.

4-5-1-1 The Stochastic Frontier Approach (SFA)

According to the Stochastic Frontier Approach (SFA), a bank is inefficient if its costs (profits) are higher (lower) than efficient banks (best practice), assuming they have the same outputs/inputs composition. As documented by Kumbhakar and Lovell (2000), the stochastic frontier approach (SFA) was first suggested by Aigner, Lovell and Schmidt (1977), and since it has been extensively used in the analysis of the cost and profit efficiency of banking sectors. For instance, Kaparakis, Miller and Noulas (1994), Kwan and Eisenbeis (1996), and Einsenbeis, Ferrier and Kwan (1999) employ the stochastic frontier analysis to investigate cost efficiencies for various samples of US banks.

Aigner, Lovell and Schmidt (1977) developed a stochastic production model by appending a random disturbance term to the production function. The error term is assumed to be the sum of two random components. These are a noise term component, which is symmetrically distributed around zero to model measurement errors and unobservable shocks, and an error term component, which is strictly negative to measure inefficiency.

Mathematically, the stochastic frontier model can be shown as:

$$TC \text{ or } TP = f(Q_i, P_i, B_i) + \varepsilon_i \tag{4.3}$$

[109] Examples of studies that use parametric methods are reviewed in the next chapter.

and $\varepsilon_i = v_i + \mu_i$ (cost function), and $\varepsilon_i = v_i - \mu_i$ (alternative profit function) (4.4)

Where

TC_i is the observed total costs,

TP_i is the observed total profits,

Q_i is the vector of outputs,

P_i is the vector of inputs,

B_i is a vector of parameters

ε_i is the vector term from the cost function, in which v is a random error and assumed to follow a normal distribution; and $\mu \geq 0$ is inefficiency and assumed to follow a half-normal distribution, and

According to Aigner, Lovell and Schmidt (1977), the stochastic frontier approach assumes that the composite error components, μ and v, are independently distributed. The inefficiencies component, μ, follows an asymmetric half-normal distribution; μ=N(0, σ_μ^2), reflecting a positive disturbance to capture the effects of inefficiency, whereas the random error, v, follows a symmetric two-sided standard normal distribution with zero mean and variance, σ_v^2, to capture the effects of the statistical noise. Both components of the composite error term are orthogonal to the inputs, outputs and or any other cost or profit efficiency regressors specified in the modelling equation. Berger and Humphrey (1997) state that the efficiency estimation of each banking firm is based on the conditional mean of the inefficiency effects term component, μ, given the residual, which is the estimate of the composed error. Maximum likelihood procedures are used to quantify the unknown parameters of the model (Battese and Coelli, 1992 and 1995). Thus, the stochastic frontier suggests that a bank's observed total costs deviates from the cost efficient frontier due to random noise and possibly inefficiency.

One major disadvantage of the stochastic frontier approach is the arbitrary choice of the distributional assumption in terms of the inefficiency component of the composite error term. For instance, earlier studies such as Stevenson (1980) and Greene (1990) use the half-normal and gamma distribution models, respectively. Cebenoyan et al. (1993) adopts the truncated normal model where Mester (1993) and Allen and Rai (1996) use the half normal distribution. More recent studies include Vennet (1998), who assumes both distributions; the half-normal and exponential, and finds little difference between the two distributions. However, Altunbas and Molyneux (1994) claim that efficiency estimates are relatively insensitive to different distributional assumptions when testing the half normal, truncated normal, exponential and gamma distributions, as they find that all these distributions generate relatively similar inefficiency estimate levels for a sample of German banks.

4-5-1-2 The Thick Frontier Approach (TFA)

The Thick Frontier Approach (TFA) was suggested by Berger and Humphrey (1992a), to be used as an alternative method to the stochastic frontier approach for investigating cost and profit efficiency. As in the case of the stochastic frontier approach, the thick frontier approach employs an underlying functional form to the cost or profit function. However, Bauer et al. (1997), Bauer et al. (1999) and Berger and Humphrey (1997) mention that the thick frontier approach is different from the stochastic frontier approach by the fact that the thick frontier approach sorts the examined sample into quartiles according to average costs, or average profits. The approach proceeds with the estimation of two "thick frontiers", one for the lowest and one for the highest average cost/profit quartile of firms. The regression of the thick frontier approach is estimated using only the best performing best practice quartile. This quartile includes firms that have the lowest average cost (or highest average profit) for their class size.

Thus, the thick frontier approach assumes that X-inefficiencies are estimated by measuring deviations in predicted costs between the lowest cost (or highest average profit) quartile and the highest average costs (or lowest average profit) quartile. The cost or profit frontier is constructed using efficiencies of the lowest average cost or highest average profit quartile. Other banks in the remaining three quartiles are assumed to include inefficient observations.

Berger and Humphrey (1997) state that the thick frontier approach does not require the imposition of distributional assumptions on the functional form inefficiency error terms.

The only assumption that the thick frontier approach has, is that inefficiencies exist, and represent differences between the lowest average cost (or highest average profit) quartile and the highest average cost (or lowest average profit) quartile. Bauer et al. (1997) notes that the difference represented by the two quartiles, indicates the general level of overall efficiency of the sample. The thick frontier approach, however, does not provide point estimates of cost and profit efficiency for all individual firms or banks in the sample.

4-5-1-3 The Distribution-Free Approach (DFA)

The Distribution-Free Approach (DFA) was introduced by Berger (1993), and since it has been used in the literature on bank efficiency, particularly, on panel data samples. For instance, Alan and Rai (1996) employ the distribution-free approach to estimate cost efficiency for banks operating in fifteen developed countries over the period 1988-1992.

Similar to the other two abovementioned approaches, the distribution free approach requires the specification of a functional form for the cost or profit function applied to cross-sectioned or time-series data. However, Bauer et al. (1997) notes that the distribution-free approach does not require the imposition of a specific shape on the distribution of the inefficiency term as in the case of the stochastic frontier approach. The distribution-free approach assumes that there is "core" efficiency or average efficiency for each firm, which tends to be constant over time. Although the distribution free approach does not require any assumptions regarding the distributional features of the inefficiency term as in the stochastic frontier approach, it does rely on the strong assumption that inefficiencies are constant over time.

There are three main approaches suggested by Berger and Humphrey (1997) and Bauer et al. (1997) that can be used to derive distribution-free efficiency estimates. These are the DFA-P WITHIN, the DFA-P GLS (Generalised Lest Squares) and DFA-P TRNCATED approaches.

First, DFA-P WITHIN is a fixed-effects distribution-free model. It estimates inefficiency from the value of a firm-specific dummy variable derived by measuring the firm's cost function variables relative to deviations from firm-specific means. Efficiency is estimated using the deviation from the most efficient firm's intercept term. Single sets of parameters are to be obtained so inefficiency is fixed over time.

Second, the DFA-P GLS applies generalised least squares to panel data to obtain single sets of parameters. It assumes that banks inefficiencies are fixed over time and that inefficiency is uncorrelated with the regressors. In the cost function estimated by Bauer et al. (1997), a separate intercept for each firm is recovered from the panel estimates, and considered as an average residual for that firm over time. The firm that has the smallest average residual is presumed to be the most efficient firm. The latter is used as a benchmark to measure the inefficiency of all other firms in the sample.

Third, the DFA-P TRUNCATED approach is used to estimate cost or profit function separately for each year. The average efficiency estimates are based on the average residuals for each bank. Berger (1993) suggests that if average residuals are extreme, their effects could be limited by truncating the residuals at both the upper and lower one percent of the distribution.

Overall, different parametric approaches are characterised by the way in which random error and inefficiency are broken down. While the results of the stochastic frontier approach appear to be dependent on a priori distributional assumptions, the thick frontier approach sorts the data in arbitrarily selected groups, and the distribution-free approach makes assumptions as to the evolution of efficiency over time. This is in contrast to the non-parametric approaches, such as Data Envelopment Analysis (DEA), which ignores the random element and assumes that all deviations from best practice can be assumed to be inefficiency.

4-5-1-4 Efficiency Measurement Functional Forms[110]

The parametric approach derives efficiency estimates from an assumed functional form, or a mathematical relationship between output and inputs prices, based on the concepts of efficiency recommended by Berger and Mester (1997). These relate to cost, standard and alternative profit functional forms. Each of these functions can be represented in a wide range of forms. The most common of which have been the Translog and Flexible Fourier

[110] For more details on efficiency measures (translog and Fourier Flexible, see Barger et al. (1997), Altunbas et al (1999), and Kumbakhar and Lovell (2000).

form[111]. For both functional forms, efficiency is measured as the distance from a cost or profit function or frontier, which is estimated including a disturbance term. This disturbance term has two components, inefficiency and random error. While the random error is assumed to be distributed as a symmetrical two-sided term, efficiency is represented by a one-sided disturbance component where efficiency represents all the effects of the data.

4-5-1-4-1 The Translog Functional Form

The translog function, which is used in the empirical analysis in this study, can take the following form;

$$Ln(TC \ or \ TP_i) = \alpha_0 + \sum_{i=1}^{m} \alpha_i \ln Q_i + \sum_{j=1}^{n} \beta_j \ln(P_i) + \frac{1}{2}\left[\sum_{i=1}^{m}\sum_{J=1}^{m} \delta_{ij} \ln Q_i \ln Q_j + \sum_{i=1}^{n}\sum_{J=1}^{n} \gamma_{ij} \ln(P_i)\ln(P_j)\right]$$
$$+ \sum_{i=1}^{m}\sum_{J=1}^{n} \rho_{ij} \ln Q_i \ln(P_j) + \varepsilon_i \qquad (4.5)$$

Where:

TC_i and TP_i are Total costs and Total Profit, respectively.

Q_i is Output I vector for firm i;

P_i is input price vector for firm i;

$\varepsilon_i = v_i + \mu_i$ (cost function) and $\varepsilon_i = v_i - \mu_i$ (alternative profit function) is an error composite term that is composed of i) v_i, is two-sided term error term representing statistical noise which is assumed to be independently and identically distributed; and ii) μ_i, is non-negative (or one-sided) random variable that represents inefficiency effects and assumed to be distributed independently v_i,.

The standard symmetry is also imposed on the translog terms of the function; that is, $\delta_{ij} = \delta_{ji}$, and $\gamma_{ij} = \gamma_{ji}$, a well as the assumption of linear homogeneity in factor prices: $\sum_{J=1}^{n} \beta_{ji} = 1; \sum_{i=1}^{n} \gamma_{ij} = 0$ and $\sum_{J=11}^{n} \rho_{jij} = 0$.

[111] These two extensively used functional forms are discussed in the empirical chapter. The empirical analysis conducted later in this thesis uses the translog functional form.

4-5-1-4-2The Fourier Flexible Functional Form

The Fourier Flexible functional form, suggested by Gallant (1981), contains besides the translog terms, Fourier terms. The Fourier is a cost or profit function that includes the full translog tems and all-first, second, and third-order trigonometric terms as well as X-efficiency and random error terms. The Fourier Flexible function can take the following form;

$$Ln(TC\ or\ TP) = \alpha_0 + \sum_{i=1}^{m}\alpha_i \ln Q_i + \sum_{j=1}^{n}\beta_j \ln(P_j) + \frac{1}{2}\left[\sum_{i=1}^{m}\sum_{J=1}^{m}\delta_{ij}\ln Q_i \ln Q_j + \sum_{i=1}^{n}\sum_{J=1}^{n}\gamma_{ij}\ln(P_i)\ln(P_j) +\right]$$
$$+\sum_{i=1}^{m}\sum_{J=1}^{n}\rho_{ij}\ln Q_i \ln(P_j) + \sum_{i=1}^{m}[\lambda_i COS z_i + \theta_j SIN z_i] + \sum_{i=1}^{m}\sum_{j=1}^{m}[\lambda_{ij} COS(z_i + z_j) + \theta_{ij} SIN(z_i + z_j)] \quad (4.6)$$
$$+\sum_{i=1}^{m}\sum_{j\geq i}^{m}\sum_{\substack{k\geq j \\ k\neq i}}^{m}[\lambda_{ijk} COS(z_i + z_j + z_k) + \theta_{ijk} SIN(z_i + z_j + z_k)] + \varepsilon_i$$

Where

TC_i and TP_i are Total costs and Total Profit, respectively;

Q_i is Output vector for firm i;

P_i is Input price vector for firm i;

$\varepsilon_i = v_i + \mu_i$ (cost function) and $\varepsilon_i = v_i - \mu_i$ (alternative profit function) has the same characteristics as the composite error term as in the translog functional form. z_i is adjusted terms of the natural log of output LnQ_i so that they span the interval $[.1.1\pi,.0.2\pi]$; the formula for z_i is $(.2\pi\text{-}\mu.a+\mu,\ln Q_i)$ where [a,b] is the range of $\ln Q_i$ and $\mu=(.9.2\pi\text{-}.1.1\pi)/(b\text{-}a)$. Thus, the Fourier terms are included only for outputs and do not affect input prices as these are only expressed by the translog terms.

Similar to the translog functional form, the standard symmetry is also imposed on the translog terms of the function; that is, $\delta_{ij}=\delta_{ji}$, and $\gamma_{ij} = \gamma_{ji}$, and the assumption of linear homogeneity in factor prices is also imposed; $\sum_{j=1}^{n}\beta_{ji} = 1; \sum_{i=1}^{n}\gamma_{ij} = 0$ and $\sum_{j=11}^{n}\rho_{kj} = 0$.

4-5-1-5 Cost, Standard Profit and Alternative Profit Efficiency Functional Forms.

4-5-1-5-1 Cost Efficiency Functional Form

As noted earlier, cost efficiency can be measured by how close a bank's cost is to a best practice bank producing the same output bundle under the same conditions. Cost efficiency estimates are derived from a cost function, in which variable costs depend on the prices of variable inputs, the quantities of variable outputs and any other netputs or control variables and environmental factors[112], and random error as well as efficiency. Such a cost function may be written as follows

$$TC_i = f_i\,(P_i,\, Q_i,\, \beta_i,\, Z_i,\, v_i,\, \mu_i) \qquad (4.7)$$

Where

TC_i denotes Total Costs for firm i;

f_i denotes some functional form that describes the relationship between Total Costs, TC_i and the other variables included in the equation;

P_i is the vector of prices of variable inputs;

Q_i id the vector of quantities of variable outputs;

β_i is a vector of the estimated coefficients;

Z_i indicates the quantities of any fixed netputs, which are included to account for the effects of these netputs on variable costs (such as environmental variables);

v_i and μ_i denote the random error term that incorporates measurement error that may temporarily give banks high or low costs. While v_i represents statistical noise (a set of exogenous variables that may affect costs, such as external shocks, weather); μ_i denotes an efficiency factor that may raise costs above the best practice level, and which incorporates both allocative inefficiencies from failing to react optimally to relative

[112]The control variable is included in the Log variable terms of the model to control for differences and biases, whereas the environmental variables are used a separate terms and included to measure the effects of these on cost or efficiency, and are usually include as dummies (see Berger and Mester (1997) for more details).

prices of inputs, P_i, and technical inefficiencies from employing too much of the inputs to produce Q_i.

To simplify the measurement of cost efficiency, the inefficiency and random terms are assumed to be separable from the rest of the function, by transforming the two sides of the above equation into natural logs;

$$ln\mathrm{TC}_i = \mathrm{f}\,(\mathrm{P}_i, \mathrm{Q}_i, \mathrm{Z}_i) + ln v_i + ln \mu_i \qquad (4.8)$$

Where

$ln v_i + ln \mu_i$ is a composite error term.

The cost efficiency of bank b is defined as the estimated cost required to produce bank b's output vector if the bank were as efficient as the best practice bank in the sample facing the same exogenous variables divided by the actual cost of bank b, adjusted for random error, i.e.,

$$COST\ EFF = \frac{TC_m}{TC_i}. \qquad (4.9)$$

The cost efficiency ratio is the proportion of costs or resources that are used efficiently. For example, if a bank b has a cost EFF of 0.70, it is said to be seventy percent efficient or equivalently is wasting thirty percent of its costs relative to a best practice facing the same conditions. Cost efficiency ranges between zero and one, and equals one for the best practice firm within the observed data.

4-5-1-5-2Standard Profit Efficiency Functional Form

The standard profit efficiency function measures how close a bank, b, is to producing the maximum possible profits given a particular level of input and output prices and other variables. The standard profit function specifies variables profits (instead of variable cost) and assumes output prices as given. The profit dependent variable allows for the consideration of revenues that can be earned by varying outputs as well as inputs. The standard profit efficiency function is modelled as

$$ln\,(\pi_i + \theta_{m+1}) = f_i\,(\mathrm{W}_i, \mathrm{Q}_i, \beta_i, \mathrm{Z}_i) + ln v_i - ln \mu_i \qquad (4.10)$$

Where

π_i is the variable profits of a firm that includes all the interest and fee income earned on the variable output minus variable costs;

θ_{m+1} is a constant added to every firm's profit so that the natural log is taken as a positive number; it consists of the minimum total profit in the sample (π_{im}) plus one;

W_i is a vector of prices of the variable output;

Q_i id the vector of quantities of variable outputs;

β_i is the vector of estimated coefficients;

Z_i indicates the quantities of any fixed netputs, which are included to account for the effects of these netputs on variable profits;

v_i and μ_i represent is a set of environmental or market variables that may affect profits. While v_i represents random error term; and μ_i represents inefficiency effects that reduce profits.

Standard profit efficiency is measured by calculating the ratio of the predicted actual profits to the predicted maximum profits of a best practice bank facing the same conditions, net of random error, i.e.,

$$PROFITEFF = \frac{TP_m}{TP_i} \qquad (4.11)$$

The standard profit efficiency ratio is the proportion of profits (variables) that are gained efficiently. For example, if a bank b has a profit EFF of 0.70, it is said to be seventy percent efficient or equivalently is wasting thirty percent of its profits relative to a best practice facing the same conditions. Similar to cost efficiency, standard profit efficiency ranges between zero and one, and equals one for the best practice firm within the observed data.

4-5-1-5-3Alternative Profit Efficiency Functional Form

The alternative profit function measures how close a bank comes to earning maximum profits given its output levels rather than output prices. The alternative profit efficiency function has two similarities with the cost and standard profit functional forms. First, the alternative profit function uses the same dependent variable as the standard profit function, but employs the same exogenous variables as the cost function.

The alternative profit efficiency function can be stated as

$$ln(\pi_i + \theta_{m+1}) = f_i\,(P_i, Q_i, Z_{m+1}) + ln\,\mu_i - ln\mu_i \qquad (4\text{-}12)$$

Where

π_i is the variable profits of a firm, which includes all the interest and fee income earned on the variable output minus variable costs;

θ_{m+1} is a constant added to every firm's profit so that the natural log is taken as a positive number, and it is calculated in the same manner as in the standard profit efficiency functional form;

P_i is the vector of prices of variable inputs;

Q_i is the vector of quantities of variable outputs;

Z_i indicates the quantities of any fixed netputs, which are included to account for the effects of these netputs on variable costs;

ln v_i represents random error; and

ln μ_i represents inefficiency effects that reduce profits.

This form is identical to the standard function except that P_i replaces W_i in the function, generating different values for the inefficiency term, ln v_i, and random error term representing noise, while lnμ_i is a error term representing inefficiency effects. The alternative profit efficiency measure is the ratio of the predicted actual profits to the predicted maximum profits for the best practice bank.

The ratio of alternative profit efficiency can be written as;

$$ALTENATIVE\ PROFIT EFF = \frac{TP_m}{TP_i} \qquad (4.13)$$

Similar to the standard profit efficiency, the alternative profit efficiency ratio is the proportion of profits (variables) that are gained efficiently. For example, if a bank b has a profit EFF of 0.70, it is said to be seventy percent efficient or equivalently is wasting thirty percent of its profits relative to a best practice facing the same conditions. Similar to cost efficiency, standard profit efficiency ranges between zero and one, and equals one for the best practice firm within the observed data

Berger and Mester (1993) state that the alternative profit function may be helpful when firms exercise some market power in setting output prices, because it takes output prices as given and incorporates the assumption that the bank can sell as much outputs as it wishes without having to lower its prices.

4-5-2 Non-Parametric Approaches

The main non-parametric approach is represented by Data Envelopment analysis (DEA). This approach has been extensively used to investigate the input-output features of a variety of decision-making units (DMUs) including banking firms. One characteristic of the non-parametric method is that it does not impose any specific functional form. Data envelopment analysis originated from the work of Farrell (1957) and was later developed by Charnes, Cooper and Rhodes (1978) and Banker, Charnes and Cooper (1984). Many studies have used Data Envelopment Analysis to estimate efficiency in banking, such as Miller and Noulas (1996). The DEA constructs a non-parametric piece-wise frontier that envelops the data, under which all the entities lie on or below. The inefficiency score calculated by DEA is defined as the percentage reduction in the use of all inputs that can be achieved to make an observation comparable with the best observations(s) in the sample with no reduction in outputs. Thus, the most efficient banks are located on the frontier, whereas less efficient of inefficient banks are positioned under the frontier.

4-5-2-1 Data Envelopment Analysis

4-5-2-1-1 DEA Definition

Data Envelopment Analysis (DEA) is a mathematical programming technique that measures the efficiency of a decision-making unit (bank or branch) relative to other similar decision making units. The DEA model is based on two assumptions: Constant

Returns to Scale (CRS), as suggested by Charnes, Cooper and Rhodes (1978), and Variables Returns to Scale (VRS), as suggested by Banker, Charnes and Cooper (1984).

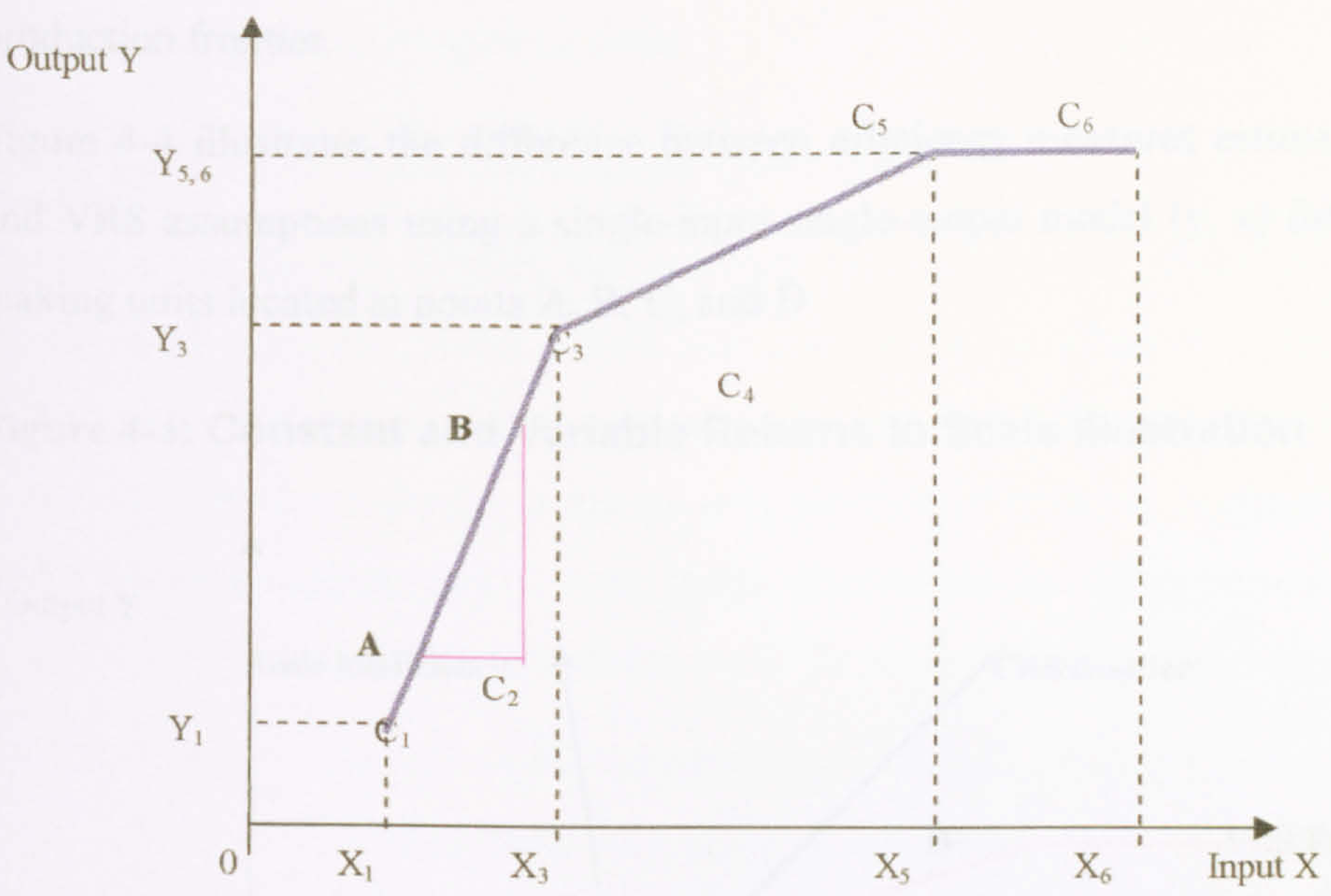
The concept of efficiency in data envelopment analysis measurement is based on either input-oriented or output-oriented approaches. First, the output-orientation approach refers to the ability of the decision-making unit to avoid wasting inputs by producing as much output as input usage allows. An output-orientated valuation seeks a projected point such that the proportional augmentation in outputs is maximised. This valuation aims to reach efficiency by focusing on productivity gains while preserving the current combination of inputs. Second, the input-orientation approach refers to avoiding wasting inputs by using as little as output production allows. An inputs-oriented valuation seeks a projected point such that the proportional reduction in inputs is maximised. This approach helps the management of the decision-making unit being evaluated to gain efficiency by maintaining current levels of outputs and decreasing the levels of inputs.

The DEA constructs a frontier that envelops the observed data point in which the data lie on or below the production or cost frontier. The distance from the computed best practice frontier represents the measured efficient frontier. A DEA efficiency score for a specific bank is defined relative to other banks in the set of banks data.

4-5-2-1-2 DEA Illustration

Yue (1992) illustrates graphically the data envelopment analysis frontier of six decision-making units; C_s. This illustration is based on the original work of Farrell (1957), which uses the single-input and single output case. Figure 4-3 shows the illustration, in which the inputs of each decision making unit is shown as Xi (i= 1, 2, 3, 4, 5, 6), and the outputs of each decision making unit is shown as Yi (i= 1, 2, 3, 4, 5, 6), and the input-output combination of each decision making unit can be shown as Cs (s= 1, 2, 3, 4, 5, 6).

Figure 4-3 DEA Production Frontier



As displayed in Figure 4-3, the input-output combinations for decision-making units C_1, C_3, C_5 and C_6 define the production frontier. The connection between these three points constructs the efficient frontier that represents achieved efficiency. Decision-making units, C_2 and C_4, lie below the frontier, which makes them inefficient since the same quantity of output can be produced with fewer quantities of inputs. However, C_2 and C_4 can both become efficient by travelling to any point on the frontier "facets" of C_1-C_3 and C_5- C_6. For example, C_2 will become efficient if it rises to point B, by producing more quantities of output, or by moving to A, by using fewer quantities of input for fewer quantities of outputs. C_2 will become more efficient if it lies anywhere on the facet AB.

4-5-2-1-3 Scale Efficiency in DEA: Constant and Variable returns to Scale

Data envelopment analysis can be used to estimate sale efficiencies based on two assumptions: constant returns to scale (CRS) and variable returns to scale (VRS). While the assumption of constant returns to scale is appropriate when all decision-making units are operating at the optimal scale, where production does not affect efficiency, variable returns to scale, in contrast, allows the scale of production possibilities to affect efficiency. Yue (1992) states that constant returns to scale occur if all proportionate increases or decreases in inputs or outputs move the firm further along or above the production frontier.

Figure 4-4 illustrates the difference between efficiency measures estimated under CRS and VRS assumptions using a single-input-single-output model (y, x) for four decision-making units located at points A, B, C, and D.

Figure 4-4: Constant and Variable Returns to Scale Illustration

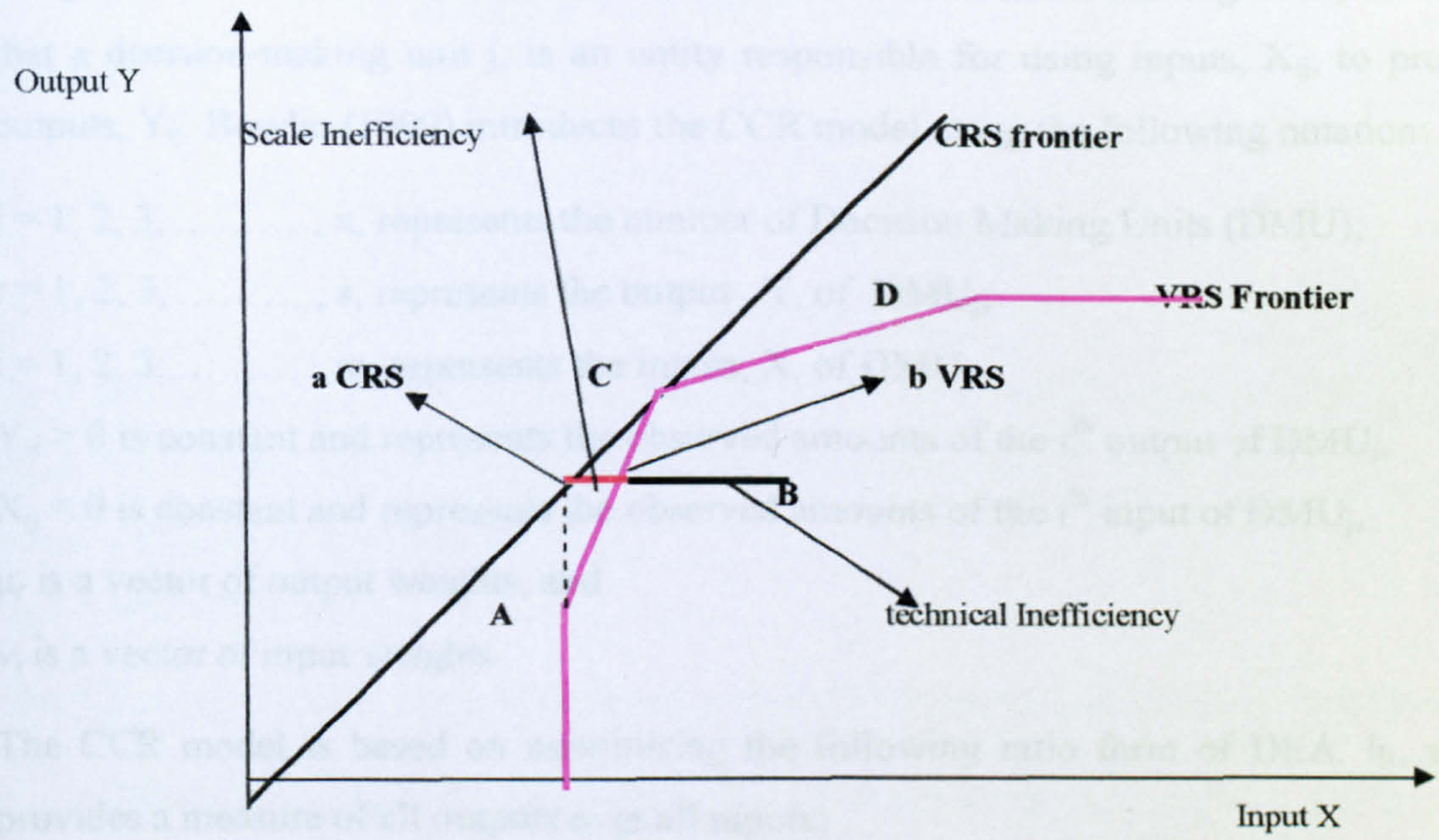


Figure 4-4 shows that the decision-making unit at point C appears to represent the best practice reference technology assuming constant returns to scale. The point C exhibits constant returns to scale because proportionate increases or decreases would place it outside the production frontier. The frontier represented by the solid purple line crossing through the points A, C, and D is constructed on the variable returns to scale assumption. Under the latter assumption, the Farrell distance efficiency measure for the point B requires the decision-making unit B to be compared against other decision-making units lying on the frontier represented by the purple solid line (labelled VRS frontier). The point a VRS on the frontier shows how much of input x that is strictly required to produce the same amounts of output, y. This point serves as a benchmark or reference point for the decision making unit at B. Total technical efficiency shows the relationship between the maximum productivity and observed productivity. The point a CRS shows the necessary input usage if the decision-making unit at point B was both technically efficient and operated at optimal scale.

4-5-2-1-3-1 Constant Returns to Scale (CCR Version)

According to Bowlin (1999), the constant returns to scale model is the basic data envelopment analysis model, which was introduced by Charnes, Cooper and Rhodes (1978, 1979, and 1981), and commonly known as the CCR version. The CCR model is designed to evaluate the performance of a number of decision making units, assuming that a decision-making unit j, is an entity responsible for using inputs, X_{ij}, to produce outputs, Y_{rj}. Bowlin (1999) introduces the CCR model using the following notation:

$j = 1, 2, 3, \dots\dots\dots, n$, represents the number of Decision Making Units (DMU);
$r = 1, 2, 3, \dots\dots\dots, s$, represents the output , Y, of DMU_j;
$i = 1, 2, 3, \dots\dots\dots, m$, represents the inputs, X, of DMU_j;
$Y_{rj} > 0$ is constant and represents the observed amounts of the r^{th} output of DMU_j,
$X_{ij} < 0$ is constant and represents the observed amounts of the i^{th} input of DMU_j,
μ_r is a vector of output weights, and
v_i is a vector of input weights.

The CCR model is based on maximising the following ratio form of DEA, h_j, which provides a measure of all outputs over all inputs;

$$\text{Maximise } h_j = 0 \leq [\sum \mu_r Y_{rj} / \sum v_i X_{ij}] \leq 1 \qquad (4.14)$$

In inequality (4.14), the numerator, $\sum \mu_r Y_{rj}$, represents a set of desired outputs obtained by the denominator, $\sum v_i X_{ij}$, which represents a set of used inputs. A decision-making unit j would prefer to obtain an optimal value of efficiency, by maximising the ratio h_j, which ranges from zero, if fully inefficient, to one, if fully efficient.

4-5-2-1-3-2 Variable Returns to Scale (VCR Version)

The variable return to scale non parametric approach is commonly known as the BCC approach, as it was suggested by Banker, Charnes and Cooper (1984). The main difference between the CCR and BCC approaches relates to the treatment of returns to scale. The BCC approach extends the CCR approach by incorporating variable returns to scale. To consider a decision-making unit as CCR efficient, it must be both scale and technically efficient, but for to consider a decision making unit as BCC efficient, it is only requires to be technically efficient.

Miller and Noulas (1996) explain the BCC model using a sample that considers N banks. Each bank produces m different output using n different inputs. The inefficiency, h, of a bank, s, is measured as follows;

$$h_s = [\sum \mu_i Y_{is} / \sum v_j X_{js}] \qquad (4.15)$$

Where

s = 1, 2, 3, ..., s, represents the number of banks;
i = 1, 2, 3, ..., m, represents the output, Y, of DMU_j;
j = 1, 2, 3, ..., n, represents the inputs, X, of DMU_j;
$Y_{is} > 0$ is constant and represents the observed amounts of the i^{th} output of DMU_j,
$X_{ijs} < 0$ is constant and represents the observed amounts of the j^{th} input of DMU_j,
μ_i is a vector of output weights, and
v_j is a vector of input weights.

The efficiency ratio, h, for a bank, s, is maximised subject to the following constraints:

$$\text{Maximise} \quad h_s = [\sum \mu_i Y_{is} / \sum v_j X_{js}] \leq 1 \text{ for } s = 1, 2, \ldots\ldots N. \qquad (4.16)$$

$$\mu_i \text{ and } v_j > 0 \qquad (4.17)$$

The inequality (4.16) ensures that the inefficiency ratios for the banks cannot exceed one. The inequality (4.17) requires that weights are positive. The maximisation of the efficiency ratio for each bank is possible by determining the weights for each output and inputs.

The transformation of the fractional linear programme into an ordinary linear programme is undertaken as follows

First

$$\text{Maximise} \qquad h_s = \sum \mu_i Y_{is} \qquad (4.18)$$

Subject to $\sum\mu_i Y_{is} - \sum v_j X_{js} \neq 0$, for s=1, 2, ...N (4.19)

$\sum v_j X_{js} \mu_i, =1$ (4.20)

Or second

Minimise β_s (4.21)

Subject to $\sum\varphi_s Y_{is} \sum v_j X_{js} \neq 0$, for s=1, 2, ...N (4.22)

$\sum v_j X_{js} \mu_i, =1$ (4.23)

The variable β_s represents the overall technical efficiency and lies between zero and one.

4-5-2-2 The Two-Stage Approach: the Tobit Regression Analysis

Bowlin (1999) suggests the use of a regression approach (any censored regression approach) in a second stage data envelopment analysis[113]. The so-called "second-stage" approach is undertaken to examine the determinants of inefficiency scores. Using the regression analysis, the data envelopment efficiency or inefficiency scores (Y_i) can be regressed against K vector of different explanatory variables factors (X_i).

Mathematically, the regression analysis can be written as follows

$$Y_i = f(K, X) \text{ or} \quad (4.24)$$

$$Y_i = b_{j1} X_{j1} + b_{j2} X_{js} + \dots\dots\dots\dots + b_{jn} X_{jm} \quad (4.25)$$

Where

X (1, 2, ...X_m) is the vector of explanatory variables, and K (b_1, b_2, ...b_n) is the vector of parameters or coefficients, including a constant term b_0.

In the regression analysis, the estimated slope coefficients or (b's) can be interpreted as marginal effects for those observations. A positive b_{jn}, indicates the n^{th} explanatory variable has a positive influence upon efficiency or inefficiency scores (Y_i). The asymptotic t-ratio associated with the estimated b_{jn} coefficient is used to test the

[113] The TOBIT regression analysis can also be used as a second stage in parametric efficiency approaches.

significance of the effects of the n^{th} explanatory variable upon technical efficiency or inefficiency scores.

Thus, Bowlin (1999) suggests the use DEA and TOBIT statistical regressions jointly in a two-stage complementary manner. While stage one uses DEA to identify efficient and inefficient decision-making units in the sample, stage two uses this information by incorporating it in the form of a dependent variable in regression formulations using a number of selected exogenous variables as independent variables.

4-5-2-3 Advantages and Disadvantages of DEA

Yue (1992), Siems and Barr (1998), Bowlin (1999) and Sarafidis (2002) discuss the characteristics of the Data Envelopment Analysis approach. They state two major advantages of DEA as a non-parametric approach over the parametric approach. First, Yue (1992) and Siems and Barr (1998) state that the DEA has a strong benchmarking power for measuring and comparing inefficiency estimates, due to its feature of identifying the best practice decision-making units that lie on the efficiency frontier. The DEA analyses each decision-making units in the examined sample independently, and then measure relative efficiency taking into account the whole population under investigation. Second, Bowlin (1999) and Sarafidis (2002) claims that the DEA approach is relatively more flexible that its parametric counterparts. This is due to the fact that it does not require an explicit specification of the functional form relating inputs to outputs, nor a statistical distribution for decomposing inefficiency scores. As already elaborated, the DEA method constructs an efficiency frontier incorporating the best practice and under which inefficient decision-making units lie.

However, Colwell and Davies (1992) and Bowlin (1999) state the DEA suffers from a number of shortcomings. First, Colwell and Davies (1992) mention that DEA is extremely sensitive to outlying observations as only one observation may cause a shift in the frontier. This observation, however, may emerge from a measurement error and, as a consequence, might overstate the technological capacity of the industry. Second, Bowlin (1999) states that DEA cannot be used to investigate the influence of exogenous explanatory variables on a decision-making unit's efficiency. Observations that are found to be below the frontier are considered relatively inefficient, only under the assumption that the management of the decision-making unit has a perfect control over all factors that affect total output and inputs. This assumption cannot be held valid in terms of reality, as there are some exogenous variables represented by measurement errors and unobservable shocks or factors that may affect decision-making unit's efficiency. The factors can be beyond the sphere of influence of the management team of the decision-making unit, and may result in making the decision-making unit fluctuate around the frontier without inevitably being inefficient.

Thus, while the parametric approach derives efficiency estimates from assumed functional forms, the non-parametric approach, mainly data envelopment analysis, is a linear programming technique that can be used to measure efficiency distances between an observation and the best practice of the examined sample.

4-6 Defining Bank Outputs and Inputs

Allen and Santomero (1996), Santos (2000) and Casu and Molyneux (2001) note that banking institutions are the core of the financial and payment system of any economy. The primary activity of a banking institution or firm is to act as an intermediary. This traditional function consists of collecting deposits and funds from depositors, and delivering loans to borrowers, or investors. Freixas and Rochet (1997) also note that contemporary banking theory also extends the functions of banking institutions to include the provision of an extensive range of non-traditional services. This encompasses the provision of liquidity and offering access to payment system, the transformation of deposits into assets of different types and maturity, the provision of collected information and monitoring services, and the provision of risk management services. As such, it becomes evident that banking institutions, principally commercial banks, are multi-product providers. The growth in new activities, such as off-balance sheet operations, has generated disagreements about to which bank definition is preferable where one considers choosing outputs and inputs when measuring bank efficiency.

Primarily, there are two major approaches that bank efficiency studies have extensively used in the definition of banking inputs and outputs to estimate efficiency, namely, the production approach and the intermediation approach (Humphrey, 2000). Both of these approaches apply the specification of traditional microeconomic theory of the banking firm, however, they differ in the specification of banking activities. Intarachote (2001) states that the adoption of either approaches depend upon the specification of bank objectives. For example, Leightner and Lovell (1998) employ net interest income and non-interest income as proxies for outputs within a bank's main objective of profit and revenue maximisation.

4-6-1 Production Approach

Casu and Molyneux (2001) discuss the production approach under which the production of services to deposit lenders and loan borrowers constitutes the primary activity of banking institutions. According to the production approach, the traditional production factors, such as labour and physical capital, are considered as inputs to produce various types of outputs, such as loans and deposits accounts. One characteristic of the production approach is that it does not require the use of monetary values of outputs; instead, it uses the number of accounts of each type. For instance, outputs are measured by the number of deposits and loans accounts, or by the number of transactions performed on each type. Besides, Miller and Noulas (1996) state that the production approach excludes interest expenses from total costs and uses only operating costs as total costs used to produce outputs. Consequently, the production approach considers labour and physical capital as inputs, and the number of processed loans and deposits as outputs.

The consideration of deposits as outputs is based on the argument that providers of deposits to banking institutions will observe their deposits turning into loans, which consists of deposits and added value. The value-added represents the services performed by the banking institution such as security and record-keeping. These services are only performed by two factors of inputs, labour and physical capital. However, a study by Hughes and Mester (1991) tests whether deposits should be considered as an input or output using the production approach. This study finds that deposits should be considered as an input. Other studies treats deposits in a different manner, such as Hancock (1985), who splits deposits into demand deposits as an output and time deposits as an input.

4-6-2 Intermediation Approach

The intermediation approach was first suggested by Sealey and Lindley (1977), and it has been extensively used in bank efficiency studies, such Miller and Noulas (1996) and Berger, Leusner and Mingo (1997), who support the choice of this approach since it captures the intermediary activities of a banking firm. The intermediation approach asserts that with the assistance of labour and capital, the banking firm has an intermediary activity that consists of transforming the funds deposited by savers into loans allocated to borrowers. According to Rebelo and Mendes (1999), the intermediation approach treats a banking institution as a multi-product firm that produces three main outputs (loans, financial applications and other banking products) by employing three main inputs (deposits, labour and capital). According to this, deposits, capital and labour are treated as inputs, while loans and investments outstanding are treated as outputs. Ferrier and Lovell (1990) state that the intermediary approach seems to be appropriate for examining cost minimisation in banking.

Unlike the production approach, the intermediation approach adopts the monetary expression of inputs and outputs, and includes interest on deposits into total costs together with labour and capital expenses, and defines earning assets (loans and investments) as outputs. Also, Intarachote (2001) views the treatment of deposits as input by the intermediation approach as convincing, since banking institutions use deposits as the funding source for earning assets.

Berger and Humphrey (1992) suggest three forms for the intermediation approach; namely, the assets approach, the added value approach, and the user-cost approach. First, the assets approach views banks as intermediaries between depositors and borrowers, so loans and other earning assets are treated as outputs, and deposits and other liabilities are treated as outputs. Second, the value-added approach uses the quality of banks' assets and liabilities to define inputs and outputs, based on their share of value-added. The approach uses only outputs from activities that create high value added such as loans, demand deposits and time and saving deposits. Finally, the user-cost approach uses the degree of the contribution to bank revenues to select the bulk of outputs and inputs used in the analysis.

The relationship between the production and intermediation approaches is displayed in Figure 4-5.

Figure 4-5: The relationship between the production and intermediation approaches[114]

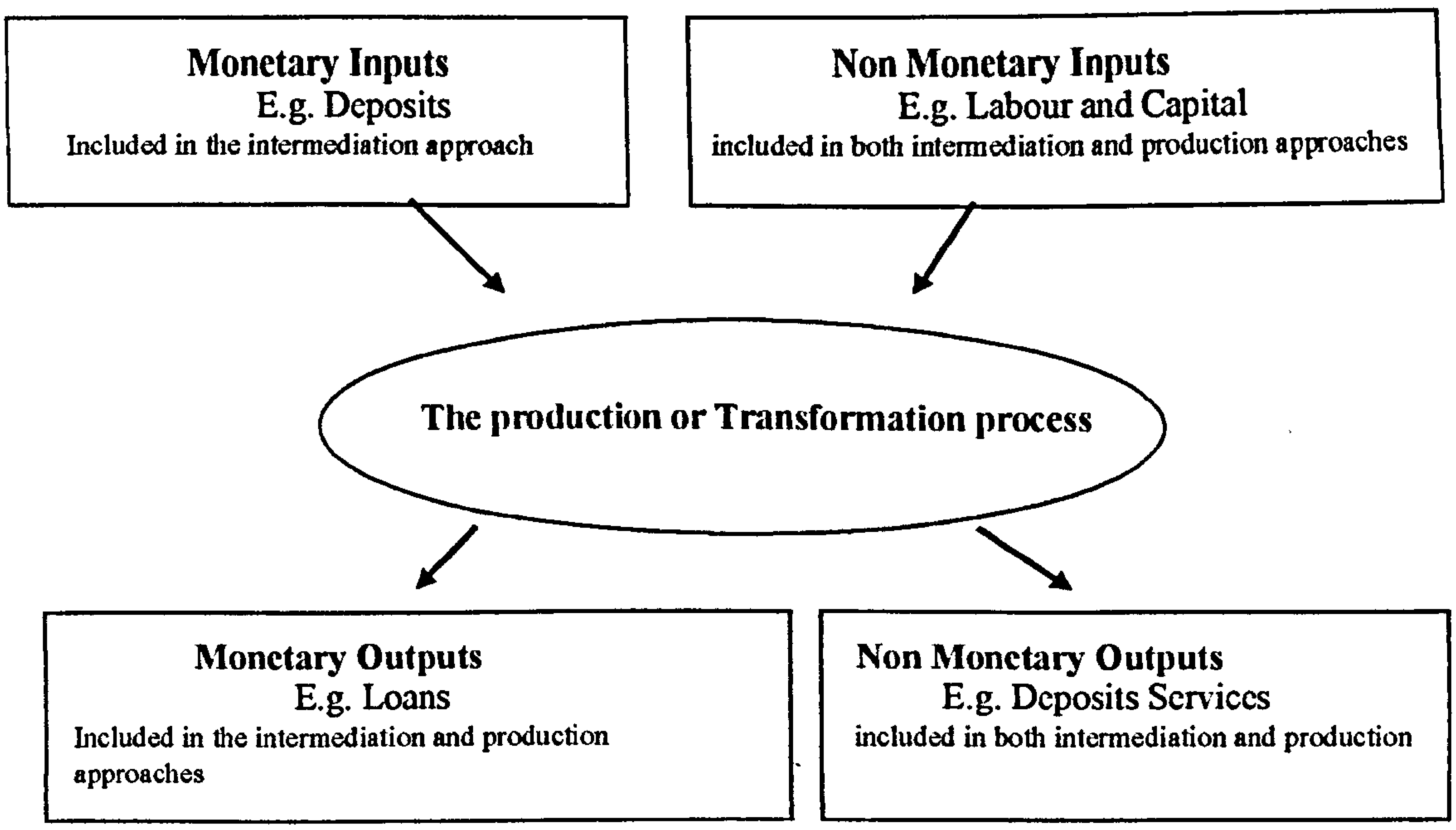


Figure 4-5 displays the difference between the production and intermediation approach. While the production approach uses non-monetary inputs and ignores the effect of monetary inputs, the intermediation approach can include both monetary and non-monetary outputs. The intermediation approach implies that the processes used in the transformation of funds drive bank production, whereas the production approach distinctively incorporates real operating functions of the bank.

4-7 Conclusion

This chapter outlines the main theoretical issues and empirical approaches used to examine cost and profit efficiency in banking. The chapter demonstrates that efficiency is related to scale and scope economies as well as to productive or X-efficiency. The chapter has also discussed the main frontier approaches that are extensively used to

[114] Source: Ashton (1998), PP.11.

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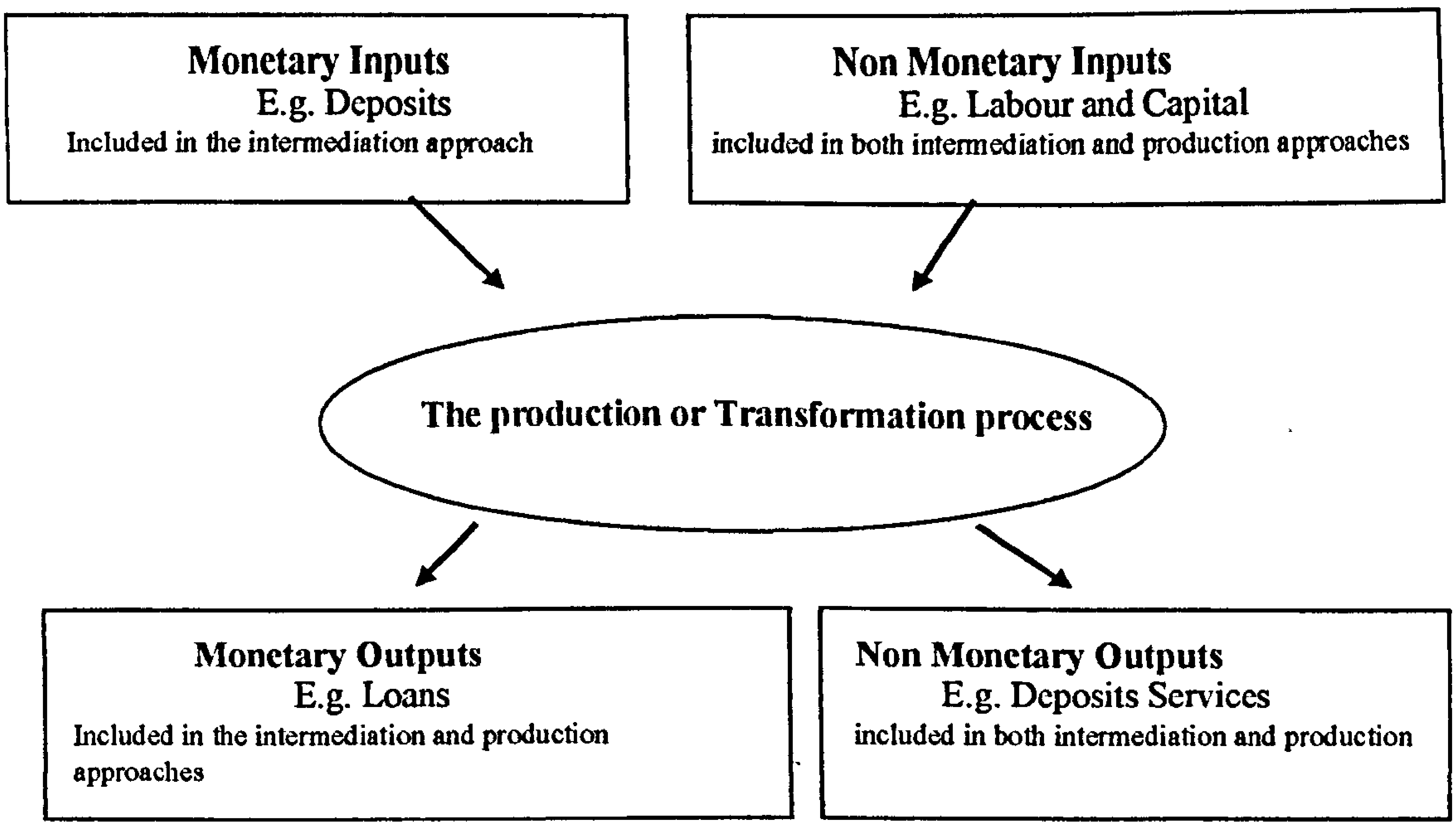

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[114] Source: Ashton (1998), PP.11.

estimate cost and profit efficiency in banking. Frontier analysis is divided into parametric and non-parametric approaches. Eisenbeis, Ferrier and Kwan (1999) agree that both families of efficiency measurement approach have advantages and disadvantages. The parametric approach allows for noise in the measurement of inefficiency, using a number of assumptions about the particular form of the economic function being estimated and the distribution of inefficiency. In contrast, the non-parametric approach is a linear programming approach that does not require any specification of the functional form or its distributional assumptions. The non-parametric approach is based on measuring all deviations from the frontier, which are attributed to inefficiency. The extant literature does not provide strong guidance as to which is the preferred approach to use in estimating bank efficiency. As all the approaches are different in their distributional assumptions to dislocate X-efficiency differences from the random error, Barr et all (1997) suggests a series of consistency tests when seeking robustness of the results.

The chapter also displays the main approaches that are used to define banks inputs and outputs. First, the production approach, being more concerned with the technical efficiency of financial institutions, defines bank activity as a production of services. Deposits are counted as outputs and interests paid on deposits are not included in bank total costs (Ferrier and Lovell, 1990). According to this approach inputs and outputs are measured in physical quantities (number of accounts, transactions processed, etc.). Second, the intermediation approach, which is extensively used in the bank efficiency literature, views banks as institutions that collect and allocate funds in loans and other assets; deposits are included among the inputs and interests in the total costs. The intermediation approach has three main types. First, the asset approach is a variant of the intermediation approach where liabilities are considered as inputs and assets as output. Second, the value added approach identifies any balance sheet item as output if it absorbs a relevant share of capital and labour, otherwise it is considered as an input or non relevant output; according to this approach deposits are considered as an output since they imply the creation of value added. Third, the user cost approach assumes that it is the net contribution to bank revenues that defines inputs and outputs; in this case deposits are counted as outputs.

The following chapter reviews the empirical findings of bank efficiency studies that have used both parametric and non-parametric approaches to estimate bank-level efficiency.

Chapter 5 Empirical Evidence on Banking Sector Efficiency: A Literature Review

5-1 Introduction

This chapter reviews the empirical literature on scale, scope and X-efficiency in banking. These studies use both parametric and non-parametric approaches to investigate bank efficiency across a variety of banking systems. The studies are motivated by the desire to examine whether such things as mergers and acquisitions, economic reforms and financial deregulation influence bank efficiency.

This chapter reviews studies that investigate bank efficiency, not just in the US and selected European economies, but also in other recently deregulated economies. The focus of attention of these latter studies is to see whether financial deregulation and liberalisation measures, including the lifting of entry constraints on non-governmental types of ownership, have positive or negative effects on banking sector performance and efficiency.

The chapter is divided into four main sections. The first section provides a review of the scale and scope economies literature focusing on US and European studies. The second section reviews the literature on bank efficiency in the USA using both parametric and non-parametric approaches. The third section reviews a number of European studies that have evaluated banks' efficiency employing parametric and non-parametric approaches. The final chapter discusses selected studies on bank efficiency in recently-deregulated banking systems[115].

5-2 Scale and Scope Economies[116]

Casu and Molyneux (2001) note that the empirical literature on bank scale and scope economies has witnessed three major developments. First, the earliest studies used

[115] The chapter will tabulate other studies at the end of each section using the structure suggested by Casu and Molyneux in Goddard, Molyneux and Wilson (2001).

[116] A number of comprehensive reviews of scale and scope literature on US and European banking can be found in Berger (1993), Berger and Humphrey (1994), Casu and Molyneux (2001.

accounting and balance sheet information to calculate ratios relating to bank costs and outputs, such as Alhadeff (1954), Schweiger and MacGee (1961), and Gramley (1962). Second, in the 1960s, a new route for bank scale and scope economies was unveiled by Benston (1965, a and b), who was the first to use the Cobb-Douglas cost function to evaluate economies of scale in banking. Third, in the 1980s, Benston, Hanweck and Humphrey (1982), introduced the translog functional form to estimate scale economies in banking. Later advances use more flexible functional forms such as the translog and the Flexible Fourier functional forms to estimate bank efficiency.

5-2-1 Scale and Scope Economies in US Banking

Alhadeff (1954) was the first to investigate scale economies in banking using the earning assets to assets ratio as a measure of output to reflect the used capacity of the bank. His study consisted of comparing the costs of Californian branch with unit banks[117] of different sizes over the period 1938 to 1950. Alhadeff (1954) found evidence of scale economies in branch banking showing that they produced greater output per dollar than unit banks. He found that large and small banks tended to have increasing returns to scale, while mid-sized banks realised constant returns to scale. Using the same methodology, Schweiger and MacGee (1961) and Gramley (1962) use total assets as a measure of bank outputs. Schweiger and MacGee (1961) found that large banks tended to have a cost advantage over small and medium-sized banks, whereas Gramley (1962) found that average cost declined as bank size increased and, therefore, larger banks had a cost advantage over small banks.

Benston (1965a, b) employed the Cobb-Douglas cost function to estimate scale economies in banking, and found that economies of scale were present, but were small. A review by Greenbaum (1967) concluded that economies of scale were generally exhausted after banks' assets size exceeded US$10 million. Banks with more than US$ 10 million in assets were therefore inefficient, because of high overhead unit costs, high transaction costs, and the lack of sufficient specialisation and limited diversification. Berger and Humphrey (1994) state that the results of studies that used Cobb-Douglas

[117] Unit banks operate out of only one office, with no branches, as required bb states having unit-banking laws. Unit banks are single office institutions primarily serving their local communities.

functional form to investigate how bank costs vary with bank size, suggest that banks that doubled their size, all else held constant, would experience reductions in average costs in the order of about five to eight percent, regardless of bank size.

Scale economies studies considered incorporating technological change and other developments that affected the banking sector. In their review of the 1970s' literature, Casu and Molyneux (2001)[118]note that it has emerged that if there were economies of scale in banking, they were not sufficient to preclude small and medium-sized banks from viable competition.

In the 1980s, Benston, Hanweck and Humphrey (1982) introduced the use of the translog cost function[119] as a new relatively flexible functional form to estimate scale economies. They suggested using it instead of the Cobb-Douglas cost function, due to the latter's disadvantages. Berger and Humphrey (1994) explain that the Cobb-Douglas functions used in earlier studies were restrictive, as it allows only three possible outcomes, which are constant, decreasing, or increasing average costs for all banks. The Cobb-Douglas function does not allow, for example, a U-shaped cost curve in which small banks have decreasing average costs, medium-sized banks have approximately constant average cost, and large banks experience increasing costs. Berger and Humphrey (1994) state that the use of more flexible functional forms when evaluating scale and scope economies has allowed research to; i) show a U-shaped average cost curve if one exists in the dataset; ii) expand data samples to include large banks with over US$ 1 billion in assets, or focus exclusively on large banks; and iii) to determine scale economies at the level of the banking firm, rather than at the level of the average branch office. Benston, Hanweck and Humphrey (1982) applied the translog functional form and found a U-shaped cost curve indicating that diseconomies of scale were present for banks with more than US$ 50 million in deposits, while banks in branching states experienced small economies of scale.

[118] These studies are Schweitzer (1972), Murphy (1972), Daniel et al. (1973), Kalish and Gilbert (1973), Longbrake and Haslem (1975), Mullineaux (1975) and Mullineux (1977).

[119] More comprehensive reviews of studies that used the cost translog function to estimate scale economics in the eighties and early nineties can found in Berger et al. (1993), Berger and Humphrey (1994) and Casu and Molyneux (2001).

Casu and Molyneux (2001) conclude that the majority of the literature conducted in the 1980s using the translog functional form reported that scale economies were present up to a very low level of output, typically around US$ 100 million. Berger et al., (1993) and Berger and Humphrey (1994) conclude from studying analyses by Mester (1987), Clark (1988) and Humphrey (1990), that the average cost curve in banking has a relatively flat U-shape with medium-sized banks realising slightly more scale economies than either large or small banks. Only small banks appear to have the potential for scale economy gains and the measured economies are usually small, in the order of five percent or less.

Overall, the empirical studies on US banking conducted during the 1980s using the translog functional form provide non consensus as to the location of the bottom of the average cost curve U, which is the scale efficient point. Berger and Humphrey (1994) elaborate that studies that include all sizes of banks usually find that average cost was minimised within the range US$ 75-100 million in assets. Studies that examine only banks with more than US$ 1 billion in assets find the minimum average cost point to be within the range US$ 2-10 billion in assets. According to Berger et al. (1993), these differences in results are caused by the translog functional form employed in such studies. This functional form may not be capable of incorporating the technologies of both large and small banks together in a single model. Or, some significant factors that vary with bank size that might have been excluded from the modelling process. In addition, Berger and Humphrey (1994) note that the differences in economies of scale studies may be due to the fact that the largest banks produce a distinct variety of products, including off-balance sheet items, that they have different technologies, or that they have a different range of cost dispersion than smaller banks that confounds the measurement of scale economies.

McAllister and McManus (1993) claim that the translog cost function generates a poor approximation when banks of assorted sizes are used. This translog functional form forces large and small banks to lie on a symmetric U-shaped average cost curve and disallows other possibilities, such as an average cost curve that falls up to some output point and remains constant thereafter. Based on this argument, Berger et al. (1993) illustrate that it may the case that scale diseconomies found for larger banks can simply be the imposed reflection of the economies found for small banks. Overall, despite the differences in the location of the scale-efficiency point, the fact that almost all estimates place this point well below the size of the largest banks clearly suggests that there are no significant overall scale economies to be gained through increases in bank size, apart for very small banks.

Saunders and Walters (1998) measure scale and scope economies for 133 of the largest 200 banks in the world at year-end 1988 using a translog cost model. It is found that, while banks with loans less than $US10 billion and more than $25 billion exhibited scale diseconomies, banks in the intermediate range realise scale economies. In addition, scope diseconomies between fee-earning and interest-earning financial services existed. As the analysed sample covers banks operating in multiple countries, Saunders and Walters (1998) conclude that international expansion may well suggest potential for economies of scale opportunities for many financial institutions. They also conclude that it was too early in the 1980s to make clear inferences about potential scope economies, which they believed might materialise after some initial fixed costs of expanding beyond traditional commercial banking activities had been incurred.

To overcome problems of poor approximation generated by the use of the translog functional form, McAllister and McManus (1993) suggest the use of non-parametric estimation approaches such as data envelopment analysis. However, Berger and Humphrey (1994) state that the use of non-parametric methods generally yields the same basic results that scale economies are important only for very small banks.

Bos and Kolari (2003) employ a stochastic translog functional form frontier cost model to estimate and compare economies of scale and scope for multi-billion dollar European and US banks in the period 1995-99. First, the cost model estimates suggest decreasing economies of scale for European banks. An increase of one dollar in total output would result in an increased cost of almost $1.127 for European banks, implying cost diseconomies of scale. Scope economies are found to be negative and insignificant for the cost model. European banks that produce a disproportionate amount of a particular output have total costs that are approximately 34% lower (but statistically insignificant) than banks that have a more balanced output mix. The insignificance of this estimate may suggest that scope economies are small in general. Second, overall economies of scale for

US banks significantly decrease but are smaller in magnitude than those for the European cost model, 112.7% and 104.2% for European and U.S. banks, respectively. Scope economies for large US banks are found to be negative and significant (at the 1% level). Cost scope diseconomies for US banks are about three times larger than for European banks. This difference in results could be due to the greater number of specialised banks in the US and universal banks in Europe. Scope estimates were generally not significant, with the exception of cost diseconomies of scope among US banks

Overall, previous US large banks studies on scale and scope economies are generally mixed, with relatively small economies or diseconomies as mentioned earlier (e.g., see Pulley and Humphrey (1993) and Mitchell and Onvural (1996) and citations therein).

5-2-2 Scale and Scope Economies in European Banking

Traditionally, there have been fewer studies on scale and scope economies on European banking compared to the US[120]. It is important to state the scale economies studies on European banking have followed the patterns experienced in the US, in which the Cobb-Douglas cost function and accounting ratios were first used in the 1970s, then the translog cost function approach in the 1980s, and a mixture of the translog and the Flexible Fourier, thereafter. Earlier studies on scale and scope economies in European banking emerged in the mid-1970s, when Maes (1975) and Lévy-Garboua and Lévy-Garboua (1975) examined the cost characteristics of French and Italian banking systems. Both of these studies found that scale economies were substantially present.

Gough (1979) uses data from 1972 to 1979 to estimate a linear cost function. He finds no evidence of scale economies for UK building societies. Similarly, Barnes and Dodds (1983) analyse data from 1970 to 1978, and find no evidence of scale economies for UK building societies. However, Cooper (1980) finds evidence of scale economies for UK building societies with assets less than £100 million, and diseconomies of scale for larger building societies. Hardwick (1989 and 1990) found evidence of scale economies for relatively smaller building societies and no evidence of scope economies.

[120] Altunbas and Molyneux (1996) and Casu and Molyneux (2001) review studies that investigate scale and scope economies in many European banking systems.

Mckillop and Glass (1994) estimates a hybrid translog cost function applied to data obtained from the 1991 annual returns for a sample of eighty-nine UK national, regional and local building societies. They found evidence of significant augmented economies of scale for both national and local societies, but only constant returns for scale for regional societies. They also found no evidence of economies of scope. Drake (1995) uses a translog multi-product cost function but found no evidence of scale economies for his sample of building societies, although Drake (1992) found mild economies of scale for societies with assets within the range £120-500 million, he found no evidence of scope.

Ashton (1998) investigates the presence of scale economies in the British retail-banking sector[121] using a distribution-free translog model over the period 1987-95. In terms of economies of scale, overall, this study finds slight diseconomies of scale using the intermediation approach (1.195), but substantial diseconomies of scale using the production approach (1.632). Constant returns to scale are found with the intermediation model for banks within the assets range of £0-5 billion (a value of 1.069 is recorded), with diseconomies of scale rising with increases in total asset size thereafter. The production approach produces different results, as banks with the assets range £0-25 billion broadly display constant returns to scale. Diseconomies of scale are reported for banks within the assets range of £25-50 billion. In terms of economies of scope, over time and across asset sizes substantial and statistically significant diseconomies of scope are found using the intermediation model, as an overall value of –53.21% for economies of scope is reported. This indicates banks that produce loans and investments separately could gain cost economies. However, diseconomies of scope appear to slightly decline as total asset size increases. A value of 70.76% for the banks in the £0-5 billion total asset group is recorded, falling to -43.10% for banks within the greater than £100 billion total asset group. Ashton (1998) also produces a variety of results using the production approach. Substantial loan specific economies of scope are recorded both over time and asset size. Overall the level of loan specific economies of scope is 124.97%. The size of loan specific economies of scope is seen to fall both over time and with increasing total

[121] Twelve banks are analysed in this study: the Royal Bank of Scotland, Standard Chartered, TSB, Barclays, Clydesdale, The Co-operative Bank, Lloyds, Midland, NatWest, Bank of Scotland, Abbey National and Yorkshire.

asset size. A value of 63.69% is reported for the 1985-1989 period rising to a value of 59.70% in the period 1994-97. A value of 98%is reported for banks in the £0 - £5 billion asset group declining to 52.85% for banks in the greater than £100 billion asset group. Reported investment specific economies of scope estimates are insubstantial. Overall investment specific economies of scope are –0.42%. Estimates of deposit specific economies of scope are slight both overall and over time. Overall levels of deposit specific economies of scope are 0.44%. Substantial deposit specific diseconomies of scope appear as the total asset size of banks rises above £75 billion increasing from –6.95% for banks in the £0-5 billion in asset group to –120.01% for banks in the over £100 billion total asset group.

Molyneux et al. (1996) employs a hybrid translog cost function to investigate scale and scope economies in France, Germany, Italy and Spain. They find differences in cost characteristics between these four countries and scale and scope economies appear to be evident in each country. Similarly, the European Commission (1997) found evidence of both economies of scale and scope in European banking during the nineties. Increasing returns to scale were found preponderant in the case of small banks, particularly in France and Germany. Strong evidence of economies of scope was also found for the largest banks.

Huizinga, Belisson and Vander Vennet (2001) investigate whether unexploited economies of scale exist in European banking due to the intensive European bank mergers and acquisitions movements that occurred throughout the 1990s. The abovementioned authors argue that economies of scale are often invoked by banks involved in consolidation operations, as one of the main motivations behind mergers. This study uses a sample consisting of 52 bank mergers covering 14 EU countries, over the period 1994-98, i.e., the period immediately preceding the introduction of the Euro. The findings of this study indicate that there are significant unexploited economies of scale in European banking, also for the very large banks. The results of this analysis show that, all groups, with the exception of mortgage banks with total assets above ten billion euro, exhibit economies of scale. In particular, the existence of scale economies is most pronounced for small mortgage banks. In addition, commercial banks are found to have a greater potential to realise scale-related cost gains than cooperative and savings banks. Nevertheless, the larger the size of the commercial bank, the smaller the advantage, as the scale economies indicator (RSCE) amounts to 81% for the smallest group of commercial banks and 89% for the group of large banks. On the other hand, no major scale economies are found to be present for cooperative and savings banks, with the exception of the smallest and largest, as all intermediate size groups show a value within the range 91-93%. Also, it is found that the off- balance sheet items increase the potential for scale economies for cooperative and savings banks for all size groups. For the commercial banks, this only holds for banks with total assets up to 5,000 million euro. The group of 'other banks' shows considerably larger economies of scale, with the exception of the smallest size group. The larger mortgage banks also exhibit economies of scale. Huizinga, Belisson and Vander Vennet (2001) conclude that their results indicate the presence of economies of scale for commercial banks, cooperative and savings banks, mortgage banks with total assets up to 10 billion euro and for all but one size group of 'other' banks. These findings at least partly contradict the wide consensus based on data from the 1970s and the 1980s that only very small banks have a potential to achieve scale economies. Huizinga, Belisson and Vander Vennet (2001) believe that their results confirm the findings by Berger and Mester (1997), Berger et al. (1999), and Vander Vennet (2001) who also observe economies of scale for large banks using data from the 1990s. The finding of potential scale economies provides a rationale for the occurrence of bank mergers. In fact, mergers, as opposed to internal growth, may be the fastest way to realize the associated cost benefits.

Maggi and Rossi (2003) analyse the efficiency of European and US commercial banks over the period 1995-98, by employing a broad definition of efficiency, which covers scale and scope economies, as well as cost efficiency. This study compares scale and scope economies scores derived from different model specifications to identify any mis-specification arising from the translog form and the robustness of the evidence provided. The results of this study indicate increasing global scale economies for US commercial banks and less pronounced evidence for EU banks, in favour of small (and medium-sized) banks. However, in the EU case, the results suggest that there is evidence in favour of increasing returns to scale particularly in the case of small banks. In contrast, translog functional form scale economies results are found to be approximately constant both overall and for different bank size (the same results are found using the Fourier-Flexible functional form). Maggi and Rossi (2003) detect evidence of scope diseconomies using the three functional forms, both in Europe and in the US. Such evidence, which is consistent with the significant level of inefficiency indicated, is, as suggested by the authors, likely to be associated to the consolidation process for Europe and to lower operational constraints in US banking.

Overall, scale and scope economies studies have evolved through the use of more flexible functional approaches. While accounting ratios were used in the 1950s, the Cobb-Douglas cost function approach was used in 1960s and 1970s, and the translog cost function has been more widely adopted thereafter. Berger et al. (1993) conclude that banking sector average cost curves have a relatively flat U-shape, with medium-sized banks being slightly more scale efficient than either very large or very small banks. However, the location of the bottom of the curve tends to be uncertain. Huizinga, Belisson and Vander Vennet (2001) state that potential scale economies are more pronounced in the 1990s than in previous decades, both in the US and the European banking markets (although X-inefficiencies are still found to dominate scale inefficiencies).

5-3 Cost and Profit X-Efficiency[122]

This sections reviews leading studies on cost and profit X-efficiency in banking. As noted in the previous chapter, Leibenstein (1966) was the first to identify X-efficiency, which consists of the differences in costs and revenues between (banking) firms and best practice firms. Inefficiencies that are not associated with size (scale) and product-mix (scope) are called X-inefficiencies. X-inefficiency comprises allocative and technical inefficiencies. While allocative inefficiency is defined as the decline in performance due to the selection of an ineffective production plan, technical inefficiency is defined as the poor implementation of this production plan. The empirical studies reviewed in this section are relatively recent. In the 1990s onwards, bank efficiency studies using

[122] This section adopts the structure suggested in Casu and Molyneux (2001) by reviewing parametric and non-parametric frontier studies on US banking followed by studies on European banking and, then those that focus on recently-deregulated and other banking systems

parametric (with translog and Fourier Flexible functional forms) and non-parametric (DEA) approaches have prospered.

5-3-1 Cost and Profit Efficiency in US Banking

Efficiency studies investigating the US are both recent and voluminous. Berger and Humphrey (1997) review 130 studies in 21 countries, three quarters of which are on US banking. Casu and Molyneux (2001) review 48 studies, twenty-five of which cover US banking. Most of the efficiency studies on US banking have used data from the 1980s and early to mid-1990s to investigate the effects of de-branching[123] on bank efficiency, as well as examining whether significant variations in efficiency have emerged after the consolidation process that has occurred in the US banking during the period under study. Other cost and profit efficiency studies in US banking are shown in Table 5–1.

5-3-1-1 Parametric Approaches

As noted earlier, a growing number of parametric-based studies using the translog and Flexible Fourier functional forms have been undertaken to investigate US banks' efficiency since the early 1990s.

Berger, Hancock and Humphrey (1993) use the profit function to derive output and input efficiency estimates. The profit function allows for the measurement of inefficiencies on both the inputs and outputs sides of the banking firm. It incorporates the revenue affects of producing at incorrect levels (or mixes) of output in addition to the cost effects of employing the inappropriate levels (of mixes) of inputs. Besides the two fixed netputs of core deposits and physical capital, the variable outputs of this study include business loans and consumer loans, whereas the variable inputs include labour and purchased funds. The aforementioned authors argue that core deposits need to be specified as a fixed variable due to the fact that they are determined by external factors, which are outside the sphere of control of the bank. Berger, Hancock and Humphrey (1993) apply the distribution-free frontier approach on the dataset that includes three panels of 384 to 599 banks, each from 1984 to 1989. This study finds that profit efficiency estimates appear to be within the range of 52-66%, with larger banks being more efficient, in

[123] Interstate Banking and Branching Efficiency Act of 1994.

general, than smaller banks. This study also finds that technical inefficiencies tend to dominate over allocative inefficiencies, suggesting that banks are not particularly poor at choosing input and output plans, but rather are poor at executing these plans. The other finding of this study suggests that output inefficiencies are greater than input inefficiencies, implying that more than half of all profit inefficiencies are in the form of deficient revenues rather than excessive costs.

Kaparakis, Miller and Noulas (1994)[124] apply the translog stochastic frontier approach to investigate the efficiency of 5548 US commercial banks, including larger banks with over US$ 1 billion in assets. The analysis of this study incorporates different factors that may appear to affect bank efficiency such as the density of population within a particular US State, whether States have branching restrictions, and various proxies for managerial quality and portfolio riskiness. Kaparakis, Miller and Noulas (1994) follow Ray (1988) who argues that outputs are a function of a large number of inputs, which are not entirely under the sphere of control of the banking firm. The model of this study includes four variable outputs (i) loans to individuals and households, ii) loans secured by real estate, iii) commercial and industrial loans, and iv) federal funds sold and securities held in trading accounts, four variable inputs (interest-bearing deposits except certificates of deposits above $100,000, the sum of certificates of deposits above $100,000 and federal funds purchase plus demand notes and other borrows money, number of employees, and premises and fixed assets), and one quasi-fixed variable netput (non-interest bearing deposits). Kaparakis, Miller and Noulas (1994) find overall cost efficiency to be around ninety percent, with a positive relationship between increasing risk and inefficiency. That is, a higher ratio of non-performing loans to total loans and a lower ratio of equity capital to total assets both lead to increase cost inefficiency. Also, Kaparakis, Miller and Noulas (1994) also find a positive relationship between cost inefficiency and bank size, with the largest banks being twice as inefficient as the most efficient group with $75-150 million in assets. The findings of this study reveal various implications for the banking industry as encouraging banking firms, in terms of regulation, to be bigger may create a suitable environment for increased cost inefficiency.

[124] Kaparkis, Miller and Noulas (1994) review eight studies and conclude that technical and/or allocative inefficiencies are present in banking, and they tend to be positively correlated with bank size.

Berger and De Young (1997) use a model that tests four hypotheses[125] to address the relationship between the problem or non-performing loans and cost efficiency in US commercial banking. The first hypothesis is the *bad luck hypothesis*, which states that such external factors as local plant closures may precipitate an increase in problem loans for a banking firm. When loans become past due, the banking firm begins to expend additional managerial efforts and expenses dealing with these problem loans. Consequently, the increase in problem loans would decrease cost efficiency, as the additional operating expenses associated with bad loans create the appearance of lower cost efficiency. The bad luck hypothesis, hence, has a negative relationship with cost efficiency. The second hypothesis is the *bad management hypothesis*, which asserts that low measured cost efficiency is an indicative of poor management practices regarding daily operations and loan portfolio management. Banking firms with incompetent managers have not the appropriate qualities to make adequate decisions about loan underwriting, monitoring and control. This is mainly due to the lack of adequate monitoring by managers as they have mediocre skills reflected by the choice of making a higher proportion of loans with uncertain, low or negative net present values. This inadequacy may lead to an increase in non-performing loans, and consequently, an increase in cost inefficiency. The bad management hypothesis, hence, is negatively associated with cost efficiency. The third hypothesis is the *skimping hypothesis*, which maintains that loan quality and cost efficiency are affected by the amount of resources devoted to underwriting and monitoring loans. A banking firm may choose to have lower costs in the short-term in order to maximise long-term profit. To reach such a target, the banking firm may skimp on the resources allocated to underwriting, monitoring and controlling loans. However, this choice may create future problems regarding the performance of loans and increased costs to deal with these. Berger and De Young (1997) argue that, in the short-term, a banking firm may appear cost efficient because of the reduced expenses related to loan and credit management. The level of non-performing loans may have no influence, but over time, an important stock of non-performing loans would build up. *The skimping hypothesis*, hence, implies a positive

[125] Berger and De Young (1997) argue that bank supervisors and researchers should use the findings of cost efficiency studies that test these four hypotheses as predictors of financial fragility.

causation between cost and increased problem loans. The final hypothesis is the *moral hazard hypothesis*, which states that the increase in loan portfolio riskiness can be interpreted as a response to moral hazard incentives made by banking firms with low levels of capital. This hypothesis, therefore, implies that low levels of capital cause an increase in non-performing loans.

Berger and De Young (1997) apply the stochastic frontier approach to data on US commercial banks over the period 1984-94, and report overall average cost inefficiency of eight percent over the entire sample. They find that when loans become past due, operating costs increase as a result of hunting these loans down. If the impact were severe, this would lead to decease in cost efficiency, as predicted by the bad luck hypothesis. Berger and De Young (1997) also find evidence of the *bad management hypothesis*, indicated by the fall in non-performing loans levels after the decrease in measured cost efficiency. This effect would be greater for banking firms if they have a relatively risky loan portfolio mix. In addition, Berger and De Young (1997) find that some highly efficient banks are *skimping* as their cost efficiency causes higher levels of non-performing loans. They also find some support for the *moral hazard hypothesis* reflected by the positive relationship between higher levels of future problem loans and banking firms with low capital driven by greater level of portfolio risk.

Overall, the four hypotheses tested by Berger and Humphrey (1997) can jointly explain the relationship between cost efficiency and non-performing loans, suggesting some implications for economic policy. Under the *bad luck hypothesis*, the failure of a banking firm is a consequence of uncontrollable external events. This implies that prudential regulation could reduce the risk of failure by limiting or insulating banking firms' exposure to external shocks. This includes implementing measures in the form of imposing limits on loan concentration, and encouraging relatively acceptable low loans to assets ratios and higher levels of capital. Under the *bad management hypothesis*, the failure of banking firms can be driven by major risk caused by relatively controllable internal factors. Banking firm managers should ensure that the available labour has all the necessary abilities to implement the production plans of the bank as well as having the suitable skills in terms of loan underwriting, monitoring and controlling.

Bauer et al. (1998) proposes six consistency conditions that efficiency estimates derived from the parametric and non-parametric frontier approaches (SFA, TFA, DFA, and DEA) should ideally meet for adequate decision-making purpose. The first three conditions state that efficiency generated by different modelling approaches should yield consistent results to one another in terms of their efficiency levels, rankings, and identification of best and worst banking firms. The remaining three conditions stipulate that efficiency estimates should be consistent over time, with the competitive conditions of the market, and with non-frontier measures of efficiency and performance. The latter three conditions help determine the degree to which efficiency estimates generated by the frontier approaches are consistent with the reality and are 'believable'. Bauer et al. (1998) attempts to evaluate to what extent four frontier approaches estimating cost efficiency meet the six conditions by examining a dataset of 683 large US banks operating in States where branching was allowed over the period 1977-1988.

Bauer et al. (1998) finds that the efficiency estimates generated by parametric approaches are consistent with one another, but inconsistent with DEA estimates. The three parametric approaches tended to yield the same distributions of efficiency (condition 1), rank banks approximately in the same order (condition 2), identify mostly the same banks as the best practice and worst practice (condition 3), be more consistent with what was generally believed given competitive conditions in the markets (condition 5), and generally were highly correlated with the standard non-frontier performance measures (condition 6). The three parametric approaches generated relatively high scores of efficiency for the vast majority of banks reflecting the state of competition in banking markets, as cost efficiency estimates were found within the range of 67.4-93.3%.

The non-parametric approach generated much lower average efficiencies, ranked the banking firms differently, and identified the best and worst banks differently from the three parametric approaches. But, the DEA approach appeared to be more consistent with non-frontier measures of performance such as ROA and various cost ratios, but overall, less strongly related to other indicators of firm performance. The DEA results yielded low efficiency estimates for most banks, possibly reflecting the confounding of random error and inefficiency, as cost efficiency was found to range between 21-38.5%. Bauer et al. (1998) conclude that when performing bank efficiency analysis, the use of multiple techniques and specifications is likely to be supportive. If the six consistency conditions are met for two or three approaches, then the drawn conclusions are likely to have some confidence.

Jayaratne and Strahan (1998) examine the effects of entry regulation imposed on US banking structure and find that heavy entry barriers would lead to an increase in the number of inefficient banking firms. US banking firms were prevented from expanding their presence inter-state due to branching restrictions. This policy resulted in the chartering of thousands of unit banks. But, this regulation was discontinued in the 1980s, as State branching deregulation in the US became permitted and widespread. Jayaratne and Strahan (1998) find that banking firms in states where branching was restricted were less profitable than banking firms in states where branching was unrestricted. They also find that average US banking firms' efficiency improved markedly when inter-state and state-wide branching restriction were lifted, manifested by decreasing loan losses and operating costs by approximately one half and one tenth, respectively. These reductions in banks' costs should be beneficial for bank client if they are passed on to them in the form of lower loan rates. Jayaratne and Strahan (1998) conclude that the improvements following branching deregulation appear to occur because better banks grow at the expense of their less efficient competitors.

Similarly, Berger and De Young (2000) assess the impact of branching regulation on US bank efficiency employing both cost and profit efficiency analyses. This study uses the Fourier Flexible function form applied to over 7000 US commercial banks. While overall cost efficiency was found to be 76.4% for small banks with less than US$ 100 million in assets, overall cost efficiency was found to be 78% for larger banks with more than US$ 100 million in assets. For the same two categories of banks, average measured profit efficiency was found to be 66.3% and 66.8%, respectively. Berger and De Young (2000) find a positive relationship between geographic expansion and bank efficiency, as banks expanding in nearby regions tend to improve their levels of cost and profit efficiency. This efficiency improvement was explained by the export of managerial skills and practices from parent banks to new branches and affiliates. This finding may have some implications for the structure of the banking industry. First, the geographic expansion of efficient banks nation-wide or cross-region would result in pushing inefficient banks to improve their efficiency or face being put out of business. Second, if a parent bank is efficient in one region, its branches and affiliates operating in other regions are likely to be efficient.

Bos and Kolari (2003) compare cost and profit efficiency estimates for a sample of European and US banks over the period 1995-99, using the stochastic translog frontier model. Consistent with the intermediation approach, three bank outputs are defined (loans, investments, and off-balance sheet activities). Based on these cost and profit models, X-efficiency scores reveal that, on average, European banks have lower cost and profit efficiencies compared to U.S. banks. In absolute terms U.S. banks have lower (higher) cost (profit) ratios. X-efficiency estimates based on the cost model for European banks are found to be 94.7%, whereas the X-efficiency estimates based on the profit model for European banks are on average considerably lower at 72.1%. For the US, the average cost X-efficiency score is 97.6% (or higher than European banks), whereas for the profit model the average X-efficiency score is also relatively higher compared to European banks at 74.9%. US banks' average cost and profit efficiency scores are higher, average cost ratios are lower, and average profit ratios are higher compared to European banks. Higher profit efficiency is positively and significantly correlated with the profit ratio. Cost and profit ratios are positively and significantly correlated. Cost X-efficiency is on average 0.743 and 0.871 for small European and US banks, respectively. Cost economies of scale are negative, especially for small U.S. banks. Regarding the small bank profit efficiency results, average profit X-efficiency is 0.607 in Europe and 0.644 in the US. One possible implication of these findings is that small banks face less competitive pressure to be cost and profit efficient than large banks. If this is indeed true, an efficiency motive for large banks to merge or acquire small banks exists. Bos and Kolari (2003) conclude that their empirical results tend to support the notion that potential profit efficiency gains are possible in cross-Atlantic bank mergers between European and US banks. Thus, an economic motivation appears to exist in favour of geographic expansion in the years ahead.

5-3-1-2 Non-Parametric Approaches

Non-parametric frontier techniques, mainly using the Data Envelopment Analysis (DEA), have been applied to estimate the cost and profit efficiency of US banking firms by many authors.

Grabowski, Rangan and Rezvanian (1993) use the Data Envelopment Analysis (DEA) approach to investigate the relationship between US bank efficiency and type of bank organisational form, over the 1980s, and compare the relative efficiency of bank holding company and branch banking structures. Using the intermediation approach, five outputs (real estate loans, commercial and industrial loans, consumer loans, investment loans, and other loans) and three inputs (labour, capital and purchased funds) were selected. The findings indicate that the entire sample generates an overall average cost efficiency of 68%. Other results include average allocative efficiency, 72%, average technical efficiency, 72%, average scale efficiency, 94%, and average pure technical efficiency at 77%. In addition, Grabowski, Rangan and Rezvanian (1993) find that the branch banking organisational form seems to be more efficient than the multi-bank holding company organisational form. Branch banks are more technically efficient as they generate more output from the used inputs compared to bank holding companies. The abovementioned authors argue that branch banks raise the availability and convenience to services to their clients, which enables them to achieve economies of large-scale operations. Also, branch banks seem to have the privilege of being able to lower the risk of failure through geographic diversification. In contrast, bank holding companies tend to hold higher operating expenses derived from the need for a board of directors, separate staff, offices, documentation, and technology for each of its affiliates. Grabowski, Rangan and Rezvanian (1993) conclude that the branch banking organisational form appears to be more efficient compared to the multi-bank holding company organisational type.

Miller and Noulas (1996) employ the DEA approach to examine scale and pure technical inefficiency for 201 large-sized banks, with assets in excess of US$1bn, over the period 1984-90. This study specifies four variable inputs (total transactions deposits, total non-transactions deposits, total interest expenses, and total non-interest expenses) and six variable outputs (commercial and industrial loans, consumer loans, real estate loans, investments, total interest income, and total non-interest income). Miller and Noulas (1996) find that scale and pure technical inefficiency to be approximately 2% and 4%, respectively, but, for the highest profit quartile, scale and pure technical inefficiencies are found to be equal to 2%. This result indicates that the most profitable banks tend to be relatively the most efficient. Miller and Noulas (1996) conduct a further regression analysis to explain the differences in efficiency scores across profit quartiles in the context of bank size, profitability, market power, and geographic location. The results of this analysis show that bank size and profitability are significantly related to pure technical efficiency, but lower technical efficiency levels are found associated with greater market power. The geographic location issue seem to be related to the branching and inter-state deregulation process launched in the 1980s, which forced US banks to embrace greater competition, compelling them to be more efficient.

Barr et al. (1999) employ the DEA model to examine bank characteristics in the context of evaluating the relative productive efficiency of a sample of US commercial banks. This study uses five variable inputs representing resources required to operate a bank (salary expenses, premises and fixed assets, other non-interest expenses, interest expenses, and purchased funds), and three variable outputs (earning assets, interest income, and non-interest income). Barr et al. (1999) find that high levels of efficiency are associated with higher levels of interest and non-interest income, earning assets, and returns on assets. Also, high levels of efficiency are found to relate to lower levels of salary expenses, interest and non-interest expenses, fixed assets, purchased funds, non-performing assets, and loans to assets.

Eisenbeis, Ferrier, and Kwan (1999) examine the cost efficiency of a sample of 254 US bank holding companies (BHCs), over the period 1986-96, using both the stochastic frontier and DEA approach in order to test the robustness of the findings. Five variable outputs (investment securities, real estate loans, consumer loans, commercial and industrial loans, and off-balance sheet items) and three variable inputs (physical capital, purchased funds and labour) were selected. The findings of this study indicate that substantial inefficiencies exist in US banking, averaging between 8% and 19% of total costs using the stochastic frontier approach, and between 28% and 40% using DEA. The findings also show that inefficiencies are, on average noticeably larger for smaller banking companies than for bigger banking companies. In addition, the study finds a strong association between inefficiencies and bank risk-taking using the stochastic frontier estimates. Inefficient banking companies tend to have higher common stock variances, lower capitalisation, and larger loan charge-offs. Eisenbeis, Ferrier, and Kwan (1999) conclude that their findings show that the stochastic frontier approach appears to provide more informative scores as compared to those from the DEA.

Overall, parametric and non-parametric efficiency studies on US banking have examined a wide range of issues including the impact of branching regulation and consolidation on bank efficiency. Overall, as identified by Berger and Humphrey (1997), existing studies on US banking indicate that X-inefficiencies constitute around one fifth or more of costs, while scale and scope inefficiencies account for up to five percent of costs in banking.

Table 5–1 Review of US Studies on Bank Efficiency

Study and Year	Data and Period of Study	Methodology	Main Findings
Sherman and Gold (1985)	Data on savings bank with 14 branch offices for the year 1982.	DEA	- Average Inefficiency estimate of the sample is 4%. - 6 out of 14 branches were found to be relatively more inefficient.
Parkan (1987)	Data on 35 branches of a major Canadian bank.	DEA	- 11 branches were found to be relatively more inefficient.
Rangan, Grabowski, Aly, and Pasurka (1988)	Data on 215 independent banks with deposits less than $400 million for the year 1986.	DEA	- The average level of inefficiency estimate for the sample is 30%, not due to scale - Inefficiency is found positively related to size, and negatively to product diversity.
Cebenoyan and Register (1989)	Data on 144 banks for the year 1986.	SFA	- Average cost inefficiency estimate is around 23% - Inefficiency is found positively related to size and risk factors.
Aly, Grabowski, Pasurka and Rangan (1990)	322 randomly chosen US banks for the year 1986.	DEA	- Inefficiency estimates were found within the range 19-25%, not due to scale - Inefficiency is found positively related products diversity.
Elyasiani and Mehdian (1990a)	Data on randomly chosen 144 US banks for the year 1985	DEA	- Average inefficiency (lost revenue) estimate was found 36%, not due to scale. - Inefficiency is found negatively related to size.
Elyasiani and Mehdian (1990b)	Data on a sample of 191 US banks with assets in access of $300 million for the years 1980 and 1985	DEA	- Average inefficiency estimate was found 10.45% in 1980 and 22.29% in 1985.
Ferrier and Lovell (1990)	Data on a sample of 575 banks for the year 1984.	DEA and SFA	- Overall technical efficiency was found 26% (SFA) and 21% (DEA). - Small banks with under $25 million are found to be the most efficient
Berger and Humphrey (1991)	Data on 7653 banks for the year 1984.	TFA	- Average inefficiency estimate was found 19%. - X-inefficiency dominates scale and scope inefficiencies.
Elyasiani and Mehdian (1992)	Data on 80 minority-owned US banks	DEA	- The average inefficiency score was found 11%.

	for the year 1988.		
Yue (1992)	Data on the 60 largest banks in Missouri for the period 1984-90.	DEA	- Average inefficiency estimate was found 20%, due to pure technical inefficiency.
Bauer, Berger and Humphrey (1993)	Panel data in 683 large US banks in branching states for thee period 1984-89.	SFA and TFA	- Average Inefficiency of the sample found to be 13.7%. - The levels of inefficiency were found to be consistent between the two approaches and over time.
Berger, Hancock and Humphrey (1993)	Data on US commercial banks for the year 1982.	DFA	- Inefficiencies were found 48% for small banks, 35% for medium-sized banks and 34% for large banks.
English, Grosskopf, Hayes and Yaisawarng (1993)	Data on 442 banks for the year 1982.	DEA	- Average inefficiency estimate was 25%.
Pi and Timme (1993)	Data on a sample of 112 banks for the period 1988-1990.	SFA	- Average inefficiency estimate was 13%.
Berger, Leusner, and Mingo (1994)	Data on 760 branches of an US banks over the period 1999-91.	DEA	- Inefficiency average was found 10% using the intermediation approach and 24% using the production approach.
Ferrier (1994)	Panel data covering 408 US banks over the period 1977-88, with $100 million in assets and operating in states that allow branching.	DEA	- Technical Inefficiency average 29.05% over the period. - Scale inefficiency average 13.11% over the period - Inefficiency increased from 24% (1982) to 33% (1988).
Grabowski, Rangan and Rezvanian (1994)	Data on a sample of 670 banks in 1979, 1983, and 1987.	DEA	- Average inefficiency estimates were found 26% (1979), 24% (1983) and 27% (1987) - Highest efficiency scores were found to the largest and medium banks within the assets group ($100-$200 million)
Kaparakis, Miller and Noulas (1994)	Data on a sample of 5548 banks with assets above $50 million for the year 1986.	SFA Translog cost function	-Average inefficiency was found 9.8%. -Inefficiency is found positively related to size (17.1% for banks with over $10 billion in assets) and low population densities locations.
Wheelock and Wilson (1994)	Data on 269 banks for the year 1983	DFA	- Average inefficiency is found to be approximately 50%.
Elyasiani and Mehdian (1995)	Data on 50 US banks for the year 1979 and 1986.	DEA	- Average inefficiency was found 3% (1979) and 5% (1986)
Hunter and Timme (1995)	Data on 317 banks with assets over $1 billion over the period 1985-90.	DFA	- Overall inefficiencies were found within the range 23-36%.
Kwan and Eisenbeis (1995)	Semi-annual data on 254 bank holding companies, for the period 1986-91.	SFA	- Average inefficiency was found 19% for small banks and 8% for large banks

			- Average inefficiency was declining over time.
Spong, Sullivan and De Young (1995)	Data on 143 banks for the year 1994	DEA	- The most inefficient banks have average inefficiency estimate of 29%, and the least inefficient banks have average inefficiency estimate of 6%.
Clark (1996)	Data on 440 banks for the years 1988 and 1991	TFA	- Average inefficiency was found 27% (1988) and 10% (1991)
De Young and Nolle (1996)	Data on 812 banks for the years 1985 and 1990.	DFA	- Average inefficiency estimate declined from 44% in 1985 to 27% in 1990.
Mahajan et al. (1996)	Data on a sample of multi-national banks for the years 1987 and 1990.	TFA	- Average inefficiency estimate were 27% in 1987 and 12% in 1990.
Mester (1996)	Data on 214 banks operating in the Third federal Reserve District for the years 1991 and 1992.	SFA	- Average inefficiency estimate was found within the range 6-9%.
Miller and Noulas (1996)	Data on sample of 201 banks with assets over $1 billion in 1984, for the period 1984-1990.	DEA	- Average inefficiency was found 5%
Berger et al. (1997)	Data on 832 bank branches for the two years 1989 and 1991.	SFA	- Average inefficiency estimates were found 6% (1989) and 21% (1991)
Berger and De Young (1997)	Data on US commercial banks over the period 1990-1995.	SFA	- Overall average inefficiency was found 8%.
Berger and Mester (1997)	Data on 6000 commercial banks for the period 1990-1995.	DFA	Large banks are found to be more efficient than small banks
De Young, Hasan and Kirchhoff (1997)	Data on 3.997 US banks for the year 1992.	SFA	Average inefficiency score was found 34%.
Humphrey and Pulley (1997)	Panel data on 683 US banks with assets over $100 million in 1988, for the three periods: 1977-80, 1981-84 and 1985-88.	SFA	- Overall average inefficiency was found 19%, 18% and 15%, for the three periods, respectively.
Mester (1997)	Data on 6630 US banks for the period 1991-92	SFA	Inefficiency estimates ranged between 7% and 15% depending different US districts.
Perstiani (1997)	A sample of US banks over the period 1980-90.	DFA	Inefficiency estimate were found within the range 23% and 19% depending on different US districts.

Schaffinit, Rosen and Paradi (1997)	Data on 291 Ontario-based branches of a large Canadian bank, subdivided into four assets groups for the year 1993.	DEA	Overall inefficiency was found between 28% and 46%.
Thompson, Brinkmann, Dharmapala, Gonzalez-Lima and Thrall (1997)	Panel data on the US's 100 largest banks in terms of assets over the period 1986-91.	DEA	Inefficiency estimates were found 19%, 29%, 39%, 38%, 43% and 35% for the examined years, respectively.
Rogers (1998)	A sample of more than ten thousand banks for the period 1991-95.	SFA	While cost efficiency was found within the range 29% and 24%, profit efficiency ranged between 31-29%.
Barr, Killgo, Siems and Zimmel (1999)	Year-end data for US commercial banks for the period 1984-98.	DEA	The small-sized banking firms are found to be the most efficient.
Siems and Barr (1998)	Data on three years: 11, 397 banks in 1991, 10, 224 banks in 1994, and 8,628 banks in 1997.	DEA	The most efficient banks earn significantly higher ROA levels, hold significantly more capital and manage relatively smaller loan portfolios with fewer troubled assets.
Eisenbeis, Ferrier and Kwan (1999)	A\sample of 254 bank holding company (BHC) over the period 1986-96.	DEA and SFA	Overall inefficiencies were found between 28% and 40% using the DEA, and between 8% and 19% of total costs using the SFA.

Note that DEA : Data Envelopment Analysis (a non-parametric frontier approach),

SFA : Stochastic Frontier Approach (a parametric Frontier approach)

TFA: Thick Frontier Approach (a parametric Frontier approach)

5-3-2 Cost and Profit Efficiency in European Banking

There is a growing number of studies that have examined bank efficiency in European banking using both parametric and non-parametric approaches. Most of the European bank efficiency studies use datasets covering the 1990s onwards, and have principally investigated whether there are any gains that can be derived from the process of bank restructuring taking place in EU countries. Maggi and Rossi (2003) state three main factors that have contributed to the increase in competition among EU financial institutions in the last few years. First, deregulation promoted by the Second European Directive on Banking and Financial Services, has led banks to compete not only in the domestic markets but also potentially all over the EU (and world). Second, efforts towards creating a European Monetary Union have increased the level of competition in the banking sector. Third, technological advances and deregulation have favoured a process of de-specialisation, allowing banks to lend at any maturity, and reducing the differences among sectors. Banking institutions have reacted to the increased European competition with an intense process of restructuring and growth leading the banking sector to experience an unprecedented level of consolidation through mergers and acquisitions among large financial institutions. The consolidation process aims at reaping profitability, reducing cost inefficiency, increasing market power, and exploiting scale and scope economies. Table 5–2 a summary of the cost and profit efficiency studies undertaken on European banking.

5-3-2-1 Parametric Approaches

Altunbas and Molyneux (1996) investigate the impact of ownership forms (private, public and mixed or mutual) on European bank efficiency by estimating cost and profit Fourier-Flexible stochastic frontiers based on the distribution-free approach[126]. Five variable outputs (mortgage loans, public sector loans, other loans, other earning assets, and off-balance sheet items) and three variable inputs (labour, physical assets, and deposits) were selected according to the intermediation approach. Covering the period

[126] This study uses the hypothesis provided by empirical evidence stating that state-owned banks perform less efficiently than private-owned banks

from 1989 to 1996, the sample of banks consists of 1195 private commercial bank, 3486 public bank, and 3486 mutual cooperative bank observations. Unusually, Altunbas and Molyneux (1996) find greater levels of cost and profit inefficiency within the private sector, as public and cooperative banks tend to be relatively more cost and profit efficient. This finding can be explained by the fact that public banks tend to have lower funding costs as their customers are less interest-rate sensitive than the depositors at commercial private banks, which are more corporate and wholesale-oriented.

Ashton (1998) investigates cost efficiencies of twelve retail banks from the UK over the 1987-95 period. This study employs the distribution-free translog specification using two models: the production and intermediation approaches. An average efficiency of 84.5% is recorded for the production model and an average of 82.2% is provided for the intermediation model. It is found that the smaller retail banks appear to relatively more efficient than their larger counterparts. This provides further support for the suggestion that substantial diseconomies exist for British retail banks with greater than £5 billion in total assets.

Battese, Heshmati and Hjalmarsson (1998) study a sample of 156 Swedish banks over the period 1984-95, to examine the efficiency of labour use in the Swedish banking market. This study estimates an operating cost model based on the translog functional form. The model includes variables with respect to bank-ownership, the size of bank's branch network, total transactions and time. Battese, Heshmati and Hjalmarsson (1998) finds average inefficiency of 11.7%, which increased between 1984 and 1991, before falling thereafter. The findings also suggest that cooperative banks, savings banks and the large commercial Handelsbanken are found to be more efficient in their labour use than other types of banks. A positive relationship between labour use inefficiency and the size of a bank's branch network is also found.

Bikker (1999) applies the stochastic cost frontier approach to the European banking industry to measure the effects of increased competition on bank efficiency. The findings of this study note that, on average, Spanish, French and Italian banks appear to be less efficient that their counterparts operating in Germany, the Netherlands and the UK. Banking firms transacting in Luxembourg, Belgium and Switzerland are found to be the most efficient. These findings seem to be consistent with those of Maudos, Pastor and Pérez (2002), who find average cost and profit efficiency levels of 82.5% and 45%, respectively, for ten EU countries. Austria and Germany emerged as the most cost efficient banking systems and Luxembourg and Portugal as the most profit efficient.

Girardone, Molyneux and Gardener (1999) investigate the main determinants of Italian banks' cost efficiency over the period 1993-96, using an unbalanced panel of 1958 bank observations. Also, they examine cost efficiency of banks across geographical regions to identify the most efficient banks according to their location (North West, East, Centre and South). This study uses the intermediation approach to define variable outputs and inputs used within the selected Fourier-Flexible stochastic cost frontier model. Two output variables (total loans and securities) and three input variables (labour, deposits, and physical capital) were defined. In addition, following Mester (1996), this study includes two fixed netputs representing financial capital (total equity) and assets quality (non-performing assets to assets ratio) to control for the quality and riskiness of bank output. The findings of this study show that average overall cost efficiency seems to range between 85% and 87% of total costs and tends to increase over time for all bank sizes. Also, economies of scale were found to be present and significant and at higher levels for the popular and credit cooperative banks. The results of the second-stage logistic regression indicate that inefficiencies appear to be inversely correlated with capital strength and positively related to the level of non-performing assets in the balance sheet, but, no clear relationship is found between assets size and bank efficiency. Also, it is suggested that quoted banks seem, on average, to be more efficient than non-quoted banks.

Schure and Wagenvoort (1999) investigate the impact of the Second Banking Directive implemented in 1992 on the efficiency of a sample of 1,974 financial institutions from fifteen countries within the EU. The Second Banking Directive introduced the single banking license in the EU, standardised minimum capital requirements, and other measures to reduce barriers to cross-border trade and establishment. Using the standard translog cost functional form, this study finds that more than eighty percent of the banks in the examined sample are not located on their cost frontier. Also, the overall cost inefficiency score is found to be 16%, and it tends to decrease at around 4% over the sample period. Schure and Wagenvoort (1999) find that UK banks were able to reduce cost inefficiencies from over 20% to essentially zero within a period of five years after the implementation of the Second Banking Directive. Although some countries experienced rapid improvements in bank efficiency, in other countries such as Austria, France, Germany and Luxembourg, more mixed results were found.

Dietsch and Lozano-Vivas (2000) compare estimated separate and pooled common cost frontiers for the French and Spanish banking systems to investigate the impact of environmental conditions on bank efficiencies. Their study applies the translog functional form based on the distribution free approach, on data covering the period 1988-92. The separate frontier analysis finds approximately similar inefficiency scores of 11.9% and 11.7% for the French and Spanish banks, respectively. The pooled common frontier analysis finds different results, as Spanish banks (90.7%) appear to be far more cost inefficient than French banks (41.9%). Dietsch and Lozano-Vivas (2000) explain the differences in cost efficiency scores between the two analyses to the effects of environmental conditions, and believe that country-specific variables, including environmental and regulatory variables represent important factors in explaining efficiency differences, and thus, they should be included in bank efficiency modelling (otherwise efficiency estimate will be overestimated). Dietsch and Lozano-Vivas (2000) re-estimate the cost efficiency frontier in the separate country analysis taking into account country-specific environmental variables including density of population, income per capita, density of demand, concentration index, capital ratio, intermediation ratio, and number of branches per square kilometres. The results of this re-analysis reveal approximately similar inefficiency scores in the former separate country-specific analysis for the French banks (11.2%), but lower new inefficiency estimates in the case of Spanish banks (25.2%). Hence, it can be concluded that the inclusion of environmental differences between different banking systems can influence efficiency estimates.

Altunbas, Evans and Molyneux (2000) examine the impact of ownership on efficiency in the German banking market by estimating individual and pooled variable cost and alternative profit efficiencies for over 1,800 German banks of different ownership type between 1989 and 1996. The structure of the banking market analysed in the study includes savings banks, cooperative banks, and large national and regional joint stock commercial banks. The model used is the Fourier-Flexible functional form with the distribution-free approach. Altunbas, Evans and Molyneux (2000) hypothesise that different ownership forms can lead to varying estimates of efficiency based on the type of relationship between bank owners and management. The lack of a capital market discipline may obstruct shareholders from the implementation of necessary measures of control over bank management. The latter may suffer from a lack of incentives and motivations to perform their management duties in a way desired by the shareholders. However, the authors recognise that factors such as competition and universality of banking services supply may lead managers (of all bank ownership types) to be familiar with the practices of cost minimisation and profit maximisation. The main result of this examination indicates that overall inefficiency estimates are 16.2% and 21.1% for the pooled cost and profit efficiency estimates. Partial results suggest that privately–owned banks are more inefficient than their publicly-owned counterparts. Also, banks of public and mutual ownership types are found to have small cost and profit advantages because of the possible advantages in terms of lower funding costs.

Altunbas, Gardener, Molyneux and Moore (2001) employ the stochastic frontier approach to investigate the cost efficiency of a large sample of European banks between 1989 and 1997. Applying the Fourier-Flexible functional form, the overall efficiency scores are found to be increasing over time from 75.5% in 1989 to 82.1% in 1997. The findings also suggest that cost efficiency estimates tend to vary considerably across countries and assets size groups. In general, efficiency decreases with bank size for the larger categories of banks. Individual frontier estimates reveal that the lowest cost inefficiencies estimates are for Italian and German banks, 12.6% and 13.5%, respectively. The least cost efficient banks are found to operate in Belgium, Ireland and Luxembourg, with over 30% of cost inefficiency.

Huizinga, Belisson and Vander Vennet (2001) examine the performance effects of European horizontal mergers and acquisitions, using a sample of 52 bank mergers from 14 EU countries[127], over the period 1994-98. The banking institutions included in this analysis include commercial banks, cooperative and savings banks, mortgage and real

[127] These countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the UK.

estate banks, and other types of bank[128]. The study analyses whether there are substantial cost and profit X-inefficiencies in the European banking sector and for the banks involved in merges and acquisitions whether these persist throughout the 1990s. The study involves the use of a non-homothetic functional form of the distribution-free translog type[129], to estimate the cost and alternative profit efficiency scores.

This study employs total costs and returns on equity as independent variables, whereas the inputs variable are deposits and labour, and the output variables are loans, securities or other earning assets. The fixed netput quantities included in this study include off-balance sheet items and equity, whereas the environmental variables are equity as a proportion of total assets, and non-interest costs as a proportion of total costs, (these two have included in order to measure possible differences in risk and output quality). Dummy variables for bank's size are included in the efficiency estimations.

The average cost efficiency of European banks is estimated at 91%, which is comparable to the results obtained by Berger and Mester (1997) for US banks. The authors believe that the degree of inefficiency found is lower than observed in the 1980s, suggesting that technological progress and increased competition may have moved the average bank towards the efficient frontier. Cooperative banks are found to exhibit a higher degree of cost efficiency than commercial banks (96% versus 82.2%). Mortgage banks and other banks are found to be more efficient, on average, than commercial banks. When the estimates are compared across countries, the Greek and Portuguese banks appear to be the least efficient banks. The average profit efficiency is estimated at 64.2%, which is considerably lower than the average cost efficiency level. The authors note that their findings are consistent with the results reported in Berger and Mester (1997) for US banks and Vander Vennet (2001) for European banks. Mortgage banks are found to be more profit efficient than commercial and cooperative banks.

The findings of this study also report that the cost efficiency of European banking systems, as well as the relative efficiency of those banks which engaged in mergers, varies considerably. Comparing merging banks with their non-merging counterparts, large merging banks are found to exhibit a lower degree of profit efficiency than average,

[128] Medium and long term credit banks and specialised governmental credit institutions
[129] This functional form is used following Lang and Welzel (1996).

while small merging banks are found to exhibit a higher level of profit efficiency than their counterparts. This study finds evidence for what the authors call the *low cost efficiency hypothesis* stating that the increase in cost efficiency is likely to be larger when both banks have relatively low pre-merger cost efficiency levels. With respect to profit efficiency, mergers are found to tend to reduce profit efficiency for large banks, while profit efficiency rises for the set of small banks. Finally, deposit rates are found to tend to increase following a merger, which indicates that merging banks are unable to exercise greater market power. Huizinga, Belisson and Vander Vennet (2001) conclude that the findings for cost efficiency suggest a role for mergers to enhance the X-efficiency of the consolidating banks. The impact may be even more pronounced for profit efficiency.

Rime and Stiroh (2001) investigate bank efficiency and scale and scope economics for a sample of 290 "universal" Swiss banks from 1996-99. This analysis uses the intermediation approach to define outputs and input variables used in the translog and alternative profit function modelling. Four output variables (loans to banks, consumer loans, mortgages and off-balance sheet items), two input variables (labour and interest expenses on all liabilities), and two fixed netputs (equity capital and physical capital) are defined in this translog model. Rime and Stiroh (2001) find overall cost and alternative profit efficiencies to be 57% and 48% for their sample, respectively. They also find little evidence of scale and scope economics for the largest banks, and that regional and cantonal banks did not appear to be less efficient than other large commercial banks. The efficiency findings are similar to that of Sheldon (1994) who found overall cost efficiency for the Swiss banks of 56%.

Maggi and Rossi (2003) investigate and compare cost efficiency between 15 EU countries and the US. This study uses a panel of data covering the period 1995-98 and including 338 European commercial banks and 279 US commercial banks. The final sample of this study includes two separate balanced panels. While the EU panel consists of 1352 observations, the US panel comprises 1116 observations. This study adopts the distribution free approach applied to three different cost function specifications: the translog; flexible Fourier and the Box-Cox cost function specification. One innovation of this study is the use of different approaches of defining outputs and inputs to compare the

EU and US banking systems. While the production approach[130] is applied to the EU countries, the value added approach[131] is thought to be appropriate for the US. The authors argue that the value added approach seem to better fit the data for US commercial banks. The results of this study indicate that Box-Cox specification generates lower rates of inefficiency compared to the other functional forms, which produce consistent outcomes. For the EU countries, the average inefficiency levels are found to be 32% using the translog, 36% with the Fourier-Flexible and, 21% using the Box-Cox specification. For the US commercial banks, the average inefficiency levels are found to be 37% as per with the translog, 38% using the Fourier-Flexible and, 17% as using the Box-Cox specification. Besides, using the Fourier Flexible form, no significant differences in inefficiency levels of banks in different sizes are found for the two panels. Using the translog and Box-Cox specifications, small banks (35% and 26.7%) are found to be more inefficient than large (30% and 21%) and medium sized (31% and 17%) banks, respectively. As for the US experience, the results show no significant differences between the results derived from the Fourier Flexible and translog functional form estimates across asset size categories. However, the Box-Cox specification suggests that large (18%) and small banks (19%) are more inefficient than medium sized banks (15%).

5-3-2-2 Non-Parametric Approaches

Various authors that have used the DEA methodology to examine efficiency in European banking. While earlier studies are reviewed in detail in Casu and Molyneux (2001), in this part of the section, we review the relatively recent studies, including Berg at al. (1993a,b), Grifell-Tatjé and Lovell (1997), Pastor, Pérez and Quesada (1997), Dietsch and Weill (1998), Mauros and Pastor (1999), and Lozano-Vivas, Pastor and Hasan (2001). Table 5–2 annexed to this section presents other studies.

Berg et al. (1993a,b) uses the DEA methodology to estimate a common pooled efficiency frontier and separate individual country frontiers for Scandinavian banking systems

[130] Under this approach, interests paid on deposits are counted as inputs, while the volume of deposits is considered to be output. Three outputs are considered by this study; deposits, loans and services, all expressed as Dollar amounts. The services variable is constructed as the total value of services income fee-based, net revenues from security and currency trading). The three inputs used are the prices of labour, capital and deposits.

[131] Under this approach, deposits, loans and services are counted as outputs, whereas labour and capital are taken as inputs.

(Finland, Norway and Sweden). These two studies extend the sample used in an earlier study[132], to cover Finish and Swedish banks. The findings of the pooled common frontier estimations suggest that the average Swedish bank is more efficient than the average Norwegian bank, which, in turn, are more efficient than the average Finnish bank. Under variable returns to scale, the levels of efficiency are found to be 89%, 78%, and 58% (Berg et al., 1993a) and 78%, 57% and 53% (Berg et al., 1993b) for the Swedish, Norwegian and Finnish banks, respectively. Berg et al. (1993a) find that banks, which had efficiency scores over 90%, are mostly large Swedish banks and only one Finnish bank, but no large Norwegian banks. Similarly, using the same methodology, Berg, Bukh and Forsund (1995) extend the samples used in Berg et al. (1993a,b) to include Danish banks and find that the largest were the most efficient in the pooled sample.

Grifell-Tatjé and Lovell (1997) employ the DEA approach to investigate Spanish commercial and savings banks efficiency over the period 1986-93. The findings of this study suggest average inefficiency of 6.5% for the savings banks and 4.3% for the commercial banks. Similarly, Lozano-Vivas (1997) uses the translog functional form based on the thick frontier approach to estimate alternative profit efficiency for a panel of 54 Spanish savings banks for the period 1986-92. Lozano-Vivas (1997) finds that 28% of the difference in predicted profits between high and low profits banks are due to inefficiency.

Pastor, Pérez, Quesada (1997) investigate the level of productivity and efficiency in the Spanish banking system. This study applied the DEA methodology to a sample of a 427 commercial banks from EU and US for the year 1992, to compare Spanish banking efficiency to European and US banking efficiency. Pastor, Pérez, Quesada (1997) find that the banking industries in the Netherlands, Italy and Portugal (85%0, Spain (82%), Belgium (78%0, Denmark (71%), and Luxemburg (59%) are the most efficiency compared to those in the UK (56%), Germany (51%) and France (37%).

Dietsch and Weill (1998) use the DEA approach to study the efficiency of a sample of 661 commercial, mutual and savings banks from eleven EU countries for the period 1992-1996. This study finds an increase in efficiency when measuring cost and profit

[132] This study was by Berg, Forsund and Jansan (1991) who examine only the Norwegian banking system.

frontiers. However, an exception applies to France, Italy, Luxembourg and the UK as they witnessed decreasing cost efficiency measures over the study period. Productivity levels were found to have increased due to technological advances. This study concludes that European integration appeared to have small but positive effects on efficiency on the banking sector prior to 1996.

Maudos and Pastor (1999) analyse the efficiency in costs and in profits of the Spanish banking sector spanning the period 1985-96 using the DEA approach.. Two outputs (profitable assets8 and securities portfolio) and three inputs (loanable funds, number of employees; and physical capital) are defined according to the intermediation approach. The results indicate, overall, higher efficiency levels for commercial banks (90.9%) and 80.2% for savings banks. In addition, the results show higher standard profit efficiency levels for commercial banks (66.5%) than savings banks (47.2%). Similar to cost and profit efficiency levels, commercial banks also enjoy higher levels of alternative profit efficiency (52.9%) than savings banks (34.7%). Referring to the disparities in the found efficiency levels, Maudos and Pastor (1999) believe that higher costs incurred by products of higher quality are not offset by higher revenues (since profit efficiencies are lower than cost efficiencies) and that market power exists in the setting of prices in Spanish banking (since alternative profit inefficiency is higher than standard). Maudos and Pastor (1999) think that the full economic and monetary integration between EU countries, this will increase the pressure of competition, and consequently, reducing market power and obliging Spanish banking sector to reduce its levels of cost and profit inefficiency.

Sheldon (1999) attempts to assess the possible impact of the Second Banking Directive that came into effect in 1993 on bank EU banks' efficiency. This Directive abolishes the requirement to obtain a license from the regulatory authorities in the guest country, and therefore permits banking institutions that are licensed in one EU country to operate in other member countries. Sheldon (1999) applies the DEA approach to unconsolidated dataset consisting of 1,783 commercial and savings banks in the EU, Norway, and Switzerland for the period 1993-97. This study finds that large banks, specialised banks, and retail banks are more cost efficient than small banks, diversified banks, and wholesale banks, respectively. Sheldon's (1999) average frontier efficiency was relatively low, at approximately 45 % of total costs and 65 % of total profits. While banks in Denmark, France, Luxembourg, and Sweden are found to have the highest average efficiency, banks in Greece, Italy, Portugal, Spain, and UK are found to have the lowest average efficiency. In addition, Sheldon (1999) finds that estimates of economies of scale in costs and profits indicate that most banks in their sample were sub-optimal in size, with optimal scales in the range of US$ 0.5-1.5 billion. Decreasing cost and profit returns to scale are reported for most multi-billion dollar banks. Sheldon (1999) believes that these may lead them to conclude that inefficient operations, rather than unexploited economies of scale, explain cost and profit differences across European banking. Also this study concludes that since measured efficiency increases with size and decreases with scope, large and/or specialized banks would be at an advantage.

Lozano-Vivas, Pastor and Hasan (2001) examine the impact of the unification of EU banking sectors due to the Second Banking Directive on bank's efficiency using the DEA approach. This study uses the 1993 data on 612 commercial banks from 10 EU countries (Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Portugal, Spain and the United Kingdom). Using the value-added approach, loans, deposits and other earning assets are defined as outputs whereas labour and physical capital are accounted for as inputs. Four other environmental variables out of ten are selected and included in the analysis with the assumption of exerting potential impact upon bank efficiency. These variables reflect the main economic conditions (salary per capita and density for demand[133]), the accessibility of banking services for customers (income per branch) and regulatory and competitive conditions (equity over total assets). Using the basic DEA model, the overall efficiency measure is found to be 28.23%. The results show that Luxembourg and Belgium score the highest average basic efficiency estimates, 49.49% and 42.20%, respectively while Portugal and Spain obtain the lowest efficiency estimates, 15.19% and 18.9%, respectively. However, when environmental variables are accounted for, the new model yields an overall efficiency estimate of 62.14%.

[133] Density for demand is measured by the ratio of deposits per square kilometre, and is assumed by Lozano Vivas et al. (2001) to be a relevant feature in determining bank efficiency. Banks, which operate in markets with a lower density of demand, incur higher expenses and may cause to deter the potential of attainable efficiency level by banks and its branches.

Luxembourg, the Netherlands, Italy and Belgium improve their average efficiency scores by around 12%. However, Denmark and Spain obtain an improvement of around 60% in their average efficiency scores. Lozano-Vivas, Pastor and Hasan (2001) note that by obtaining the coefficient of variation in the efficiency scores of the banks in our sample, the authors observe that the dispersion of efficiency across banks is 82.4% (49.8%) when the common frontier excludes (includes) environmental variables. This implies that, when including environmental variables, measured efficiency rises and efficiency differential across banks decreases. Lozano-Vivas, Pastor and Hasan (2001) conclude that environmental conditions are divisive in explaining banks' efficiency. They conclude that the EU market would increase cross-border competition and further adjustments are required about a much more competitive environment.

Overall, parametric and non-parametric studies on EU banking systems investigate mainly the impact of the transformation of EU countries into a single market and consolidation, upon bank efficiency. Overall, these studies have utilised the cross-border comparison analysis and find levels of efficiency not significantly different from those found in the US.

Table 5–2: Review of EU and other European Studies on Bank Efficiency

Study and Year	Country	Data and Period of Study	Methodology	Main Findings
Vassiloglau and Giokas (1990)	Greece	Data on 20 bank branches located in the vicinity of Athens	DEA	Average annual inefficiency estimate of 9%.
Berg, Forsund and Jansen (1991)	Norway	Data on 264 banks for the period 1980-89	DEA	Small banks are the most efficient banks in the sample.
Berg, Claussen and Forsund (1993)	Finland, Norway and Sweden	Data on 502 Finnish banks, 141 Norwegian banks, and 120 Swedish banks for the year 1990	DEA	Overall inefficiency was found to be 42% for Finland, 22% for Norway and 11% for Sweden
Berg, Forsund, Hjalmarsson and Sumoninen (1993)	Finland, Norway and Sweden	Data on 502 Finnish banks, 150 Norwegian banks, and 126 Swedish banks for the year 1990	DEA	Overall inefficiency was found to be 47% for Finland, 43% for Norway and 22% for Sweden
Tulkens (1993)	Belgium	Data on 773 branches of a large publicly-owned bank for the month January 1987.	DEA or DFA	- Overall Inefficiency was found to be 3%. - 136 branches are found to be efficient - Small branches are found to be more inefficient than larg branches.
Altunbas, Molyneux, and DiSalvo (1994)	Italy	Data on 516, 452 and 483 Italian credit cooperative banks for the years 1990, 1991, and 19992, respectively.	SFA	The average inefficiency score was found 13.1% (1990) 15.9% (1991) and 17% (1992).
Berg and Kim (1994)	Norway	Data on 173 banks for the year 1988.	TFA	The sample's average inefficiency score is found to be 19%.
Drake and Howcroft (1994)	UK	Data on 190 branches drawn from one of the six largest clearing banks	DEA	Overall average inefficiency was found to be 8%.
Sheldon (1994)	Switzerland	Data on 477 Swiss banks from 1987 to 1990	DEA	The sample's average inefficiency score is found to be 44%.
Berg, Forsund, and Bukh (1995)	Finland, Denmark, Norway and Sweden	Data on 714 banks from the four Nordic countries for the year 1993	DEA	The largest Danish and Swedish banks are found to be th most efficient.

Favero and Papi (1995)	Italy	Data on a sample of 174 banks for the year 1991.	DEA	Average inefficiency was found to be 4% using th production approach and 5% using the ine4rmediatio approach
Grifell-Tatje and Lovell (1995a)	Spain	Data on approximately all savings banks for the years from 1986 to 1990.	DEA	Overall average inefficiency of 22%, 22%, 21%, 17% an 17% for the five years of analysis.
Grifell-Tatje and Lovell (1995b)	Spain	Data on approximately all savings banks for the years from 1986 to 1991.	DEA	Overall average inefficiency of 25%, 26%, 25%, 20%, 23% and 20% for the six years of analysis.
Maudos, Pasto and Quedada (1995)	Spain	Data on savings banks for the period 1985-94.	SFA	Average inefficiency estimate was found to be 32%
Pastor, Pérez and Quesada (1995)	7 EU countries and the US	Data on banks: 168 US, 67 French, 59 Spanish, 45 Austrian, 22 Germans, 31 Italian, 18 UK and 17 Belgian for the years 1992.	DEA	Overall average inefficiency estimates were found 5% fo France, 7% for Germany, 8% for Italy, Austria, and Belgium 19% for the US and Spain, and 46% for the UK.
Allen and Rai (1996)	OECD countries	Data on 194 banks from 11 OECD countries of which 9 are EU countries for the period 1988-92.	DFA and SFA	- Cost inefficiencies dominate scale and scope inefficiencies. - cost inefficiency was found to be, on average, 27.5% o total costs.
Dietsch and Vivas (1996)	France and Spain	A sample of 223 French banks and 101 Spanish banks over the period 1988-92.	DEA	Cost inefficiency is found to be within the range 4-53% i France, compared to 4-93% in Spain.
Altunbas et al. (1997)	Germany	Data on a sample of 4659 banks for the years from 1988 to 1995.	SFA	The average annual inefficiency ranged from 5% to 7%.
Altunbas and Molyneux (1997)	EU	Data on 13603 European banks for the years from 1988 to 1995.	SFA	The average annual inefficiency ranged between 24% an 28%.
Athannasssopoulos (1997)	Greece	Data on a sample of 68 commercial branches of a large bank	DEA	Average inefficiency of the bank branches was found to b 10%
European Commission (1997)	10 EU countries	Data on a sample of balance sheet and income statements data from the period from 1990 (295 banks) to 1994 (1451 banks) for 10 EU countries.	DEA and SFA	- The sample's average inefficiency levels ere found to b 28%, 29%, 27%, 25%, and 23% for the five years o analysis, respectively, using the SFA. - The sample's average inefficiency levels increased fron 4% in 1990 to 7% in 1994.
Lovell and Pastor (1994)	Spain	Data on 545 branch of a large anonymous bank for the first semester if 1995.	DEA	- Average inefficiency was found 8% - 60 branches were found to be the most efficient.

Resti (1997)	Italy	Data in 270 banks over the period 1988-92.	DEA and SFA	Average inefficiency was found to be 31% for the SFA an 25% for the DEA.
Pastor, Lozano and Pastor (1997)	A number of EU countries	Data on 24 Belgian, 29 Danish, 150 French, 203 German, 26 Italian, 68 Luxembourgian, 26 Dutch, 17 Portuguese, 28 Spanish and 45 British banks for the year 1993.	DEA	Average inefficiency scores were found to be: 15% for Ital and Portugal, 18% for Spain, 22% for Belgium, 29% fo Denmark and the Netherlands, 44% for the UK, 49% fo Germany, and 63% for France.
Ashton (1998)	UK	Data on a sample of 99 UK building societies from annual report and accounts from 1990 to 1996.	SFA (both Translog and Fourier-Flexible functional forms)	- Using the Flexible-Fourier functional form, the averag efficiency estimate is found to be 76% - Using the Translog functional form, the average efficienc estimate is found to be 72.52%
Casu and Girardone (1998)	Italy	Data on 32 banking groups and 78 bank parent companies and subsidiaries for the year 1995.	DEA and SFA	- Average SFA inefficiency estimates was found to be 7.73% for banking groups and 5.53% for bank parent companie and subsidiaries. - Average DEA inefficiency estimates was found to b 21.3% for banking groups and 997% for bank paren companies and subsidiaries
Dietsch and Weill (1998)	11 EU countries	Data on 661 commercial, mutual and savings banks from 11 EU countries for the period 1992-96.	DEA and SFA	Cost and profit inefficiencies tend to decrease over time.
Maudos, Pastor, Pérez, and Quesada (1998)	11 EU countries	Data on 879 European banking firms over the period 1993-96.	DFA	Average cost inefficiency was found to be 9%.
Altunbas, Gardener, Molyneux and Moore (1999)	EU countries	Data for a sample of European banks over the period 1988-95.	SFA Fourier Flexible	Average inefficiency was found to be 25% of total costs, an tend to increase over time
Casu and Molyneux (1999)	France, Germany, Italy, Spain, and the UK	A sample of 750 banks from five EU countries over the period 1993-97.	SFA (Fourier Flexible)	- Inefficiency estimates were found to be within the rang 13-15% of total costs, and tend to decrease over time. Fo bank sizes. - Inefficiency tends to be inversely related to capital strength and positively correlated with the level of non-performin loans in the balance sheet. - No clear relationship between efficiency and bank asset size was found - Quoted banks are found to be more efficient than non

				quoted banks.
Guarda and Rouabah (1999)	Belgium, France, Germany, Luxembourg, Switzerland, and the UK	Data on 136 banks from six European countries over the period 1994-97.	SFA Translog	- Smaller banks (38.6%) are found to be more inefficien than larger banks (25.3%). - Banks in Luxembourg are the found to be the most efficien with, 67% and 85% for small and large banks, respectively. - UK small banks are found to be the most inefficient bank (45.5%), whereas large French banks are found to be th most inefficient banks (35.9%).
Mados and Pastor (1999)	Spain	Data on a number of savings banks and commercial banks	DEA	- Average cost efficiency in savings banks and commercia banks are found to be 80.2% and 90.9%, respectively. - The standard profit efficiency levels of the commercia banks (66.5%) are found to be higher than that of the saving banks (47.25)
Maudos, Pastor, Pérez, and Quesada (1990)	EU countries	Data on a sample of 879 banks from 11 EU countries for the period 1993-96.	Translog SFA	Average cost inefficiency estimate for the whole sample wa found to be 56%.
Sheldon (1999)	EU, Norway and Switzerland	Unconsolidated data for 1783 commercial and savings banks for he period 1993-97.	DEA	- Average cost and profit frontier efficiency estimates wer found to be 45% and 65%, respectively. - Banks in Denmark, France, Luxembourg, and Sweden ten to have the highest average scores, while banks in Greece Italy, Portugal, Spain, and the UK tend to have the lowes average efficiency scores. - Large banks, specialised banks, and retail banks are foun to be the most cost and profit efficient than small banks diversifies banks and wholesale banks, respectively.
Greiber and Herz (2000)	Demark, France, Germany, Italy, Spain and the UK	The sample contains between 552 and 800 balance sheets of different banks for the period 1990-96 with a total of 4792 observations	SFA translog	- Technical cost inefficiency was found to be within th range 3.1-29.6%. - Larger banks are found to be more efficient than smal banks.
Hasan, Lozano-Vivas and Pastor (2000)	10 EU countries	Data on 611 commercial banks: 24 Belgian, 29 Danish, 150 French, 203 German, 26 Italian, 68 Luxembourgian, 22 Dutch, 17 Portuguese, 28 Spanish and 45 from the UK	DEA	Average inefficiencies were found to be: 15.99% fo Portugal, 18.91 % for Spain, 19.91% for Denmark, 22.08% for the UK, 24.23% for France, 25.43% for Italy, 26.67% fo Germany, 37.38% for the Netherlands, 42.20% for Belgiun and 49.49% for Luxembourg.

Williams and Gardener (2000)	EU countries	An unbalanced panel dataset comprising over 6,300 savings banks observations over the period 1990-98.	SFA Flexible Fourier	- Average cost inefficiency was found to be 8.3%. - Average profit inefficiency was found to be 20.3%
Altunbas, Gardener, Molyneux and Moore (2001)	EU countries	Data on sample of European banks for the period 1980-95	SFA Flexible Fourier	- Average inefficiency was found to be around 25% of tota costs - Inefficiency estimates are found to be increasing over time.
Cummins and Rubio-Misas (2001)	Spain	A sample consisting of approximately all insurers reporting to the Spanish regulatory authorities over the period 1989-1998.	DEA	Cost efficiency is found relatively low in the Spanisl insurance market, averaging only 22.7% in 1998.
Rime and Stiroh (2001)	Switzerland	A sample of 290 Universal Swiss banks for the period 1996-1999	SFA	Average cost and alterative profit efficiencies were found t be 57% and 49%, respectively.
Turati (2001)	France, Germany, Italy, Spain and the UK	A sample of about 250 commercial banks for the period 1992-99.	SFA	- Cost efficiency was found to be within the range 80.5 83,8% in 1999. - No significant differences were found in average efficienc scores among the five European countries.
Maudos, Pastor and Pérez (2002)	Spain	Data on a number of commercial and savings banks for the years 1995 and 1996.	DEA	Universal banks are found to be more efficient thai specialised banks.
Maggi and Rossi (2003)	EU countries and the US	Data on 338 large commercial banks from 15 EU countries and 279 large US commercial banks, for the period 1995-98.	DFA	- For the EU countries, average inefficiencies were 36% an 32% using the Fourier-Flexible and Translog functiona forms, respectively. - For the US, average inefficiencies were found to be 37 an 32%, using the Fourier-Flexible and Translog functiona forms, respectively.
Weill (2001)	6 Eastern and 11 western EU countries	A sample of 535 banks from 11 EU countries, (Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Portugal, Spain and the UK) and 105 banks from 6 eastern Europe (the Czech Republic, Hungary, Latvia, Poland, Slovenia, and Slovakia).	SFA	The medium efficiency scores are found to be 54.45% fo Eastern European banks and 68.97% for Western Europea banks without environmental variables compared to 54.48% and 68.93% with environmental variables, respectively.

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5-3-3 Efficiency Studies on Recently-Liberalised or Emerging Markets

In their comprehensive international literature review on bank efficiency, Berger and Humphrey (1997) highlight the fact that, out of nearly 130 efficiency analyses of financial institutions across twenty-three countries, only a small number have examined banking sectors in developing countries. The relatively scant literature on bank efficiency outside the US and Europe focuses on efficiency differences among banks with various ownership types and assets size. This may be due to the fact that the banking systems in developing countries are still in their infancy and markets are usually characterised by high state-ownership, newly privatised banks, and the recent entry of foreign banks. The policy issues often investigated in these studies address the questions regarding liberalisation measures including the effects of ownership, privatisation and entry deregulation on bank efficiency. We are aware that there is only one study that covers Maghreb countries, and this is by Cook, Hababou and Roberts (2001), who examine the Tunisian experience using the DEA approach. A summary of the cost and profit efficiency studies undertaken on banking sectors in transition economies are summarised in Table 5–3.

5-3-3-1 Financial Liberalisation and Financial Repression

Gruben and McComb (1997) state that developing countries have historically been more aggressive than industrialised countries in their detailed control of the banking system. Governments have imposed far higher requirements in order to control financial and other resources and their utilisation by the financial sector. Capital markets traditionally did not exist, and if did, they have (in general) not sufficiently developed to influence economic growth.

Gemech and Struthers (2003) review the literature on financial repression/liberalisation starting from McKinnon (1993) and Shaw (1973), who introduced the *Complementarity Hypothesis*. According to this hypothesis, artificial ceilings on interest rates would reduce savings and accumulation capital necessary for investments as well as allocate available financial resources inefficiently. Thus, the *McKinnon-Shaw hypothesis* states that the removal of financial restrictions in "financially-repressed countries" is processed by the means of allowing markets forces to determine real interest rates to their market level. Besides, McKinnon (1973) indicates that financial repression may generate the *dualism effect*. That is, enterprises (usually government-owned firms) that benefit from subsidised financial resources stated in the central *economic plans* seem to tend to invest in relatively capital-intensive technologies, while enterprises that are not privileged by *central planners* (usually private-owned firms) seem to tend to invest in high-yielding projects with shorter maturity.

Fry (1997) uses the term "financial repression" to express the situation where the market is not liberalised. According to Griffiths and Wall (1999), financial repression occurs when the real rate of interest is negative and below the equilibrium rate of interest. Griffiths and Wall (1999) argue that financial repression is incorporated in the Keynesian idea that investment is elastic with changes in interest rates. This relationship makes financial repression seem to stimulate investment and growth. However, advocates of financial liberalisation say that the availability of savings rather than the cost of borrowing effectively determines the level of investment. Fry (1997) suggests that financial repression is damaging for the banking industry and from the perspective of economic growth. Financial repression consists of indiscriminate distortions of financial prices including interest and foreign exchange rates. The result of this type of financial policy is to reduce the real rate of growth and the real size of the financial system (McKinnon and Shaw, 1973). Most developing countries have operated for longer a substantial period under financial repression. Commercial banks, that typically dominate financial systems in these countries, they are, by consequence, most affected by financial repression. They typically allocate credits by considering non-economic criteria. Many factors may influence the lending decision, including political pressures, name of borrower, loan size and requirements to lend to priority sectors.

Hao, Hunter and Yang (1999) and Gilbert and Wilson (1998) agree that even though financial repression enabled Korea to achieve high growth rates during the 1960s and 1970s, it resulted in heavy costs to the banking industry. Overall, they state that the governmental interference had a negative effect on the productivity and development of the Korean banking sector.

Overall, financial liberalisation consists of four major measures: 1) liberalisation of interest and exchange rates, 2) promotion of market-based credit allocation, 3) the privatisation of government-owed banks, and 4) the relaxation of restriction on banks' portfolios.

The most important measure on which the financial liberalisation programme is centralised is the liberalisation of interest rates. The advocates of this argue that liberalised interest rate would make them positive and this would stimulate savings. An increase in real interest rates has two main effects. First, it should raise savings and, hence, encourage investments and economic growth. Second, it would force investors to invest in projects that have a higher output-input ratio. That is, when investment is of higher productivity, the resulting gains in efficiency will lead to higher growth rates.

The privatisation of state-owned banks is one important measure in financial liberalisation. As in the corporate sector, privatisation involves transferring the ownership or management of the bank from the hands of the state to national and foreign private agents. Gruben and McComb (1997), for instance, report that the Mexican government privatised its 18 banks between June 91 and July 92. The proceeds were used to pay down the public debt left over from the financial crisis of the 1980s, and led to an improved competitive environment. Gorton (1992) notes that one implication of financial liberalisation is the appearance of new or newly-privatised banks. The creation of such banks leads to an increase in lending activity and more competition in the system.

Gemech and Struthers (2003) present arguments that support financial repression and those that favour financial liberalisation. First, arguments praising the advantages of financial repression include Stiglitz (1994), who argues that financial repression can produce positive effects. By lowering the levels of interest rates, banks will have low-cost resources, and the rate of credits would accelerate if credits are allocated towards more profitable sectors such as export-oriented industries. In addition, Gemech and Struthers (2003) invoke the effects on the domestic financial sector. Capital account liberalisation would permit resident enterprises to be listed non-resident markets. This would tend to reduce liquidity in the domestic market, and consequently restrain its development. Gemech and Struthers (2003) refer to Diaz-Alejandro (1985) to claim that financial liberalisation is adequately linked to macroeconomic instability. The liberalisation experiences of South American countries in the 1970s, often led to financial crises manifested by insolvencies and massive government interventions resulting in nationalising private institutions and low domestic savings.

Second, Gemech and Struthers (2003) state that arguments favouring financial liberalisation indicate that financial deregulation measures tend to improve the functioning of the domestic financial systems, increase the accessibility to funds available on foreign markets, and allows cross-country risk diversification. Obstfeld (1998) indicates that international financial markets can facilitate the access to world savings to their most productive utilisation irrespective of geographical location. Stulz (1999) and Mishkin (2001) argue that financial liberalisation would promote transparency and accountability, reduce adverse selection and moral hazard, and alleviate liquidity problems in domestic financial markets. The entry of foreign banks into the domestic financial market helps facilitate access to new technology and reduce inefficiencies.

Therefore, financial liberalisation consists of breaking down barriers that restrict the operations of a financial market or an economy. Liberalisation of the banking sector refers to a situation where entry and exit barriers to the banking industry are removed. Under this, banks have the liberty of fixing and adjusting charges for the services they render and the incentives they offer to their clients. The effect of such an approach is to enhance competition, improve efficiency in banking institutions, ameliorate the quality of financial services, increase financial depth and breadth as more banking firms would join the industry, widen the range of financial instruments, and lower costs of banking services.

5-3-3-2 Bank Efficiency in Recently-Liberalised Financial Systems Derived from Parametric Approaches

Parametric approaches, particularly the stochastic frontier method, have been widely used to investigate bank efficiency in emerging economies.

Hasan and Marton (2000) introduce the experience of the Hungarian banking sector during the transitional period from a centralised economy to a market-oriented system.

During the 1990s, Hungary privatised its banking system and designed policies to promote foreign capital involvement in the domestic banking system. By 1998, all major banks were privatised and newly established banks grew rapidly. By then, Hungary became the first country in Eastern Europe to establish a fully privately owned banking sector that successfully overcame the constraints of problem loans, under-capitalisation and high concentration. Hasan and Marton (2000) investigate the effects of liberalisation measures on Hungarian banks, both domestic and foreign-owned institutions, over the transitional period 1993-1997. Using a sample of 145 bank observations over 1994 to 1997, they employ the Fourier Flexible stochastic frontier approach to estimate alterative profit and cost efficiency scores for their sample of banks operating in Hungary. Three output variables (total loans, total investment, and total borrowed funds) and inputs (price of labour and price of borrowed funds) are identified. The results indicate that, overall, average cost efficiency is 21.62% and alternative profit efficiency is 29.08%. The results also indicate that domestic-owned banks are more cost (24.84%) and alternative profit (29.93%) inefficient than their foreign counterparts, 20.96% and 25.24%, respectively. Banks with higher involvement of foreign capital tend to have lower levels of inefficiency. Hasan and Marton (2000) conclude that the privatisation of state-owned banks and an increase in foreign ownership in banking institutions are associated with improved efficiency, particularly, profit efficiency.

Mertens and Urga (2001) investigate cost and profit efficiency in the Ukrainian banking system for the year 1998, using two parametric approaches, SFA and TFA. The sample of this study includes data on 79 commercial banks that account for three quarters of total assets of the Ukrainian banking system in 1998. Mertens and Urga (2001) use three outputs (inter-bank loans, clients loans, Investment in securities and other investments), two inputs (labour and deposits), and two netputs (bank's capital and share of non-performing loans in total loans). The results show cost efficiency of 67.2% and 80.5% using the SFA and TFA, respectively. The results also show that profit efficiency of 71.66% and 65.77% using the SFA and TFA, respectively. In terms of cost efficiencies, small banks (68.6%, SFA, and 81.6%, TFA) are more cost efficient than large and medium-sized banks (63.1%, SFA, and 77.5%, TFA). In terms of profit efficiencies, large and medium-sized banks (73.15%, SFA, and 67.19%, TFA) are more profit efficient than small banks (71.54%, SFA, and 65.22%, TFA). These results imply that small banks operate efficiently in cost terms but are less efficient in profit terms. The results also indicate that large banks show significant diseconomies of scale while small banks show significant scale economies.

Weill (2001) analyses differences in the cost efficiency between domestic and foreign owned banks in the Czech Republic and Polish banking systems, using a number of bank characteristics in the comparative analysis including the degree of risk preferences, size and structural of activities of every bank. The sample of this study comprises 31 Polish (19 domestically-owned and 12 foreign-owned) and 16 Czech banks (8 domestically-owned and 8 foreign-owned) for the year 1997. This study employs the stochastic translog cost functional form and the intermediation approach in which outputs are loans and investments, and inputs are labour, physical capital and borrowed funds. The model also includes the level of capital proxied by equity in order to control for the difference in risk. The results suggest that foreign banks have better management reflected by higher mean efficiency level than domestically owned banks. Foreign banks tend to benefit from higher levels of allocative efficiency in output, suggesting that their choice of output and pricing is more optimal. However, Weill (2001) states that the differences in inefficiency between banks in these two countries cannot be only explained by ownership. Management of domestically owned banks tend to have the advantage of having better knowledge of the local market than foreign-owned managers who may have poor information on local borrowers, resulting in adverse selection for foreign-owned banks. Weill (2001) concludes that foreign-owned banks appear to be more exposed to moral hazard problems in countries in transition due to the uncertainty of accounting information, which leads to mis-evaluation of collateral and equity.

Williams and Intarachote (2001) attempt to establish whether financial liberalisation policies, which are designed to increase the competitiveness of the banking system, would improve the profit efficiency of Thai banks. Williams and Intarachote (2001) argue that financial deregulation affects cost and revenues efficiencies in three ways. First, the restructuring of the financial sector is expected to realise economies of scale. Second, inefficiencies are postulated to fall as banks move closer to the best practice. Finally, abnormal bank profits often associated with financial repression and oligopolistic behaviour are expected to erode. The alternative profit approach based on the stochastic frontier is applied using panel data to determine whether efficiency is increasing, decreasing or constant. The sample used includes 29 banks operating in Thailand between 1990 and 1997, of which 15 banks are domestically owned and 14 banks are foreign-owned. Using the global advantage hypothesis, Williams and Intarachote (2001) pre-suggest that foreign –owned banks outperform domestic banks in developing countries. The presence of supposedly more efficient foreign-owned banks is expected to raise domestic banks' efficiency, which explains why financial deregulation programmes specify reducing entry barriers for foreign capital. The results of this study indicate that, on average, between 1990 and 1997, domestic owned and foreign-owned Thai banks lost 15.14% and 14.74%, respectively, due to inefficiencies. Particularly, the most efficient banks operating in Thailand seem to be Japanese capital-owned. The two smaller assets size classes of Thai banks lost a smaller proportion of potential profits to inefficiencies than the two larger assets size classes. Williams and Intarachote (2001) conclude that the deregulation-induced expansion of banking activities ultimately did not decrease the financial fragility of Thai banks.

Kasman (2002) uses a Fourier-flexible cost function specification to investigate cost efficiency, scale economies, and technological progress in the Turkish banking system over the deregulated period 1988-98. Similar to Zaim (1995), this study attempts to investigate the impact of financial liberalisation measures, including the lifting of entry constraints foreign banks. Consistent with the intermediation model, three outputs (short-term loans, long-term and specialised loans, and securities), three inputs (borrowed funds, labour and capital), one control variable (Number of branches), and two environmental variables (the ratio of non-performing loans to total loans; and the ratio of liquid assets to total assets) are defined. Kasman (2002) finds average cost inefficiency of 23.6%, and efficiency of the banks improved over the sample period. Kasman (2002) believes that the fall in average inefficiency over time was due to the deregulation even though the Turkish banking sector remains relatively more inefficient than its US and

European counterparts[134]. In addition, Kasman (2002) finds evidence of significant economies scale over the sample period. The average scale economies are found to be 74.3%. The results also suggest that scale inefficiencies dominate X-inefficiencies. No clear relationship between size and cost inefficiency is found. Medium-sizes banks, with assets within the range US$400-600 million, and the largest banks (with assets in excess of US$ 2 billion) are the most efficient. The less efficient banks are both large banks and small banks. The results of Kasman (2002) also suggest the existence of significant economies of scale for all classes. In contrast to the findings of the other empirical studies where larger banks were usually seen to be facing scale diseconomies or decreasing scale economies (e.g. Berger et al., 1987), this study finds evidence of scale economies for each bank size class. The magnitude of scale economies ranges from 41.2% for the very smallest banks to 12.2% for largest banks.

Kasman (2002) argues that the presence of significant economies of scale for small and medium-sized banks should motivate these banks to react to this opportunity and move rightward on their average cost curve, either by increasing output levels or by merging with other banks. The Turkish banking sector has not witnessed any merger activity among private banks in its recent history, but because of significant economies scale in the industry, more merger activity between small and medium-sized banks should (he argues) be encouraged. That is, an increase in size would realize some cost advantages for all banks, especially small and medium-sized ones.

Kraft, Hofler, and Payne (2002) examine the effects of bank privatisation and foreign capital entry on bank efficiency in Croatia, over the period 1994-2000. They estimate a Flexible-Fourier stochastic cost frontier model with a truncated normal distribution on the inefficiency term. The results suggest that new private and privatised banks are not the most efficient through most of the period. Privatisation is found not to have immediate effects on improved efficiency. Foreign-owned banks, however, have substantially better efficiency scores than their domestic counterparts. Kraft, Hofler and Payne (2002) conclude that, from a policy point view, liberalisation in the form of

[134] Berger et al. (1993) found that the X-inefficiency for the U.S. depository institutions is approximately 20% of costs; whereas Allen and Rai (1996) report that the average cost inefficiency for the European countries is approximately 15 % of cost.

privatisation and opening the local banking market to foreign-capital is not necessarily a productive measure.

Bonin, Hasan and Wachtel (2003) use data from 1996 to 2000 and an unbalanced panel consisting of 220 banks covering 830 observations to investigate the effects of foreign ownership on banking sector cost and profit efficiency across eleven transition countries[135]. Foreign participation in domestic banking institutions in these eleven transition countries has increased dramatically in the second half of the 1990s. Bonin, Hasan and Wachtel (2003) suggest that foreign bank entry has generated more efficient and more competitive banking sectors. The stochastic translog frontier approach is used in this study with four output variables (total deposits, total loans, total liquid assets and investments other than loans and liquid assets) and two input prices (the price of capital and the price of funds). Overall, the results indicate that banking sectors in these countries became more efficient and more competitive toward the end of the 1990s. The mean cost and alterative profit efficiencies are found to vary within the range 23.21-94.99% and 88.22-90.14%, respectively. Larger banks in these transition countries are found to be unambiguously less efficient The largest banks in many of these countries are specialised government banks ongoing from the previous state-owned period. Government-owned banks are found to be less efficient than their private counterparts. Majority foreign-owned banks are found to more efficient than their private domestic counterparts. Particularly, banks with international institutional capital have higher returns on assets and are more efficient by profit measures than other foreign-owned banks. However, these banks are found to not exhibit significantly better cost efficiency than their counterparts. Hence, it can be concluded that international institutional investors are more interested in banks with high financial performance than in facilitating the transfer of new technology and modern banking practices.

Green, Murinde and Nikolov (2003) investigate whether foreign-owned banks are more efficient than domestic banks in Central and Eastern Europe. Their study applies the translog stochastic frontier to panel data of 273 foreign and domestic banks located in

[135] These countries are four northern European countries, the Czech Republic, Hungary, Poland, and Slovakia; four southern European countries, Bulgaria, Croatia, Romania, and Slovenia, and the three Baltic countries, Estonia, Latvia, and Lithuania

Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland and Romania over the period 1995-99. While labour, deposits and capital are used as inputs, loans, other earning assets and non-interest income are employed as outputs. One finding of this study is that, with the exception of the Czech Republic and on average, banks in Central and Eastern Europe have exhibited small or negligible economies of scale and are effectively operating at or close to scale-efficient levels. In addition, Green, Murinde and Nikolov (2003) find that the mean efficiency of foreign banks does not appear to be significantly different from the mean efficiency of domestic banks in the sample economies. They conclude that there is no string evidence to sustain the argument that foreign ownership of banks is a vital factor in improving banks efficiency, and thus the positive effects of liberalisation bank efficiency can be questionable.

Huang and Wang (2003) who investigate bank efficiency in Taiwan by applying the Fourier Flexible functional form over the period 1981-97. This study uses 22 domestic backs of whom 11 banks are private-owned. The results of this study suggest that cost savings can arise from optimising the inputs mix more than from improving technology used and managerial performance. Overall, technical inefficiency was 12% of total costs whereas allocative inefficiency was bout 15.8%, which tends to decrease over time due to the effects of liberalisation.

5-3-3-3 Bank Efficiency in Recently-Liberalised Financial Systems Derived from Non-Parametric Approaches

Data envelopment analysis, DEA, has also been extensively used in studies investigating bank efficiency in recently liberalised economies.

Zaim (1995) investigates the effects of liberalisation policies implemented over the period 1981-90, on Turkish commercial banks' cost efficiency. The investigated dataset represent only two years, 1981 and 1991, to differentiate between the pre- and post-liberalisation periods and compares efficiency scores of different bank ownership types over the period. In the 1980s, Turkey implemented various deregulation measures in the financial sector including interest rate, credit and entry liberalisation. Zaim (1995) uses DEA and the intermediation definitions of inputs and outputs to examine banking sector efficiency over the selected years. This study finds that technical efficiency increased by an average of 10% between 1981 and 1990. Pure technical inefficiency is found to be the major source of most of Turkish banks' efficiency as they were operating at the constant returns to scale area in both the pre-and post-liberalisation periods. In addition, privately owned banks are found to be the most efficient. Government-owned banks were found to be adversely affected by allocative inefficiency, which resulted in closing and/or the reduction of staff of unprofitable branches. Zaim (1995) concludes that while liberalisation measures had a severe impact on unprofitable banks and branches (that were forced to exit the market), they succeeded in stimulating commercial banks to take measures that would enhance both technical and allocative efficiency.

Isik and Hasan (1998) investigate the impact of structure, control and governance on the cost of efficiency of Turkish commercial banks. This investigation employs the DEA approach at three separate points in time; 1988, 1992 and 1996, in order too account for the changes in the macro-economy and regulatory environment. The intermediation approach is used to define four output variables (short-term loans, long-term loans, off-balance sheet items and other earning assets) and three input variables (labour, capital and purchased funds). The study estimates the average efficiency score for the sample over the three investigated years at 72%. Average efficiency scores are found to have consistently fallen over time, from 78% in 1988, to 71% in 1990 and to 68% in 1996. Technical inefficiencies are found to be the dominant source of cost inefficiency in Turkish commercial banking (rather than allocative inefficiencies). Also, assets size is not found to be significantly correlated with efficiency, implying that banks of different sizes might be equally efficient. However, being a large bank in Turkey is strongly positively associated with levels of pure technical efficiency and negatively related to scale efficiency. In addition, Isik and Hasan (1998) find that chief executive officers of efficient banks tend not to be chairman of the board. This implies that the banks that separate decision management (the CEO) from decision control (the Chairman) would have higher levels of efficiency. Overall, this study finds that privately owned banks tends to be the most efficient firm in the Turkish banking system.

Similarly, Jackson, Fethi and Inal (1998) apply the DEA methodology to examine the productivity growth performance of thirty-eight Turkish commercial banks over the post-liberalisation period 1992-96. Using the Value-added approach, they construct a model that defines two inputs (Number of employees, and the sum of non-labour operating costs and direct expenses on buildings and amortisation expenses) and three outputs (loans, demand deposits, and time deposits). This study finds that Turkish commercial banking experienced a productivity growth over the period of study with the exception of 1993 and 1994, when economic growth contacted in Turkey. Among the three types of ownership, private ands foreign banks showed greater productivity compared to the state-owned banks. Sumerbank, which was privatised in 1995, experienced enormous productivity growth in the post-liberalisation period. Jackson, Fethi and Inal (1998) conclude that the productivity growth of both private and state-owned banks were due to technological advancements that is, the outcome of competition which rose in the post-liberalisation period.

Cook, Hababou and Roberts (2001) investigate the impact of financial liberalisation on bank efficiency in Tunisia. The sample of their study includes ten banks operating in Tunisia between 1992 and 1998, of which five banks are government-owned and the remaining are domestic or foreign private owned. Using the DEA approach, the investigation adopts the intermediation approach, in which the specified inputs are interest expenses and non-interest expenses (as proxies for funding costs and operating costs, respectively. This study estimates the level of average inefficiency at 45%. Government-owned banks (55%) are found to be more inefficient than private banks (36%). Inefficiency is found to be associated with the importance of non-performing loans, as troubled banks have inefficiency scores averaging at 52% compared to less troubled banks' inefficiency of 40%. Also, this study finds that inefficiency arises with size implying that the larger the bank the more inefficient it is. The small, medium-sized, and large banks have average inefficiency estimates of 20%, 42% and 68%, respectively. The authors conclude that efficient banks in Tunisia tend to have private ownership, carry fewer problem loans, record higher foreign equity participation, and are generally smaller. Financial reforms, however, have been less successful in closing the inefficiency gap between public, domestically owned private, and foreign owned banks.

Burki and Niazi (2003) investigate the impact of liberalisation reform policies, including privatisation, entry access to foreign and private capital and central bank autonomy, upon the banking sector in Pakistan over the 1990s. They apply the DEA approach to a sample of 366 observations of nearly all commercial banks (divided into state-owned, private and foreign banks) operated within the period 1991-2000. Based on the intermediation approach, three outputs are defined (i- loans and advances, ii- investments, and iii- contra accounts) and four inputs are identified (i- labour, ii- physical capital, iii- operating cost, and iv- financial capital). Burki, and Niazi (2003) find mean cost efficiency over the entire period to be 74.5%, which varied from the highest efficiency of 92.3% in 1991 to lowest efficiency of 46.4% in 1996. Overall, allocative efficiency (83.6%) is found to be contributing more to cost inefficiency than technical efficiency (88.2%). Moreover, Burki and Niazi (2003) find foreign-owned banks (79.7%) to be more efficient than private banks (75.1%) while least cost efficiency was achieved by state-owned banks (60.5%). In addition, Burki and Niazi (2003) found that individual reforms promoting competition has not led to an improvement in average efficiency of banks in the post-reform period as hypothetically expected. The complete liberalisation of the banking sector, also led to a significant decline in all the efficiency measures. Burki and Niazi (2003) explain that the adverse impact of liberalisation reform policies on banking efficiency could be due to the unfavourable macroeconomic performance of the Pakistani economy during most of 1990s. The lower GDP growth rates in 1990s affected certain sectors in which banking sector loans and investments were concentrated. Lower growth rates have generated problems associated with weak debt servicing of borrowers, and thus increasing loan defaults and credit risks. Therefore, in Pakistan, the poor economic growth recorded in 1990s led loan default rates to grow tremendously during the period. Burki and Niazi (2003) hypothesise that individual policy reforms would generate better results if economic growth environment is also conducive.

Stavárek (2003) estimates commercial banks' efficiency in the Visegrad[136] countries before joining the EU using the DEA approach. Stavárek (2003) attempts to identify which of the banking sectors in the respective countries is the most efficient and whether there has been an improvement in banking efficiency spanning the period 1999-2002. Since 1990, the four countries have witnessed liberalisation reforms in order to create

[136] This group includes the Czech Republic, Hungary, Poland and Slovakia and is called according to the Hungarian town of Visegrad, where the agreement of cooperation were signed by presidents of former Czechoslovakia, Poland and Hungary on 15 February 1991.

market-driven banking sectors. Reforms include mainly relaxing restraints on private and foreign banks, ownership restructuring and recapitalisation, as well as management of nonperforming loans. The dataset of this study contains 59 banks in 1999, 72 banks in 2000, 70 banks in 2001, and 62 banks in 2002. Three inputs (labour, capital, and deposits), and two outputs (loans and net interest income) are employed. The results indicate average efficiency levels for the four countries to be 90% using the VRS approach. The Czech and Hungarian banking sectors are found, on average, to be the most efficient followed by the Polish banking sector, while the Slovak banking is evaluated as the least efficient. One finding of this study was the substantial increase of the Hungarian sector's average efficiency that may be explained by positive effects of relatively fast and successfully performed restructuring and privatization of the largest banks and banking system as a whole. To further investigate the determinants of efficiency of financial intermediation in Visegrad's countries banking sectors, Stavárek (2003) follow a two-stage approach with a Tobit regression, in which DEA efficiency scores are used as the dependent variable, whereas the independent environmental variables are related to geographic location (country dummy variables) and bank profitability (return on average equity), bank structure and size (equity on total assets and total assets) and bank ownership (dummy variable indicating type of ownership). Stavárek (2003) finds evidence of statistically significant factors of profitability, foreign ownership, and (to a certain extent) the size of a bank influences banks efficiency in the Visegrad countries.

Thus, bank efficiency studies in recently-liberalised economies have concentrated on investigating the effects of the liberalisation and deregulation reform policies on the efficiency of the respective banking sectors. Particular reform policies include privatisation and the abolishment of entry barriers by allowing private and foreign banks to operate locally. For instance, while some of the studies find that allowing foreign-owned banks to enter the banking sector have improved the efficiency of banks, others find adverse effects. These conflicting findings are explained by Berger at al. (2000) according to two hypotheses. While the *home field advantage* hypothesis states that domestic-owned banks are more cognisant of needs of domestic banking markets, which increase their ability relative to the foreign-owned banks' ability, the *global advantage* hypothesis states that foreign-owned banks are in more appropriate position of scoring higher levels of efficiency due to their relative technological advances and management superiority.

A summary of both parametric and non-parametric studies of bank efficiency in developing and emerging economies are shown in Table 5–3

Table 5–3 Review of Studies on Bank Efficiency in Other Countries, excluding the US and EU

Study and Year	Country	Data and Period of Study	Methodology	Main Findings
Oral and Yolalan (1990)	Turkey	Data on the Turkish Bank branches	DEA	Inefficiency estimates are within the range 13-47%.
Fukuyama (1993)	Japan	Data on 143 banks for the year 1990	DEA	Average inefficiency score is found to be 14%.
Fukuyama (1995)	Japan	Data on 462 Japanese banks for the years 1989, 1990 and 1991.	DEA	Average inefficiency scores is found to be 54% in 1990 an 1991, and 56% in 1991
Zaim (1995)	Turkey	95 banks for the two years of 1981 and 1990	DEA	Average inefficiency estimates are found 17% in 1991 an 6% in 1990.
Bhattacharyya, Lovell and Sahay (1997)	India	Data on 70 commercial banks over the deregulation period 1986-91.	DEA	- Inefficiency scores are found to be within the range 17.19 80.44% over the period of analysis - Government-owned banks are more efficient (87%) tha privately and foreign-owned banks (75%)
Taylor, Thompson, Thrall and Dharmapala (1997)	Mexico	Data on 13 commercial banks fro the years 1989, 1990 and 1991.	DEA	Average inefficiency scores are found to be 25% in 198 28% in 1990, and 31% in 1991.
Leightener and Lovell (1998)	Thailand	Data on 31 banks for the period 1989-91.	SFA	Average annual efficiency estimates are found to be 58% 49%, 45%, 42%, 34% and 31% for the years unde investigation, respectively.
Okuda and Mieno (1999)	Thailand	Data on a sample of Thai domestic banks over the period 1985-94.	SFA Translog	- Average inefficiency score is found to be just over 25%. - Large banks are found to be the most cost efficient.
Altunbas, Liu, Molyneux and Seth (1999)	Japan	Data on 130 banks in 1993 and 1994 and 121 banks in 1995.	SFA Fourier-Flexible	- Diseconomies of scale are found when risk and qualit factors are taken onto account. - Average inefficiency estimates are found to be within th range 5-7%.
Hao, Hunter and Yang (1999)	Korea	Data on 19 private banks over the period 1985-95	SFA	- Inefficiency estimates are found to be within the range 9 15%. - The financial deregulation of 1991 was found to have ha

				little or no significant effects on the level of sample banl efficiency.
Intarachote and Brown (2000)	Thailand	Data on an unbalanced of 15 Thai banks and 15 foreign-owned banks and a number of finance and specialised institutions	DEA	Overall cost inefficiency scores are found to be within th range 52-47% for Than banks, 50-67% for foreign-owne banks, and 86-95% for other financial institutions
Jackson and Fethi (2000)	Turkey	Data on sample of 48 commercial banks for the year 1998	DEA	Average inefficiency estimates is found to be 23%.
Avkiran (1999)	Australia	Data on 4 major trading banks and 6 regional banks for the period of deregulation 1986-95.	DEA	Average technical efficiency was found to be 91.67%. Efficiency decreased from 97.7% in 1986, to 81.2% in 199 and then increased to 94.2% in 1995.
Drake and Hall (2000)	Japan	Data on a sample of 149 Japanese banks for the financial year ending March 1994	DEA	Average efficiency score is found to be 72.35% with minimum efficiency score of 53.37%.
Hasan and Marton (2000)	Hungary	Data on all Hungarian banks that reported during the 1993-97 period, 154 bank observations.	SFA Fourier-Flexible	Average cost and alternative profit efficiency estimates r found to be 21.62% and 29.08%, respectively. The higher the foreign involvement in bank ownership, th lower is the inefficiency.
Mertens and Urga (2001)	Ukraine	Data on sample of 79 commercial banks for the year 1998.	SFA and TFA	- Average cost efficiency was found to be 67.2% using th SFA and 80.5% using the TFA. - Average profit efficiency was found to be 71.99% using th SFA and 65.77% using the TFA. - Small banks are found to operate more efficiently in cos terms but less efficiently in profit terms.
Saha and Ravishanker (2000)	India	Data on 25 public sector banks for the year 1995	DEA	Efficiency estimates are found to be within the range 58-74% with an average efficiency of 69%.
Caderes (2001)	Chile	Data on all institutions in the Chilean banking system.	DEA	Average efficiency scores are found to be within the rang 68.4-76.7%. Small banks are found to be more inefficient than large an medium-sized banks.
Cook, Hababou and Roberts (2001)	Tunisia	Data on 10 Tunisian banks (5 public and 5 privates, for the period 1992-97.	DEA	- Average inefficiency is found to be 45% using th intermediary approach

				- Public-owned banks (55% are found to be more inefficien than Private-owned banks (36%)
Kwan (2001)	Hong Kong	Quarterly data on a number of multi-branch banks for the period 1992-99.	SFA	Average efficiency estimates are found to be within the rang 16-30%.
Sathye (2001)	India	Data on 94 commercial banks for the period 1997-98 (27 public-owned banks, 33 private-owned banks and 34 foreign-owned banks)	DEA	- Average efficiency score is found to be 83% as per Mode A, and 62% as per Model B. - Foreign-owned banks are found to be in the highes efficiency quartiles in both models
Weill (2001)	Czech Republic and Poland	Data on a sample of 31 Polish banks (of which 12 foreign-owned) and 16 Czech banks (of which 8 are foreign-owned) for the year 1997.	SFA Translog	Foreign-owned banks are found to be more efficient thai other banks, suggesting better management.
Darrat, Topuz and Yousef (2002)	Kuwait	Data on 8 banks for the period 1994-97.	DEA	Average cost inefficiency is found to be 32%
Isik and Hassan (2002)	Turkey	Data on a sample of commercial banks over the years 1988, 1992 and 1996.	DEA	Average cost efficiency of the sample consistently fell ove time, from 78% in 1988, to 71% in 1992 and 68% in 1996.
Rao (2002)	UEA	Data on 35 banks for the period 1998-2000.	SFA Translog and Flexible-Fourier	- Average inefficiency estimates increased from 14% in 198 to 25.21% in 2000 using the Fourier-Flexible, but de crease from 30.48% in 1998 to 25.53% in 2000, using the translog. - Small banks are found to be more efficient than large an medium-sized banks.
Williams and Intarachote (2002)	Thailand	Data on 29 banks for the period 1990-97.	SFA	- Average alternative profit inefficiency is found to b 15.14% for domestic-owned banks, and 14.74% for foreign owned banks. - Small banks are found to be more efficient than large an medium-sized banks. - Efficiency decreased at an increasing rate over time.
Bonin, Hasan and Wachel (2003)	11 Eastern Europe countries	Data on unbalanced sample of 220 banks and 830 observations for the period 1996-2000.	SFA Translog	- Government-owned banks are less efficient than private an foreign-owned banks - Foreign-owned banks are more profit efficient than cos efficient.
Burki, and Khan Niazi (2003)	Pakistan	23 commercial banks for the year 1991, 36 banks for the period 1992–	DEA	-Mean cost efficiency is found to be 74.5%. - Allocative inefficiency (83.6%) contributes more than

		1994, 39 banks for 1995, 40 banks for 1996–1998, 39 banks for 1999, and 37 banks for 2000.		technical inefficiency (88.2%). - The highest levels of efficiency were achieved by foreign banks (79.7%), followed by private banks (75.1%) while state-owned banks achieved least cost efficiency (60.5%).
Yildimir and Philippatos (2003)	12 countries from central and east Europe	Date for the period 1993-2000.	DFA and SFA	- The managerial inefficiencies in CEE banking markets were found to be significant, with average cost efficiency level for 12 countries of 72 and 77 percent by the DFA and the SFA, respectively.

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5-4 Conclusion

This chapter provides a literature review of a number of bank efficiency studies, including those that examine scale, scope and X-efficiency. These studies employ distinct methods for the estimation of cost and profit efficiency and its determinants as well as economies of scale and scope. Two major families of approaches have been extensively used; the parametric and non-parametric approaches. Overall, studies of efficiency on banking systems conclude that scale economies are significantly outsized by X-efficiency, and banks can realise savings through improving their X-efficiency more than through scale economies.

The popular empirical literature that focuses on the US (Berger et al., 1993; Clark, 1996; Clark and Speaker, 1994; Evanoff and Israilevich, 1991; Gilbert, 1984; Humphrey, 1990; Mester, 1987; Mitchell and Onvural, 1996) generally shows that overall the average cost curve is relatively flat with some evidence of scale efficiency gains for small banks. Studies on scope economies are still more controversial with little consensus as to the existence and the extent of product mix efficiency (Berger and Humphrey, 1991 and 1994). Bank efficiency studies in Europe provide more evidence that the average cost curve tends to be U-shaped and that scope economies exist. Overall, as concluded by Berger et al (1993) find that X-inefficiencies count for 20% of costs in banking whereas scale elasticities and scope economies count for 5%.

Studies on efficiency in European banking systems have not arrived at different findings from those studies on the US banking system. They focused on investigating the relationship between efficiency and issues such as consolidation and allowing banks to operate in all countries in the EU. Bank efficiency studies in other economies investigate the effects of liberalisation reforms on bank efficiency. Conflicting results are found. Reform measures can improve bank efficiency, but equally they can reduce bank efficiency. Studies on liberalising financial systems do, however, appear, to show that private domestic and foreign banks, are more efficient that their state-owned counterparts. Foreign-owned banks and banks with foreign participation are also often found to be more efficient.

Chapter 6 Methodology, Data, Variables Definition and Results

6-1 Introduction

This chapter examines the cost and alterative profit efficiency of a sample of fifty financial institutions in the three North African countries of Algeria, Morocco and Tunisia over the time period 1994 to 2001. As noted in earlier chapters, this period witnessed a number of economic, financial and political events including the implementation of a number of economic and financial liberalisation measures. Two major liberalisation measures relate to the dismantling of restrictions on private and foreign capital access into the national banking industries through either direct investment or privatisation, and the deregulation of all price control including interest rates. Grigorian and Manole (2002) state that liberalisation measures incorporating legal and regulatory reforms, enterprise privatisation and prices deregulation are most responsible for improving the quality of services and financial soundness of banking institutions in transition countries. Within this configuration, one would therefore expect that financial liberalisation and possibly other potential factors would yield an important impact on the cost and profit efficiency of banks in the transition countries under study. This chapter attempts to explore empirically the conditions that are likely to be associated with cost and profit efficiency in Maghreb banking[137]. That is, a relationship may exist between the cost and profit efficiency levels of banking firms and a number of potential firm-specific and environmental variables. In particular, the extant literature, including Bonin, Hasan and Wachtel (2003), suggests that in the case of transition economies, a number of potential efficiency determinants are likely to exist and these are related to such factors as managerial competence, financial liberalisation and the degree of effectiveness of governmental and regulatory policies.

[137] This study takes a similar approach to Casu and Girardone (2003) who examine cost and (alternative) profit efficiency of large banking forms by defining a common EU frontier over the period immediately following the completion of the EU's Single Market Programme in 1992. More specifically, this paper employs parametric (Stochastic Frontier Approach, SFA) and non-parametric (Data Envelopment Analysis, DEA) methodologies.

This study uses a sample that comprises fifty banking firms that were functioning in Algeria, Morocco and Tunisia, consisting of a total of 281 observations over the time period 1994-2001. In terms of assets, the sample represents an estimated 70% of total banking sector's assets, and 90%, 85% and 80% of total banking assets in the three countries, respectively. The sample excludes the central banks and a number of other banks, including a number of offshore and specialised banks, due mainly to the unavailability of information. Using the intermediation approach, the stochastic Frontier Approach (SFA) with the translog specification and the Data Envelopment Analysis technique (DEA) will be applied to the sample to estimate cost, scale, and alternative profit bank efficiency scores as well as scale economies for the banking institutions in the respective countries. Besides, this chapter outlines the methodology used to estimate efficiency scores based on the frontier approaches suggested by Coelli (1996, a and b). The chapter explains the characteristics of the stochastic frontier and the DEA methods and the translog functional form, the calculation of efficiencies and scale economies. In the data section, the chapter examines the properties of the sample, including the descriptive statistics and the variables used to estimate banking sector efficiency. The final part of the chapter reports our results.

6-2 Methodology

As noted above, this thesis uses the parametric (and nonparametric) methods to estimate the "best practice cost and alternative profit frontier" for a sample of Maghreb banking institutions. These methods are the stochastic frontier approach with a translog function specification and DEA, respectively. The main methodological focus is on the translog stochastic frontier approach in both cost and profit efficiency estimation, while DEA estimates are used as a comparative benchmark to cross check results derived from the translog frontier approach results and to ensure that consistency conditions are met[138].

6-2-1 The Stochastic Translog Frontier Functional Form

The estimation of cost and profit efficiency scores is based on the assumed existence of a relationship between measures of costs, total costs (TC), or total profits (TP), input prices

[138] The DEA approach taken is the VRS version.

(P) and output quantities (Q). Mathematically, this relationship is presented in a form of a cost or profit function. For instance, the cost function presented as TC = TC (Q, P) displays the relationship between production costs and the prices of variable inputs.

The cost and alternative profit functions are specified as translog functions, that is, as mentioned in earlier chapters, more flexible than other specifications such as the Cobb-Douglas (see Berger and Humphrey, 1994). The thesis pools the banks in the sample into one model to take into account the differences in efficiency estimates at the national levels by including a set of country variable dummies as undertaken by Dietsch and Lozano-Vivas (2000).

6-2-1-1 The General Form of the Stochastic Frontier Approach

In this thesis, the stochastic cost and profit frontier model to be estimated for a sample of N banking firms can be given as

$$LnTC_i = f(Q_i, P_i, \beta i, Z_i) + (v_i + \mu_i);\text{ for the Cost function} \quad (6.1)$$
$$LnTP_i = f(Q_i, P_i, \beta i, Z_i) + (v_i - \mu_i);\text{ for the Alternative profit function} \quad (6.2)$$
$$i = 1, 2, 3, \ldots\ldots\ldots\ldots, N;$$

Where TC_i is observed total costs of bank i, TP_i is observed total profits of bank i, Q_i is the vector of output levels and P_i the vector of input prices for bank i, β_i represents a sect of estimated coefficients, and Z_i represents a vector of environmental variables[139]. While $f()$ is a functional form in which lnTC function is the predicted log cost function of a cost-minimising bank functioning at conditions of (Q_i, P_i, B_i), the $lnTP_i$ function is the predicted log total profits function of a profit-maximising bank functioning at same conditions of (Q_i, P_i, B_i). v_i and μ_i both represent a two-component error term, ε. While v_i is a two-sided error term representing statistical noise (assumed to be independently and identically distributed and have a normal distribution with mean 0 and variance σ_v^2), μ_i is non-negative random variables that account for technical inefficiency effects.

The calculation of cost and profit efficiency scores using the stochastic model is based on the assertion that total costs or return on equity for a bank i will deviate from the cost or

[139] Environmental Variables are other variables that are nor included within the input and output variables.

profit efficient frontier due to the effects of the two-component error term, v_i (random noise) and μ_i (inefficiency effects).

6-2-1-2 The Specification of the Translog Stochastic Frontier Approach

In our analysis, we adopt the Translog functional form instead of the Fourier-Flexible functional form as suggested by McAllister and McManus (1993). While the Fourier Flexible form is a preferred specification it requires large amounts of data observations, and this requirement is impractible for our analysis, as the number of banks (50) and observations (257) is not sufficiently large.

Thus, the functional form used to estimate cost and alternative profit efficiency scores and scale economies is specified as the translog form. The translog functional form for the cost and alternative profit efficiency frontiers is specified as:

For the cost function:

$$Ln\ (TC/P_3)=\alpha_0+\sum_{i=1}^{m}\alpha_i \ln Q_i+\sum\beta_j \ln(P_j/P_3)+\frac{1}{2}\left[\sum_{i=1}^{m}\sum_{j=1}^{m}\delta_{ij}\ln Q_i \ln Q_j+\sum_{i=1}^{n}\sum_{j=1}^{n}\cdot\gamma_{ij}\ln(P_i/P_3)\ln(P_j/P_3)\right]+$$
$$\left[\sum_{i=1}^{m}\sum_{j=1}^{n}\rho_{ij}\ln Q_i \ln(P_j/P_3)\right]+\psi_i\ Z+v_i+\mu_i$$

(6.3)

For the alternative profit function:

$$Ln\ (TP/P_3)=\alpha_0+\sum_{i=1}^{m}\alpha_i \ln Q_i+\sum\beta_j \ln(P_j/P_3)+\frac{1}{2}\left[\sum_{i=1}^{m}\sum_{j=1}^{m}\delta_{ij}\ln Q_i \ln Q_j+\sum_{i=1}^{n}\sum_{j=1}^{n}\cdot\gamma_{ij}\ln(P_i/P_3)\ln(P_j/P_3)\right]+$$
$$\left[\sum_{i=1}^{m}\sum_{j=1}^{n}\rho_{ij}\ln Q_i \ln(P_j/P_3)\right]+\psi_i\ Z+v_i-\mu_i$$

(6.4)

Where *lnTC* is the natural logarithm of total bank production costs (operating and financial costs); *lnTP* is the natural logarithm of total actual profits, lnQ_i is the natural logarithm of bank outputs (i.e. loans, securities, off-balance sheet items), $\ln P_i$ is the natural logarithm of *i*th input prices (wage rate, interest rate and physical capital price);

Z_i represents a vector of environmental variables, v_i and μ_i is a two-components error term representing noise and inefficiency effects, and $\alpha, \beta, \delta, \gamma, \rho$ and ψ are coefficients to be estimated.

Since the duality theorem requires that the cost function be linearly homogeneous in input prices and continuity requires that the second order parameters are symmetric, the following restrictions apply to the factor prices of the cost and alternative profit functions in the two above equations: $\sum_{i=1}^{3} \beta_j = 1$; $\sum_{i=1}^{n} \gamma_{ij} = 0$; $\sum_{i=1}^{n} \rho_{ij} = 0$ for all j. Moreover, the second order parameters of the cost and alternative profit efficiency functions must be symmetric, that is, $\delta_{ij} = \delta_{ji}$ and $\gamma_{ij} = \gamma_{ji}$ for all i and j.

We use the computer program FRONTIER Version 4.1c (see Coelli 1996a) to estimate the maximum-likelihood estimates for the parameters in the Translog stochastic frontier. According to Coelli (1996a), the FRONTIER Version 4.1 can provide maximum likelihood estimates of the parameters of stochastic cost functions. This version can accommodate unbalance panel data and considers a number of variables that are directly correlated with the model. It can also accommodate panel data, time-varying and invariant efficiencies, cost and production functions, half-normal and truncated normal distributions, and functional forms which have a dependent variable logged or original units[140].

The Coelli (1996a) computer programme follows a three-step procedure in the process of estimating the maximum likelihood estimates of the parameters of the stochastic frontier cost function[141]. First, the programme obtains the Ordinary Least Squares (OLS) estimates of the function. Coelli (1996) states that the OLS estimates are unbiased due to the non-zero expectation of u_{it}. Second, the programme conducts a two-phase grid search across the parameter space of γ, which range from 0.1 to 0.9. That is, it is to evaluate the log-likelihood function for a number of values of γ between zero and one. During this procedure, d_i are set to zero and the values of B_0 and σ^2 are adjusted

[140] However, FRONTIER Version 4.1c cannot estimate efficiency assuming exponential or gamma distributions.

[141] The nature of the log-likelihood function of the model given the distributional assumptions on μ and v can be found in Battese and Coelli (1993) and Coelli, Prasada Rao and Battese (1998).

according to the corrected OLS formula for the half-normal model. Third, the estimates of the largest log-likelihood value in this later step are used in the last step as starting values in the iterative maximisation procedure in the estimation process.

6-2-1-3 The Calculation of Efficiency Estimates using the Translog Stochastic Frontier Approach

As seen in earlier chapters, cost or profit efficiency is measured as the distance between a firm and the best practice firms using the translog stochastic model for our sample. Therefore, the calculation of a bank's X-efficiency is equivalent to the ratio of the predicted cost or profit of the most efficient best practice bank to the predicted cost of profit of that bank. The prediction of individual firm cost or profit efficiencies are estimated using stochastic frontiers. For the stochastic cost frontier, the measures of cost efficiency relative to the cost frontier are defined as:

$$\text{Efficiency estimate } (-\mu_i)_i = E(Y_i^* | U_i, X_i) \,/\, E(Y_i^* | U^i, = 0, X_i), \qquad (6.5)$$

Where

$^*Y_i$ is the cost of the i-th firm, which will be equal to Y_i when the dependent variable is in original units and will be equal to exp (Y_i) when the dependent variable is in logs. The cost or profit EFF is defined as exp ($-\mu_i$). If the above measure, cost or profit EFF, was found to be 0.70 for a banking firm, it implies that this firm is seventy percent efficient. Consistently, it also implies that a banking firm employs thirty percent extra cost or resources (or earns thirty percent less profits) relative to the best practice firm under the same environmental conditions to produce the same quantities of output vector. According to Resti (1997), the above measure incorporates a relationship between the minimum and the actual cost of banking firm i. While the nominator indicates the estimate of cost or profit required to produce a banking firm i's of output vector if the banking form were as efficient as the most efficient best practice banking firm in the population, the denominator of the same measure defines the actual cost or profit of banking firm i, adjusted for random error

6-2-2 The Calculation of Scale economies or elasticities using the Translog Cost Stochastic Frontier Approach

Scale elasticities or economies are calculated to estimate whether the sample of banks under study are enjoying scale economies, and thus uncovering the effects of size on cost efficiency. Scale economies are usually referred to as a measure of the potential beneficial effects when two forms or more are considering a consolidation project. Ester (1996) indicates that scale elasticity is the proportioned increase in cost due to a small proportional increase in outputs. Following Mester (1996), within sample scale elasticities are estimated according to the following formula (the first differential of the cost function with respect to output);

$$\mathrm{SE} = \sum_{i=1}^{3} \frac{\partial \ln TC}{\partial \ln Q_i} \qquad (6.6)$$

By applying this formula to our translog stochastic cost frontier model, the above measure can be expressed as

$$SE = \sum_{i=1}^{m} \alpha_i + \left[\sum_{i=1}^{m} \sum_{j=1}^{n} \delta_{ij} \ln Q \right] + \left[\sum_{i=1}^{m} \sum_{j=1}^{n} \rho_{ij} \ln(P_j / P_3) \right] \qquad (6.7)$$

If the calculated SE is less than 1 then increasing returns to scale, implying economies of scale. On the other hand, if SE = 1 then constant returns to scale and if SE < 1 then decreasing returns to scale, implying diseconomies of scale.

6-2-3 The Calculation of Scale Efficiencies using the Translog Stochastic Frontier Approach

Evanoff and Israilevich (1995) note that comparing scale economies (scale elasticities) with x-inefficiencies are misleading as the former is an elasticity and the latter is a relative efficiency measure. Thus, Evanoff and Israilevich (1995) suggest that one should calculate scale inefficiencies for accurate comparisons.

The scale elasticity measure, SE = ∂lnTC/∂lnQ, is an elasticity associated with a particular output level and indicates the relative change in cost associated with an increment change from this output level. Scale inefficiency (SI), on other hand, can be measured as the aggregate cost of N inefficient firms ($\varepsilon \neq 1.0$) relative to the cost of a single efficient firm ($\varepsilon = 1.0$); that is $I = [N * C_I / C_E]-1.0$, where C_I and C_E are the cost of production at the inefficient and efficient firms, respectively.

Therefore, the two concepts differ because elasticity is related to incremental changes in output, and inefficiency related to the change in output required to produce at the minimum efficient scale. The inefficiency measure is typically associated with significantly larger output changes as it measures the difference in total or average cost at distinct output levels. Furthermore, the cost savings realised by an incremental increase in output by a scale inefficient firm is irrelevant for measuring inefficiency since this is not the savings realised by producing at the efficient scale. Berger and Mester (1997) suggest that scale efficiency estimates the costs of production associated with producing a quantity of output of each banking firm relative to the minimum cost of production within a particular assets size class. In addition, Williams (2003) notes that the concept of scale efficiency calculates the change in outputs required if a bank is producing at the cost efficient scale. Williams (2003) suggests that policy implications regarding bank consolidation should be based on comparable measures of efficiency; that is, scale efficiency and X-efficiency as opposed to scale elasticity and X-efficiency.

Given the following simple representation for the cost function:

$$\ln C = a + b\,(\ln Q) + .5\,c\,(\ln Q)^2, \qquad (6.8)$$

Then the scale elasticity for inefficient firms ε_I = SE = ∂lnTC/∂lnQ = b, on the other hand the scale elasticity for the efficient firms = 1.0; by definition.

The scale inefficiency (see Evanoff and Israilevich, 1995) then can be written as:

$$SI = e^{(.5/c)(1-\varepsilon_I)^2} - 1.0, \qquad (6.9)$$

that is, scale inefficiency is a function of the first and second derivatives of the function (cost function as well as other functional forms) with respect to output (the second derivation aims to reach c which is the key for inefficiency calculation). Similar to other scale economies and X-efficiency measures, the measure of scale efficiency is bounded between one and zero.

Furthermore, if the estimated scale elasticity value is insignificantly different from unity, this does not imply scale inefficiency is insignificantly different from zero because the statistical difference of the elasticity measure from a value of unity depends entirely on the standard error of the estimated coefficient b (the results of cost scale efficiencies are reported Table A3–6 in Appendix A3).

6-2-4 Data Envelopment Analysis Approach (DEA)

Data envelopment analysis (DEA) estimates of bank efficiency are used in this thesis as consistency tests when we compare and test the robustness of the results derived from the translog stochastic frontier analysis.

6-2-4-1 Constant Returns to Scale (CCR)

The Data Envelopment Analysis is a non parametric technique that can estimate efficiency scores by maximising the ratio of outputs over the inputs. Coelli (1996b) elaborates the approach of DEA. Assuming a data set that includes K inputs (k = 1,...,K), M outputs (m = 1,...,M) for N firms (j =1,...,N). Then for the *i*-th observation, the set of input and output can be represented by the column of input vector x_i and the column of output vector y_i and the sets of inputs and outputs for the *i*-th observation are x_{ik}, and y_{im}. The input matrix X = [K×N], and the output matrix Y = [M×N] represent the data for all N firms. The optimal weights are obtained by solving the mathematical programming problem:

$$\max_{u,v}(u'y_i / v'x_i)\,, \qquad (6.10)$$

$$\text{s.t. } u'y_j / v'x_j \leq 1,\ j = 1,2,\ldots,N, \qquad (6.11)$$

$$u, v \geq 0. \qquad (6.12)$$

Efficiency scores represented by the ratio of all outputs over all inputs are calculated by maximising $u'y_i / v'x_i$. u is a vector of output weights [Mx1] and v is a vector of input weights [Kx1]. The inequality equation requires that the weights are positive. The DEA selects the weights that maximise each firm's productive efficiency score.

However, at this stage, a problem of the infinite number of solutions to linear programming is raised. To overcome this, the constraint $v'x_i = 1$ is imposed to provide the multiplier form of the DEA linear programming problem:

$$\max_{\mu,\nu}(\mu' y_i), \tag{6.13}$$

$$\text{s.t.} \quad \nu' x_i = 1, \tag{6.14}$$

$$\mu' y_j - \nu' x_j \leq 0, \quad j = 1,2,\ldots,N, \tag{6.15}$$

$$\mu, \nu \geq 0, \tag{6.16}$$

Where the change of notation from u and v to μ and ν is used to reflect the transformation. The dual envelopment form of the input-oriented CRS-DEA linear programme of equation (6.15) can be written as:

$$\min_{\theta,\lambda}, \tag{6.17}$$

$$\text{s.t.} \quad -y_i + Y\lambda \geq 0, \tag{6.18}$$

$$\theta x_i - X\lambda \geq 0, \tag{6.19}$$

$$\lambda \geq 0, \tag{6.20}$$

Where θ is a scalar and λ is an N×1 vector of constants. The objective function seeks to minimise the efficiency score, θ, which represents the amount of radial reduction in the use of each input. The first constraint (the output constraint) implies that the production of the *rth* output by observation *i* cannot exceed any linear combination of output *r* by all firms in the sample. The second constraint involves the use of input *s* by observation *i*, and implies that the radially reduced use of input *s* by firm *i* cannot be less than the same linear combination of the use of input *s* by all firms in the sample. The value of θ obtained will be the efficiency score for the i-th firm that satisfy: $\theta \leq 1$. When θ value is 1 (the point is on the frontier), the firm is technically efficient according to the Farrell

(1957) definition. Equation (6.18) must be solved N times, once for each firm in the sample and then a value of θ is obtained for each firm (see Coelli et al., 1998).

Equation (6.18) above assumes that constant returns to scale are imposed on every observation in the sample. It does not take into account factors which make firms unique beyond the simple input-output mix (such as inefficiencies which result from operating in areas of increasing or decreasing returns to scale due to size constraints).

6-2-4-2 Variable Returns to Scale (VRS)

Banker, Charnes and Cooper (1984) extend the Constant Returns to Scale model to account for variable returns to scale (VRS) when not all firms are operating at an optimal scale. The Variable Returns to Scale specification decomposes technical efficiency into pure technical efficiency and scale efficiency. Mathematically, this can be expressed by $\theta_{CRS} = \theta_{VRS} \cdot \theta_{Scale}$. The CRS linear programming problem can be modified to account for VRS by adding a convexity constraint to provide:

$$\min_{\theta,\lambda} \lambda \qquad (6.21)$$

$$ST \qquad -y_i + Y\lambda \geq 0, \qquad (6.22)$$

$$\theta X i - Y\lambda \geq 0, \qquad (6.23)$$

$$N1' \ \lambda = 1, \qquad (6.24)$$

$$\lambda = 0, \qquad (6.25)$$

where N1 is an N×1 vector of ones. This approach forms a convex hull of interesecting planes which envelope the data more tightly than the CRS . The convexity constraint $N1'\lambda = 1$ ensures that an inefficient firm is only benchmarked against firms of similar size.

6-2-4-3 Constant, Increasing and Decreasing Returns to Scale

Under the VRS specification, Coelli (1996) indicates that a form is operating in an area where returns to scale are constant, increasing or decreasing. To determine whether the firm is operating in the area of increasing or decreasing returns to scale, an additional

DEA problem with the non-increasing returns to scale formulation (NIRS) is required. This is executed by modifying the VRS constraint from equality that governs the sum of linear combination parameters to a constraint of less than or equal to one (by substituting the $N1'\lambda = 1$ restiction with $N1'\lambda \leq 1$) to provide:

$$\min_{\theta,\lambda} \lambda \tag{6.26}$$

$$ST \qquad -y_i + Y\lambda \geq 0, \tag{6.27}$$

$$\theta Xi - Y\lambda \geq 0, \tag{6.28}$$

$$N1' \ \lambda \leq 1, \tag{6.29}$$

$$\lambda \geq 0, \tag{6.30}$$

The nature of the scale inefficiencies due to increasing or decreasing returns to scale for a particular firm can be determined by considering whether the NIRS TE score is equal to the VRS TE score. If they are unequal, then increasing returns to scale exist for that firm but if they are equal then decreasing returns to scale apply.

6-2-4-4 Economic, Technical and Allocative Efficiency

The calcucaltion of technical and allcoative efficiencies in the DEA approach requires the avability of input price information and the choice of the type of optimisation objectives: cost minimisation or revenue maximsation. As our analysis is about cost minimisation uder the VRS assumption, the input-oriented DEA model is run to obtain technical efficiencies (TE), and this requires us to solve the following cost minimisation DEA problem:

$$\min_{\lambda, x_i} P_i X_i, \tag{6.31}$$

$$ST \qquad -y_i + Y\lambda \geq 0, \tag{6.32}$$

$$X_{ix}^{*} - X\lambda \geq 0, \tag{6.33}$$

$$N1' \ \lambda = 1, \tag{6.34}$$

$$\lambda \geq 0, \tag{6.35}$$

where P_i is a vector of input prices for the i-th firm and x_i^* is the cost minimisation vector of input quantities for the i-th firm, given the input prices P_i and the output levels y_i. The total cost (economic) efficiency of the i-th form is calculated as: $EE = P_i x_i^* / P_i x_i$. (the ratio of minimum cost to observed cost, for the i-th firm), then the allocative efficiency is calculated as Allocative Efficiency (AE) = Cost Efficiency (CE) / Technical Efficiency (TE).

6-3 Sample Characteristics

The data sample used in this study represents a number of financial institutions functioning geographically in the three North African countries of Algeria, Morocco and Tunisia. The sample covers the time period from 1994 to 2001 and includes fifty banking and financial firms consisting of 281 observations. Information on this sample is drawn from the London-based International Bank Credit Analysis LTD's '*Bankscope*' database.

Overall geographic location and assets size (in terms of assets) characteristics of the sample under study show that medium and large-sized banks represent nearly more than three quarters of the total sample, Algerian banks tend to be relatively large while Moroccan and Tunisian banks tend to be relatively medium and small-sized, and commercial banks dominate the sample in terms of assets size and number of banks.

6-3-1 Total Assets and Number of Banks in the Sample

6-3-1-1 Assets

In terms of total assets, the sample represents more than two thirds of the financial industries in the three countries excluding the central banks and those financial institutions with no available information. Overall, the sample represents approximately 87% of total bank assets in Algeria, 50% in Morocco and 70% in Tunisia. Table 6–1 elaborates the quantitative importance of the sample in the three countries in terms of banking sector assets share. TableA3–1 in Appendix A3 reports selected financial aggregates and ratios statistics of our sample.

Table 6–1: the quantitative importance of the sample in Algeria, Morocco and Tunisia in terms of Assets (in million US$), and number of banks from 1994 to 2001

Countries	Algeria			Morocco			Tunisia		
Countries	Sample Total Assets	Total Banking Assets	%	Sample Total Assets	Total Banking Assets	%	Sample Total Assets	Total Banking Assets	%
1994	24026.6	29987	80.12	9420	16781	56.13	2051.9	11576	17.37
1995	24135.7	25589	94.32	10920.3	19289	56.61	11102.2	13279	83.61
1996	24933.2	25482	97.58	14468.1	20297	71.28	14985.5	14623	81.96
1997	24135.7	25803	93.54	10920.3	26350	1.44	10947.3	14448	75.77
1998	26933.2	27454	98.10	14468.1	28532	50.71	14586.6	15315	95.24
1999	20506.3	28887	70.99	15444.6	29925	51.61	14822.9	15.694	94.95
2000	28174.4	30000	93.30	14468.1	30660	47.19	14550.4	17261	84.30
2001	21765.1	30100	73.10	14551.4	30661	47.30	15791.6	17261	84.30
Total	**194610.5**	**223202**	**87.19**	**1046660.9**	**202494**	**51.68**	**96838.4**	**138196**	**70.07**

Number of Banks in the sample

Countries	Algeria		Morocco		Tunisia	
Years	Number of Bank in the sample	Average Bank assets	Number of Bank the sample	Average in Bank assets	Number of Bank in the sample	Average Bank assets
1994	5	4805.3	5	1884.0	7	283.1
1995	7	3448.0	6	1820.1	16	693.9
1996	7	3591.9	7	2066.9	22	590.3
1997	6	4022.4	7	1560.0	23	476.0
1998	6	4488.9	7	2066.9	26	561.0
1999	8	2563.3	8	1930.6	27	549.0
2000	9	3130.5	10	1446.8	26	559.6
2001	7	3109.3	7	2078.8	22	717.8
Total	**55**	**3538.4**	**57**	**1836.2**	**169**	**573.0**

Source: Bankscope (Sep 2002)

As indicated in Table 6–1, the sample under study represents approximately 70% of the banking system banks in Algeria, Morocco and Tunisia, in terms of assets, over the period of analysis from 1994 to 2001. Total sample assets increased from approximately

US$35bn of total banking assets in 1994 to more than US$50bn in 1998-2001. The number of banks in the sample increased from 27 in 1994 to 43 banks in 1999 and 45 banks in 2000, due to the greater availability of information in later years. Over the period of study, while Algerian banks represent nearly half of the total sample' assets, they represent only one fifth of total sample in terms of the number of banking firms. This indicates that Algerian banks, on average, are larger in size than in Morocco and Tunisia. Unlike Algerian banks, Tunisian banking firms included in the sample represent nearly a quarter and three fifths of our sample in terms of total assets and number of banks, respectively. This shows that Tunisian banks have the characteristic of being relatively small sized. Finally Moroccan banks represent almost a quarter and one fifth of the sample's banking assets and number, correspondingly.

6-3-1-2 Bank's Type

In the context of the bank type, five bank specialisations can be distinguished for banking firms included in the sample under study. It is very important to note that these banking firms in the sample are subject to the same regulatory and supervisory authorities and laws in the respective countries. These specialisation types are; commercial, specialised governmental banks, multi-lateral governmental banks, merchant and investment banks or securities houses, and other non-banking financial institutions including leasing and factoring firms. However, as seen earlier in chapter three, the newly amended banking legislations in the three countries have reduced the compartmentalities between these types of financial firms with the objective in favour of universal banking.

First, the activities of commercial banks are related to four major functions. These are the collection of deposits from various households and other agents in any term or form; the allocation of any categories of loans allocated to financing firms' investments and households' consumption, the involvement in international trade transactions on behalf of their clients, and the trade in foreign exchange and provision of liquid and means of payments.

Second, specialised governmental banks are traditionally used by the government to finance their budget development plans. The activities of specialised banks include the

collection of medium and long-term deposits (especially from government-owned enterprises) as well as giving long-term loans to government-owned enterprises.
Third, multi-lateral governmental banks are development banks that existed in Tunisia that are equally owned between the Tunisian government and a number of Gulf and the Libyan governments. These banks are also known as development banks as they have activities related to giving long and medium-term loans and, (and under certain conditions short-term credit), they participate in enterprise capital, collect deposits of which term is more than one year, and they hold sight deposits of their personnel and enterprises of which they hold the majority of capital.
Fourth, merchant banks or investment houses are banks that provide advice and assistance services in the field of corporate financing, financial management and financial engineering and in general all their services relate to the creation, development and restructuring of enterprises.
Finally, other non-banking financial institutions include leasing and factoring firms. Leasing banks activities include ensuring the financing of movable and immovable equipment acquisitions and providing their clients, economic agents, hire opportunities for professional usage. The economic operator has the possibility to finance the leased good and obtain a residual value at the end of the contract. Factoring firms have activities related to managing by means of appropriate financial management techniques customers' invoice accounts by purchasing their claims and ensure the collection of these claims.
Table 6–2 categories the banking and financial firms used in the sample according to their core specialisation.

Table 6–2 : List and proportion of banks' sample according to bank type, 1994-2001

Algeria		Morocco		
Commercial Banks	**Specialised governmental banks**	**Commercial Banks**	**Specialised governmental banks**	**Other banks**
*Al-Ryan Bank-Algeria *Al-Baraka Bank *Arab Banking Corporation-Algeria *Banque de Dévéloppement Local *Banque Algérienne de Dévéloppement Local *Banque Éxtérieure de l'Algérie *Banque Nationale d'Algérie *Compagnie Algérienne de Banques *Crédit Populaire d'Algérie	*Banque Algérienne de Dévéloppment	*Banque Centrale Populaire *Banque Commercial du Maroc *Banque Marocaine du Commerce Extérieur *Banque Marocaine pour le Commerce et l'Industrie *Citibank (offshore branch) *Crédit du Maroc *Crédit Immobilier et Hôtelier *Société Générale Marocaine de Banques *Wafabank	*Banque Nationale de Dévéloppement Economique *Caisse Nationale de Crédit Agricole	*Société d'Équipement Domestique et Manager

Tunisia				
Commercial Banks	**Specialised governmental banks**	**Multi-lateral governmental banks**	**Merchant banks**	**Other banks**
*Amen Bank *Arab Banking Corporation-Tunisia *Arab Tunisian Bank *Banque de l'habitat *Banque de Tunisie *Banque du sud *Banque Franco-Tunisiénne *Banque Internationale Arabe de Tunisie *Banque Nationale Agricole *Banque Tunisiénne de Solidarité *North Africa International Bank *Société Tunisiénne de Banques *Tunis International Bank *Union Bancaire pour le Commerce et l'Industrie *Union Internationale de Banques.	*Banque de Dévéloppement Economique en Tunisie *Banque Nationale de Devéloppement Touristique	*Banque Arabe Tuniso-Libyénne de Developpment et du Commerce Éxtérieur *Banque de Tunisie et des Émirates d'Investissment *Tunisian -Kuwaiti Development Banks *Banque Tuniso-Qatari d'Investissements	*Beit Ettamouil Saoudi Tounsi	*Amen Lease *Arab Tunisian Lease *Compagnie Internationale de Leasing *General Leasing *Tunisie Factoring

Banks[1]	Algeria	Morocco	Tunisia	All
Commercial banks	80%	96%	85%	86%
Specialised Governmental banks	20%	3%	6%	12%
Multi-Lateral Governmental banks	0%	0%	3%	0.8%
Investment/ Security houses	0%	0%	3%	0.6%
Non-banking financial institutions (leasing and factoring firms)	0%	1%	3%	0.6%

Source: Bankscope (Dec. 2002)

1 These percentages are according to total assets share if the sample.

In terms of bank type, Table 6–2 shows that commercial banks dominate our sample with a total of 80% of total assets in Algeria, 96% in Morocco and 86% in Tunisia. Overall, other non commercial banks represent approximately 15% of total assets of the sample. As detailed, non-commercial financial firms consist of specialised governmental banks, investment banks, non-banking financial institutions (leasing and factoring firms) and multi-lateral governmental financial institutions. In the three countries, commercial and non-commercial banks are subject to the same regulatory institution (Central Banks or/and Ministry of Finance). In addition, Algerian banks represent half of the sample under study while the other half is shared between Moroccan and Tunisian banks. Algerian commercial banks account for 40% of total assets of commercial banks included in the sample, while Moroccan and Tunisian commercial banks account for 35% and 25%, respectively.

6-3-1-3 Assets Size Characteristics

The following table displays the size dimension of banks under study in terms of their assets. Table 6–3 categorises the banking firms into nine size groups from the smallest to the largest.

Table 6–3: Distribution of Sample banks assets size between 1994 and 2001 (in percent %)

Assets Size in Million US$	1994	1995	1996	1997	1998	1999	2000	2001	All
1-99.9	0.15	0.16	0.47	0.31	0.85	1.06	0.99	0.46	0.60
100-249	1.29	1.39	1.65	2.05	2.61	2.31	2.36	3.23	2.35
250-499	2.33	1.69	0.62	0.70	1.47	1.27	0.95	1.25	1.15
500-999	2.01	11.00	10.79	12.46	13.29	8.26	5.15	3.20	8.42
1000-1999	16.24	17.81	14.18	16.13	22.18	23.20	20.72	27.60	21.18
2000-2999	14.54	11.62	22.04	23.89	9.83	11.75	14.42	24.66	17.86
3000-3999	9.34	6.98	17.84	12.59	14.22	12.12	21.75	7.76	12.63
4000-4999	0.00	9.85	0.00	8.77	9.36	15.94	13.98	17.03	11.50
5000 +	54.10	39.49	32.41	23.11	26.19	24.07	19.68	14.81	24.32
T. Assets (US$, millions)	35498.5	48777.2	56386.8	51746.8	48701.2	57352.6	66805.7	49698.2	414967.0

Source: Bankscope (Jan. 2000 & 2002)

On average, financial institutions with total assets greater than US$5000mn account for approximately a quarter of the sample. Overall, small banks whose total assets are less than US$1000mn represent approximately 13% of total the sample. Medium-sized banks with total assets between US$1000mn and US$3000 account for about 40% of the sample. Large banks with total assets greater than US$3000mn represent more than 47%. As it has been already noted, in terms of geographic location, Algerian banks, on average, tend to be relatively large, whereas Moroccan banks and Tunisian banks tend to be relatively medium and small sized.

6-4 Definitions of Variables

6-4-1 Inputs and Output Definition: Intermediation Approach

Following a number of studies such as Mester (1996) and Berger and Mester (1997), this thesis uses the intermediation approach suggested by Sealey and Lindley (1977) to define bank outputs and inputs to explore cost and profit efficiency in Maghreb banking. The intermediation approach assumes that a banking firm collects different types of deposits and savings to convert these into various types of loans, using labour and capital.

Due to the extensive intermediary functions carried out by Maghreb banking, the intermediation approach seems to be appropriate for defining bank outputs and inputs. Berger and Humphrey (1997) indicate that the intermediation approach may be more appropriate due to the fact it includes interest expenses, which often represent one-half to two-thirds of banks' total costs. Casu and Molyneux (2002) state that the intermediation approach may be superior for evaluating the importance of frontier efficiency to the profitability of financial institutions since the minimisation of total costs, not just production costs, is needed to maximise profits. Thus, the intermediation approach is employed to determine the selection of inputs and outputs for the analysis of Maghreb bank efficiency.

This study follows Girardone (2000) who uses interest-bearing borrowed funds, labour and physical assets as inputs. While the latter item includes the costs associated with premises and fixed assets, the borrowed funds encompass all types of deposits (short-term, time and savings, industrial, etc...), notes and debentures, and all other interest-bearing borrowed funds. The outputs include all loanable funds (Q1) and investment assets expressed as other earnings assets (OEAs, Q2). Following Stiroh (2001), we also include the numeral value of off-balance sheet items (OBS, Q3) as a third output. De Young (1997) supports the inclusion of OBS as an output as this type of business has become an increasingly important source of income and revenue in recent years, especially with the growth of universal banking.

The prices of inputs used in this study are interest expenses, salaries, and other expenses, and these are calculated as follows. First, the price of borrowed funds (P1) is calculated by dividing total interest expenses by interest-bearing borrowed funds. Second, the price of labour (P2) is derived by dividing staff expenses by total assets. Following Altunbas et al. (2000), we use total assets instead of staff numbers, as information on the latter is not sufficiently available. Finally, the price of other physical and other assets (P3) is measured by taking other expenses excluding interest and staff expenses as a percent of other physical assets. These expenses include total expenditure on premises and fixed assets. All the outputs, inputs and inputs prices are measured in nominal terms of millions of US dollars. In estimating cost efficiency, the dependent variable of the function to be modelled is total costs (TC). This variable is the sum total of interest expenses, labour expenses and non-interest and labour expenses. In estimating alternative profit efficiency, ROE or net income is used instead of TC.

Table 6–4 displays quantitative and variable definitions, and summary statistics for inputs and output measures used in this study. Tables in Appendix 3 display the detailed descriptive statistics of the variables for the banks under study

Table 6–4: Variable definitions for banks inputs and outputs for Algeria, Morocco and Tunisia over the period 1994-2001

Variables	Description	Minimum	Maximum	Mean	Standard Deviation
TC	Total cost (includes Interest expense, Personnel expense, Commission expense, Fee expense, Trading expense, other operating expense) (US$ millions).	1.9	6469.0	93.6	111.4
TP	Total Profit before taxes	1.0	112.3	17.2	21.6
P1	Price of funds (%) (Total interest expense/ total customer deposits (demand, saving and time deposits)).	0.05%	125.00%	1.03%	0.55%
P2	Price of labour (%) (Total personnel expense/total assets).	0.05%	3.72%	1.10%	0.61%
P3	Price of physical capital (Non-interest expense /total assets).	0.29	13.00%	11.98%	1.31%
Q1	The value of total aggregate loans (all types of loans) (US$ millions).	3.7	6757.93	911.1	1206.6
Q2	The value of total aggregate other earning assets (short-term investment, equity and other investment and public sector securities (US$ millions)).	1.0	3986.4	368.6	692.9
Q3	The value of the off-balance sheet activities (US$ millions).	1.0	6681.0	566.0	887.0

Source: Bankscope (June 2003)

Table 6–4 reports the definitions, means, standards of deviation, maximum and minimum values of the input and output variables used in the stochastic frontier estimation. The table indicates that the average bank in the sample had total costs and total profits before taxes amounting to US$ 93.3 million and US$17.2million, respectively, and, in terms of the outputs, had US$911million in loans (Q1), US$368.6million in other earning assets (Q2), and US$ 566million in Off-balance sheet items (Q3). The average inputs prices are 1.03% for the price of borrowed funds, 1.10% for the price of labour and 132% for the price of fixed assets.

6-4-2 Potential Correlates of Efficiency

Dietsch and Lozano-Vivas (2000) note that the inclusion of country and other specific information in common frontier estimations of bank efficiency is important as differences in bank efficiencies across countries can be explained by the differences in a country's economic situation[142]. Therefore, in addition to the traditional model and following Molyneux et al. (2000), this study includes a number of environmental variables that are believed might influence the behaviour of banking firms and these may be able to explain potential differences in cost efficiency levels across the three Maghreb countries under study.

We use a combination of seven bank-specific variables, plus a time trend (t), alongside binary (dummy) variables assigned for geographical location and specialisation. These include variables that account for bank size (total assets), risk, solvency and capital adequacy (equity and equity to assets ratio), risk structure (loan loss provisions to net interest revenue ratio), liquidity (liquidity to total assets ratio), and profitability (return on equity ratio). In addition, dummy variables are included in the model to distinguish the geographical location of the respective banking systems in Algeria, Morocco, and Tunisia. Also, dummy variables to distinguish between commercial banks and other types of banks are also included. The following table shows the descriptive of these environmental variables.

142 The inclusion of variable other than firm-specific variables, including control and environmental variables, is used only in parametric modelling.

It has been suggested in previous empirical studies that efficiency and size are positively correlated. Hasan and Marton (2000), for instance, find that larger banks are more cost and profit efficient than smaller banks in Hungary, while Srivastava (1999) reports the existence of economies of scale in the Indian banking. Similarly, Leaven (1999) finds that Thai medium and large-sized banks are more profit efficient than small banks. Larger banks may benefit from scale and scope economies, and tend to have diversified lines of financial services associated with higher degrees of management competence However, Isik and Hassan (2002) investigate the cost efficiency for Turkish banks, and find a negative relationship between cost efficiency and banks size. Similarly, Leightener and Lovell (1998) find that size is negatively associated with productive efficiency for both domestic and foreign banks in Thailand. Thus, the relationship between efficiency and bank size seem to be ambiguous.

Table 6–5: Descriptive statistics of the efficiency correlates variable 1994-2001

Dimension	Variable	Minimum	Maximum	Mean	Standard Deviation
Bank Size	Total Assets (US$ millions)	23.1	7829.7	1458.6	1740.2
Solvency and capital adequacy	Equity (US$ millions)	2.4	489.6	111.5	101.8
Assets Quality	Loan Loss Provisions to Net Interest Revenues (%)	1.41	1500.00	41.24	194.40
Liquidity	Liquid Assets to Total Assets (%)	0.03	89.80	16.50	19.04

Source: Bankscope (June 2003)

The equity is included in the model as an indicator of bank soundness. The variable reflects two aspects: the level of risk and bank capitalisation, which is about 16%, on average, for the sample[143]. The level of equity or capital reflects the bank's solvency risk and its ability to absorb losses. The inclusion of capital adequacy aggregates, therefore, in efficiency modelling allows us to control for the risk preferences of banks. Having higher levels of risk would be associated with higher levels of equity sufficient to absorb any loan losses. One would expect higher levels of risk to lead to greater costs and

[143] Which is satisfactory considering the 8% recommended by the Basle Committee (1992).

therefore cost inefficiency. On the other hand, equity leads deposits as the first funding source available to bank management, and it is considered more costly than deposits. That is, banks will tend to have higher costs if they are more dependent on equity than deposits as a funding source. Large banks depend more on deposits and debt financing for their lending than small banks, thus controlling for equity could reduce scale bias. Also, Berger and Mester (1997) include the financial capital variable in their model and find a positive relationship between well-capitalised firms and efficiency. Efficient banks tend to control costs by allocating their assets into less risky projects through either greater scrutinising of lending or using the advantages of diversification. This is consistent with moral hazard and agency conflict between managers and shareholders where less monitored mangers with lower equity have incentives to expense preference. Thus, well-capitalised bank face lower costs of going bankrupt and then the cost of funding is reduced.

The loan loss provisions to net interest revenue ratio (LLP/NIR) is also included in the model as an additional indicator of banking risk and also as a medium to measure bank management efficiency in the credit allocation process. Many studies use similar indicators, for example, Hughes et al. (1996, a and b), Mester (1996), and Girardone (2000), use the non performing loans to total loans ratio to account for risk in bank efficiency modelling. However, the unavailability of data on nonperforming loans has led us to include loan loss provisions as a proportion of net interest revenue as our alternative assets quality variable. For the sample, the average estimate of this ratio is 41%, but it is negative in Algeria (-13%), and positive in Moroccan (24%) and Tunisia (75%), indicating that assets quality problems have been extreme in Algeria, and the ratio appeared to be not much better in Morocco, although Tunisian bank provisioning levels appear relatively strong. Kwan and Eisenbeis (1994) and Berger and DeYoung (1997) find a positive relationship between problem loans and inefficiency, whereas Berger and DeYoung (1997) note also that non-performing assets can be caused exogenously by economic shocks according to "the bad luck theory" or endogenously by either inefficient loan allocation management according to "the bad management theory" or the management decision to diminish short-term expenses by cutting back on loan origination and monitoring resources according to "the skimping theory". All the banking firms in this study have lent substantially to the non-profitable government-owned sector in the respective systems, and this sector has been responsible for the large amount of non-performing assets in the respective systems over the period under study.

While the liquidity dimension is represented by liquid assets to assets ratio, which is estimated at an average of 16.50% for the sample, banking firms in the sample are categorised into two types; commercial banks and non commercial banks. Similarly, banking firms are categorised according to the geographical allocation. Dummy variables are included to distinguish between these types of specialisation and country location.

Thus, the additional variables included in the model include a measure of banks' size (total assets), quality of bank's loans (LLP/NIR), the level of its financial capital (equity), and liquidity (liquid assets to assets), and also variables that include a time trend (t), specialisation, and geographic location. Dummy variables take the value one when the i-*th* bank is located respectively in Algeria, Morocco and Tunisia.

6-5 The Translog Cost and Profit Functions

6-5-1 Standard Cost and Profit Frontier Specifications

Based on the translog stochastic specification elaborated earlier, the translog cost and alternative profit equations are estimated using the FRONTIER 4.1 software suggested by Coelli (1995) which estimates the maximum likelihood function.

For the cost function:

$$Ln\left(\frac{TC}{P_3}\right)=\alpha_0+\sum_{i=1}^{3}\alpha_i \ln Q_i+\sum_{j=1}^{3}\beta_j \ln(P_j/P_3)+\frac{1}{2}\left[\sum_{i=1}^{3}\sum_{J=1}^{3}\delta_{ij}\ln Q_i \ln Q_j+\sum_{i=1}^{3}\sum_{J=1}^{3}\kappa_{ij}\ln(P_i/P_3)\ln(P_j/P_3)+\right]$$
$$+\sum_{i=1}^{3}\sum_{J=1}^{3}\rho_{ij}\ln Q_i \ln(P_j/P_3)+\psi_i Z+\varepsilon \tag{6.36}$$

For the alternative Profit function:

$$Ln(\frac{TP}{P_3}) = \alpha_0 + \sum_{i=1}^{3} \alpha_i \ln Q_i + \sum_{j=1}^{3} \beta_j \ln(P_j/P_3) + \frac{1}{2}\left[\sum_{i=1}^{3}\sum_{J=1}^{3} \delta_{ij} \ln Q_i \ln Q_j + \sum_{i=1}^{3}\sum_{J=1}^{3} \kappa_{ij} \ln(P_i/P_3)\ln(P_j/P_3) + \right] + \sum_{i=1}^{3}\sum_{J=1}^{3} \rho_{ij} \ln Q_i \ln(P_j/P_3) + \psi_i Z + \varepsilon \qquad (6.37)$$

Where (i=1, 2, 3) and (j=1, 2, 3) with the following restrictions:

Symmetry $\delta_{ij} = \delta_{ji} \quad \kappa_{ij} = \kappa_{ji}$;

Linear Homogeneity $\sum_{i=1}^{3} \beta_j = 1 \quad \sum_{i=1}^{3} \kappa_{ij} = 0 \quad \sum_{i=1}^{3} \rho_{ij} = 0$;

TC= Total costs and expenses of production;

TP= Total profits;

Q_{i1} = Total all types of loans;

Q_{i2}= Total other earning assets including securities;

Q_{i3} = Total Off balance sheet items;

P_{i1} = Price of Deposits;

P_{i2} = Price of Labour;

P_{i3}= Price of Physical capital;

Z_i = Environmental efficiency correlates

$\varepsilon_i = (v_i + \mu_i)$ for the cost efficiency function and $\varepsilon_i = (v_i - \mu_i)$ for the alternative profit efficiency function is a stochastic error term; which is composed of v_i (representing noise) and μ_i (representing inefficiency effects);

α, β, δ, κ, ρ, and ψ are parameters to be estimated.

In accordance with the linear homogeneity in prices and following Kwan and Eisenbeis (1994), Berger and Mester (1997), Girardone, Molyneux and Gardener (2000), and Weill (2001), TC, TP, P_1, and P_2 are normalised by the price of physical capital, P_3.

6-5-2 Coelli and Battese Models (1992 and 1995)

According to Sena (1999), FRONTIER 4.1 has been created specifically for the estimation of production frontiers. As such, it is a relatively easy tool to use in estimating stochastic frontier models. It is flexible in the way that it can be used to estimate both production and cost functions, can estimate both time-varying and invariant efficiencies, or when panel data is available, and it can be used when the functional form have the dependent variable both in logged or in original units. The FRONTIER 4.1 programme solves two general models, which are the Error Components Model (Coelli and Battese Models (1992)) and the Technical Efficiency (TE) Effects Model (Coelli and Battese Models (1995)).

The translog stochastic analysis is based on two models Battese and Coelli (1992) and Battese and Coelli (1995). The Battese and Coelli models have the main advantages that i) panel data of the banking firms do not require to be complete, i.e., unbalanced panel data can be used, and ii) estimates of efficiency for each banking firm for each time period can be obtained, and these estimates are bound between one, the most efficient, and zero, the least efficient. This thesis uses both Battese and Coelli (1992) and Battese and Coelli (1995) specifications to examine the cost efficiency of a number of Algerian, Moroccan and Tunisia financial and banking firms over the 1994-2001 period. While the Battese and Coelli (1992) specification includes the firm-specific variables to examine the firm-specific-related effects on cost efficiency, the Battese and Coelli (1995) specification extends the first specification to include a number of control and environmental variables.

6-5-2-1 Coelli and Battese Models (1992): The Fixed Effects Model

The models in this stage are estimated utilising Battese and Coelli's (1992) time-varying approach. This approach gives some flexibility concerning the distribution of inefficiency term in the stochastic frontier; truncated or half normal. Furthermore, it allows us to examine the time-varying efficiency model against the time-invariant model. Therefore, one of the advantages of the time-varying inefficiency model is that the technical inefficiency changes overtime can be distinguished from technical change, provided the latter is specified in the model parameters, in the frontier function. This discrimination is only possible given that the technical inefficiency effects are stochastic and have the specified distributions. However, this approach does not allow us to add the efficiency correlates directly into the model.

The Battese and Coelli (1992) model, error components model, can be formulated as

$$Y_{it} = X_{it}\,\mathrm{b} + (V_{it} - U_{it}) \qquad (6.37)$$

Where Y_{it} is the (logged) output obtained by the i-th firm in the t-th time period; X_{it} is a (kx1) vector of (transformation of the) input quantities of the i-th firm in the t-th time period; b is a (kx1) vector of unknown parameters; and V_{it} are assumed to be iid N(0, s_v^2) random errors, and $U_{it} = U_i$ exp (-h(t-T)), where U_i are assumed to be iid as truncations at zero of the N(m_i, s_u^2).

Some other models can be accounted for as special cases of the fixed effects model and can also be solved using the FRONTIER 4.1 software. As noted earlier, setting h=0, the time invariant model of Battese, Coelli and Colby (1989) is obtained. The Battese and Coelli (1988) model results from the previous one for the particular case of problems in which balanced data is available. If we add m=0 to the aforementioned assumptions, the Pitt and Lee (1981) model results. If we finally set T=1 in the Pitt and Lee model (1981), we obtain the original cross-sectional data model of Aigner, Lovell and Schmidt (1977). If h>0, the inefficiency term, U_{it}, is always decreasing with time, whereas h<0 implies that U_{it} is always increasing with time. That could be one of the main problems when using this model, technical efficiency is forced to be a monotonous function of time.

Thus, while Cebenoyan et al. (1993) use the truncated normal model; Stevenson (1980) and Greene (1990) use the normal and gamma distribution respectively. Second, Mu (μ) is restricted to be zero in order to get the Pitt and Lee's (1981) half-normal model. Allen and Rai (1996), Kaparakis et al. (1994) and Mester (1996) use the half-normal specification to model inefficiency in banking. Third, both Mu (μ) and Eta (η) are restricted to be zero to obtain the time-invariant model as outlined in Battese, Coelli and Colby (1989).

All the above models assume that the inefficiency term to be independently and identically as truncations at zero of the N(μ, σ_u^2) distribution. This definition of the inefficiency term matches the original definition of the stochastic frontier, which was proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and Van de Broeck (1977).

Therefore, Battese and Coelli's (1992) model defines the inefficiency term U_i as non-negative random variables which are assumed to account for technical inefficiency in production and are often assumed to be *ii*d. as truncations at zero of the $N(\mu,\sigma_U^2)$ distribution. The inefficiency term u_{it} in this model is assumed to be an exponential function of time, involving only one unknown parameter. The technical inefficiency effects are assumed to be defined by

$$u_{it} = \{exp[-\eta(t-T)]\}u_i \ , \quad i = 1,2,\ldots,N; t = 1,2,\ldots,T; \qquad (6.38)$$

Where u_{it} is assumed to be independently and identically distributed (i.i.d) as the generalised truncated-normal random variable and η is an unknown scalar parameter.

6-5-2-2 Coelli and Battese Models (1995): The Technical Efficiency Effects Model

According to Battese and Coelli (1995), the 1992 specification has a substantial disadvantage. Mathematically, the technical inefficiency effects of different firms at any given time period, t, are equal to the same exponential function ($exp[-\eta(t-T)] \equiv exp[\eta(T-t)]$) of the corresponding firm-specific inefficiency effects at the last period of the panel (u_{it}). That is, the classification of the firms in accordance with to the magnitude of the technical inefficiency effects is the same at all time periods. Battese and Coelli (1995) imply that the time-varying model does not account for situations in which some firms may be relatively inefficient initially but become relatively more efficient in subsequent periods. Based on this analysis, it would be more elaborate to carry out estimations of both specifications (Battese and Coelli 1992 and 1995) to our sample, and then carry out final selection of a preferred model according to Log-Likelihood ratio test (LR test).

The Technical Efficiency (TE) effects model (Battese and Coelli 1995) can be expressed as $Y_{it} = X_{it}$ b + (V_{it} - U_{it}), where Y_{it}, X_{it}, b and V_{it} are as defined earlier and U_{it} ~N(m_{it}, s_u^2), where m_{it} = Z_{it}d, Z_{it} is the vector of firm-specific variables which may influence the forms' efficiency. FRONTIER 4.1 programme offers also the solution of the model of

Stevenson (1980) which is a particular case of the previous model that can be obtained for the cases in which T is equal to 1 (for cross-sectional data)

As noted earlier, this thesis uses the computer program FRONTIER 4.1 (see Coelli 1996) to estimate the maximum-likelihood estimates for the parameters in the Translog stochastic frontier for cost efficiency functions[144]. The estimation follows a three-step procedure in the process of estimating the maximum likelihood estimates. First, the programme obtains the Ordinary Least Squares (OLS) estimates of the function. Coelli (1996) states that the OLS estimates are unbiased due to the non-zero expectation of u_{it}. Second, the programme conducts the two-phase grid search across the parameter space of γ, which range from 0.1 to 0.9. That is, it is to evaluate the log-likelihood function for a number of values of γ between zero and one. During this procedure, d_i are set to zero and the values of B_0 and σ^2 are adjusted according to the corrected OLS formula for the half-normal model. Third, the estimates of the largest log-likelihood value in this later step are used in the last step as starting values in the iterative maximisation procedure in of the estimation process.

The estimation of efficiency scores using the approach suggested by Battese and Coelli's (1992, error components model), is processed without the inclusion of any of the environmental variables. This model requires only the inclusion of firm-specific variables directly into the model so some of the efficiency differences between banks across countries and overtime can be explained. Running this model constitutes one stage of the two-stage method in which efficiency estimates from the frontier are regressed on the influences of selected variables. Some authors, such as Pitt and Lee (1981) regress the efficiency scores obtained from this process upon a number of exogenous and non-exogenous variables.

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[144] FRONTIER 4.1 is a single purpose package specifically designed for the estimation of stochastic production frontiers. The estimates of efficiency are produced as a direct output from the package. FONTIER allows for the specification of the distributional assumptions for the estimation of the inefficiency term in a program control file. According to Coelli (1996), the FRONTIER Version 4.1c can provide maximum likelihood estimates of the parameters of stochastic cost functions. This version can accommodate unbalance panel data and considers a number of variables that are directly correlated with the model. It can also accommodate panel data, time-varying and invariant efficiencies, cost and production functions, half-normal and truncated normal distributions, and functional forms which have a dependent variable logged or original units. However, FRONTIER Version 4.1 cannot accommodate exponential or gamma distributions (for more details See Sena (1999).

6-6 Choosing and Deriving the Appropriate Cost and Profit Models using the Translog specification

6-6-1 Standard Cost and Profit Frontier Specifications

Our analysis consists of running a number of models with different combinations of environmental variables before selecting the preferred model that has the characteristic of best fitting our dataset. The main cost and alternative profit efficiency models are derived from the banking efficiency literature with a number of various assumptions relating to the distribution of efficiency terms. The process of selecting the preferred model(s) is associated with testing a number of hypotheses. The modelling process will start by ignoring the environmental variables, and then these variables will be gradually added to the model to see if the new specification best fits the data.

Table 6-6 summaries the models estimated for both cost and alternative profit efficiency functions in this study, and also contains the specifications of the models. In later sections, we differentiate between cost and profit efficiency models by assigning either C for cost efficiency models or P for the alternative profit efficiency models. Also, we differentiate between step 1 in which Battese and Coelli specifications (1992) are used, and step 2 in which the Battese and Coelli specification (1995) is used by assigning 1 for step 1 and 2 for step 2 just after the signs of C or P. For example, model 2-1 is the model that has the translog specification and the two variables of Assets and Equity modelled according to step 2 (using the Battese and Coelli specification (1995)). Model C-2-1 refers to the same specification but for the cost efficiency function, and model P-2-1 refers to the alternative profit efficiency function.

Table 6–6: A Summary of the estimated models selection

Models	Variables
Stage 1: Model Estimation using Battese and Coelli Model (1992)	
Model 1-1:	Eta Yes, Mu Yes
Model 1-2:	Mu Yes, Eta No
Model 1-3:	Both No
Model 1-4:	Mu No, Eta Yes
Stage 2: Model Estimation using Battese and Coelli Model (1995)	
Step1: Excluding environmental variables	
Model 2-1-0:	Basic translog excluding logged bank-specific and other environmental variables
Step 2: Including Non-logged Bank-specific and environmental variables	
Model 2-1	Assets, Equity.
Model 2-2	Assets, Equity, Time trend (t).
Model 2-3	Assets, Equity, LLP/NIR.
Model 2-4	Assets, Equity, LLP/NIR, Time trend (t).
Model 2-5	Assets, Equity, LLP/NIR, Liquid Assets/Assets,
Model 2-6	Assets, Equity, LLP/NIR, Liquid Assets / Assets, Time trend (t).
Model 2-7	Assets, Equity, LLP/NIR, Liquid Assets/ Assets, Algeria, Morocco, Tunisia, Com, Non Com.
Model 2-8	Assets, Equity, LLP/NIR, Liquid Assets/ Assets, Algeria, Morocco, Tunisia, Com, Non Com, Time trend (t).

Mu is yes implies half-normal distribution
Mu is No implies truncated normal.
Eta is Yes implies time variant
Eta is No implies time invariant.

Table 6–6 summarises the steps and models estimated during the process of arriving at the preferred cost and alternative profit efficiency models. First, we use Battese and Coelli (1992) specification to estimate eight (four cost and four alternative profit) translog frontier models. Second, we apply the Battese and Coelli (1995) model specification to estimate both cost and profit translog frontier models, including a range of environmental (country and specialisation variables) and other explanatory variables (bank-specific variables). The arrival at the preferred model will be carried out by comparing the Log-likelihood ratio tests of the models at every step. These tests are explained next.

6-6-2 Structural Tests

In order to choose the model that best fits our data sample, we perform structural tests. These tests aim to use the Log-Likelihood Ratio Tests (LR) to examine whether a (reduced) model provides the same fit as a (fuller) model. The LR tests are undertaken at two main levels. These are Battese and Coelli (1992) time-variant against time-invariant, the Battese and Coelli (1992) half-normal against truncated normal, and the Battese and Coelli (1995) reduced model versus the Battese and Coelli (1995) full model[145]. Other tests include testing hypotheses whether all parameters equal to zero. Our selection of the preferred model is based on the comparison of LR tests. As a first step, we select the best model using the Coelli and Battese (1992) specification, then we select the best model from the Coelli and Battese (1995) specification, then we compare the two best models from the two specifications to choose the preferred model based on LR test estimates.

The null hypothesis to test at every stage is that the model with a reduced number of either/both bank-specific and environmental variables does not fit the data set better than other models with a larger number of variables. That is, to arrive at the preferred model, we test whether a model with a large number of parameters can be preferred over a nested simpler model with a smaller number of parameters. For this, we use the generalised likelihood ratio (LR) statistic as defined as:

$$LR = -2 * [\, l\,(H_0) - l\,(H_1)] \qquad (6.39)$$

Whereby $l\,(H_0)$ is the log-likelihood statistic of the reduced model and $l\,(H_1)$ is the log-likelihood statistic for the extended model. The outcome of LR is then compared to the outcome obtained from the table of X^2 distribution at a degree of freedom equal to the difference in the number of parameters between the two models, at a defined level significance, usually 5%. If the LR statistic is found to be significant, then we accept the

[145] Full model implies a model with more parameters than the reduced model. Using the Battese and Coelli model (1995), hypotheses tests are performed at three sub-levels; models with only bank specific variables, models with only environmental variables and then models with bank-specific and environmental variables.

null hypothesis that the extended model fits better our dataset, but if it is found to be insignificant we, therefore, reject the null hypothesis and consequently retain the simpler model.

Also, the other hypothesis tested uses the Gamma outcome (γ) to see whether no technical inefficiency effects exist. The null hypothesis is H_0: $\gamma = 0$, whereas the alternative hypothesis is H_0: $\gamma > 0$. To test this hypothesis we require the outcome of the generalised likelihood ratio test produced by Frontier 4.1. If H_0: $\gamma = 0$, this test statistic is assumed to be distributed as a Chi-square random variable with degrees of freedom equal to the number of restrictions. Overall, if the outcome of the generalised likelihood ratio exceeds the 5% critical value at the given degrees of freedom equal to the number of restrictions involved, we reject the null hypothesis of no technical inefficiency. Thus, to retain a model, it has to fulfil the condition rejecting the null hypothesis that no technical efficiency effects are present (If we accept this null hypothesis, it implies that the model cannot follow a stochastic path and therefore should be discarded).

6-6-2-1 Estimation According to Battese and Coelli (1992) Specification

As explained above in Table 6–6, for exposition, we use notations C and P to distinguish between cost and profit efficiency estimates and 1 and 2 to distinguish between different estimation methodologies. 1 refers to stage one in which the Battese and Coelli Model (1992) is used, and 2 refers to stage two in which the Battese and Coelli model (1995) is employed. For example, model C-1-1 refers to the cost efficiency function model (truncated normal distribution and time-variant) estimated in stage 1 (Battese and Coelli, (1992)), whereas C-2-1 refers to our first estimated cost efficiency model in stage 2 (Battese and Coelli model (1995)). Similarly, model P-1-1 refers to the alternative profit efficiency function model (time-variant) estimated in stage 1 (Battese and Coelli, (1992)), whereas P-2-1 refers to our basic cost efficiency model in stage 2, estimated using the Battese and Coelli (1995) approach.

There are eight models estimated according to the Battese and Coelli (1992) specification; four models for cost efficiency estimates and four models for the alternative profit efficiency estimates. These eight models are models C-1-1 and P-1-1, which assume the truncated normal distribution with inefficiencies evolving over time; models C-1-2 and P-1-2, which assume that a half normal distribution exists with time invariant characteristics, models C-1-3 and P-1-3, which both follow the truncated normal distribution but with time invariance, and finally models C-1-4 and P-1-4, which both have half-normal distribution, but are time-variant.

The comparison of the time-variant models (models C-1-1 and P-1-1) against the time-invariant models (models C-1-3 and P-1-3) implies the formation of two null hypotheses. First, the specification of the estimated time-variant model (model C-1-1 and P-1-1) is compared with the time-invariant model (models C-1-3 and P-1-3). The preferred specified model is selected using the log-likelihood ratio test (LR test). The first null hypothesis states that the specification of the translog time-invariant model best fits the data compared to the time-variant model. The null hypothesis is rejected if the time-invariant model cannot be specified using the stochastic frontier methodology.

Second, the translog truncated normal time-variant model is compared with the half-normal time variant model for both cost and alternative profit efficiency. The specification of the truncated time-variant model chosen from step 1 is compared with the half-normal time-variant model (models C-1-4 and P-1-4). The second null hypothesis outlines that the half-normal time-variant model specification best fits the data than the specification of the truncated time-variant model. Using the log-likelihood ratio, the null hypothesis is rejected given the appropriate degrees of freedom. The choice of the preferred model will be based on comparing the likelihood ratio estimates.

Table 6–7 summaries the four cost efficiency models estimates using Battese and Coelli (1992) specification.

Table 6–7: Cost Function Model Estimation using Battese and Coelli Model (1992)

Models	Hypothesis	LR test	Log-L value	Degree of Freedom	$X^r_{0.05}$	Decision
Model C-1-1: Mu Yes (truncated normal, Eta Yes (time variant)	-	145.84	0.3	-		Accept H_0
Model C-1-2: Mu No Eta No (half-normal, time-invariant)	H_0=m=h=0	0	0.2	2	5.99	Reject H_0
Model C-1-3: Mu Yes Eta No (truncated normal, time-invariant)	H_0=h=0	144.12	0.3	1	3.84	Reject H_0
Model C-1-4: Mu No Eta Yes (half-normal, time variant)	H_0=m=0	125.13	0.2	1	3.84	Reject H_0

Table 6–7 summaries the four cost efficiency function models estimated using the Coelli and Battese (1992) specification. As Table 6–7 shows, we retain model C-1-1 as a benchmark model to which other models are compared. Model C-1-1 follows a truncated normal distribution with a time variant assumption. First, we compare model C-1-1 with model C-1-2 which assumes half normal distribution and time invariance. The LR test provides a value less than the 5% level of Chi-square 5.99 with 2 degrees of freedom. This implies that Model C-1-2 with time invariance and half normal distribution is not statistically different to our benchmark model C-1-1 with time variance and truncated normal distribution. Second, we compare the benchmark model C-1-1 with model C-1-3 which has a truncated normal distribution and time invariance characteristics. The LR test provides a value 0, which is less than the equivalent Chi-square value of 3.84 at the 5% significance level and 1 degree of freedom. Similar to the first step, the LR test outcome suggests that the benchmark model still remains the preferred choice based on data fitting criteria. Finally, we compare our basic model C-1-1 with model C-1-4 which assumes half normal distribution and time variance. The outcome of LR test is found to be less than the equivalent Chi-square value at the 5% significance level with 1 degree of freedom. From these three steps, it is apparent that LR tests indicate that the other three

models are not statistically different from the benchmark model C-1-1. The LR tests may also indicate that any of the four models can represent our sample under study, even though they have different statistical assumptions. Thus, while we can conclude that model C-1-1 which assumes the truncated normal distribution fits our data, there is not sufficient evidence to assume that other models do not significantly represent our dataset. This result cannot distinguish between the different models under investigation so either one can assume a truncated normal or half normal efficiency score distribution, or time variance / invariance, and any specification reveals the same findings. This may imply that the quantity (or quality) of our data is not sufficient for analysis using the Battese and Coelli (1992) specification. Also, these findings are suggestive that we should consider other models, such as using the Battese and Coelli (1995) specification to choose the preferred cost efficiency model for the banking sample under study.

Table 6–8 repeats the procedure outlined above and contains information on the alternative profit efficiency models estimated according to the Battese and Coelli (1992) specification.

Table 6–8: Stage 1: Profit Functions: Model Estimation using Battese and Coelli Model (1992)

Models	Hypothesis	Log likelihood value	Degree of Freedom	$X'_{0.05}$	Decision
Model P-1-1: Mu Yes (truncated normal), Eta Yes (time variant)		-0.1	*	-	-
Model P-1-2: Mu No Eta No (half-normal, time-invariant)	H_0=m=h=0	-0.1	2	5.99	Reject H_0
Model P-1-3: Mu Yes Eta No (truncated normal, time invariant)	H_0=h=0	-0.1	1	3.84	Reject H_0
Model P-1-4: Mu No Eta Yes (half-normal), time variant)	H_0=m=0	-0.1	1	3.84	Reject H_0

Table 6–8 shows that the Log-likelihood value for the three models P-1-2, P-1-3 and P-1-4 are the same (-0.1); this would provide an outcome of zero for the Log-likelihood test for the dual comparison of (model P-1-2 and model P-1-3) and (model P-1-2 and model P-1-4). This suggests that the efficiency estimates derived from the three models are not statistically significantly different. Following the steps undertaken on the cost efficiency model, we compare the benchmark model at this stage P-1-1 with a truncated normal with time variance with any of the other three models. The LR test provides a value that does not exceed the 5% critical level with degrees of freedom equal to 1 of 3.84. This suggests that model P-1-1 can be retained to derive efficiency estimates. However, once again, this finding leads us to suggest that the model P-1-1 is the preferred model representing our data.

6-6-3 Battese and Coelli (1995): the Estimation of the Translog cost frontier including various environmental variables (Models 5 to 18)

In this stage of our analysis, the cost and alternative profit efficiency models are compared using the approach suggested by Battese and Coelli (1995). This approach allows for the inclusion of a number of environmental variables, either related to the internal characteristics of the banks (bank-specific) or to the overall environment under which banks are operating (macroeconomic and regulatory). As noted in section 6-4, a number of variables have been selected from the established literature. These variables include total assets (size), equity (capital strength), liquid assets to assets ratio (liquidity), loan loss provision to net interest revenue ratio (assets quality), a time trend (t), country dummies (geographical location and economic conditions), and specialisation dummies (commercial and non-commercial). First, we run models that contain only bank-specific variables, then, we estimate models using only the environmental variables, and finally, we include a combination of bank-specific and environmental variables in our later models. It is crucial to note that the modelling in the next two stages is processed according to the Battese and Coelli (1995) specification. As the process of arriving at the preferred model is identical for both cost and alternative profit efficiency, we will elaborate this process for the cost efficiency stage, but just keep it brief for our discussion of alternative profit efficiency so as to avoid repetition.

6-6-3-1 Stage 1: Models with only Bank-specific Variables

At the beginning of this stage, we estimate a model that does not contain any of the bank-specific or environmental variables. We call this model C-2-1-0 for the cost function, and model P-2-1-0 for the alternative profit function. Then, given our selection of bank specific variables, there are both seven cost efficiency and alternative profit function models that contain bank-specific and time trend (t) variables. The Log-Likelihood ratio (LR) test will be performed between the model including the two variables (total assets and equity) and other models (fuller model). The null hypothesis is that the cost or alternative profit efficiency model with these two bank-specific variables, or reduced model, better fits our data than other model specifications, or fuller models.

Table 6–9 and Table 6–10 show the results of the hypothesis testing to arrive at the preferred model at this stage for cost and alternative profit efficiency functions, alternatively.

Table 6–9: Stage 2: Cost Functions: Model Estimation using Battese and Coelli Model (1995) with bank-specific variables.

Models	LR test	Log likelihood Value	Degrees of Freedom	$X^{r}_{0.05}$	Decision
Model C-2-1-0	*	-0.355	*		-
Model C-2-1	52.41	-0.95	-	-	Accept H_1
Model C-2-2	56.87	-0.73	1	7.82	Reject H_0
Model C-2-3	52.36	-0.95	1	7.82	Reject H_0
Model C-2-4	56.97	-0.76	2	9.49	Reject H_0
Model C-2-5	89.37	0.89	2	9.49	Reject H_0
Model C-2-6	93.45	0.10	3	11.07	Reject H_0

Table 6–9 shows that the very basic cost translog model has not produced a generalised-likelihood ratio statistic, a situation where this model cannot be used to compare other models. The generalised likelihood-ratio statistic serves as an indicator, if found

significant, as to whether our model follows a stochastic path. Also, Table 6–9 shows that all estimated models except for the basic cost efficiency translog model C-2-1-0 have significant values of the generalised likelihood-test at the 5% critical value with the correspondent number of degrees of freedom. This implies that these are consistent with following a stochastic pattern. Thus, as the C-2-1-0 specification cannot be retained as a benchmark in the selection of the preferred model, and in order to have a *de novo* benchmark; we retain model C-2-1 to compare with the others, since it has the lowest number of non-logged parameters (only the assets and equity variables). As mentioned earlier, the comparison is feasible if the two compared models are related to each other, that is, the reduced model is nested in the fuller models.

First, we compare model C-2-1 which accommodates the Assets and Equity variables, with model C-2-2 which extends model C-2-1 to include a time trend (t) to control for technological change. The Log-likelihood ratio test produces an outcome of 0.44, which is less than the 3.84 chi-square value at 5% critical value with 1 degree of freedom. This implies that model C-2-1 (the translog with Assets and Equity variables) is the preferred model at this stage and no time effect can be detected from our sample.

Second, as model C-2-1 is the preferred model at this point, we compare this with model C-2-3, which enlarges C-2-1 to contain the LLP/NIR variable next to Assets and Equity. The log-likelihood ratio test reports a value of 0, which is less than the Chi-square value of 3.84 at the 5% significance level with 1 degree of freedom. This implies that the inclusion of the LLP/NIR variable has not had any impact on our data. Thus, we suggest that model C-2-1 continues to be the preferred cost efficiency model using the Battese and Coelli (1995) approach.

Third, we compare model C-2-1 with C-2-4 which includes LLP/NIR and time trend (t) variables (as well as Assets and Equity). The outcome of the Log-likelihood ratio test is 0.38, which is less that the Chi-square value of 5.99 at the 5% significance level with 2 degrees of freedom. This leads us to suggest that the inclusion of the LLP/NIR and time trend (t) variables in our benchmark model (C-2-1) has not significantly improved the fit. Thus, model C-2-1 with just the Assets and Equity variables remains the preferred cost efficiency model.

Fourth, the preferred model C-2-1 is compared with C-2-5, which contains, in addition to Assets and Equity, the variables of LLP/NIR and Liquid Assets/ Assets. The log-likelihood ratio test generates a value of 3.68. This value is less than 5.99, which is the Chi-square 5% critical value at 2 degrees of freedom. As in the former three steps, this value of likelihood ratio test shows that the addition of LLP/NIR and Liquid Assets/Assets variables to the *de novo* benchmark model C-2-1 has not changed the fit of the latter model. Consequently, we still retain the model C-2-1 with the assets and equity variables as our preferred cost efficiency model specification.

Finally, we compare the preferred cost efficiency model (C-2-1) with model C-2-6. Model C-2-6 extends model C-2-1 to include LLP/NIR, Liquid Assets/Assets and time trend (t) variables. The value of the Log-likelihood ratio test is found to be 2.1, which again is less than the correspondent chi-square value of 7.82 at the 5% significance level (with three degrees of freedom). Thus, the inclusion of additional variables (LLP/NIR, Liquid Assets/Assets and time trend (t)) to our benchmark model C-2-1 has not yielded a better fitting model to our data. Hence, we retain model C-2-1 with Assets and Equity variables as the preferred model for our cost efficiency estimates.

To sum up, at this stage of including only non-logged bank-specific variables, we have arrived at the preferred cost efficiency model using Battese and Coelli (1995) specification. Next, after analysing the alternative profit efficiency models, we undertake a similar procedure to compare fuller models that include both country and specialisation variables.

Similar to above, Table 6–10 displays the results of the null hypothesis testing that a model with a larger number of non-logged bank-specific parameters is a better representation of our data than a nested model with a reduced number of bank-specific parameters.

Table 6–10: Stage 2: Profit Functions: Model Estimation using Battese and Coelli Model (1995) with bank-specific variable.

Models	LR test	Log Likelihood value	Degrees of freedom	$X^{r}_{0.05}$	Decision
Model P-2-1-0	10.52	-0.21	-	3.84	Accept H_1
Model P-2-1	29.60	-0.19	1	5.99	Reject H_0
Model P-2-2	33.13	-0.19	2	7.82	Reject H_0
Model P-2-3	30.78	-0.19	2	7.82	Reject H_0
Model P-2-4	36.17	-0.19	3	9.49	Reject H_0
Model P-2-5	33.90	-0.19	3	9.49	Reject H_0
Model P-2-6	44.49	-0.19	4	11.07	Reject H_0

Table 6–10 shows, using the Battese and Coelli (1995) specification, the basic alternative profit efficiency model P-2-1-0, and the models that include only non-logged bank-specific variables, have values of the generalised likelihood ratio higher that the Chi-square equivalent value at 5% critical level with the corresponding degrees of freedom. This suggests that all the models displayed in Table 6–10 follow a stochastic pattern and, thus, can be used to select a preferred alternative profit efficiency model.

In addition, Table 6–10 shows that the basic alternative profit efficiency model P-2-1-0 has a log-likelihood ratio statistic of -0.21, while other specifications have the same values for this statistic at -0.19. This implies that there is little/no difference between these models when they are compared, as the likelihood ratio test statistic yields a null value. This may suggest that the inclusion of a greater number of non-logged bank-specific variables to our basic model does not improve the fit of our basic model. Also, when we compare the basic alternative profit efficiency mode P-2-1-0 to any of the other models shown in Table 6–10, the value of the likelihood ratio test is found to be the same; -0.04. This value is less than Chi-square value equivalent at the 5% critical value with the corresponding number of degrees of freedom. Consequently, this suggests that the basic model P-2-1-0 can be retained as the preferred model for alternative profit efficiency estimates, and the inclusion of any of the non-logged bank-specific variables does not improve the data fit.

Therefore, at this stage of just running a basic model and models with only bank-specific variables, we find that the cost efficiency model C-2-2 which contains Assets and Equity variables and the basic translog alternative profit efficiency model P-2-1-0 to be the preferred models specification. We use these two models in the next stage of our analysis in order to further choose the preferred model, but this time using only environmental variables.

6-6-3-3- Stage 2: Models with Bank-specific and Environmental Variables

Given our selection of environmental variables, which are bank type dummies (commercial and non-commercial) and country dummies (Algeria, Morocco and Tunisia); we run four new models (two for cost efficiency and two for alternative profit efficiency). Each of the models estimated contains four non-logged bank-specific variables (Assets, Equity, LLP/NIR, and Liquid Assets/Assets) and five environmental variables (Algeria, Morocco, Tunisia, Commercial and non-Commercial), and additional model is estimated which also includes a time trend (t) variable to control for technological change. The cost models estimated at this stage are models C-2-7 and C-2-8, and the alternative profit models P-2-7 and P-2-8. When these models are estimated, they will be compared to the preferred cost and alternative profit efficiency models that have been previously selected. These models are model C-2-1 with Assets and Equity variables for cost efficiency and the basic translog model P-2-1-0 for alternative profit efficiency.

Table 6–11 and Table 6–12 summarise the hypothesis testing that the preferred models so far (models C-2-1 and P-2-1-0) better fit our data than the other models that extend to include both a time trend (t) and environmental variables (models C-2-7 and C-2-8, and models P-2-7 and P-2-8).

Table 6–11: Stage 2: Cost Functions: Model Estimation using Battese and Coelli (1995) Model

Models	LR test	Log likelihood value	Degrees of freedom	$\chi^{r}_{0.05}$	Decision
Model C-2-1	52.41	-0.95	-	5.99	Accept H_1
Model C-2-7	215.11	0.71	7	16.91	Reject H_0
Model C-2-8	144.96	0.36	8	18.31	Reject H_0

First, Table 6–11 shows that the new two models of C-2-7 and C-2-8 have values of generalised likelihood ratio statistic higher than the correspondent Chi-square values at the 5% critical level with the correspondent number of degrees of freedom. This suggests that both models follow a stochastic path and, therefore, can be retained in the process of choosing a preferred model.

Second, we compare the preferred cost efficiency model C-2-1 selected from earlier analysis, with that of model C-2-7 which includes the non-logged bank-specific and environmental variables (Assets/Equity, LLP/NIR, Liquid/Assets, Algeria, Morocco, Tunisia, Com, Non Com). The log-likelihood ratio test provides an outcome of 3.32, which is lower than the Chi-square value at the 5% critical level with the correspondent number of degrees of freedom. This suggests that the inclusion of the aforementioned variables does not significantly improve the data fit compared to the preferred cost efficiency model C-2-1 derived earlier.

Finally, we repeat the exercise and compare the preferred cost efficiency model C-2-1 selected from earlier stage, with that of C-2-8 which includes the non-logged bank-specific and environmental variables and time trend (t) (Assets/Equity, LLP/NIR, Liquid/Assets, Algeria, Morocco, Tunisia, Com, Non Com, time trend (t)). The log-likelihood ratio test is -0.7, and therefore we reject the hypothesis that Model C-2-8 provides a better fit than the preferred model previously selected.

Therefore, the preferred cost efficiency model at this stage of our analysis still remains model C-2-1, which includes the two non-logged bank-specific variables of Assets and Equity. This is shown in later sections, and is used to derive our cost efficiency estimates to be analysed in the results section.

The next step is to test for the preferred alternative profit function model specification. The results are shown in Table 6–12.

Table 6–12: Stage 2: Profit Functions: Model Estimation using Battese and Coelli Model (1995)

Models	LR test	Log likelihood value	Degrees of freedom	$X^{r}_{0.05}$	Decision
Model P-2-1-0	10.52	-0.21	-	3.84	Accept H_1
Model P-2-7	96.73	-0.16	8	18.31	Reject H_0
Model P-2-8	91.81	-0.16	19	16.91	Reject H_0

First, Table 6–12 displays clearly that, models P-2-7 and P-2-8 have generalised likelihood-ratio test higher than the equivalent Chi-square values at the 5% significance level with the corresponding degrees of freedom. This suggests that the model P-2-7; which contains the non-logged bank-specific and environmental variables of Assets, Equity, LLP/NIR, Liquid/Assets, Algeria, Morocco, Tunisia, Commercial, and Non Commercial; and model P-2-8 which extends model P-2-7 to include a time trend (t), is not significantly different. That is, the inclusion of time trend does not change the fitness of model P-2-7. Thus, we compare the most basic translog preferred alternative profit model P-2-1-0 with model P-2-8.

Second, we use the log-likelihood ratio test to compare between models P-2-1-0 and P-2-8. The value of the test is found to be 0.74, which less than the matching Chi-square value at the 5% critical value at the corresponding number of degrees of freedom. This result implies that extending our models to control for environmental differences does not improve the fit of the preferred model P-2-1-0 selected earlier. Thus, we retain the basic translog alternative profit efficiency model P-2-1-0 to estimate our alternative profit efficiency scores that will be used in the results analysis.

To recap, in this section, we have utilised the Log-likelihood ratio test to arrive at the preferred model specification for estimates for both cost and alternative profit efficiency. A number of models with different combinations of non-logged bank-specific and environmental variables have been tested. The comparison between the nested models and the fuller models has resulted in selecting model C-2-1 with Asset and Equity variables to be the preferred model for cost efficiency estimation, while the basic model P-2-1-0 has been found to be the preferred model for our alternative profit efficiency estimation. These two models are used in the following sections to derive efficiency scores upon which analysis of our results is undertaken.

6-6-3-4- Choosing between Battese and Coelli (1992) and Battese and Coelli (1995) Models

As noted above, we have used both Battese and Coelli (1992 and 1995) specifications to examine the cost efficiency of a number of North African banking firms over the 1994-2001 period. While the Battese and Coelli (1992) specification includes the log terms of the outputs and input variables, to examine the bank-specific-related effects on cost efficiency, the Battese and Coelli (1995) specification extends the first specification to include a number of environmental variables.

Unfortunately, we cannot statistically compare the Battese and Coelli (1992) specification and the Battese and Coelli (1995) specification. This is because they are not nested. As such, we have to make a judgment as to which is the best approach to adopt. Guidance is given by Battese and Coelli (1995) who noted that Battese and Coelli (1992) specification has a substantial disadvantage. Mathematically, the technical inefficiency effects of different firms at any given time period, (t), are equal to the same exponential function $(exp[-\eta(t-T)] \equiv exp[\eta(T-t)])$ of the corresponding firm-specific inefficiency effects at the last period of the panel (the u_{it} s). That is, the classification of the firms in accordance with the magnitude of the technical inefficiency effects is the same at all time periods. Battese and Coelli (1995) suggest that the time-varying model does not account for situations in which some firms may be relatively inefficient initially but become relatively more efficient in subsequent periods.

Due to the disadvantages of the Coelli and Battese specification (1992), the results reported in the following section are derived from the preferred models using the Battese and Coelli (1995) Approach.

6-7- Results

6-7-1- The Preferred Models

The maximum likelihood estimates of the preferred translog models of cost and alternative profit efficiency are presented in Table 6–13 and Table 6–14. The translog cost efficiency model derived from the approach suggested by Battese and Coelli (1995) includes logged-terms efficiency correlates and two environmental variables, assets and equity, while the alternative profit efficiency models contains only efficiency correlates and excludes other environmental variables. Asymptotic standard errors and t-ratios are presented beside each set of estimates in Table 6–13 and Table 6–14. T-ratios indicate the significance of the coefficients and they are defined as the ratio of the estimated coefficients to their corresponding standard errors.

Table 6–13: Maximum likelihood estimates of the preferred cost function model (Battese and Coelli (1995) with three environmental variables) for the whole sample over the period 1994-2001

Parameters	Variables	Coefficient	standard-error	t-ratio[1]
α_0	Constant	-0.7400**	0.3475	-2.1298
α_1	lnQ1	1.0328*	0.1054	9.8015
α_2	lnQ2	0.4280*	0.0666	6.4225
α_3	lnQ3	-0.1685*	0.0713	-2.3624
β_1	LnP1/P3	0.3315*	0.1454	2.2799
β_2	lnP2/P3	0.4137*	0.1511	2.7368
δ_{11}	lnQ1lnQ1	0.0155***	0.0108	1.4381
δ_{12}	lnQ1lnQ2	-0.1312*	0.0139	-9.4527
δ_{13}	lnQ1lnQ3	0.0629*	0.0140	4.4965
ρ_{11}	lnQ1lnP1/P3	0.1091*	0.0095	11.4687
ρ_{12}	lnQ1lnP2/P3	-0.0575*	0.0136	-4.2417
δ_{22}	lnQ2lnQ2	-0.0004	0.0080	-0.0463
δ_{23}	lnQ2lnQ3	0.0929*	0.0207	4.4884
ρ_{21}	lnQ2lnP1/P3	-0.1301*	0.0408	-3.1901
ρ_{22}	lnQ2lnP2/P3	0.0488**	0.0225	2.1661
δ_{33}	lnQ3lnQ3	0.0267	0.0213	1.2523
ρ_{31}	lnQ3lnP1/P3	0.0100	0.0170	0.5888
ρ_{32}	lnQ3lnP2/P3	-0.0225***	0.0139	-1.6151
κ_{11}	lnP1/3lnP1/P3	-0.0100	0.0261	-0.3829
κ_{12}	lnP1/P3lnP2/P3	0.0057	0.0176	0.3242
κ_{22}	lnP2/P3lnP2/P3	0.0059	0.0173	0.3421
Ψ_0	Constant	0.7793*	0.0783	9.9508
Ψ_1	Assets	-0.0001*	0.0000	-5.2426
Ψ_2	Equity	-0.0060*	0.0005	-11.7878
sigma-squared (σ^2)		0.1469*	0.0200	7.3312
Gamma (γ)		0.8590*	0.0411	20.8964
Log likelihood function		-0.9500	9312200	
LR test of the one-sided error		**52.3650**		

- 1- t-ratio defines the ratio of the estimated coefficients to their corresponding standard errors, indicates the significance of the coefficients and therefore some of the t-ratios of important coefficients of the cost functions.
- *, **, *** denote the significance of the parameters of the coefficients at the 1%, 5% and 10% significance level using the t-distribution table and t-ratios obtained from the table at the given degree of freedom equals to the number of our observation in the sample minus the number of estimated coefficients in the ML model. The degree of freedom is the outcome of 281 minus 25, that is, 257.

Table 6–14: Maximum likelihood estimates of the preferred translog alternative profit function mode for the whole sample over the period 1994-2001

Parameters	Variables	Coefficients	standard-error	t-ratio[1]
α_0	Constant	-2.1315*	0.6268	-3.4007
α_1	lnQ1	0.6431*	0.1971	3.2637
α_2	lnQ2	0.2019***	0.1356	1.4889
α_3	lnQ3	0.1169	0.1384	0.8451
β_1	LnP1/P3	1.8020*	0.2804	6.4266
β_2	lnP2/P3	-1.6239*	0.2883	-5.6327
δ_{11}	lnQ1lnQ1	-0.0568*	0.0204	-2.7848
δ_{12}	lnQ1lnQ2	0.0426***	0.0269	1.5813
δ_{13}	lnQ1lnQ3	-0.0279	0.0260	-1.0708
ρ_{11}	lnQ1lnP1/P3	-0.0019	0.0201	-0.0923
ρ_{12}	lnQ1lnP2/P3	-0.0331	0.0281	-1.1759
δ_{22}	lnQ2lnQ2	0.0451*	0.0153	2.9576
δ_{23}	lnQ2lnQ3	-0.2078*	0.0400	-5.1944
ρ_{21}	lnQ2lnP1/P3	0.4050*	0.0786	5.1551
ρ_{22}	lnQ2lnP2/P3	-0.2114*	0.0430	-4.9185
δ_{33}	lnQ3lnQ3	-0.1123*	0.0398	-2.8228
ρ_{31}	lnQ3lnP1/P3	-0.0894*	0.0338	-2.6445
ρ_{32}	lnQ3lnP2/P3	-0.0550**	0.0263	-2.0889
κ_{11}	lnP1/3lnP1/P3	0.0557	0.0481	1.1571
κ_{12}	lnP1/P3lnP2/P3	0.1021*	0.0341	2.9958
κ_{22}	lnP2/P3lnP2/P3	0.0552**	0.0326	1.6904
sigma-squared (S)		0.1249*	0.0124	10.0725
gamma		0.6711*	0.0631	10.3655
Log likelihood function		-0.2100	198896000	
LR test of the one-sided error		10.5248		
[note that this statistic has a mixed chi-squared distribution]				

- 1- t-ratio defines the ratio of the estimated coefficients to their corresponding standard errors, indicates the significance of the coefficients and therefore some of the t-ratios of important coefficients of the alternative profit function.
- *, **, *** denote the significance of the parameters of the coefficients at the 1%, 5% and 10% significance level using the t-distribution table and t-ratios obtained from the table at the given degree of freedom equals to the number of our observation in the sample minus the number of estimated coefficients in the ML model. The degree of freedom is the outcome of 281 minus 25, that is, 257.

Table 6–13 and Table 6–14 report the Maximum Likelihood Estimates of the preferred cost and alternative profit functions models according to the Battese and Coelli (1995) approach. Primarily, these two tables provide us with a number of *generic* observations. First, it appears that out of twenty-two coefficients plus the two constants terms, there are ten coefficients with a negative sign for the cost efficiency model, and out of the twenty coefficients plus the constant term there are ten coefficients with a negative sign. Second, the variables that are associated with highest values of coefficients in the cost efficiency model are Loans, Other Earning assets, and the Prices (P1 and P2), whereas for the alternative profit efficiency, they are Loans and Prices (P1 and P2). Third, the variables that are connected with high t-ratios in absolute terms are Equity, (LnQ1 Ln (P1/P3)), Loans and Total Assets for the cost efficiency model and prices (P1 and P2) and (lnQ2 lnQ3) for the alternative profit efficiency model. Considering the definition of the t-ratio, the last observation may imply that the indicated variables can be relatively more important than the other variables in the model specifications in explaining the efficiency levels for our sample. Fourth, the environmental explanatory variables in the cost function have standard error of less than 5% with coefficients estimates values significant at the 1% critical value. Thus, both log-firm-specific and other explanatory variables are important in influencing inefficiency levels in North African banking.

Besides, the cost efficiency and alternative profit efficiency models have values of 0.8590 and 0.6711 for γ (Gamma estimates reported at the end of the two tables) with 0.0411 and 0.0124 as standard error estimates. Coelli, Rao and Battese (1998) mention that if a value of γ is found to be zero, this indicates that the deviations from the frontier are entirely caused by noise or random error, whereas a value of one is indicative of that all deviations are entirely caused by technical inefficiency. Thus, the relatively (significant at 1% and 5% and) high values of γ found for our cost and alternative profit efficiency models suggest that most of the deviations from the frontiers are due to the technical inefficiency effects and that the random error is less that ten percent, especially for the cost efficiency model.

6-7-2 Cost and Profit Efficiency in Algeria, Morocco and Tunisia Derived from the Preferred Models

Table 6–15 and Table 6–16 report the average cost and alternative profit efficiency estimates for our sample over the period from 1994 to 2001 derived from the preferred cost and profit models as outlined above. The two tables report estimates of efficiency according to time (from 1994 to 2001), geographic location (Algeria, Morocco and Tunisia), and bank type (commercial and non commercial banks)[146].

Table 6–15 Cost efficiency in Algeria, Morocco, and Tunisia banking over 1994-2001

Year	1994	1995	1996	1997	1998	1999	2000	2001	ALL
Algeria	87.05	78.96	79.37	79.30	84.44	75.80	67.57	60.68	**69.73**
Morocco	76.29	76.02	80.11	77.91	80.58	80.02	82.37	75.20	**75.49**
Tunisia	67.45	67.19	70.33	72.45	70.17	66.29	67.73	64.01	**66.59**
Commercial	78.12	72.60	77.24	78.86	80.66	76.10	75.04	70.07	**72.69**
Non Commercial	69.97	65.89	64.74	68.84	66.86	65.53	67.72	54.35	**64.53**
Investment	*	57.90	70.40	66.89	67.32	64.23	68.42	53.63	**65.21**
Specialised Banks	74.81	74.66	72.18	70.63	72.22	72.60	74.92	56.54	**71.00**
Non banking Ins.	*	*	45.41	44.35	46.75	43.85	45.37	57.62	**48.27**
Multi-lateral Bank	65.13	65.12	70.95	93.48	81.15	81.42	82.17	49.62	**73.63**
All	**75.81**	**71.86**	**73.99**	**74.66**	**74.23**	**70.61**	**70.95**	**65.54**	**72.21**
Asset Size (US$ million)									
Year	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**ALL**
1-99	58.30	38.18	53.25	44.35	51.82	46.11	45.20	37.12	46.79
100-249	65.98	58.47	66.99	69.57	72.30	61.70	58.58	60.40	64.25
250-499	75.71	77.57	88.02	91.05	58.78	52.51	50.51	41.71	66.98
500-999	64.45	66.58	73.29	72.55	76.64	75.68	76.87	78.16	73.03
1,000-1,999	75.86	76.10	71.60	78.02	86.46	83.07	85.16	76.13	79.05
2,000-2,999	75.12	76.36	80.84	80.23	82.34	87.11	86.45	93.23	82.71
3,000-3,999	92.89	78.29	88.62	91.84	92.77	95.38	90.22	96.03	90.76
4,000-4,999	*	91.66	*	91.37	88.53	86.89	92.11	93.90	90.74
5,000+	90.03	92.19	91.60	91.11	95.01	95.40	95.21	93.35	92.99
ALL	74.79	72.82	76.78	78.90	78.30	75.98	75.59	74.45	75.95
Assets in million US Dollar	**1-99**	**100-249**	**250-499**	**500-999**	**1,000-1,999**	**2,000-2,999**	**3,000-3,999**	**4,000-4,999**	**5,000+**
Algeria	30.32	43.31	28.50	*	70.73	72.60	86.46	89.94	92.68
Morocco	*	*	56.59	66.37	80.02	78.84	92.56	93.90	*
Tunisia	49.21	65.95	69.44	74.07	82.90	91.67	*	*	*
Commercial	48.01	57.77	37.48	74.69	81.49	85.03	91.33	90.71	92.57
Non Commercial	52.02	62.83	64.94	69.84	70.73	72.60	86.64	91.66	94.57
Investment	60.31	68.92	54.93	*	*	*	*	*	*
Specialised Banks	*	*	61.57	69.84	70.73	72.60	86.64	91.66	94.57
Non banking Ins.	43.72	44.83	56.59	*	*	*	*	*	*
Multi-lateral Bank	*	74.73	86.68	*	*	*	*	*	*

Source: Author's own estimation

146 Table A3–2 and Table A3–3 in Appendix A3 report cost and alternative profit efficiency estimate for every banking firm used in the sample under study.

Table 6–16: Alternative profit efficiency in Algeria, Morocco, and Tunisia banking over 1994-2001

Year	1994	1995	1996	1997	1998	1999	2000	2001	ALL
Algeria	73.18	71.15	76.11	79.12	74.49	82.05	78.08	44.77	**66.87**
Morocco	68.11	67.14	64.28	59.63	58.01	46.03	53.09	90.68	**63.81**
Tunisia	71.14	72.70	73.49	73.66	73.82	74.44	73.76	69.64	**72.69**
Commercial	70.40	70.73	71.22	71.02	72.20	69.76	68.75	74.33	**69.65**
Non Commercial	72.52	74.43	74.81	74.77	71.08	72.66	73.98	60.45	**71.19**
Investment	*	80.88	77.54	76.31	74.42	74.46	75.12	65.53	**75.28**
Specialised Banks	70.52	71.71	74.08	70.62	67.81	75.49	79.99	47.82	**69.62**
Non banking Ins.	*	*	75.41	74.43	67.30	74.76	73.93	46.13	**66.72**
Multi-lateral Bank	74.52	70.72	72.22	77.70	74.81	65.95	66.86	82.32	**73.14**
All	**70.85**	**71.18**	**72.21**	**71.84**	**71.09**	**70.57**	**70.03**	**68.90**	**70.83**
Asset Size (US$ million)									
Year	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**ALL**
1-99	72.43	72.53	77.03	74.43	73.32	71.49	71.36	58.14	71.34
100-249	75.00	72.79	75.05	76.04	74.29	71.85	73.41	55.74	71.77
250-499	69.00	68.52	75.36	74.96	61.58	64.51	62.72	66.92	67.95
500-999	62.57	73.94	71.97	69.96	72.68	70.17	73.01	71.19	70.69
1,000-1,999	71.18	74.38	72.69	72.84	69.19	71.30	72.58	69.88	71.75
2,000-2,999	66.63	59.59	67.12	68.25	68.87	72.89	72.73	78.94	69.38
3,000-3,999	64.27	60.11	60.53	53.36	53.13	49.78	55.93	78.39	59.44
4,000-4,999	*	77.55	*	84.20	76.99	64.72	60.25	70.38	72.35
5,000+	74.73	70.10	78.84	75.47	77.25	73.17	80.09	71.84	75.19
ALL	69.48	69.95	72.32	72.17	69.70	67.76	69.12	69.05	69.94
Assets in million US Dollar	**1-99**	**100-249**	**250-499**	**500-999**	**1,000-1,999**	**2,000-2,999**	**3,000-3,999**	**4,000-4,999**	**5,000+**
Algeria	68.26	72.57	72.40	*	72.76	75.39	64.98	69.81	75.27
Morocco	*	*	51.52	61.46	70.03	64.50	55.88	70.38	*
Tunisia	71.71	70.11	70.99	72.66	72.96	74.11	*	*	*
Commercial	68.18	71.89	73.11	73.85	71.53	68.74	57.04	68.99	75.00
Non Commercial	72.16	64.63	65.06	65.76	72.76	75.39	74.82	77.55	79.82
Investment	80.69	72.06	61.44	*	*	*	*	*	*
Specialised Banks	*	*	68.50	65.76	72.76	75.39	74.82	77.55	79.82
Non banking Ins.	72.16	60.93	51.52	*	*	*	*	*	*
Multi-lateral Bank	*	68.33	75.16	*	*	*	*	*	*

Source: Author's own estimation

Table 6–15 and Table 6–16 display the technical efficiency estimates of banks in Algeria, Morocco and Tunisia for the cost and alternative profit efficiency derived from the preferred models over the period of study 1994-2001. To facilitate analysis of the size-efficiency relationship, we divide our sample into nine asset size groups expressed in millions of US dollars, ranging from the smallest group, group one, with assets less than $100mn, to the largest group, group nine, with total assets greater than $5 billion.

Table 6–15 shows that cost inefficiency averages around twenty-eight percent for the whole sample (cost efficiency is 72.21% overall). This suggests that the same level of output could be produced with approximately three quarters of current inputs if the banking institutions under study operated on the most cost efficient frontier. For comparison, the average level of cost inefficiency found in Maghreb banking is higher than inefficiency levels indicated by Berger and Humphrey's (1997) survey of 130 previous bank efficiency studies and Carbo *et al.*'s (2000) study that compared cost inefficiency in a number of EU countries, and found that bank inefficiency range between ten and fifteen percent, and around twenty-two percent, respectively. However, our results are found to be within the range of similar studies on developing countries, such as Rao (2002) on UEA banking system (25-31%), but higher than the results obtained in other studies such as Mertens and Urga (2001) on Ukrainian banking system (23%) and Hasan and Marton (2000) for Hungarian banks (21%).

For alternative profit efficiency, average inefficiency levels are found to be slightly higher than cost inefficiency at about thirty percent. This suggests that the level of profit can be increased by approximately a third keeping the same level of outputs if the banking institutions under study were operating on the most profit efficient frontier. For comparison, the level of alternative profit inefficiency of Maghreb banking is higher than that suggested by Williams and Intarachote (2002) who estimate the alternative profit inefficiency of 29 banks operating in Thailand and found inefficiency levels averaged at 15%, but approximately similar to that found by Mertens and Urga (2001) and Hasan and Marton (2000), 28% and 29%, respectively. In the context of our sample, the level of alternative profit inefficiency can be explained by factors linked to profit-related activities. Banks in the three countries under study are strongly influenced by potential pressure and other non-market forces that may force them to allocate resources to activities or firms that have experienced low levels of profits. Particularly, this factor is well observed in Algeria, where, for decades, banking institutions have made significant amounts of lending to the non-performing government-owned sectors. The selection of credits as well as government influence, importance of the public sector, and relative weakness of the private sector might have led the banking sector to subsequently absorb non-performing loans, and as a result record high levels of profit inefficiency. Thus, the hypotheses of "bad luck" and "bad management" suggested by Berger and de Young (1997) may explain the relatively low level of (cost and) profit efficiency in Algeria, Morocco and Tunisia's banking.

The results can also be viewed in terms of bank type, geographic location and size. First, in terms of bank type, it seem that commercial banks are more cost efficient but slightly less profit efficient than non-commercial banks. Second, in terms of geographic location, Moroccan banks are more cost efficient than Algerian and Tunisian banks, whereas Tunisian banks are more profit efficient than Algerian and Moroccan banks. Third, in terms of size, large and medium-sized banks tend to be more cost efficient than smaller banks, but small and larger banks tend to be more profit efficient than their medium-sized counterparts. The results may imply that macro-economic conditions and regulatory measures in Morocco and Tunisia are relatively more favourable to have lower cost inefficiencies than in Algeria. As Casu and Molyneux (2000) note, country-specific characteristics can be important in influencing bank efficiency levels, including macroeconomic conditions and the degree and speed of financial, economic and regulatory reforms. Within this context, Tunisia and Morocco commenced implementing financial liberalisation and economic reforms in favour of private and foreign capital earlier and faster than Algeria--nearly more than half of banks' capital in Tunisia and Morocco is owned by foreign investors. Privatisation programmes in Morocco and Tunisia have strengthened the role of both domestic private and foreign-owned sectors in the economy compared to Algeria. The link between the size of the private sector and banking efficiency may indicate that the privatisation of state-owned enterprises to boost competition is significant in improving commercial bank efficiency. Besides, in the case of Tunisia, the country is characterised by higher rates of GDP per capita, and this may suggest that its banks may be more successful in attracting deposits and generating stronger cash flows than banks in Morocco and Algeria. Higher GDP per capita tends to generate more savings, and hence more deposits and consequently more bank lending.

To conclude, it is found that cost and alternative profit inefficiency averaged about 30% over the period 1994-2001. It is also found that commercial banks are significantly more cost inefficient and less profit efficient than non-commercial banks. In addition, large- and medium-sized banks tend to be more cost efficient but less profit efficient than small and medium-sized banks. Overall, in the three countries, it seems that cost inefficiency and alternative profit inefficiency experienced an increase over the time period from 1994 to 2001, although it is higher in Algeria than in Morocco and Tunisia. This would suggest financial and economic reforms have not made an influential impact on the cost and profit efficiency performance of the banking sectors in the three countries under study. Anecdotal evidence also suggests that the financial sectors in the three countries still seem to be suffering from the absence of competition and market pressures.

6-7-3 Properties of Cost and Alternative Profit Inefficiencies: Characteristics of the Most and Least Efficiency

Following Spong et al (1995), Bauer et al (1997) and Girardone (2001), this section runs consistency tests by comparing efficiency estimates derived from the preferred cost and alternative profit efficiency models on traditional accounting measures of performance in order to distinguish the characteristics of the most and least efficient banks. This is undertaken by ranking banks from the most efficient to the least, and then dividing the observations into two equal sub-groups, in which the first sub-group contains the first two upper quartiles, namely, the most efficient firms, whereas the second sub-group consists of the two lower quartiles, namely, the least efficient firms.

This approach enables us to analyse the differences between the most efficient and least efficient banks and identify the properties that determine bank efficiency in North African banking. Similar to Girardone (2001), banks that operate well on both the cost and profit efficiency sides, would apparently be categorised into the most efficient sub-group, and *vice versa*. Banks in the most cost and profit efficient-sub-group are assumed to be using their resources more efficiently in the production process and as having better abilities in the profit generation process.

To study the property of bank efficiency, we concentrate on the dimensions manifested by financial and accounting ratios, including: assets quality, liquidity, profitability, and balance sheet structure. Table 6–17 reports details of financial ratios of the most efficient and least efficient banks over the period of study from 1994-2001.

Table 6–17: Properties of banks cost and alternative profit efficiency in Algeria Morocco and Tunisia over 1994-2001 (In average Percentages %)

Efficiency Type	Cost Efficiency		Alternative Profit Efficiency	
Properties of Banks	Least Efficient	Most Efficient	Least Efficient	Most Efficient
Bank Efficiency	60.23	81.77	63.46	77.03
Equity to Assets ratio	1.47	17.88	2.62	16.75
LLP to NIR ratio	45.85	36.72	54.31	28.44
Liquid assets to assets	15.61	17.38	15.59	17.39
Loans to assets ratio	63.78	62.41	64.46	61.81
Deposits to assets	74.09	70.75	73.26	71.56
ROE	19.45	27.09	19.65	26.88
ROA	1.92	4.11	1.58	4.45
Cost to assets ratio	9.99	7.43	9.52	7.91

See Table A3–4 in Appendix A3 for the names of least and most cost and profit efficient banks.

Table 6–17 provides us with the main differences between the characteristics of the most efficient and the least efficient banks in our sample. Overall, Table 6–17 shows that efficient and inefficient banks differ in some aspects, but have similar characteristics in other regards.

First, on average, cost efficiency for the most efficient banks was 82%, while for the least efficient banks it was 60%. In terms of alternative profit efficiency, the most efficient banks have an average efficiency estimate of 77%, whereas the least efficient banks have an average efficiency score of 63%.

Second, Table 6–17 shows that the most efficient banks, either in terms of cost efficiency or alterative profit efficiency, have lower levels of costs to assets ratio. That is, the most efficient banks tend to have overall lower rates for the price of funds, labour and other expenses, and therefore record higher levels of profitability. Thus, the most efficient banks tend to have the property of having low lower rates of expenses to assets, suggesting advantages in funding costs, and/or better be able to control operating expenses, specifically labour expenses.

Third, as to be expected, the most cost and alternative efficient banks have higher rates of ROE and ROA than the most inefficient banks suggesting that there might be differences in the way the most and least efficient banks generate income. The more efficient banks may be more selective in their investment and lending behaviour resulting in higher returns.

Fourth, Table 6–17 also suggests that the most efficient banks have higher average equity to assets ratios, implying that well capitalised banks are more efficient than under-capitalised banks. This result is similar to the findings of previous studies that find that well capitalised banks are more efficient; for instance Berger and Mester (1997). A possible explanation for this could be based on the theory of moral hazard. According to Kwan and Eisenbeis (1999) and Berger and De Young (1997), "the moral hazard hypothesis" predicts that inefficiencies are positively correlated with risk and consequently negatively with capitalisation. Under "the model hazard hypothesis, "*banks with relatively low capital respond to moral hazard incentives by increasing the riskiness of its loan portfolio, which results in higher nonperforming loans on average in the future*" (Berger and De Young, 1997, p5). That is, the managers of banks that are closer to bankruptcy will be more inclined to excessive risks, which are not necessarily in line with the owners' objectives. Therefore, it appears that banks with low cost efficiency tend to have lower levels of capitalisation.

Fifth, the table shows that efficient banks have relatively lower rates of loan-loss provisions to net interest revenues ratios (LLP/NIR). According to Berger and De Young (1997), the bad *management theory* can be called upon to explain these differences. Under the 'bad management' hypothesis, low measured cost efficiency recorded for inefficient banks is a signal of poor senior management practices. That is, "*loan managers do not sufficiently monitor and control their operating expenses, which are reflected in low measured cost efficiency almost immediately. Managers in these banks also do not practice adequate loan underwriting, monitoring, and control*" (Berger and De Young, 1997, p4). The theory presents a number of reasons to the weakness of management practices. First, "*loan managers may have poor skills in credit scoring and therefore choose a relatively high proportion of loans with low or negative net present values*. Second, loans managers may be "*less than fully competent in appraising the* *value of collateral pledged against the loans*. Third, "loan managers *may have difficulty monitoring and controlling the borrowers after loans are issued to assure that covenants are obeyed*" (Berger and De Young, 1997, p4). In contrast to the almost immediate reduction in measured cost efficiency, poor underwriting and monitoring practices lead to high numbers of nonperforming loans only after some time passes, the loan portfolio becomes seasoned, and delinquencies begin to mount. An increase in the value of non-performing loans will lead to an increase in the value of loan loss provisions. The bad management theory predicts that nonperforming loans will be negatively associated with cost efficiency.

In summary, Table 6–17 shows that the most cost and profit efficient banks in Algeria, Morocco and Tunisia are more effective in controlling their expenses side as well as having better profit generation capacity. These banks may tend to have better bank management reflected by controlling operating expenses and better risk management practices.

6-7-4 Cost and Alterative Profit Efficiencies: Ownership Characteristics

Literature on efficiency and ownership has hypothesised that privately and foreign-owned banks are more efficient than their public and domestic counterparts, but findings are varied. Bosco (2003) finds that foreign banks seem to outperform domestic banks in terms of profit and cost efficiency. Kraft, Kofler and Payne (2002) examine cost efficiency in Ukrainian banking over the period 1994 to 2000, and find that new private and privatised banks were not the most efficient banks through most of the period. In addition, they found that, overall, foreign-owned banks have substantially better efficiency scores than all types of domestic banks. Green, Murinde and Nikolov (2002) find that the foreign banks do not appear to be significantly different from domestic banks. Vasconcelos and Fucidji (2002) find no significant evidence for the hypotheses that i) the entry of foreign banks in Brazil would increase total bank credit; and ii) foreign banks are more efficient than their domestic counterparts, over the period 1994-01.

The cost efficiency estimates of Maghreb banking and financial firms according to ownership types, classified by country, are reported in the Table 6–18.

Table 6–18: Cost Efficiency Estimates According to Ownership

Years	1994	1995	1996	1997	1998	1999	2000	2001	Average
All Banks									
Foreign	92.42	65.74	68.23	67.04	65.08	46.37	43.79	62.09	**57.92**
Foreign Private	71.00	69.42	72.16	69.73	70.49	68.12	72.55	67.75	**69.72**
Foreign Public	46.77	42.14	63.98	79.59	79.01	76.10	72.42	48.49	**66.62**
Private	81.36	72.08	63.96	60.87	58.60	55.57	51.40	58.31	**54.46**
Public	78.03	79.19	79.21	77.82	82.48	80.04	85.72	64.93	**77.41**
Public-Private-Foreign	77.00	72.71	77.29	80.78	78.49	78.69	80.61	76.88	**76.32**
Algeria									
Foreign	*	*	*	*	*	25.42	28.84	63.66	**48.57**
Foreign-Public	*	38.18	46.17	52.65	62.01	51.70	39.92	50.83	**48.78**
Public	87.05	85.76	84.91	84.63	88.92	88.21	86.43	61.99	**83.56**
Private	*	*	*	*	*	*	14.03	61.66	**37.85**
Morocco									
Public-Private-Foreign	86.35	83.78	86.54	88.76	89.49	89.44	90.92	79.96	**86.86**
Foreign-Private	70.75	75.30	74.42	71.58	75.33	73.71	78.12	80.70	**74.99**
Public	56.63	46.74	54.12	59.23	*	*	80.80	62.85	**63.00**
Private	81.36	82.73	86.08	88.21	76.66	72.14	73.70	*	**72.13**
Tunisia									
Foreign	92.42	65.74	68.23	67.04	65.08	53.35	47.52	61.46	**61.66**
Foreign-Private	71.13	67.45	71.71	69.36	69.53	67.01	71.43	63.43	**68.67**
Foreign-Public	46.77	46.09	72.89	93.06	87.51	88.30	88.67	47.33	**75.54**
Public	66.19	76.88	76.18	73.95	76.05	70.23	85.69	78.77	**74.57**
Private	*	61.43	52.90	51.75	49.58	48.95	49.95	57.64	**50.72**
Public-Private-Foreign	58.30	67.18	72.00	77.35	74.36	73.31	75.46	74.83	**71.04**

Author's own estimation

The Kruskal Wallis non-parametric test indicates that cost efficiency estimates across all ownership type is significantly different at the level of 5% (p=0.00%).

Foreign banks are banks which are fully owned by foreign capital. Foreign-Private banks are banks which are owned by both foreign and private capitals. Foreign-State banks are those which are owned by foreign and government capitals. While public banks are fully owned by the government, private banks are fully owned by the private sector. Finally, the public-foreign-private ownership type reflects a quoted bank on either the Casablanca or Tunis Stock Exchanges, or public-foreign-private-owed banks are banks in which private, foreign and government ownerships cohabitate.

Overall, Table 6–18 indicates that government-owned banks (77.41%) and banks with mixed ownership types (76.32%) are the most efficient banks in North Africa during the period 1994-2001. In contrast, private (54.46%) and foreign-owned (57.92%) banks are the least cost efficient banks over the same period. On the one hand, the table indicates that public banks (83.56%) are the most efficient in Algeria, whereas banks with mixed ownership types are the most cost efficient in Morocco (86.86%) and public banks and banks with foreign and public ownership types are the most cost efficient banks in Tunisia, 75.54% and 74.57%. On the other hand, Table 6–18 reveals that private (37.85%) and foreign (48.57%) banks in Algeria, public (63.00%) banks in Morocco, and private banks (50.72%) are the least efficient banks.

In Algeria, private and foreign public banks are not the most cost efficient. As they are not pervasive throughout the territory, private and foreign–owned banks represent less than one tenth of total banking sectors' assets. It might be premature to expect to experience efficiency gains through privatisation in the form of new entry of private and foreign banks. Foreign and private-owned banks are in their early presence in Algeria, and the setting up of such banks requires substantial expenditures on new structures, offering higher salary packages to attract skilled workers, and substantial expenses to attract customers away from the existing government-owned banks. This shows that the banking sector in Algeria has not yet benefited the new private and foreign entrants, another indication of the absence of competition in Algeria. Within this framework, we significantly reject the hypothesis that, in Algeria, foreign and private-owned banks are more efficient than domestic and public counterparts. Thus, we find little empirical evidence to sustain the argument that bank ownership (foreign versus domestic and private versus government-owned) is an important factor in improving banks' cost efficiency in Algeria.

In Morocco and Tunisia, the privatisation process and foreign bank entry into the banking sector might have led to increased cost efficiency in the banking sector. The new (institutional) investors might have brought potential benefits to the banks in terms of better resource allocation, formation of human capital, higher efficiency, increased competition and increased stability (Levine (1996 and 1997) and Goldberg et al. (2000)). In Morocco, banks with mixed ownership and public-foreign-owned banks are the most efficient. Foreign capital may have opted for investing in existing banks rather than creating new structures. As seen in early chapters, foreign investors, mainly institutional, might have evaluated that investing in existing banks would be potentially more beneficial. The existing banks might have endured outdated management approaches and inappropriate risk assessment techniques associated with salient shortage of updated technology. Instead of this, the existing banks might have accumulated a strong background of expertise and knowledge about the banking needs of the local market banking. Based on this, new investors might have only injected new managerial and risk assessment techniques to match the experience and expertise of existing banks. Thus, it can be considered that privatisation in the form of allowing private and foreign investors to takeover government shares, has ameliorated the cost efficiency of the newly privatised banks. This remark is similar to the argument by Litan, Masson and Pomerleano (2001), who assert that the presence of foreign investors in the banking sector can be favourable to the local market as they tend to import with them improved technologies, increased liquidity and more experienced management. Levine (1996 and 1997) and Goldberg et al. (2000) indicate that foreign entrants may hypothetically enlarge the quantity and quality of financial services supply available to customers by contributing towards upgrading the existing managerial skills and technologies current in the financial system. Our results on Morocco and Tunisia are similar to those by Bhattacharyya, Lovell and Sahay (1997), who use the DEA and stochastic frontier analysis to examine the efficiency of 70 Indian commercial banks during the early stages of deregulation (1986-91). They found that banks with mixed ownership (quoted) are the most efficient, followed by foreign-owned banks and privately-owned banks.

Therefore, it can be concluded that banks in which foreign and private capital hold some stakes (because of privatisation), are more efficient in Morocco and Tunisia than those banks that are completely private and foreign ownership.

The efficiency differences across ownership types can also be captured thorough alternative profit efficiency. The alternative profit efficiency estimates of Maghreb banking and financial firms according to ownership types, classified by country, are provided in Table 6–19.

Table 6–19: Alterative Profit Efficiency Estimates: According to Ownership

Years	1994	1995	1996	1997	1998	1999	2000	2001	mean
					All Banks				
Foreign	79.13	75.78	77.90	72.66	69.93	69.68	77.70	47.59	**62.34**
Foreign Private	71.83	74.04	75.50	73.66	74.72	70.56	69.37	78.02	**74.16**
Foreign Public	73.29	69.70	72.15	76.73	74.35	75.21	75.23	68.31	**72.95**
Private	69.28	73.68	73.03	72.54	68.29	69.48	69.60	46.21	**64.49**
Public	71.27	68.61	71.82	71.70	72.00	76.81	72.12	77.07	**72.27**
Public-Private-Foreign	65.69	71.51	69.00	68.91	69.22	64.63	64.23	89.05	**70.88**
					Algeria				
Foreign	*	*	*	*	*	70.28	77.03	31.70	**46.75**
Foreign-Public	*	72.53	74.70	78.47	79.46	84.35	86.05	42.63	**74.03**
Public	73.18	70.92	76.35	79.25	73.49	83.63	78.57	68.93	**77.21**
Private	*	*	*	*	*	*	83.24	18.35	**50.80**
					Morocco				
Public-Private-Foreign	62.33	66.87	64.05	57.13	56.91	43.93	46.47	93.03	**62.44**
Foreign-Private	67.15	70.17	65.89	64.34	64.71	53.47	51.36	83.92	**65.12**
Public	79.47	62.32	61.87	61.89	*	*	34.96	91.99	**64.93**
Private	69.28	69.73	65.99	63.29	56.48	43.61	45.40	*	**53.45**
					Tunisia				
Foreign	79.13	75.78	77.90	72.66	69.93	69.47	77.87	53.94	**68.58**
Foreign-Private	74.17	75.32	77.42	75.53	76.73	73.97	72.97	76.06	**75.97**
Foreign-Public	73.29	66.87	70.88	75.87	71.80	70.64	69.83	81.16	**72.41**
Public	62.41	66.10	66.07	64.71	70.51	68.63	69.47	94.68	**68.28**
Private	*	77.62	76.55	75.62	74.20	79.83	76.55	51.78	**71.65**
Public-Private-Foreign	72.43	73.83	71.84	73.95	73.84	74.98	73.11	86.39	**75.10**

Author's own estimation

The Kruskal Wallis non-parametric test indicates that profit efficiency estimates across all ownership types are not significant at the level of 5% (p=59.7%).

Table 6–19 indicates that the fully private and foreign-owned banks are the least alternative profit efficient in our sample, 64.49% and 62.43%, where banks with public and mixed ownership banks are found to be the most efficient, between 71% and 75% respectively. Similar to Bosco (2003), these differences may reflect inferior levels of net loans value and net profit (margins) for fully foreign and private-owned banks than other types due to either differences in market strategies or/and to differences in the composition and behaviour of customers. Fully-private and foreign-owned banks might have found it relatively difficult to compete with long-established domestic banks.

In Algeria, public and foreign-public-owned banks are the most alternative profit efficient with 77.21% and 74.03%, respectively, while fully-private and foreign owned banks are the least profit efficient, 50.80% and 46.74%, respectively. The large gap between the most and least profit efficient provides more evidence of limited competition in the Algerian banking system. As noted in early chapters, the government-owned banks dominate the banking system in Algeria, with more than 90% of total bank assets. Thus, the high alternative profit efficiency of government-owned banks appears to stem from their market power and an absence of competition in the Algerian banking system, where large state-banks compete along side relatively small foreign and private-owned banks.

In Morocco, while private banks are the least profit efficient (53.45%), foreign private banks are the most efficient (65.12%), followed by public banks (64.93%) and banks of mixed ownership (62.44%). The relative small gap in efficiency between these ownership types reveals that the Moroccan banking sector has some indications of competition due to the entry of foreign banks. Demirguc-Kunt and Huizinga (2001) find that an increased presence of foreign banks is associated with a reduction in profitability and margins for domestic banks. They also find that banks with foreign shareholders tend to have higher profits than banks with non-foreign shareholders in developing countries, while the opposite is true for developed industrial economies. Overall, the most cost efficient banks in Morocco tend to be the most alternative profit efficient. This suggests that foreign-private-owned banks and those with mixed ownership are likely to have increased their profit efficiency by decreasing their cost inefficiency.

In Tunisia, Table 6–19 indicates that foreign-private banks are the most alternative profit efficient (75.97%), followed by banks of mixed ownership (75.10%). Also the table shows that public (68.28%) and foreign (68.58%) banks are the least alternative profit efficient. Similar to Morocco, the Tunisian banking system seems to operate in a relatively competitive environment, since the gap in efficiency between the ownership groups is not as large as in Algeria. The presence of foreign and private capital in banks may orient managers towards adopting more revenue-focused strategies that generate greater profits.

Overall, contrary to Algeria where the private sector and foreign banks have chosen to establish new banks, Private and foreign investors in Morocco and Tunisia have opted for investing in the existing banking firms rather than setting up new banks. The creation of the stock exchanges and the ambitious programme of privatisation, together with political stability have encouraged this option. While privatisation has helped banks with mixed ownership to have higher efficiency scores than their banks with just one type of ownership in Morocco and Tunisia, in Algeria, the government-owned banks still have high efficiency scores due (presumably) to their greater market presence. In Morocco and Tunisia, foreign participation in the banking sector is likely to have been beneficial in terms of importing capital (Krozner, 1998), and improving management of existing firms (Crystal et al., 2001).

6-7-5 Explaining Cost and Profit Efficiency Differences in Algeria, Morocco and Tunisia

This section of the thesis examines the determinants and sources of bank efficiency by estimating a second stage efficiency regression. In this regression, the relationship between our efficiency estimates and a set of country, structural and financial firm-specific variables are explored. The second stage regression consists of regressing the efficiency scores derived from the preferred models on a set of independent variables, which are selected based on Hao, Hunter and Yang (1999) and Girardone (2001).

In this regression, we use the logistic regression analysis, as according to Mester (1993, 1996), the logistic analysis explores the relationship and correlation between the independent variables and the dependent variables, also; it allows us to use the uncensored data as the dependent variable as it ranges between zero, the least efficient banks, and one, the most efficient banks.

The regression model can be estimated as follows

Cost or profit efficiency scores= f (LnA, EA, LLP/NIR, ROE, CA, NII/TI, Specialisation, Geographical Location)[147] (6.40)

Where A is Total Assets, EA is the equity to assets ratio, LLP/NIR is the ratio of loan loss provisions to net interest revenue, ROE is return on equity, CI is cost to assets ratio, NII/TI is non interest income to total income ratio, Specialisation includes dummies for commercial and non-commercial banks, and Geographical Location includes dummy variables for Algeria, Morocco, and Tunisia.

The independent variables included in the model are defined as follows. The variable lnTA is the natural logarithm of total assets and is included to control for the impact of scale bias on efficiency. The variable LLP to NIR is the ratio of loan loss provisions to net interest revenue. It is included to provide measures of the impact of non-performing assets on cost and profit efficiency. Equity capital to Assets ratio is included to adjust for different risk levels among the sample banks. The ROE is included to examine the relationship between the profitability of banks and their efficiency. The non-interest income over total income ratio is included to measure the impact of output mix on efficiency and income diversification. The coefficient of this ratio could be positive or negative depending on the bank's expertise and strategic objective. It is expected to be positive if a bank has the technical ability to offer non-interest income product lines, i.e., fee based services, which permit the bank to achieve a higher level of efficiency from its resources (especially its human capital). It is expected to be negative if the bank human capital resources and expertise is oriented more towards traditional commercial and industrial lending activities. The cost to assets ratio is included in the model to test for the consistency condition that banks with higher costs to assets ratios tend to be more inefficient. Country dummies are included in the regression model to capture the possible difference in efficiency between the banks in the three countries, Algeria, Morocco and Tunisia. A country dummy is equal to one if the bank is within the country and zero if it is not. The logistic regression model is estimated using Minitab and the results are reported in Table 6–20.

[147] These variables have been used by various authors such as Girardone (2001).

Table 6–20: Logistic Regression Analysis of the Determinants of Cost and Alternative Profit Efficiency in Maghreb Banking Systems (1994-2001)

Efficiency	Cost Efficiency		Alternative Profit Efficiency	
Parameter	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**
Constant	0.124	0.0929	0.823	0.0560
Ln Total Assets	0.013	0.0937	-0.058	0.0732
Equity/Asset	1.175	0.0342	0.386	0.0749
LLP/NIR	-0.028	0.0662	-0.024	0.0705
ROE	0.448	0.0427	0.238	0.0655
Cost/assets	-0.688	0.0711	-2.019	0.0289
Non Int Income/ Income	-0.776	0.0486	-2.606	0.0036
Commercial	0.006	0.0987	0.488	0.0181
Non Commercial	-0.006	0.0987	-0.488	0.0181
Algeria	-0.540	0.0148	-0.240	0.0513
Morocco	0.760	0.0450	0.031	0.0339

Tunisia dummy variable has been removed from the model by Minitab due to multicolinearity.

Table 6–20 shows that all independent variables included in the table have p-values less than 10%. This indicates that there is sufficient evidence that the parameters of the two models are not equal to zero using a significant level of 10%[148]. Thus, as the coefficients are found to be significantly different from zero, this indicates that there is statistical evidence that banks in the three countries with different financial characteristics have varying levels of efficiency.

To explore the relationship between the dependent variable, efficiency estimates, and the independent variables and the financial variables, the sign of the coefficients are examined. For both cost and alternative profit efficiency models, the Equity to Assets ratio, ROE, and Commercial and Morocco dummies have coefficients with positive signs, whereas LLP to NIR, Cost to Assets, Non Interest Income/ Income, and non-

[148] The variables of Equity/ Assets, ROE, Non Interest Income/ Income, Morocco and Tunisian dummies for the case of cost efficiency, and the variables of costs/ assets, Non Interest Income/ Income, bank type dummies, and Morocco dummy for the case of alternative profit efficiency, have p-value of less than 5%. The log-likelihood ratio tests the null hypothesis that all the coefficients associated with the predictors equal zero versus these coefficients not all being equal to zero. Given that the likelihood ratio of the two models has p-value smaller than the accepted significance of 10%, this indicates that there is sufficient evidence that at least one of the coefficients is different from zero. The goodness fit of tests have p-value greater than 1.312, indicating that there is insufficient evidence to claim that the model does not fit the data adequately.

commercial and Algeria dummies have coefficients with negative signs. Assets variable is the only one that has a coefficient with a positive sign in the both cost efficiency model and alternative profit model.

The positive sign of the capital to assets variable coefficient suggests that there is a positive relationship between efficiency and capital ratios, conforming what we have just seen in the last section that banks the most efficient banks tend to have higher levels of capital to assets ratios than the less efficient banks. Banks with higher levels of efficiency seem to have more capital to assets and this enables them to absorb higher default risks of their customers and clients (typically the non-performing government-owned enterprises in many cases). Yildimir and Philippatos (2003) found similar results—higher levels of inefficiencies are associated with banks with higher levels of capital to assets ratio.

The coefficients of LLP/NIR have a negative sign, that is, efficiency estimates are inversely correlated with LLP to NIR. LLP to NIR have two sides. First, a bank increases its loan loss provisions when it realises that the bulk of non-performing assets is increasing. This situation is consistent with the findings of the last section in which the most efficient group was found to have lower levels of risk. Second, an increase in the ratio of LLP to NIR may be the result of a greater increases in interest expenses compared to interest income, suggesting greater competition in the market, or increases in the levels of non-performing assets

The positive sign on the ROE coefficient suggests a positive relationship between profitability and cost and profit efficiency (as would be expected). In addition, cost and alternative profit efficiencies tend to be negatively correlated with cost to assets and non-interest income to total income. Cost and profit efficient banks have lower levels of costs to assets reflecting lower levels of labour, interest and other expenses. In terms of geographic location and specialisation, Moroccan and Tunisian banks tend to be the most cost and profit efficient in the sample. This suggests that country conditions in Morocco and Tunisia are possibly more suitable for increasing banks' cost and profit efficiency. Moroccan and Tunisian banks have more private and foreign capital in their shareholdings than Algerian banks. Commercial banks are found to be more cost and profit efficient compared to non-commercial banks. In addition, there is a positive relationship between the size and cost efficiency for Maghreb banks.

6-7-6 Estimated Levels of Scale Economies and Scale Efficiencies

6-7-6-1 Scale Economies

Productive efficiency is associated with the optimisation of firm's behaviour at two levels, either output maximisation or input minimisation. In terms of output maximisation, efficient behaviour involves the production of optimal outputs at a lower level of cost per unit. That is, scale economies imply that for over a given range of output, per unit costs decline as output increases. Using the cost function, there are three cases related to scale; increasing return to scale, decreasing returns to scale, and constant returns to scale. Evanoff and Israilevich (1991) explain that economies of scale exist if, over a given range of output, per unit costs decline as output increases; a case for increasing returns to scale; however, scale diseconomies exist when, over a given range of outputs, per unit cost increase as output decreases; decreasing returns to scale. Scale efficient behaviour is the case when we have constant returns to scale suggesting that changes in output will result in proportional changes in costs.

Following the explanation by Evanoff and Israilevich (1991) and using the translog cost function employed in our study, scale economies are calculated as the percent change in cost with respect to percent change in output[149]. Overall, the results of our scale economies analysis reveal that scale economies are present in Algeria, Morocco and Tunisia banking and they lie within the range of 8.5% and 66.5% for our assets size classes. Table 6–21 provides more details on the scale economies estimates, while Table A3–5 in Appendix A3 reports scale economies estimates for every banking firm used in our sample over the period under consideration.

[149] The formula used to derive scale economies estimates are calculated according to the formula suggested in the methodology chapter. Scale economies can be estimated by differentiating the translog cost function with respect to outputs.

Table 6–21: Scale Economies estimates in Algeria, Morocco, and Tunisia banking over 1994-2001

Year	1994	1995	1996	1997	1998	1999	2000	2001	ALL
Algeria	43.36	47.8	47.9	51.34	50.72	53.22	53.72	69.41	**52.18**
Morocco	46.47	45.72	44.89	44.74	49.7	46.71	44.58	35.7	**44.81**
Tunisia	73.36	66.73	67.65	68.54	67.94	72.66	70.76	65.03	**69.08**
Commercial	49.98	54.29	52.26	52.27	55.29	54.6	53.12	53.02	**53.10**
Non Commercial	68.17	68.61	94.16	75.77	79.58	80.44	81.55	76.45	**78.09**
Investment	*	72.33	76.29	78.36	80.66	80.81	80.46	69.73	**76.95**
Specialised Banks	64.48	64.73	65.61	64.04	64.59	63.61	58.95	61.55	**63.45**
Non banking Ins.	*	*	97.33	96.49	96.56	95.57	95.53	85.82	**94.55**
Multi-lateral Bank	75.56	75.44	72.76	70.11	75.07	76.53	75.11	74.63	**74.40**
All	**54.40**	**53.42**	**53.48**	**54.87**	**56.12**	**57.53**	**56.35**	**56.71**	**55.36**

Asset Size (US$ million)

Year	1994	1995	1996	1997	1998	1999	2000	2001	ALL
1-99	85.03	81.36	88.24	96.49	97.28	95.73	94.98	93.19	**91.54**
100-249	77.25	77.73	75.02	74.8	73.64	75.75	75.47	77.97	**75.95**
250-499	67.37	67.67	67.46	68.61	85.43	81.34	76.09	64.43	**72.30**
500-999	61.98	62.34	60.68	60.43	56.96	56.53	54.1	57.05	**58.76**
1,000-1,999	47.11	44.49	51.25	51.44	48.1	47.84	46.93	51.21	**48.55**
2,000-2,999	44.28	45.38	46.05	53.79	62.44	56.04	51.62	40.07	**49.96**
3,000-3,999	36.11	41.35	50.68	36.02	34.69	31.78	31.79	27.49	**36.24**
4,000-4,999	*	80.21	*	27.77	28.43	34.91	31.72	30.07	**38.85**
5,000+	54.61	28.53	30.7	34.98	34.91	29.89	31.88	22.11	**33.45**
ALL	59.22	58.78	58.76	56.04	57.99	56.65	54.95	51.51	**56.18**

Assets in million US Dollar	1-99	100-249	250-499	500-999	1,000-1,999	2,000-2,999	3,000-3,999	4,000-4,999	5,000+
Algeria	90.69	81.19	62.98	*	48.38	85.11	48.18	38.52	32.79
Morocco	*	*	90.64	51.58	46.12	42.47	33.04	30.07	*
Tunisia	94.79	75.09	68.58	59.66	51.90	44.67	*	*	*
Commercial	91.26	74.41	62.76	58.08	49.07	43.52	33.83	31.20	30.15
Non Commercial	96.19	77.13	74.60	61.16	48.38	85.11	81.72	80.21	77.78
Investment	96.22	74.79	65.87	*	*	*	*	*	*
Specialised Banks	*	*	72.73	61.16	48.38	85.11	81.72	80.21	77.78
Non banking Ins.	96.19	85.69	90.64	*	*	*	*	*	*
Multi-lateral Bank	*	77.00	66.62	*	*	*	*	*	*

Scale economies estimates are significant in terms of geographical location, ownership, specialisation at the 5%. Scale economies are also found not to be different from unity at a significance level of 10%.

Table 6–21 reports the results for scale economies in our sample according to time, geographical location, specialisation and size. Overall, the economies of scale estimate is around 54% for the average bank in our study, which provides evidence of the existence of substantial scale economies in each year under consideration. Table 6–21 shows that scale economies estimates (46%) for our sample are not negligible; and tend to dominate over X-inefficiencies (29%). This finding opposes some findings in the literature. Berger, Hunter and Timme (1993) and Berger and Humphrey (1997) find that X-inefficiencies (20%) tend to be larger than scale economies (5-10%). We believe that our results are different from that of the literature because of the small size of our sample.

Table 6–21 also indicates that the magnitude of scale economies is in the range of 8.5% for very small banks (banks with total assets less than US$100mn) to 66.5% for very large banks (banks with total assets more than US$5bn). Bank scale economies seem to be greater in Morocco (55%) and Algeria (48%) than in Tunisia (31%). Also, commercial banks (47%) appear to be experiencing substantial realisable scale economies compared to non-commercial banks (22%). Table 6–21 also shows evidence of the presence of substantial economies of scale for all bank assets size classes, particularly bank with over US$100million, i.e., medium and large-sized banks. There is also no evidence that scale economies tend to exhaust over the period under study. Table 6–21 shows that overall the average cost curve for our sample tends to have a U-shaped curve with a downturn sloping, due to the use of the translog frontier function and implying a negative relationship between assets size and scale economies. A negative relationship has also been found in the literature, including Williams (2003) and Carbo, Gardener and Williams (2002).

Our results suggest a relatively positive relationship between small size, constant return to scale, non-commercial bank type and Tunisia as a geographical location. This is in contrast to Mertnes and Urga (2001) and Kasman (2002), who find high levels of scale economies estimates for small banks. Because of the existence of scale economies in the Maghreb banking industry, more growth-related activities (either more expansion of outputs production, branching or consolidation) for medium and large-sized banks appear to be foreseeable, especially in Morocco and Algeria. As seen in Chapter 3, bank mergers seem to be happening in Morocco. Banque Commerciale du Maroc (BCM) and Wafabank have agreed to merge into one entity effectively in the first quarter or so of 2004. This merger will create a new entity known as VCM-Wafabank and this will become the largest bank in Morocco in terms of assets, deposits and branches. Also, as noted in Chapter 3, the banking market in Maghreb region seems to be under-populated as only one bank branch for less more than 20,000 capita in Algeria and Morocco and more than 10,000 capita in Tunisia, compared to one branch to less than 5,000 capita in some developed countries. Therefore, an increase in size through branching or number of accounts could be methods to realise economies of scale in the Maghreb area. Given our findings that Maghreb commercial banks enjoy relatively higher levels of cost inefficiency and substantial scale economies between 1994 and 2001, an increase in size could realise some cost savings, particularly for medium and large-sized banks. Medium and large-sized banks can diversify their assets, by spreading and lowering overall risk, which may result in diminishing non-performing assets. Medium and larger-sized banks may have greater resources to manage more efficiently the processing of customers, which can lead to lower credit losses. Also, large and medium-sized banks tend to concentrate on protecting their image and reputation, which may result in higher ratings and lower funding costs regarding purchased funds.

Unlike Matousek (2004) who questions the role of small banks in the banking industry, the close-to-unity results for very small banks and the substantial potential scale economies for medium and large banks question the regulatory implications of having banks size of types in terms of their contributions to banking sector efficiencies overall. Small banks tend to be privately-owned and involved in specialised activities, raising the potential for obtaining costs savings through economies of scope. Although the results support the view that Maghreb regulators should promote small-size banking and specialised activities, the results also support the view that medium and large-sized banks should also be encouraged to grow so as to achieve constant returns scale. The regulator should relax branching and expansion requirements, encourage consolidation in the banking industry, and review bank output regulation measures so more population and economic sectors can be accessible. These measures, if taken, do not appear to harm the overall efficiency of the banking systems in the three countries as the optimal size cannot be absolutely identified.

However, we must treat the above findings with caution as Maghreb banking systems seem still to be absorbing the effects of a prolonged period of financial repression. That is, the absence of fully-fledged competition and the slow path of embracing technology and financial innovation, and the relatively high level of governmental interventions can be considered as important factors responsible for yielding the scale economies results reported above. Overall, our results show that banks can make cost savings by both changing their size (scale economies), and emulating industry best practice (X-efficiency).

6-7-6-2 Scale Efficiencies

As it is noted in earlier sections, scale efficiencies are different from scale economies. Williams (2003) notes that while scale economies measure the change in cost associated with an incremental change in output, scale efficiency measures the change in output if a bank is to attain cost efficiency scale. That is, scale efficiency measures the costs associated with producing outputs of each firm relative to the most scale efficient firm within a particular assets size class. Williams (2003) indicates that scale efficiency estimates should be used with X-efficiency estimates in order to derive policy and regulatory implication. Scale efficiency estimates are computed for our sample, and reported in Table 6-23 according to time trend, geographical location, specialisation and assets size. Table A3–6 in Appendix A3 reports scale efficiency estimates for every banking and financial firm in our sample and for each year under study.

Table 6–22: Scale Efficiencies estimates in Algeria, Morocco, and Tunisia banking over 1994-2001

Year	1994	1995	1996	1997	1998	1999	2000	2001	ALL
Algeria	91.56	91.56	91.55	92.45	92.08	92.62	93.18	95.628	**92.58**
Morocco	92.33	92.43	92.05	91.96	92.43	91.88	91.59	89.05	**91.70**
Tunisia	98.02	96.99	96.86	96.85	97.17	97.14	96.73	96.08	**96.98**
Commercial	92.58	96.93	93.55	93.64	93.85	93.59	93.21	93.16	**93.44**
Non Commercial	97.36	97.58	98.23	98.13	98.31	98.26	97.95	97.51	**97.92**
Investment	*	98.08	98.40	98.59	98.69	98.68	96.68	97.66	**98.40**
Specialised Banks	96.49	96.43	96.51	96.22	96.17	95.93	94.81	94.90	**95.93**
Non banking Ins.	*	*	99.96	99.94	99.92	99.80	99.88	99.12	**99.77**
Multi-lateral Bank	98.22	98.22	98.06	97.75	98.44	98.62	98.44	98.38	**98.27**
All	**93.97**	**93.63**	**93.49**	**93.76**	**93.89**	**93.88**	**93.83**	**93.58**	**93.75**

Asset Size (US$ million)

Year	1994	1995	1996	1997	1998	1999	2000	2001	ALL
1-99	98.91	99.13	99.42	99.96	99.94	99.77	99.81	99.84	**99.60**
100-249	99.01	98.69	98.32	98.27	98.19	98.41	98.35	98.56	**98.40**
250-499	97.30	97.35	97.33	97.52	99.24	99.04	98.09	96.80	**98.40**
500-999	96.34	96.39	95.99	95.94	95.24	95.12	94.60	95.27	**95.61**
1,000-1,999	92.78	92.96	93.76	93.87	92.98	92.92	92.71	93.44	**93.18**
2,000-2,999	91.86	92.59	92.37	93.83	94.83	93.79	93.00	90.63	**92.86**
3,000-3,999	98.32	91.07	92.37	98.29	88.82	87.73	87.72	86.04	**89.05**
4,000-4,999	*	99.02	*	86.15	86.42	87.89	86.68	87.06	**89.20**
5.000+	90.14	86.39	87.24	88.90	87.88	86.90	87.71	83.72	**87.36**
ALL	93.81	94.84	94.60	93.75	93.73	99.77	99.81	92.73	**93.33**

Assets in million US Dollar	1-99	100-249	250-499	500-999	1,000-1,999	2,000-2,999	3,000-3,999	4,000-4,999	5,000+
Algeria	99.65	99.07	96.54	*	92.69	99.44	91.99	89.25	98.66
Morocco	*	*	99.76	93.99	92.50	91.29	88.18	87.06	*
Tunisia	99.79	98.36	97.47	95.80	93.98	92.02	*	*	*
Commercial	99.58	98.26	96.49	95.50	93.25	91.64	88.46	87.48	87.00
Non Commercial	97.88	97.90	97.32	94.88	100.00	99.60	99.45	95.57	100.00
Investment	99.96	98.26	97.06	*	*	*	*	*	*
Specialised Banks	*	*	98.11	96.01	92.69	99.44	99.09	98.77	98.76
Non banking Ins.	99.90	99.61	99.76	*	*	*	*	*	*
Multi-lateral Bank	*	98.63	97.19	*	*	*	*	*	*

Scale economies estimate are fount to be only significant in terms of geographical location, ownership, specialisation at the 5%.

Table 6–22 reports the results of our scale efficiency estimates for our sample in terms of time, assets size, geographical location and specialisation. Average scale efficiency for our sample for all size classes is found to be around 93%. The results of scale efficiencies tend to be similar to the results of scale sconomies. Tunisian financial firms are found to be more scale efficient (97%), then Algerian (92.5%) and Moroccan banking firms (91.7%). Commercial banks are found to be less scale efficient 93.4%) than non-commercial banking and financial firms (97.2%).The results reported in Table 6–22 can be interpreted as the percentage change in unit cost that is required for the different average-sized banks to operate at the cost efficient scale of each size classes. For instance, a bank with more than US$5bn in total assets seems to be able to make cost savings (13% less than the actual costs), if it operates at the optimal scale of banks within the same category of assets size class.

Similar to the results in the scale economies section, Table 6–22 provides evidence of the negative relationship between assets size and scale efficiencies for our sample under consideration. Scale efficiency estimates are closer to unity for the smallest bank assets size class (99.6%) than for the largest bank size class (87.4%). Overall, banking firms with less than US$1000m tend to have scale inefficiency less than 5%, banking firms with assets size between US$1000m and US$3000mn are found to have scale inefficiency estimate of 7%, whereas banks with larger than US$3000mn have scale inefficiency of more than 10%.

In summary, our findings suggest the presence of substantial scale economies and scale efficiencies for our sample under study, in particular for medium and large banks, and these tend to dominate X-inefficiencies. The results also provide evidence of a negative relationship between assets size and scale economies and scale efficiencies. Therefore, banking and financial firms in Algeria, Morocco and Tunisia can achieve potential gains of costs savings if they realise economies of scale, operate at the optimal scale efficient level, and reduce X-inefficiencies.

6-7-7 The Estimations of Efficiency Scores using the DEA Approach

In this section, the cost efficiency for the banking systems under study is estimated using Data Envelopment Analysis. This process is carried out following Bauer et al. (1999) who suggests that we should conduct DEA type estimates as a consistency test to check the robustness of the results obtained using alternative approaches. The analysis will be undertaken using the assumptions of both CRS and VRS in order to localise scale efficiencies. The CRS appropriately holds when all the members of the sample are operating at optimal scale. The VRS discards this optimality assumption and takes into consideration a number of factors that may influence banks' efficiency such as imperfect competition and constraints on finance. The CRS assumes that units operate at the optimal area, whereas the VRS assumes the opposite

The technical efficiency results using DEA, assuming constant and variable returns to scale, averaged around 0.80 and 0.90 respectively, allocative efficiency around 0.55, and cost efficiency averaged at 0.51 over the sample period. As indicated earlier, the difference between the efficiency estimates under CRS and VRS is attributed to scale efficiency. The scale efficiency averaged around 0.88 for the financial institutions in the countries under study over (1994-2001) the sample period.

The efficiency results of the DEA analysis for the whole sample are shown in Table 6–23. In Appendix A3, DEA estimates are reported for every banking firm used in this study for every year (1994 to 2001) from Table A3–7 to Table A3–15.

Table 6–23: Results the whole sample DEA

Year	CSR	VRS	Scale eff	Allocative Eff	cost eff	IRS	CON	DRS
1994	0.8074	0.9258	0.8769	0.7082	0.6695	0.2353	0.4118	0.3529
1995	0.7333	0.8296	0.8840	0.5331	0.4516	0.1724	0.3103	0.5172
1996	0.7445	0.8806	0.8504	0.5357	0.4907	0.2222	0.3056	0.4722
1997	0.8049	0.9641	0.8340	0.5337	0.5160	0.1111	0.3611	0.5278
1998	0.8224	0.9207	0.8900	0.4995	0.4726	0.2564	0.3846	0.3590
1999	0.8306	0.9053	0.9068	0.4609	0.4386	0.3023	0.3488	0.3488
2000	0.8096	0.8887	0.9098	0.5519	0.5066	0.3111	0.3111	0.3778
2001	0.8723	0.9277	0.9343	0.5585	0.5333	0.1714	0.4571	0.3714
mean	0.8031	0.9053	0.8858	0.5477	0.5099	0.2286	0.3571	0.4143

IRS, CON and DRS indicate the proportions of banks that are located in the increasing, constant and decreasing returns to scale areas, respectively.

Table 6–23 suggests significant opportunities for efficiency gains in the financial and banking markets in Algeria, Morocco and Tunisia. The DEA estimates suggest that, the average North African financial and banking firm could have reduced its costs by nearly 50% over the period 1994-2001. Table 6–23 also reports that the average technical, allocative and scale efficiencies of North African banks over the period of 1994-2001 are 90.35%, 54.77%, and 88.85%, respectively. This implies that, over the time period of 1994 to 2001, cost efficiency change is mainly due to changes in allocative and technical efficiency more than scale efficiency. According to Evanoff (1999), allocative inefficiency occurs when inputs are combined in suboptimal proportions. Regulation and poor management are typically given as major reason for this.[150] The average DEA cost efficiency score found in this study, around 50%, is lower than that found in other studies, such as Casu and Molyneux (2000) who found a score of 65% for a number of European banks and Dietsch and Weill (1998) who found average efficiency levels in the EU of 64% in 1996, but higher than those found by Darrat, Topuz and Yousef (2002) who found average cost inefficiency of 32% for Kuwaiti banks in 1994-97, and by Cook, Hababou and Roberts (2001) who found efficiency to be 45% for Tunisian banks.

The decomposition of cost efficiency reveals that the most severe efficiency loss occurs as a result of allocative inefficiency, which averages only 54.77% over the time period of the study. That is, allocative inefficiencies can explain the cost inefficiencies by more than 40% than technical inefficiencies. This suggests that banks in our sample, on average, are not efficient in choosing the right cost minimizing combination of inputs. Evidently, this is a characteristic of a market that has been shielded from effective competition (Cummins and Rubio-Misas, 2001). As we have noted throughout the thesis, banking institutions in Maghreb countries, in particular those with a major presence, tend to be more constrained by the lack of independence due to excess management control and political interference resulting in suboptimal utilisation of banking resources. The second major source of efficiency loss among the banks in our sample arises from technical inefficiency, i.e., the failure of the average bank to operate on the cost frontier. This type of efficiency averaged 90% over the time period from 1994 to 2001. Technical inefficiency is a limitation in a period of rapid technological change, suggesting that many banks must improve their technical performance dramatically to remain in the market.

Cummins and Rubio-Misasm (2001) note that bank cost efficiency can be improved when firms move from either increasing or decreasing returns to scale to constant returns to scale. This move will involve wasting fewer returns due to firms being either too small

[150] An extreme example presented by Evanoff (1999) would be if regulations mandated that regulated forms use a particular process to produce a commodity. For example, no machinery can be used. Even if the inputs other than capital were used as effectively as possible, the ban on machinery would most likely result in a production process that would be less efficient than the unrestricted process

or too large. On this basis, if any of the Algerian, Moroccan or Tunisian governments policies' has encouraged consolidation and been beneficial, then we expect the proportion of firms operating with increasing returns to scale to decrease (IRS) over the sample period, the proportion operating with constant returns to scale (CRS) to increase, and/or the proportion operating with decreasing returns to scale (DRS) to decline. Scale efficiency is relatively high, averaging 88% over the period of analysis 1994-2001. Approximately 41%, 23% and 36% of the sample are operating on the decreasing, increasing and constant returns to scale position of the best cost practice frontier, respectively. No major trend can be detected for the change in the proportion of increasing return to scale, suggesting that consolidation in the three countries has not increased the proportion of scale efficient firms.

The average efficiency scores by firm size quartile are considered and shown in Table 6–24. The size quartiles in the table are based on total assets, with quartile 1 (Q1) containing the smallest firms and quartile 4 (Q4) the largest.

Table 6–24: The average cost efficiency scores by firm size quartile (average values)

Efficiency	Cost Efficiency				Technical Efficiency			
Year	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1994	0.6405	0.5838	0.6600	0.7690	1.0000	0.8883	0.6710	0.8506
1995	0.3860	0.2364	0.4390	0.7083	0.9737	0.6479	0.7967	0.8914
1996	0.4552	0.3304	0.4450	0.7320	0.9289	0.8020	0.8363	0.9474
1997	0.2800	0.4167	0.5393	0.8279	0.9963	0.9601	0.9089	0.9907
1998	0.4123	0.3986	0.3774	0.6669	0.9362	0.8667	0.9008	0.9735
1999	0.4171	0.3766	0.3558	0.6029	0.8649	0.8866	0.8896	0.9762
2000	0.4788	0.5312	0.4234	0.5860	0.8875	0.9063	0.7924	0.9542
2001	0.5529	0.4668	0.3483	0.7652	0.9649	0.9358	0.8727	0.9374
Mean	0.4529	0.4176	0.4485	0.7073	0.9440	0.8617	0.8335	0.9402
Efficiency	Allocative Efficiency				Scale Efficiency			
Year	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1994	0.6405	0.6495	0.6710	0.8392	0.9075	0.8405	0.7905	0.9508
1995	0.3914	0.3519	0.5481	0.8026	0.8790	0.9791	0.7957	0.8825
1996	0.4692	0.3943	0.5133	0.7660	0.7383	0.9503	0.8208	0.8923
1997	0.2807	0.4266	0.5940	0.8337	0.8212	0.9033	0.7732	0.8382
1998	0.4230	0.4588	0.4071	0.6746	0.7023	0.9878	0.9424	0.8873
1999	0.4433	0.4169	0.3749	0.6070	0.7296	0.9876	0.9733	0.9207
2000	0.4992	0.5663	0.5315	0.5700	0.7674	0.9813	0.9697	0.9198
2001	0.5566	0.4853	0.3878	0.8043	0.9280	0.9690	0.9101	0.9300
Mean	0.4630	0.4687	0.5035	0.7372	0.8092	0.9499	0.8720	0.9027

Table 6–24 shows the largest firms have the highest efficiency estimates averaging 70%, whereas other bank sizes have much lower efficiency estimates of 43%. When quartile four is excluded from the analysis, in most of years in the sample period, it appears that there is no relationship between cost efficiency and size quartile. Thus, it is unclear if firm size is significantly related to bank efficiency.

In all the quartiles, the decomposition of cost efficiency into allocative, technical, and scale efficiency reveals that the largest-firm cost efficiency advantage is primarily attributable to technical efficiency. Thus, larger banks primarily define the production frontier, suggesting a significant advantage in employing technology. However, bigger is better does not seem significant as the second largest banks have cost efficiency equal to the smallest-sized banks. Thus, there is little evidence that size and efficiency are related in dimension for the case of the Algerian, Moroccan and Tunisian banking using the DEA methodology.

Further analysis of efficiency by size quartile shows that a higher proportion of cost efficiencies is due to allocative efficiency rather than scale efficiency. Quartiles 3 and 4 have the highest average allocative efficiencies. This suggests that any advantages conveyed by larger scale in terms of selecting optimal input quantities tend to be offset by the difficulties of allocating resources in larger and more complex organisations. Scale efficiency by size quartile provides important information regarding the governments' policies of encouraging banking industry consolidation. The table shows that the smallest quartile (Q1) is clearly less scale efficient than firms in the three larger quartiles (Q2, Q3, and Q4), suggesting that many firms in Quartile 1 are operating with increasing returns to scale. Thus, government policy makes sense if it enables small firms to attain more efficient scale, encouraging the merger of such firms into larger entities. However, the figures also suggest that there are limits to the efficiency gains from consolidation. Firms in Q4 are less scale efficient than firms in Q2 and Q3, implying that many large firms may be operating with decreasing retunes to scale.

Table 6–25 reveals efficiency scores derived from the DEA estimation according to geographic location and bank type.

Table 6–25: Efficiency estimates according to Geographic location and Bank' Type (average Values)

Years	1994	1995	1996	1997	1998	1999	2000	2001	Average
					Algeria				
Technical Efficiency	0.8370	0.8291	0.9139	0.9527	1.0000	1.0000	0.9662	0.9331	**0.9290**
Allocative Efficiency	0.7686	0.7833	0.8116	0.8223	0.8433	0.6710	0.6708	0.4531	**0.7280**
Scale Efficiency	0.9598	0.8879	0.9007	0.9180	1.0000	0.9388	0.9522	0.8883	**0.9307**
Cost Efficiency	0.6896	0.6653	0.7717	0.7813	0.8433	0.6710	0.6588	0.4451	**0.6908**
					Morocco				
Technical Efficiency	0.9848	0.9038	0.9539	0.9555	0.8841	0.8261	0.8294	0.8857	**0.9029**
Allocative Efficiency	0.7154	0.3513	0.3599	0.4380	0.1841	0.1565	0.3288	0.5073	**0.3802**
Scale Efficiency	0.7646	0.7920	0.7666	0.6883	0.7954	0.9424	0.9236	0.9293	**0.8253**
Cost Efficiency	0.7072	0.3105	0.3444	0.4317	0.1673	0.1343	0.2679	0.4549	**0.3523**
					Tunisia				
Technical Efficiency	0.9470	0.8020	0.8468	0.9713	0.9123	0.9006	0.8847	0.8847	**0.8937**
Allocative Efficiency	0.6600	0.4919	0.5039	0.4800	0.5050	0.4767	0.5966	0.5966	**0.5388**
Scale Efficiency	0.8980	0.9250	0.8611	0.8564	0.8901	0.8869	0.8898	0.9221	**0.8912**
Cost Efficiency	0.6283	0.4110	0.4478	0.4668	0.4692	0.4477	0.5458	0.5458	**0.4953**
					Commercial Banks				
Technical Efficiency	0.9252	0.8318	0.8759	0.9714	0.9315	0.9374	0.9048	0.9376	**0.9144**
Allocative Efficiency	0.7316	0.5382	0.5246	0.5422	0.5135	0.4791	0.5994	0.6648	**0.5742**
Scale Efficiency	0.8644	0.8564	0.8663	0.8299	0.9200	0.9523	0.9520	0.9396	**0.8976**
Cost Efficiency	0.6960	0.4535	0.4769	0.5288	0.4861	0.4621	0.5502	0.6350	**0.5361**
					Non-Commercial Banks				
Technical Efficiency	0.9268	0.8229	0.8806	0.9511	0.9034	0.8511	0.8531	0.9052	**0.8868**
Allocative Efficiency	0.6653	0.5171	0.5170	0.5187	0.4771	0.4302	0.4468	0.3170	**0.4862**
Scale Efficiency	0.9000	0.9709	0.7959	0.8413	0.8421	0.8301	0.8163	0.9221	**0.8648**
Cost Efficiency	0.6210	0.4457	0.4741	0.4933	0.4509	0.3989	0.4102	0.3021	**0.4495**

Table 6–25 shows that are significant differences in cost efficiencies of banks in Algeria, Morocco and Tunisia over the period of study. Algerian banks appear to be the more cost efficient compared with Tunisian and Moroccan banks. This finding is opposite to those derived from the parametric analysis in which Moroccan and Tunisian banks are the most cost and profit efficient in the sample. In terms of bank types, commercial banks tend to have higher rates of cost efficiency than non-commercial banks.

6-7-8 DEA and Translog Stochastic Estimates Comparison

In this part of the thesis, we consider whether cost efficiency patterns observed from the Stochastic Frontier Analysis are similar to those observed from the Data Envelopment Analysis using the Spearman rank correlation test. Also, in order to identify the most appropriate methodology and results that can be possibly used for regulatory and managerial purposes, we compare the ranking order of the efficiency scores with a simple accounting ratio of bank efficiency, the cost to assets ratio to see if the estimates relate to common financial measures of bank efficiency.

First, comparing the cost efficiency derived using DEA (50%) with those of SFA (70%), the results from both methodologies are substantially different. Puig-Junoy (2000) mentions that DEA efficiency scores are lower that those obtained from the stochastic frontier. He argues that DEA estimates are typically lower because the stochastic frontier approach allows banks to depart from the frontier due to both random error and inefficiency, whereas DEA measured random error is part of inefficiency.

Second, the Spearman rank correlation test between efficiency scores derived from the two methodologies is found to be around –4.2%[151]. While the stochastic cost frontier analysis suggests that commercial banks and Moroccan and Tunisia banks are the most cost efficient in our sample, the DEA results conclude that commercial banks and Algerian banks are the most cost efficient in the sample. Size, expressed in total assets, appears to have a relatively neutral influence in the DEA analysis.

Third, the Spearman rank correlation that compares cost efficiencies derived from the two approaches and a simple cost to assets ratios shows that results from both methodologies are not significantly related. However, the stochastic frontier cost efficiencies estimates appear to be more correlated to the cost to assets ratio (25%) compared to the DEA ordering (-2.2%). Thus, given the sample test, we believe that translog stochastic frontier estimates appear to be more robust and consistent with the sample characteristics than the DEA results.

[151] This test has a p-value of 48%, which is not significant at significance level of 10%.

6-8 Conclusion

This chapter presents the results of cost and alternative profit efficiency estimates derived from the utilisation of the Stochastic Frontier Approach (SFA) with the translog function specification. The sample includes 251 observations for 50 financial firms operating in Algeria, Morocco and Tunisia over the 1994-2001 period. This thesis finds mean cost and alternative profit efficiency levels in the three countries to be 29% and 32%, respectively, with no noticeable trend over time. Scale economies (average of 44%) are found to be present and substantial in the Maghreb banking system and these are dominating X-inefficiencies. Scale inefficiency are also computed and found to be within the range 1-13%.

The findings according to bank characteristics are found to be mixed. Commercial banks are significantly more cost inefficient and less profit efficient than non-commercial banks. In addition, large-and medium-sized banks tend to be more cost efficient but less profit efficient than small and medium-sized banks. Overall, in the three countries, bank cost and alternative profit inefficiency is found to be higher in Algeria than in Morocco and Tunisia. This would suggest financial and economic reforms have not made an influential impact on cost and profit efficiency of the banking sectors in the three countries under study. Evidence also suggests that the financial sectors in the three countries still seem to be suffering from the absence of competition and market pressures.

The overall results found in this study is that banking firms with mixed structures of ownership (a combination of private, public and foreign), or listed, are more cost and profit efficient than their counterparts with a single type of ownership. We suggest that the three types of ownership may combine so as to reduce various inefficiencies associated with single ownership types. For example, foreign ownership might bring new technology and updated systems of risk management, the private sector emphasises the profitability motive and lending to more profitable sectors, whereas government ownership brings experience and knowledge in the domestic market. These factors combined seem to result in a more efficient bank operating units than those that have sole ownership features.

Chapter 7 Main Findings and Limitations of the Study

7-1- Introduction

Financial deregulation measures have been implemented in Algeria, Morocco and Tunisia over the last two decades. The primary objective of these measures is to encourage banks to function more competitively within a market-based regulatory framework. During the pre-deregulation period, banks were not permitted to make their balance-sheet decision-making autonomously. Interest rates were determined in circles outside money markets, (which did not exist), and *l'encadrement du credit* was utilised to allocate credits centrally to *secteurs publics,* which were most favoured by planners, i.e., the central government. This conduct prevented banking firms from functioning according to market-based rules. Recently, various financial liberalisation measures have been introduced to encourage banks to function under market-based regulations, and this should encourage such firms to concentrate on improving their cost and profit efficiency levels.

This study has sought to provide an overview of the political economy aspects of Algeria, Morocco and Tunisia during the 1960s to date, and has also provided an overview of the recent developments in the three countries' banking sectors, including measures of financial deregulation and their banking sector developments. In particular, the principal objective of this study is to estimate the cost and alternative profit efficiency of a sample of 50 banking institutions in Algeria, Morocco and Tunisia over the period ranging from 1994 to 2001. Over this period, the financial sectors in the three countries experienced an unprecedented entry of foreign and private banks into local banking markets, as well as a substantial reorganisation of systems aimed at creating a more market-based system.

7-2- Main Findings of the study

This thesis uses the translog stochastic frontier approach to estimate bank cost and profit inefficiency in Algeria Morocco and Tunisia. The results show that the average cost and profit inefficiency was estimated to be 29% and 32%, respectively, whereas the DEA cost efficiency estimates were found to be larger, 44-46%. Using the consistency measures including spearman rank correlation analysis, we found that the translog frontier analysis results appear to be more robust than the DEA results. The conflicting results derived from the two competing methodological approaches, however do not prevent us from concluding that there is significant scope to reduce the inputs of the respective banking systems without decreasing the levels of output. The analysis also principally reveals that; first, Moroccan and Tunisian banks are more cost efficient than their counterparts in Algeria, secondly, banks that are involved in traditional income-generating activities are more profit efficient that other banks, and thirdly, banks that have higher levels of loan loss provisions to net interest revenues are more cost inefficient than other banks. However, no significant relationship was found between cost and profit efficiency and bank size. Also, the analysis reveals the existence of substantial scale economies within the range of 8.5-66.5%, especially for medium and large-sized banks. This result may provide an incentive for further growth-related activities in the banking systems under study. In addition, the cost and profit inefficiencies that appear to prevail in North African banking, we argue, are likely to reflect the still limited presence of competitive pressures in the banking systems under study. Following Evanoff (1999), inefficient banks in North African countries continue to exist because they may be protected, especially as we know that the largest banks are typically State-owned or have major state shareholders.

One aim of this study is to evaluate the degree to which the financial and economic reform measures implemented so far (in the 1990s) within the liberalisation programme have influenced cost and profit efficiency in North African banking. The levels of cost inefficiency found suggest that bank's managers as well as bank regulators in the respective banking systems need to increase their efforts to facilitate improvements in bank cost efficiencies. We consequently suggest that bank managers need to improve their loan portfolio management by using more efficient loan and credit evaluation procedures. In addition, bank regulators should take further measures that orient the financial sector to be more competitive. As banks with private and foreign-owned capital appear to be more efficient, one possible policy measure may be to privatise state-owned banks, which still dominate Maghreb banking especially in Algeria. Due to the fact that local capital lacks experience in modern banking management instruments, the Algerian Government could consider seeking to transfer ownership of their state banks to foreign owners. Grigorian and Manole (2002) explain that foreign owned banks may have the ability to capitalise on their access to better risk management and operational techniques, which is usually made available through their parent banks abroad. In addition, as foreign ownership is likely to be concentrated, foreign owned banks are less prone to typical corporate governance conflict between (dispersed) owners and management. The other evidence also shows that well capitalised foreign owned banks are more likely to cherry-pick the best borrowers available in the market (especially those from their own countries of origin), thereby improving the quality of their loan portfolios and increasing *ex post* returns. On the deposit side, owing to a popular perception that, if necessary, a foreign owned bank will be bailed out by its more powerful parent institutions abroad, foreign ownership plays a role of implicit deposit insurance.

In addition, one other aspect to improve cost efficiency is to implement further financial and economic liberalisation measures, especially full liberalisation of interest rates. This measure should help market conditions so foreign investors will be more attracted to North African markets. However, foreign investors might be obstructed from Algerian banking because of the absence of aspects of stabilisation including political stability and security.

Adding to this, our study finds evidence for the existence of scale economies in Maghreb banking, especially in Morocco and Algeria. Commercial medium and large-sized banks appear to potentially realise the largest scale economies, thereby suggesting a greater incentive for growth-related activities, including consolidation between these banks.

Although a number of financial liberalisation measures have been introduced in the three countries under studies, bank efficiency levels appear to be in need of further improvements. In addition, general macroeconomic climate is likely to have had a negative impact on bank performance over the period of study. The presence of financial inefficiencies in the three countries may provide evidence that banks seem also to bear the long-living experience of financial repression. The unprofitability of public enterprises, where the high levels of non-performing bank loans are concentrated, is likely to have resulted in low, and sometimes negative, economic growth. As indicated earlier, slower economic growth is often associated with weak debt servicing of borrowers, it leads to more loan defaults and enhanced credit risks. This tends to be the case for North African countries where due to poor economic growth in most of the 1990s loan default rates have increased. Thus, it might be hypothesised that economic and financial reform measures would generate better effects on bank cost and profit efficiency if the economic growth environment was improved.

7-3- Financial Repression/Liberalisation in Algeria, Morocco and Tunisia

The emergence of *loi de la monnaie et du credit* in Algeria (1990), *la loi bancaire* in Tunisia (1987), and the *la loi des banques* in Morocco (1993) has brought a new era to the respective banking systems. The banking structures of the three countries are currently accommodating increasing levels of private and foreign ownership, which was once irreversibly denied to this allegedly strategic sector. Financial repression measures, which branded banks as administrative appendices rather than independent profit-making organisations, distorted local banking markets in terms of interest rates below their market levels, and produced the *dualism effect.*

As elaborated in Chapter 3, widespread financial liberalisation measures were undertaken aimed at reducing the presence of government ownership in the banking sector, increasing the share of private and foreign bank ownership, as well as eliminating sources of distortions including the administrative determination of interest rates, and the directed allocation of credits. Also, universal banking is now allowed in all three banking systems.

Although financial liberalisation measures have been widespread, their immediate effects seem to have been delayed. This may be due to the profound impact of long-established financial repression measures. The level of non-performing assets of the infamous *secteur public* illustrates clearly this aspect. Thus, more time is required to see if the positive effects of financial liberalisation are realised.

7-4- Limitations of the Study

Our objective in this study is to estimate cost and profit efficiency in the three North African countries of Algeria, Morocco and Tunisia using contemporary methodologies. The stochastic frontier approach and DEA analysis have been extensively used to conduct research with such a purpose. However, while our analysis uses these two popular approaches; such approaches suffer from a number of shortcomings.

First, the analysis may suffer from under-representation, resulting from the fact that some banks in our sample are not adequately represented in the dataset. While some banks are represented during the whole period, other bank observations exist just for a few years. Also, the consistency of data may be questionable. A single and original source of data would have been ideal, but we found it impossible to obtain data from all the banking firms in question, and therefore, had to rely on a "second" best alternative, Bankscope. Also, our results may also be questionable because we have mixed in our sample both very small financial firms with very large banking in our study. This inclusion may produce biased results that could be sensitive to either of the categories of banks.

Second, the translog functional form used in the stochastic frontier approach has a number of drawbacks. Comparing to the Fourier-Flexible specification, the Translog form does not fit well the data that are far from the mean in terms of output size or mix. According to McAllister and McManus (1993), this disadvantage would be reflected in the results as some of the differences in scale economies using translog studies are caused by the poor fit of the data. Berger and Mester (1997) note that the local approximations of the translog may distort scale economy measurements since it imposes a symmetric U-shaped average cost curve.

Finally, it appears to be difficult to link changes in policy, i.e., financial liberalisation measures, to changes in bank efficiency in the three countries under study. This is because policy reforms are still ongoing and it may require a longer time span to examine whether liberalisation has really affected bank efficiency levels.

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A1 Appendix A1

Table A1–1: Algeria: Selected Social Indicators

Years	1996	1997	1998	1999	2000	2001	2002
Population							
Residents Population (in million)*	28.38	28.85	29.30	29.77	30.25	30.75	31.32
Population aged 0-14 (in million)	11.1	11.1	10.7	10.6	10.6		
Rural population (%)	41.7	41.9	41.2	40.4	39.7		
Birth rate per thousand	-	26.5	-	25.3	24.8		
Death rate per thousand	6.0	5.1	-	5.6	5.4		
Growth rate (%)	1.8	1.7	1.6	1.5	1.5	1.6	2.4
Health							
Infant mortality per thousand	37.0	35.3	-	34.0	33.3	-	39.0
Physicians per thousands people	-	-	1.0	0.8	-		
Education							
Primary school enrolment (%)	94.1	-	-	93.0	94.0	95.0	
Secondary school enrolment *%)	56.3	-	58.4	57.0	60.0	62.0	
Illiteracy Rate	37.1	35.8	35.9	34.6	33.3	-	-
Employment							
Labour force (% of total population)*	22.02	20.16	20.45	20.40	20.63	21.4	32.03
Unemployment rate*	39	39	39	41	42	38	
Income							
GDP per Capita in US$	1,641.8	1,649.2	1,604.9	1,589.1	1,753.5		

Source: Various but mainly IMF (2003) and World Development Indicators (world, Bank, 2001,2004)

* IMF, "International Financial Statistics", February 2004, p90-93.

Table A1–2: Morocco: Selected Social Indicators

Years	1971	1987	1993	1997	1998	1999	2000	2001	2002
Population									
Residents Population (in million)	15.4	22.7	25.6	27.3	27.8	28.2	28.7	29.17	29.64
Population aged 0-14 (in million)	7.0	9.6	9.8	9.6	9.6	9.3	9.3		
Rural population (%)	10.0	12.2	12.6	12.8	12.8	12.8	12.9		
Birth rate per thousand	41.0	31.4	27.3	23.2	22.8	22.4	21.9		
Death rate per thousand	17.4	7.4	7.0	6.3	6.2	6.1	5.9		
Growth rate (%)	2.8	2.4	2.0	1.7	1.7	1.7	1.6	1.6	1.6
Health									
Infant mortality per thousand	125.2	82.0	65.6	51.0	-	47.8	41.0	-	39.0
Physicians per thousands people	13.7	4.4	3.1	2.8	2.6	2.4	2.3		
Education									
Primary school enrolment (%)	52.5	71.7	88.3	88.6	-	79.0	84.0	88.0	
Secondary school enrolment *%)	12.6	38.0	44.9	49.9	-	31.0	-	-	
Literacy Rate	14.0	34.0	45.0	49.0	51.7	51.7	49.0	50.0	51.0
Employment									
Labour force (% of total population)	23.6	26.7	27.7	28.5	27.3	26.4	26.4		
Unemployment rate	2.3	14.4	15.9	16.9	19.1	22.0	21.5		
Income									
GDP per Capita in US$	275.0	819.0	1,027	1,224	1,284	1,239	1,159		

Source: Various but mainly IMF (2003) and World Development Indicators (world, Bank, 2001,2004)

Table A1–3: Tunisia: Selected Social Indicators

Years	1980	1985	1994	1999	2000	2001	2002
			Population				
Residents Population (in million)	6.39	7.26	8.81	9.41	9.52	9.62	9.73
Rural population (%)	48.0	46.0	39.0	35.0			
Life expectancy in years	62	66	71	72	72	-	73
Birth rate per thousand	35	29	23	17			
Death rate per thousand	9	7	6	6			
Growth rate (%)	2.7	3.0	1.7	1.3	1.2	1.1	1.1
			Health				
Infant mortality per thousand	69	52	32	24			
Physicians per thousands people	0.3	0.5	0.6	0.8			
			Education				
Primary school enrolment (%)	102	115	117	95.0	95.0	97.0	
Secondary school enrolment *%)	27.0	39.0	57.0	68.0	70.0	68.0	
Literacy Rate	45.0	53.0	64.0	70.0	71.0	72.0	73.0
			Employment				
Labour force (% of total population)	34.4	34.2	37.5	38.9			
Unemployment rate	12.9	16.1	15.6	15.8			
			Income				
GDP per Capita in US$	635.0	966.0	1,791.0	1,736			

Source: Various but mainly IMF (2003) and World Development Indicators (world, Bank, 2001,2004)

Table A1–4: Selected Population Indicators

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Population Characteristics (in Million)											
Algeria	25.33	25.81	26.29	26.78	27.28	27.79	28.10	28.49	29.51	29.96	30.73
Morocco	24.18	24.65	25.12	25.58	26.07	26.39	26.85	27.31	27.78	28.25	28.73
Tunisia	8.10	8.26	8.43	8.60	8.78	8.96	9.09	9.22	9.33	9.44	9.56
MENA countries	219.07	224.01	229.84	235.71	241.80	247.64	253.27	259.28	265.92	272.18	278.46
Population Characteristics (in percent to MENA countries)											
Algeria	11.56	11.52	11.44	11.36	11.28	11.22	11.09	10.99	11.10	11.01	11.04
Morocco	11.04	11.00	10.93	10.85	10.78	10.66	10.60	10.53	10.45	10.38	10.32
Tunisia	3.70	3.69	3.67	3.65	3.63	3.62	3.59	3.56	3.51	3.47	3.43
Total %	26.30	26.21	26.04	25.86	25.69	25.50	25.29	25.08	25.05	24.85	24.79
Population Growth (in Percent)											
Algeria	2.91	1.87	1.87	1.87	1.87	1.87	1.09	1.41	3.56	1.55	2.55
Morocco	2.03	1.94	1.91	1.83	1.92	1.21	1.75	1.72	1.70	1.70	1.70
Tunisia	2.13	2.04	2.03	2.04	2.03	2.04	1.46	1.39	1.28	1.18	1.23
MENA countries	3.36	2.26	2.60	2.56	2.58	2.42	2.27	2.37	2.56	2.35	2.31

Source: Arab Monetary Fund, Annual Report, 2001

Table A1–5: Selected GDP Indicators

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total GDP at Purchase Value in billion of US$ at current prices											
Algeria	62.05	45.71	47.87	49.77	41.97	41.26	46.85	47.87	47.36	48.07	53.80
Morocco	25.82	27.83	28.45	26.80	30.35	32.99	36.64	33.41	35.67	34.99	32.90
Tunisia	12.31	13.01	15.50	14.61	15.63	18.03	19.59	18.90	19.92	19.91	19.44
MENA countries	466.52	450.96	484.09	486.10	494.47	534.80	584.76	605.54	585.85	623.94	708.42
Share of GDP in MENA (in percent)											
Algeria	13.30	10.14	9.89	10.24	8.49	7.72	8.01	7.91	8.08	7.70	7.59
Morocco	5.53	6.17	5.88	5.51	6.14	6.17	6.27	5.52	6.09	5.61	4.64
Tunisia	2.64	2.88	3.20	3.01	3.16	3.37	3.35	3.12	3.40	3.19	2.74
Total %	21.47	19.19	18.97	18.76	17.79	17.26	17.63	16.54	17.57	16.50	14.98
Annual GDP Growth rates											
Algeria	11.7	-26.3	4.7	4.0	-15.7	-1.7	13.5	2.2	-1.1	1.5	11.9
Morocco	13.0	7.8	2.2	-5.8	13.2	8.7	11.1	-8.8	6.7	-1.9	-6.0
Tunisia	22.7	5.6	19.1	-5.7	7.0	15.3	8.7	-3.5	5.4	-0.1	-2.4
MENA countries	16.1	-0.9	9.8	1.3	4.3	11.2	8.4	5.8	-2.0	6.5	12.3
GDP Per Capita in US $											
Algeria	2,449	1,771	1,821	1,858	1,538	1,484	1,667	1,680	1,605	1,604	1,751
Morocco	1,068	1,129	1,133	1,048	1,164	1,250	1,365	1,224	1,284	1,239	1,145
Tunisia	1,520	1,574	1,838	1,698	1,781	2,013	2,155	2,051	2,135	2,109	2,022
MENA countries	4,998	4,834	5,284	5,185	5,080	5,259	5,629	5,782	5,191	5,610	6,676

Source: Arab Monetary Fund, Annual Report, 2001

Table A1-6: Algeria GDP Indicators

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
In Million US $											
Total Exports	14.55	13.31	12.15	10.88	9.97	11.32	14.14	14.66	10.83	13.74	22.85
Total Imports	15.47	10.79	11.46	11.56	11.94	12.85	11.20	10.64	11.11	11.27	11.27
Resource Gap	-0.92	2.52	0.69	-0.68	-1.97	-1.53	2.94	4.02	-0.28	2.47	11.58
Private Consu.	35.27	21.91	24.72	27.26	23.55	23.02	24.44	24.44	25.96	24.86	22.47
Public Consu.	9.97	6.73	7.69	8.65	7.05	6.50	7.69	8.01	8.57	8.16	7.49
Consumption	45.24	28.64	32.41	35.91	30.6	29.52	32.13	32.45	34.53	33.02	29.96
Investments	17.74	14.56	14.77	14.53	13.35	13.27	11.77	11.40	13.11	12.59	12.25
GDP	62.05	45.71	47.87	49.77	41.97	41.26	46.85	47.87	47.36	48.07	53.80
In Percent of GDP											
Total Exports	23.45	29.12	25.38	21.86	23.76	27.44	30.18	30.62	22.87	28.58	42.47
Total Imports	24.93	23.61	23.94	23.23	28.45	31.14	23.91	22.23	23.46	23.44	20.95
Resource Gap	-1.48	5.51	1.44	-1.37	-4.69	-3.71	6.28	8.40	-0.59	5.14	21.52
Private Consu.	56.84	47.93	51.64	54.77	56.11	55.79	52.17	51.05	54.81	51.72	41.77
Public Consu.	72.91	62.66	67.70	72.15	72.91	71.55	68.58	67.79	72.91	68.69	55.69
Consumption	28.59	31.85	30.85	29.19	31.81	32.16	25.12	23.81	27.68	26.19	22.77
Investments	28.59	31.85	30.85	29.19	31.81	32.16	25.12	23.81	27.68	26.19	22.77
GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Arab Monetary Fund, Annual Report, 2001

Table A1–7: Morocco GDP Indicators

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
In Million US $											
Total Exports	6.34	6.16	6.40	6.10	7.55	9.09	7.99	7.72	8.09	8.55	8.72
Total Imports	7.71	7.52	8.12	7.94	9.38	11.24	9.41	9.98	9.74	10.16	10.73
Resource Gap	-1.37	-1.36	-1.72	-1.84	-1.83	-2.15	-1.42	-2.26	-1.65	-1.61	-2.01
Private Consu.	16.67	18.57	18.78	17.33	20.50	22.56	24.71	21.81	22.82	21.39	20.24
Public Consu.	4.00	4.33	4.78	4.84	5.20	5.74	6.17	5.94	6.46	6.76	6.38
Consumption	20.67	22.9	23.56	22.17	25.7	28.30	30.88	27.75	29.28	28.15	26.62
Investments	6.52	6.30	6.60	6.02	6.48	6.84	7.17	6.92	8.03	8.46	8.29
GDP	25.82	27.83	28.45	26.80	30.35	32.99	36.64	33.41	35.67	34.99	32.90
In Percent of GDP											
Total Exports	24.55	22.13	22.50	22.76	24.88	27.55	21.81	23.11	22.68	24.44	26.50
Total Imports	29.86	27.02	28.54	29.63	30.91	34.07	25.68	29.87	27.31	29.04	32.61
Resource Gap	-5.31	-4.89	-6.05	-6.87	-6.03	-6.52	-3.88	-6.76	-4.63	-4.60	-6.11
Private Consu.	64.56	66.73	66.01	64.66	67.55	68.38	67.44	65.28	63.98	61.13	61.52
Public Consu.	80.05	82.29	82.81	82.72	84.68	85.78	84.28	83.06	82.09	80.45	80.91
Consumption	25.25	22.64	23.20	22.46	21.35	20.73	19.57	20.71	22.51	24.18	25.20
Investments	25.25	22.64	23.20	22.46	21.35	20.73	19.57	20.71	22.51	24.18	25.20
GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Arab Monetary Fund, Annual Report, 2001

Table A1–8: Tunisia GDP Indicators

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
In Million US $											
Total Exports	5.36	5.25	6.13	5.91	7.02	8.10	8.25	8.30	8.50	8.45	8.46
Total Imports	6.23	5.90	7.20	7.01	7.48	8.8	8.55	8.77	0.14	8.78	9.12
Resource Gap	-0.87	-0.65	-1.07	-1.1	-0.46	-0.7	-0.3	-0.47	8.36	-0.33	-0.66
Private Consu.	7.83	8.12	9.57	9.06	9.69	11.34	11.94	11.38	12.09	11.96	11.70
Public Consu.	2.01	2.16	2.48	2.38	2.55	2.94	3.05	2.98	3.12	3.09	3.02
Consumption	9.84	10.28	12.05	11.44	12.24	14.28	14.99	14.36	15.21	15.05	14.72
Investments	3.33	3.38	4.52	4.27	3.85	4.45	4.91	5.00	5.35	5.30	5.38
GDP	12.31	13.01	15.50	14.61	15.63	18.03	19.59	18.90	19.92	19.91	19.44
In Percent of GDP											
Total Exports	43.54	40.35	39.55	40.45	44.91	44.93	42.11	43.92	42.67	42.44	43.52
Total Imports	50.61	45.35	46.45	47.98	47.86	48.81	43.64	46.40	0.70	44.10	46.91
Resource Gap	-7.07	-5.00	-6.90	-7.53	-2.94	-3.88	-1.53	-2.49	41.97	-1.66	-3.40
Private Consu.	63.61	62.41	61.74	62.01	62.00	62.90	60.95	60.21	60.69	60.07	60.19
Public Consu.	79.94	79.02	77.74	78.30	78.31	79.20	76.52	75.98	76.36	75.59	75.72
Consumption	27.05	25.98	29.16	29.23	24.63	24.68	25.06	26.46	26.86	26.62	27.67
Investments	27.05	25.98	29.16	29.23	24.63	24.68	25.06	26.46	26.86	26.62	27.67
GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Arab Monetary Fund, Annual Report, 2001

Table A1–9: Algeria GDP per Economic Activity

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
In Million US $											
Agriculture &other	6.44	4.22	5.24	5.14	4.01	3.99	4.97	4.52	5.27	5.08	4.51
Mining $ Other	13.98	12.67	11.49	10.71	9.53	1`0.56	13.39	14.18	10.89	13.37	21.93
Manufacture	6.45	4.73	5.46	6.08	4.83	4.34	4.06	4.09	4.60	4.04	3.89
Electricity, gas and water	0.40	0.30	0.48	0.56	0.43	0.50	0.45	0.47	-	-	-
Construction	6.89	4.63	5.09	5.70	4.70	4.21	4.49	4.77	5.10	4.52	4.55
Commodity Sector	**34.16**	**26.55**	**27.76**	**28.19**	**23.5**	**13.04**	**27.36**	**28.03**	**25.86**	**27.01**	**34.88**
Distributive Sector	**14.88**	**9.94**	**10.94**	**11.43**	**10.11**	**9.51**	**10.23**	**10.52**	**11.27**	**11.47**	**10.20**
Government Sector	8.07	5.27	5.97	6.25	5.33	4.83	5.72	5.97	6.37	6.05	5.58
Service sector	8.07	5.27	5.97	6.25	5.33	4.83	5.72	5.97	6.37	6.05	5.58
GDP (net of taxes)	57.11	41.76	44.67	45.87	38.94	27.38	43.31	44.52	43.5	44.53	50.66
Net Indirect Taxes	4.94	3.95	3.2	3.9	3.03	13.88	3.54	3.35	3.86	3.54	3.14
GDP	**62.05**	**45.71**	**47.87**	**49.77**	**41.97**	**41.26**	**46.85**	**47.87**	**47.36**	**48.07**	**53.80**
In Percent of GDP											
Agriculture $ other	10.38	9.23	10.95	10.33	9.55	9.67	10.61	9.44	11.13	10.57	8.38
Mining $ Other	22.53	27.72	24.00	21.52	22.71	25.59	28.58	29.62	22.99	27.81	40.76
Manufacture	10.39	10.35	11.41	12.22	11.51	10.52	8.67	8.54	9.71	8.40	7.23
Electricity, gas and water	0.64	0.66	1.00	1.13	1.02	1.21	0.96	0.98	-	-	-
Construction	11.10	10.13	10.63	11.45	11.20	10.20	9.58	9.96	10.77	9.40	8.46
Commodity Sector	55.05	58.08	57.99	56.64	55.99	57.20	58.40	58.55	54.60	56.19	64.83
Distributive Sector	23.98	21.75	22.85	22.97	24.09	23.05	21.84	21.98	23.80	23.86	18.96
Government Sector	13.01	11.53	12.47	12.56	12.70	11.71	12.21	12.47	13.45	12.59	10.37
Service sector	13.01	11.53	12.47	12.56	12.70	11.71	12.21	12.47	13.45	12.59	10.37
GDP (net of taxes)	92.04	91.36	93.32	92.16	92.78	91.95	92.44	93.00	91.85	92.64	94.16
Net Indirect Taxes	7.96	8.64	6.68	7.84	7.22	8.05	7.56	7.00	8.15	7.36	5.84
GDP	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Arab Monetary Fund, Annual Report, 2001

Table A1–10: Morocco GDP per Economic Activity

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
In Million US $											
Agriculture $ other	5.47	5.34	4.38	3.94	5.62	4.82	7.07	5.16	6.05	5.16	4.03
Mining $ Other	0.65	0.61	0.59	0.53	0.56	0.59	0.64	0.75	0.76	0.76	0.69
Manufacturing	**4.75**	**4.79**	**5.16**	**4.82**	**5.71**	**6.06**	**6.25**	**5.90**	**6.09**	**6.72**	**5.89**
Electricity, gas and water	1.59	1.08	2.03	2.01	2.13	2.78	2.93	2.82	2.93	2.95	2.74
Construction	1.38	1.38	1.41	1.29	1.31	1.46	1.54	1.55	1.61	1.66	1.65
Commodity Sector	**12.94**	**13.20**	**13.57**	**12.59**	**15.33**	**15.71**	**18.43**	**10.28**	**17.44**	**17.25**	**15.00**
Commerce Hotels	5.19	5.67	5.99	5.52	6.00	6.53	7.06	6.15	6.88	6.08	6.06
Transport &comm.	1.60	1.60	1.80	1.77	1.80	2.05	2.06	1.95	2.06	2.12	2.09
Distributive Sector	**6.79**	**7.27**	**7.79**	**7.29**	**7.8**	**8.58**	**9.12**	**8.1**	**8.94**	**8.2**	**8.15**
Government Sector	3.07	3.36	3.63	3.50	3.71	4.34	4.67	4.55	4.92	5.04	4.79
Other Services	3.02	3.08	3.45	3.43	3.85	8.70	4.40	4.22	4.37	4.43	4.41
Service sector	**6.09**	**6.44**	**7.08**	**6.93**	**7.56**	**13.04**	**9.07**	**8.77**	**9.29**	**9.47**	**9.2**
GDP (net of taxes)	25.82	26.91	28.44	26.81	30.69	37.33	36.62	27.15	35.67	34.92	32.35
Net Indirect Taxes											
GDP	25.82	27.83	28.45	26.80	30.35	32.99	36.64	33.41	35.67	34.99	32.90
In Percent of GDP											
Agriculture $ other	17.70	19.84	15.40	14.70	18.31	12.91	19.31	19.01	16.96	14.78	12.46
Mining $ Other	2.52	2.27	2.07	1.98	1.82	1.58	1.75	2.76	2.13	2.18	2.13
Manufacture	18.40	17.80	18.14	17.98	18.61	16.23	17.07	17.66	17.07	19.24	18.21
Electricity, gas and water	6.16	4.01	7.14	7.50	6.94	7.45	8.00	10.39	8.21	8.45	8.47
Construction	5.34	5.13	4.96	4.81	4.27	3.91	4.21	5.71	4.51	4.75	5.10
Commodity Sector	50.12	49.05	47.71	46.96	49.95	42.08	50.33	37.86	48.89	49.40	46.37
Commerce Hotels	20.10	21.07	21.06	20.59	19.55	17.49	19.28	22.65	19.29	17.41	18.73
Transport &comm.	6.20	5.95	6.33	6.60	5.87	5.49	5.63	7.18	5.78	6.07	6.46
Distributive Sector	26.30	27.02	27.39	27.19	25.42	22.98	24.90	29.83	25.06	23.48	25.19
Government Sector	11.89	12.49	12.76	13.05	12.09	11.63	12.75	16.76	13.79	14.43	14.81
Other Services	11.70	11.45	12.13	12.79	12.54	23.31	12.02	15.54	12.25	12.69	13.63
Service sector	23.59	23.93	24.89	25.85	24.63	34.93	24.77	32.30	26.04	27.12	28.44
GDP (net of taxes)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

GDP	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Arab Monetary Fund, Annual Report, 2001

Table A1–11: GDP per Economic Activity

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
In Million US $											
Agriculture $ other	1.94	2.17	2.50	2.15	1.96	2.05	2.69	2.51	2.50	2.55	2.35
Mining $ Other	0.83	0.81	0.87	0.60	0.61	0.65	0.75	0.69	0.65	0.69	0.72
Manufacturing	2.08	2.20	2.56	2.51	2.89	3.42	3.58	3.47	3.66	3.62	3.56
Electricity, gas and water	0.25	0.25	0.29	0.27	0.29	0.36	0137	0.74	0.41	0.40	0.39
Construction	0.50	0.49	0.69	0.72	0.78	0.87	0.87	0.84	9.01	0.90	0.90
Commodity Sector	5.6	5.92	6.91	6.25	6.53	7.35	7.89	8.25	8.13	8.16	7.92
Commerce Hotels	1.78	1.68	1.99	1.20	2.45	2.73	2.90	2.78	2.95	3.21	3.11
Transport &comm.	0.84	0.87	1.11	1.10	1.18	1.35	1.44	1.46	1.53	1.57	1.60
Finance & Banks	0.43	0.49	0.57	0.58	0.59	0.74	0.81	0.70	0.76	0.80	0.81
Distributive Sector	**3.05**	**3.04**	**3.67**	**2.88**	**4.22**	**4.82**	**5.15**	**4.94**	**5.24**	**5.58**	**5.52**
Government Sector	1.55	1.69	1.96	1.92	2.01	2.49	2.63	2.61	2.74	2.62	2.53
Other Services	1.06	0.71	0.89	0.82	0.72	1.05	1.04	1.09	1.19	0.91	0.91
Service sector	**2.61**	**2.40**	**2.85**	**2.74**	**2.73**	**3.54**	**3.67**	**3.70**	**3.93**	**3.53**	**3.44**
GDP (net of taxes)	11.26	11.36	13.43	11.87	13.48	15.71	16.71	16.89	17.3	17.27	16.88
Net Indirect Taxes	1.05	1.65	2.07	2.74	2.15	2.32	2.88	2.01	2.62	2.64	2.56
GDP	**12.31**	**13.01**	**15.50**	**14.61**	**15.63**	**18.03**	**19.59**	**18.90**	**19.92**	**19.91**	**19.44**
In Percent of GDP											
Agriculture $ other	15.76	16.68	16.13	14.72	12.54	11.37	13.73	13.28	12.55	12.81	12.09
Mining $ Other	6.74	6.23	5.61	4.11	3.90	3.61	3.83	3.65	3.26	3.47	3.70
Manufacture	16.90	16.91	16.52	17.18	18.49	18.97	18.27	18.36	18.37	18.18	18.31
Electricity, gas and water	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00
Construction	4.06	3.77	4.45	4.93	4.99	4.83	4.44	4.44	4.57	4.52	4.63
Commodity Sector	45.49	45.50	44.58	42.78	41.78	40.77	40.28	43.65	40.81	40.98	40.74
Commerce Hotels	14.46	12.91	12.84	8.21	15.67	15.14	14.80	14.71	14.81	16.12	16.00
Transport &comm.	6.82	6.69	7.16	7.53	7.55	7.49	7.35	7.72	7.68	7.89	8.23
Finance & Banks	3.49	3.77	3.68	3.97	3.77	4.10	4.13	3.70	3.82	4.02	4.17
Distributive Sector	**24.78**	**23.37**	**23.68**	**19.71**	**27.00**	**26.73**	**26.29**	**26.14**	**26.31**	**28.03**	**28.40**
Government Sector	12.59	12.99	12.65	13.14	12.86	13.81	13.43	13.81	13.76	13.16	13.01
Other Services	8.61	5.46	5.74	5.61	4.61	5.82	5.31	5.77	5.97	4.57	4.68
Service sector	**21.20**	**18.45**	**18.39**	**18.75**	**17.47**	**19.63**	**18.73**	**19.58**	**19.73**	**17.73**	**17.70**
GDP (net of taxes)	**91.47**	**87.32**	**86.65**	**81.25**	**86.24**	**87.13**	**85.30**	**89.37**	**86.85**	**86.74**	**86.83**
Net Indirect Taxes	8.53	12.68	13.35	18.75	13.76	12.87	14.70	10.63	13.15	13.26	13.17

GDP	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Arab Monetary Fund, Annual Report, 2001

Table A1–12: Merchandise Export and Imports

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Foreign Exchange: domestic currency per US Dollar (period average)											
Algeria	8.9575	18.473	21.836	23.345	35.059	47.663	54.749	57.707	58.739	66.640	75.285
Morocco	8.242	8.707	8.538	9.299	9.203	8.540	8.716	9.527	9.604	9.804	10.627
Tunisia	0.8783	0.9246	0.8844	1.0037	1.0116	0.9458	0.9733	1.1059	1.1343	1.2477	1.3853
Imports (in Billion US Dollar)											
Algeria	9.68	7.68	8.65	8.76	9.57	10.78	9.10	8.69	9.83	9.72	9.69
Morocco	7.91	7.52	8.02	6.85	8.06	8.53	8.25	7.88	10.27	10.80	12.41
Tunisia	6.13	5.52	6.45	6.21	6.57	7.89	7.70	7.95	8.35	8.07	8.39
MENA	104.82	103.02	121.01	118.34	118.86	132.59	139.47	139.54	153.91	150.27	161.55
Share of import according to TOTAL MENA (in Percent)											
Algeria	9.23	7.45	7.15	7.40	8.05	8.13	6.52	6.23	6.39	6.47	6.00
Morocco	7.55	7.30	6.63	5.79	6.78	6.43	5.92	5.65	6.67	7.19	7.68
Tunisia	5.85	5.36	5.33	5.25	5.53	5.95	5.52	5.70	5.43	5.37	5.19
Total	22.63	20.11	19.11	18.44	20.36	20.51	17.96	17.57	18.48	19.03	18.87
Exports (in Billion US Dollar)											
Algeria	11.00	11.79	11.37	10.10	8.59	10.26	13.22	13.89	10.95	12.45	19.93
Morocco	4.23	4.28	3.98	3.69	3.97	4.71	4.74	4.67	7.14	7.51	7.96
Tunisia	3.55	4.08	4.04	3.80	4.64	5.78	5.52	5.76	5.74	7.27	5.84
MENA	141.01	125.98	130.39	122.25	127.63	148.63	174.12	177.39	139.85	174.89	248.55
Share of Exports according to TOTAL MENA											
Algeria	7.80	9.36	8.72	8.26	6.73	6.90	7.59	7.83	7.83	7.12	8.02
Morocco	3.00	3.40	3.05	3.02	3.11	3.17	2.72	2.63	5.11	4.29	3.20
Tunisia	2.52	3.24	3.10	3.11	3.64	3.89	3.17	3.25	4.10	4.16	2.35
Total	13.32	15.99	14.87	14.39	13.48	13.96	13.48	13.71	17.04	15.57	13.57

Source: Arab Monetary Fund, Annual Report, 2001

Table A1–13: Selected Balance of Payment Indicators

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Trade Balance (in Billion US Dollar)											
Algeria	4.187	5.478	3.210	2.420	-0.260	0.150	4.120	5.690	1.510	3.360	12.300
Morocco	-2.072	-1.764	-2.463	-2.056	-2.107	-2.482	-2.193	-1.864	-2.319	-2.448	-3.197
Tunisia	-2.252	-2.141	-2.151	-1.955	-1.761	-1.989	-1.567	-2.064	-2.063	-1.199	-1.678
Current Account (in Billion US Dollar)											
Algeria	1.420	2.367	1.300	0.800	-1.820	-2.250	1.250	3.450	-0.900	0.020	8.930
Morocco	-0.200	-0.418	-0.439	-0.524	-0725	-1.186	0.035	-0.087	-0.144	-0.167	-0.490
Tunisia	-0.821	-0.442	-0.675	-0.595	-0.478	-0.774	-0.610	-1.263	-0.966	-0.469	-0.476
Capital Account (in Billion US Dollar)											
Algeria	-1.000	-1.020	-0.100	-0.830	-2.540	-4.050	-3.350	-2.290	-0.630	-2.400	-1.360
Morocco	1.888	1.379	1.242	0.973	1.244	-0.189	0.031	0.465	0.231	1.679	-0.115
Tunisia	0.651	1.142	0.553	0.776	0.853	0.990	1.123	1.297	1.058	0.337	0.382
Overall Balance (in Billion US Dollar)											
Algeria	0.084	1.047	-1.110	-0.030	-4.360	-6.300	-2.100	1.160	-1.530	-2.380	7.570
Morocco	1.697	0.964	0.794	0.443	0.482	-0.982	0.292	0.553	0.247	1.639	-4.15
Tunisia	-0.205	0.738	-0.138	0.387	0.442	0.097	0.532	0.065	0.097	-0.55	-0.123

Source: Arab Monetary Fund, Annual Report, 2001

A2 Appendix A2

Table A2–1: Government Budget Indicators from 1990 to 2000 (in Percent)

Ratios	Total Revenues to GDP ratio			Total Spending to GDP ratio			Budget Balance to GDP ratio		
Year	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia
1990	28.8	26.9	31.4	25.6	27.5	36.8	3.2	-0.6	-5.4
1991	32.5	25.0	29.3	28.4	26.0	35.3	4.1	-1.0	-6.0
1992	30.0	26.2	29.4	29.5	28.4	33.3	0.5	-2.2	-3.9
1993	27.6	27.0	30.7	33.6	28.2	34.55	-6.0	-1.2	-3.8
1994	29.5	24.4	31.7	31.4	29.5	33.7	-1.9	-5.1	-2.0
1995	30.6	24.0	30.2	29.8	22.1	34.4	0.8	1.9	-4.2
1996	32.9	23.5	30.6	29.0	28.8	35.5	3.9	-5.3	-2.9
1997	33.5	23.5	28.7	31.2	26.3	32.6	2.3	-0.8	-3.9
1998	27.8	25.5	29.6	31.7	30.2	32.0	-3.9	-4.7	-2.4
1999	30.0	27.7	29.5	30.3	29.4	31.7	-0.3	-1.7	-2.2
2000	39.3	26.2	29,4	29.6	32.7	32.7	9.9	-6.5	-3.3
Average	**31.1**	**25.6**	**30.0**	**30.0**	**28.1**	**33.9**	**1.1**	**-2.5**	**-3.3**

Source: Various.

Table A2-2: Money Supply Indicators from 1990 to 2000 (in Percent)

Ratios	Long-Run Mobilisation Ratio (M1/M2)			Magnetisation Ratio (M2/GDP)			M1/GDP		
Year	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia
1990	78.8	87.9	50.8	63.0	44.7	42.4	49.2	39.3	21.5
1991	78.2	87.1	47.9	48.0	45.1	42.3	37.5	39.3	20.3
1992	71.7	87.2	47.1	48.0	47.8	38.1	34.4	41.7	17.9
1993	71.2	87.0	46.1	52.7	49.2	43.1	37.6	42.8	19.9
1994	65.8	86.3	47.2	48.6	48.9	43.1	32.0	42.2	20.3
1995	64.9	85.4	48.9	39.9	51.7	42.3	25.9	44.2	20.7
1996	64.4	84.8	48.7	35.6	48.3	43.0	24.3	41.0	21.0
1997	62.1	84.4	46.9	39.2	52.4	45.7	24.3	44.2	21.5
1998	63.2	83.6	47.7	46.3	52.3	44.5	29.3	43.7	21.3
1999	60.6	83.5	46.1	46.3	58.0	49.0	28.1	48.5	22.6
2000	62.8	83.7	44.6	41.2	61.1	51.7	25.9	51.2	23.0
Average	67.61	85.54	47.45	46.25	50.86	44.11	31.68	43.46	20.91

Source: Various, but mainly Arab Monetary Fund Statistics Report 2002.

Table A2–3: Selected Macro-economic and Monetary Indicators from 1990 to 2000 (in Percent)

Ratios	Real GDP Growth			Money supply Growth M2			Credit to the economy Growth		
Year	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia
1990	-	3.9	-	13.0	7.9	6.0	18.0	16.3	2.7
1991	-	6.9	-	20.6	11.6	5.0	31.9	23.0	12.7
1992	-	-4.1	-	24.7	7.8	7.0	26.6	12.1	21.3
1993	-	-1.0	-	21.6	5.2	7.0	-46.6	5.5	2.0
1994	-	10.4	3.2	15.3	11.5	8.0	38.9	9.2	7.7
1995	-	-6.6	2.4	10.5	6.7	6.0	85.0	11.8	10.1
1996	-	12.2	7.1	14.4	5.8	14.0	37.3	9.4	14.5
1997	1.1	-2.2	5.4	18.2	8.2	16.0	-4.6	6.7	9.7
1998	5.1	7.7	4.8	19.1	7.8	5.0	-1.4	10.3	7.8
1999	3.2	-0.1	6.1	14.0	11.6	20.0	27.9	9.8	-
2000	2.4	1.0	4.7	13.0	7.9	14.0	-17.0	7.7	-
Average	-	2.55	-	16.76	8.36	9.82	17.82	11.07	-

Ratios	Unemployment Rate			Inflation Rate			Population Growth		
Year	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia	Algeria	Morocco	Tunisia
1990	-	15.8	15.5	20.2	7.0	6.5	2.55	2.03	2.13
1991	-	17.3	15.7	25.5	8.0	8.2	2.91	1.94	2.04
1992	-	16.0	15.7	31.0	5.7	5.8	1.87	1.91	2.03
1993	-	16.0	15.6	21.6	5.2	4.0	1.87	1.83	2.04
1994	24.0	20.0	15.6	31.7	5.1	4.7	1.87	1.92	2.03
1995	28.0	23.0	15.6	28.4	6.1	6.3	1.87	1.21	2.04
1996	28.0	18.0	15.6	20.3	3.0	3.8	1.09	1.75	1.46
1997	28.0	17.0	15.9	5.7	1.0	3.7	1.41	1.72	1.39
1998	28.0	19.0	15.6	5.0	2.7	3.1	3.56	1.70	1.28
1999	29.9	22.0	15.8	2.6	0.7	2.7	1.55	1.70	1.18
2000	30.0	22.0	15.7	0.3	1.9	3.1	2.55	1.70	1.23
2001	28	-	-	4.2	-	-	-	-	-
2002	26	-	-	1.4	-	-	-	-	-
Average	-	18.74	15.66	17.58	4.22	4.72	2.10	1.76	1.71

Source: Various.

Table A2–4 Summary of Main Macroeconomic and Banking Indicators in Algeria, Morocco and Tunisia

Country				Algeria				
Variables	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Real GDP per Capita Growth	-35.82	-27.08	-7.21	-5.91	-6.89	-4.2	9.18	-5.11
Loans to private/ GDP	16.99	26.33	29.51	26.51	25.31	27.95	19	19.93
Inflation	29	29	18.7	5.7	4.9	2.7	0.3	4.2
Real Interest Rate	-7.13	-6.05	-0.19	5.77	5.24	7.53	6.45	-0.82
M2/ GDP	40.19	37.14	34.77	38.68	44.6	43.11	40.65	48.23
Currency outside bank/ GDP	12.39	11.6	11.05	12.07	13.53	13.17	11.88	13.56
Country				**Morocco**				
Real GDP per Capita Growth	2.01	-1.75	1.83	-14.26	1.08	-6.51	-9.99	-2.03
Loans to private/ GDP	25.89	29.27	28.08	46.58	50.77	51.99	56.99	53.47
Inflation	5.2	6.0	3.0	1.0	2.7	0.7	1.9	0.6
Real Interest Rate	6.74	3.83	5.26	6.82	3.51	4.91	3.44	3.82
M2/ GDP	64.07	66.77	61.65	90.91	74.19	76.48	83.8	86.28
Currency outside bank/ GDP	15.12	15.49	14.45	14.88	15.34	16.06	16.65	17.05
Country				**Tunisia**				
Real GDP per Capita Growth	0.08	6.36	3.26	-8.22	0.53	0.93	-10.17	-0.12
Loans to private/ GDP	54.92	54.1	47.92	48.61	57.63	48.57	48.59	59.2
Inflation	4.8	6.3	3.7	3.7	3.1	2.7	2.9	1.9
Real Interest Rate	3.83	2.36	3.97	3.06	3.66	3.09	2.89	4.06
M2/ GDP	47.25	45.52	45.22	47.52	54.25	49.58	54.67	55.15
Currency outside bank/ GDP	7.72	7.67	7.53	7.35	8.46	7.65	8.27	8.07

Source: Arab Monetary Fund Statistics Report, 2002.

Table A2–5: Algeria: Structure of Bank Balance sheet in Algeria from 1990 to 2001 in Percent.

Ratios	Assets						
Year	Cash	Deposits at Central Banks	External Assets	Credits to the Government	Credits to the Economy	Portfolio & Others	Total Assets
1990	0.21	0.42	1.91	9.49	52.31	35.65	100.00
1991	0.08	0.35	3.22	4.46	45.20	46.65	100.00
1992	0.07	0.70	2.76	3.76	54.64	38.06	100.00
1993	0.08	4.30	1.92	34.95	25.61	33.13	100.00
1994	0.13	0.53	4.27	19.46	29.09	46.55	100.00
1995	0.21	0.23	2.73	12.76	46.29	37.77	100.00
1996	0.19	0.73	2.32	10.14	55.68	30.95	100.00
1997	0.27	0.99	1.55	18.34	49.78	29.06	100.00
1998	0.35	0.63	1.71	25.45	45.32	26.55	100.00
1999	0.24	0.45	1.45	13.48	48.55	25.45	100.00
2000	0.34	1.84	1.45	30.71	39.67	25.99	100.00
2001	0.34	7.98	1.51	27.00	37.46	25.73	100.00

Ratios	Liabilities							
Year	Demand deposits	Time & Savings deposits	External Liabilities	Credits from the Central Bank	Credits from the Government	Equity	Others	Total Assets
1990	22.35	15.44	0.79	14.05	0.18	3.95	43.24	100.00
1991	18.46	12.52	1.30	13.24	0.34	3.60	50.53	100.00
1992	18.67	19.38	1.77	10.43	0.78	3.46	45.51	100.00
1993	21.97	21.00	1.51	3.42	10.49	4.14	37.47	100.00
1994	18.69	23.56	3.34	4.82	3.69	3.57	42.35	100.00
1995	17.28	22.99	1.85	15.52	3.65	4.35	34.36	100.00
1996	16.77	23.36	1.49	18.57	6.99	3.85	28.95	100.00
1997	17.11	27.53	0.98	14.71	5.67	3.75	30.25	100.00
1998	20.74	29.41	1.58	14.03	3.46	4.11	26.67	100.00
1999	18.32	30.06	1.60	16.15	2.94	3.69	27.24	100.00
2000	31.61	1.36	8.72	1.71	4.42	28.63	31.61	100.00
2001	38.45	1.67	0.00	1.23	5.60	28.84	38.45	100.00

Table A2–6: Morocco: Structure of Bank Balance sheet in Tunisia from 1990 to 2000 in Percent.

Ratios	Assets							
Year	Cash	Deposits at Central Banks	External Assets	Credits to the Government	Credits to the Economy	Portfolio	Others	Total Assets
1990	1.07	7.17	6.61	31.32	35.88	1.16	16.79	100.00
1991	0.83	10.03	4.92	24.75	42.43	0.88	16.17	100.00
1992	0.78	5.06	4.37	31.92	45.67	0.80	11.40	100.00
1993	0.80	5.67	3.69	32.94	46.00	0.26	10.64	100.00
1994	0.69	4.76	4.38	32.86	45.59	0.91	10.82	100.00
1995	0.66	4.89	3.36	30.13	49.64	0.99	10.32	100.00
1996	0.82	4.59	3.31	28.29	51.18	0.35	11.46	100.00
1997	0.65	3.85	1.48	23.35	60.23	10.19	-	100.00
1998	0.98	3.90	1.68	21.39	61.16	10.89	-	100.00
1999	1.79	4.04	1.64	18.72	62.56	11.25	-	100.00
2000	1.73	4.09	1.95	18.95	62.75	10.53	-	100.00
2001	2.43	5.85	1.65	20.60	58.96	6.49	4.01	100.00
2002	1.75	6.35	2.32	20.46	58.31	6.69	4.13	100.00

Ratios	Liabilities							
Year	Demand deposits	Time & Savings deposits	External Liabilities	Credits from the Central Bank	Credits from other banks	Non-Residents Deposits	Equity	Other	Total Assets
1990	57.01	25.41	1.91	6.17	0.33	1.59	6.83	2.67	100.00
1991	54.03	26.58	1.91	7.35	0.30	1.58	7.33	2.81	100.00
1992	53.78	29.40	2.59	2.07	0.40	2.18	8.38	3.78	100.00
1993	51.66	31.49	2.75	0.71	0.34	2.41	9.57	3.81	100.00
1994	51.22	29.76	3.90	0.72	0.46	3.44	9.60	4.80	100.00
1995	51.36	30.69	2.27	0.75	0.50	1.77	9.89	5.04	100.00
1996	49.36	30.92	2.59	1.42	0.84	1.75	10.15	5.42	100.00
1997	46.23	25.54	1.36	0.48	0.88	0.48	15.43	10.96	100.00
1998	46.26	23.76	1.56	1.23	1.17	0.39	16.41	10.77	100.00
1999	48.03	23.65	1.57	0.46	1.12	0.45	16.28	10.02	100.00
2000	48.05	23.41	1.33	2.20	1.19	0.13	16.49	8.52	100.00
2001	47.35	28.05	3.43	0.00	3.67	0.18	15.55	1.77	100.00
2002	49.99	25.66	3.17	0.00	4.15	0.14	15.56	1.32	100.00

Table A2-7: Tunisia: Structure of Bank Balance sheet in Tunisia from 1990 to 2000 in Percent.

Ratios	Assets							
Year	Cash	Deposits at Central Banks	External Assets	Credits to the Government	Credits to the Economy	Portfolio	Others	Total Assets
1990	0.50	1.03	2.24	9.37	66.74	2.35	17.77	100.00
1991	0.41	1.00	2.19	5.56	67.27	2.66	20.91	100.00
1992	0.47	1.22	2.57	5.00	65.80	2.56	22.38	100.00
1993	0.48	2.02	2.79	4.65	65.60	2.60	21.85	100.00
1994	0.44	1.75	2.44	2.72	67.39	2.67	22.60	100.00
1995	0.59	4.75	3.75	2.05	61.66	2.42	24.79	100.00
1996	0.49	4.62	4.23	3.96	61.09	2.63	22.67	100.00
1997	0.48	1.56	1.56	3.93	61.31	2.80	26.55	100.00
1998	0.49	3.87	3.97	2.84	59.92	2.91	24.04	100.00
1999	0.49	1.34	3.88	6.53	61.41	3.17	23.05	100.00
2000	0.50	1.03	2.24	9.37	66.74	2.35	17.77	100.00
2001	0.55	2.30	3.07	5.66	61.81	3.03	23.58	100.00
2002	0.51	1.96	3.54	5.77	63.38	3.77	21.06	100.00

Ratios	Liabilities							
Year	Monetary deposits	Quasi-Monetary deposits	External Liabilities	Credits from the Central Bank	Special Resources	Equity	Others	Total Assets
1990	19.75	37.16	4.86	7.25	8.59	7.61	14.79	100.00
1991	16.56	37.75	5.01	8.23	8.70	8.39	15.36	100.00
1992	15.70	36.15	5.52	7.03	8.13	9.19	18.27	100.00
1993	15.14	25.80	5.73	7.35	7.69	9.82	19.14	100.00
1994	16.17	34.08	6.66	5.17	7.97	10.71	19.31	100.00
1995	16.12	33.17	6.50	5.50	6.68	13.31	18.73	100.00
1996	16.08	33.28	7.56	1.20	6.02	13.45	22.40	100.00
1997	17.05	35.39	7.60	0.82	5.66	13.46	20.03	100.00
1998	16.91	33.80	7.26	0.73	5.29	13.59	16.67	100.00
1999	16.60	36.37	8.60	0.58	4.78	13.16	19.92	100.00
2000	14.99	35.01	7.69	1.96	7.48	12.28	20.58	100.00
2001	15.07	35.36	6.95	3.31	7.63	10.96	20.72	100.00
2002	13.68	37.46	7.43	1.87	8.71	11.39	19.47	100.00

Table A2–8: Banking firms operating in Algeria

Bank Name	Symbol	Specialisation	Year Establishment	Year Privatisation	Ownership
Al-Ryan Banque-Algérie		Commercial	2000		Foreign
Arab Bank		Commercial	2000		Foreign
Arab Banking Corporation-Algérie[152]	ABC-A	Commercial	2000		Foreign
Banque Algérienne de Dévéloppment Rural	BADR	Commercial	1982		Public
Banque de Dévéloppment Local	BDL	Commercial	1985		Public
Banque El-Baraka-Algérie	El-Baraka	Commercial	1991[153]		Foreign-public
Banque Éxtérieur d'Algérie	BEA	Commercial	1967		Public
Banque Générale Meditérraniénne	BGM	Commercial			Private
Banque Nationale d'Algérie	BNA	Commercial	1966		Public
BNP/Paribas		Commercial			Foreign
Caisse Nationale d'Épargne et de Prévoyance[154]	CNEP	Commercial	1964		Public
Citibank-Algérie[155]		Commercial	1998		Foreign
Compagnie Algérienne de Banques	CAB	Commercial	1999		Private
Crédit Populaire d'Algérie	CPA	Commercial	1967		Public
Natexis Banque[156]	Natexis	Commercial	2000		Foreign
Société Générale d'Algérie		Commercial	2000		Foreign
Algerian International Bank		Merchant	2000		Private
So-Finance		Merchant			Private
Union Bank		Merchant	1995		Private
El-Mouna Bank		Offshore	1998		Foreign
Banque Algérienne de Dévéloppement	BAD	Specialised	1963		Public
FINLEP		Investment			Private
Société de Refinancement		Specialised	1998		Private

[152] 70% of this bank is owned by the parent banks based in Bahrain.
[153] This bank is equally shared between the Saudi-based banks Al-Baraka and the Algerian Bank BADR.
[154] This banks was the State's biggest savings bank, but was transformed into commercial bank in 1997.
[155] This bank is working with Energy businesses.
[156] 80% of this bank is owned by the parent banks, and the remaining by small Algerian capital

Table A2-9: Banking firms operating in Morocco

Bank Name	Symbol	Specialisation	Year Est.	Year privatisation	Ownership
Banque Commerciale du Maroc[157]	BCM	Commercial	1911		listed
Banque Marocaine du Commerce Éxtérieur[158]	BMCE	Commercial	Sep 1959		Listed
Banque Marocaine pour l'Afrique et l'Orient	BMAO	Commercial			
Banque Marocaine pour Commerce et l'Industrie[159]	BMCI	Commercial	1964		Listed
Banque Nationale de Crédit Agricole	BNCA	Commercial			
Crédit du Maroc	CM	Commercial	1963		Private (Credit Lyonnais (51%)
Crédit Immobilier et l'Hôtelier[160]	CIH	Commercial	1920[161]		Public
Banque Central Populaire (Crédit Populaire du Maroc)	BCP	Commercial	1961		
Banque Centrale Populaire	BCP	Commercial	Feb 1961		51% Public. And 49% private
Société Générale Marocaine de Banques[162]	SGMB	Commercial			
Société Marocaine de Dépôt et Crédit	SMDC	Commercial			
Wafabank[163]	Wafabank	Commercial	1985		listed
ABN-Amro Bank-Maroc		Foreign			
Arab Bank- Maroc					
Citibank- Maroc					
Caisse Marocaine des Marchés	CMM				
Caisse de Dépôt et de Gestion	CDG				
Bank Al-Amal					Public
Banque Marocaine					
Banque Nationale pour le Dévéloppement Economique	BNDE	Specialised			Public

[157] In 1992, Banque Commerciale du Maroc acquired Société de Banque et de Crédit.
[158] This bank was the first to be privatised.
[159] In 2001 the BNP Paribas's 51.5% subsidiary BMCI acquired the ABN Amro's local arm for Us$30mn.
[160] This bank used to be real-estate/mortgage bank.
[8] Under the name la Caisse de PERTs immobiliers du Maroc, and was named CIH in 1967, and was allowed to operate as a deposit money bank in 1986.[161] Created in 193
[162] SGMB is the only major non-Casablanca bourse listed bank, 50%-owned by Societe Generale France
[163] Established in 1964, but renamed to Compagnie Marocaine de Credit et de Banque in 1985, then to Wafabank in 19 April 1997, after absorbing Union Bancaire Hispano-Marroqi (1958). Wafabank increased its share of total bank deposits from 8.8% in 1994 to 12% to 2000.

Table A2–10: Banking firms operating in Tunisia

Bank Name	Symbol	Specialisation	Year Establishment	Year Privatisation	Ownership
Amen Bank[164]	AM	Commercial	1971-Listed		
Arab Banking Corporation-Tunisia	ABC-T	Commercial			
Arab Tunisian Bank	ATB	Commercial	1982-Listed		Private 64% Arab bank
Banque de l'Habitat	BH	Commercial	1989-Listed		32% gov
Banque de Tunisie	BT	Commercial	1984-Listed		Private
Banque du Sud	BS	Commercial	1968-Listed	1997	State 2.6%
Banque Franco-Tunisiénne	BFT	Commercial			
Banque Internationale Arabe de Tunisie	BIAT	Commercial	1976-Listed		Private local (73%)
Banque Nationale Agricole	BNA	Commercial	1959-Listed		Gov (18%)
Banque Tunisiénne de Solidarité	BTS	Commercial			
Citibank	Citibank	Commercial			
Société Tunisiénne de Banques[165]	STB	Commercial	1957		Gov 21%
Union Bancaire pour le Commerce et l'Industrie	UBCI	Commercial	1961-Listed		Private
Union Internationale de Banques[166]	UIB	Commercial)	1963-Listed		
Union Tunisiénne de Banques	UTB	Commercial			
Banque Arabe Tuniso-Libyénne de Developpment et du Commerce Extérieur	BATLDCE	Merchant, development and commercial	August 1983		50% Gov. 50% Libyan Arab Foreign Bank, Tripoli (50%)
Banque de Coopération du Maghreb Arab	BCMA	Development			
Société Tuniso-Saoudienne d'Investissement et de Developpement	STUSID	Investment	1981		
Banque de Tunisie et des Émirates d'Investissment	BTEI	Development			
Banque Tuniso-Kuweitiénne de Developpement	BTKD	Development			
Banque Tuniso-Qatari d'Investissment	BTQI	Merchant			
Amen Lease	AL	Leasing			
Arab International Leasing	AIL	Leasing			
Arab Tunisian Lease	ATL	Leasing	1996		

[164] This bank is the first bank created fully by domestic private capital.
[165] In 2000, this bank absorbed the Banque Nationale de Developpement Touristique (1959)and Banque de Developpement Economique de Tunisie (1959).
[166] This bank has been acquired y France's Societe Generale of a 52% stake.

Compagnie Internationale de Leasing	CIL	Leasing	
General Leasing	GL	Leasing	
Tunisie Leasing	TL	Leasing	
Union Tunisiénne de Leasing	UTL	Leasing	
Banque d'Affaire de Tunisie	BAT	Merchant	
International Maghreb Merchant Bank	IMMB	Merchant	
Alubaf Investment Bank	Alubaf	Commercial	
Beit Ettamouil Saoudi Tounsi	BTST	Islamic	1983
Citibank-Offshore		Offshore	
North Africa International Bank	NAIB	Commercial	1984
Tunis International Bank	TIB	Merchant	1982

A3 Appendix A3

TableA3–1: Descriptive Statistics of the our Sample (1994 to 2001, millions of US $)

Variables	Mean	Standard Deviation	Minimum	Maximum
Loans	911.1	1206.6	3.7	6756.9
NEW OEA	368.6	692.9	1.0	3986.4
Fixed Assets	183.1	241.9	0.2	1353.4
Total Assets	1485.6	1740.2	23.1	7829.7
Total Interest bearing deposits and funds	1219.3	1521.2	0.8	6719.2
Total Liabilities	1374.1	1674.8	2.1	7666.8
Equity	111.5	101.8	2.4	489.6
New OBS	566.0	887.0	1.0	6681.0
Liquid Assets (Memo)	216.8	357.0	0.1	2716.6
Net Interest Revenue	35.4	51.0	-197.0	248.4
Interest Income	91.0	109.6	1.0	648.5
New Non Interest Income	17.4	28.3	1.0	247.3
New Total Income	108.5	119.5	2.4	671.6
New Interest EXP	55.6	77.3	1.0	525.2
Personnel Expenses	13.4	13.2	0.2	53.0
New Other Expenses	24.5	41.8	0.1	300.1
New Total Expenses	93.6	111.4	1.9	646.9
Loan Loss Provisions	14.8	30.6	-99.7	288.6
Profit before Tax	14.2	18.5	-2.1	109.0
Price of Funds	8.88%	14.07%	0.79%	125.00%
Price of Labour	1.10%	0.61%	0.05%	3.72%
price of Physical capital	131.98%	179.31%	0.29%	1300.00%
ROE	13.39%	12.56%	-20.83%	145.04%
ROA	1.54%	1.23%	-1.56%	6.73%
Liability/ Assets	83.81%	15.99%	8.24%	99.26%
Equity/Assets	16.19%	15.99%	0.74%	91.76%
Loan Loss Provision / Net Int Rev	41.24%	194.40%	1.41%	1500.00%
Equity / Net Loans	35.50%	61.59%	1.09%	632.43%
Net Int Rev /Assets	2.73%	1.89%	-5.09%	11.13%
Non Int Exp /Assets	2.69%	1.55%	0.24%	12.55%
Net Loans / Total Assets	63.23%	21.72%	5.44%	96.86%
Net Loans / DUNDS	97.08%	56.84%	6.02%	462.50%
Liquid /Assets	16.50%	19.04%	0.03%	89.80%
Revenues/Assets	10.45%	9.75%	1.66%	53.44%
Cost/Assets	8.71%	9.08%	1.74%	49.04%
Cost to Income Ratio	82.72%	22.12%	38.46%	312.69%

Source: Bankscope

Table A3–2: Cost Efficiency estimates for Algerian, Moroccan and Tunisian Banks over 1994-2001 – Individual Bank Estimates

Form\Year	1994	1995	1996	1997	1998	1999	2000	2001	Avg.
Al Rayan Algerian Bank	*	*	*	*	*	*	*	54.91	54.91
Albaraka of Algeria-Banque Al Baraka d'Algerie	*	38.18	46.17	52.65	62.01	51.70	39.92	50.83	48.78
Alubaf International Bank	92.42	65.50	76.01	80.98	80.40	52.38	26.65	34.30	63.58
Amen Bank	*	61.43	63.80	68.59	68.62	72.42	76.23	68.87	68.56
Amen Lease	*	*	*	45.80	45.25	44.12	43.96	63.59	48.54
Arab Banking Corporation - Algeria	*	*	*	*	*	25.42	28.84	72.40	42.22
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*	68.89	68.89
Arab Tunisian Bank	*	65.97	79.84	73.72	74.58	68.30	72.81	70.54	72.25
Arab Tunisian Lease	*	*	48.83	46.41	40.26	39.37	44.17	68.79	47.97
Banque Algérienne de Développement - B.A.D.	94.57	91.66	86.64	74.87	75.20	74.81	65.51	54.68	77.24
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	46.77	46.09	53.89	95.91	95.38	90.62	90.18	48.84	70.96
Banque Centrale Populaire	*	*	*	*	*	*	80.80	62.85	71.82
Banque Commerciale du Maroc	93.62	90.64	91.22	92.35	92.58	94.57	93.50	77.92	90.80
Banque de Developpement Economique de Tunisie	64.45	67.99	79.99	80.26	74.33	80.30	*	*	74.55
Banque de Développement Local	72.27	68.01	59.99	74.70	90.85	89.88	85.18	58.40	74.91
Banque de l'Agriculture et du Developpement Rural	*	92.15	89.04	90.04	96.65	97.34	95.90	*	93.52
Banque de l'Habitat	*	68.85	54.34	82.70	86.82	87.79	90.55	75.91	78.14
Banque de Tunisie	*	53.41	62.32	70.99	72.63	75.60	79.52	75.13	69.94
Banque de Tunisie et des Emirates d'Investissement - BTEI	*	*	91.88	90.20	79.64	85.98	87.15	45.81	80.11
Banque du Sud	*	81.90	86.35	89.79	87.44	87.42	90.19	70.52	84.80
Banque Extérieure d'Algérie	80.10	89.40	91.32	92.18	93.38	93.45	94.53	71.84	88.27
Banque Franco-Tunisiénne	*	*	*	*	45.06	33.96	36.32	*	38.45
Banque Internationale Arabe de Tunisie - BIAT	*	69.85	77.07	75.67	85.90	90.68	91.51	79.54	81.46
Banque Marocaine du Commerce Extérieur - BMCE	*	*	91.18	91.33	92.97	96.19	96.35	78.39	91.07
Banque Marocaine pour le Commerce et l'Industrie BMCI	*	81.31	83.58	*	*	80.97	90.51	82.01	83.68
Banque Nationale Agricole	*	91.68	86.46	92.23	92.96	93.64	94.64	78.77	90.06
Banque Nationale d'Algérie	92.89	78.29	88.00	*	*	89.44	89.57	*	87.64
Banque Nationale de Développement Touristique	67.93	70.97	62.08	63.23	53.74	53.64	*	*	61.93
Banque Nationale pour le Développement Economique - BNDE	*	*	*	60.09	66.96	64.38	74.06	*	66.37
Banque Tunisiénne de la Solidarité	*	*	*	*	92.24	59.20	88.37	*	79.94
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	83.49	84.16	88.02	91.05	66.93	72.22	74.16	50.40	76.30
Banque Tuniso - Qatari d'Investissements	*	*	53.24	46.44	55.52	57.73	67.68	*	56.12
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	58.76	60.30	64.85	58.64	67.93	68.81	69.74	*	64.15
CAB-Compagnie Algérienne de Banques	*	*	*	*	*	*	14.03	61.66	37.85
Caisse Nationale de Crédit Agricole	*	*	*	*	*	*	79.69	63.05	71.37
Citibank NA (Branch)	*	*	*	*	*	*	46.46	64.80	55.63
Compagnie Internationale de Leasing	*	*	41.99	40.86	42.49	40.64	41.09	39.75	41.14
Crédit du Maroc	79.08	79.40	80.18	82.59	82.93	86.03	83.31	81.51	81.88
Crédit Immobilier et Hotelier	56.63	46.74	54.12	59.23	*	*	*	*	54.18
Crédit Populaire d'Algérie	95.41	95.03	94.44	91.37	88.53	84.35	94.64	*	91.97
General Leasing	*	*	*	*	41.95	46.26	45.95	57.34	47.87
North Africa International Bank - NAIB	58.30	62.56	71.99	67.71	48.43	49.89	42.81	*	57.39
Société d'Equipement Domestique et Menager	*	*	*	*	63.83	51.39	54.56	*	56.59

Form\Year	1994	1995	1996	1997	1998	1999	2000	2001	Avg.
Société Générale Marocaine de Banques	70.75	75.30	74.42	71.58	75.33	73.71	78.12	80.70	74.99
Société Tunisiénne de Banque	*	*	86.35	86.63	90.44	87.27	95.15	78.46	87.38
Tunis International Bank	*	57.90	66.10	64 05	66.81	49.00	50.44	61.44	59.39
Tunisie Factoring	*	*	*	*	*	41.30	42.52	58.63	47.48
Union Bancaire pour le Commerce et l'Industrie SA UBCI	*	66.51	70.31	73.76	79.99	78.07	81.09	71.83	74.51
Union Internationale de Banques	*	*	81.65	80.86	88.60	83.10	91.69	76.05	83.66
Wafabank	81 36	82 73	86 08	88 21	89.48	92 89	92 84	*	87 66
Average	75.81	71 86	73 99	74 66	74 23	70 61	70 95	65 54	72.21

Source: Author's own estimation

Table A3–3: Alternative Profit Efficiency estimates for Algerian, Moroccan and Tunisian Banks over 1994-2001 – Individual Bank Estimates

Form\Year	1994	1995	1996	1997	1998	1999	2000	2001	Avg.
Al Rayan Algerian Bank	*	*	*	*	*	*	*	34 89	34.89
Albaraka of Algeria-Banque Al Baraka d'Algerie	*	72.53	74.70	78.47	79.46	84.35	86.05	42.63	74.03
Alubaf International Bank	79.13	73.80	82.59	70.37	69.14	55.16	67.95	19.95	64.76
Amen Bank	*	77.62	75.22	74.73	72.07	70.05	63.71	74.20	72.51
Amen Lease	*	*	*	76.18	75.61	82.46	79.26	40.70	70.84
Arab Banking Corporation - Algeria	*	*	*	*	*	70.28	77.03	28.50	58 60
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*	57.82	57.82
Arab Tunisian Bank	*	77.75	78.19	76.45	78.53	81.51	82.84	79.02	79.19
Arab Tunisian Lease	*	*	72.93	71.16	62.13	71.75	80.03	45.91	67.32
Banque Algérienne de Développement - B.A.D.	79.82	77.55	74 82	74.71	74.44	88.19	81.71	53.03	75.53
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	73.29	66.87	69 08	80.44	76.73	79 03	74.79	86.18	75.80
Banque Centrale Populaire	*	*	*	*	*	*	34.96	91.99	63.47
Banque Commerciale du Maroc	53.79	49.90	46 04	43.19	43.77	20.00	19.37	95.81	46.49
Banque de Developpement Economique de Tunisie	62.57	69.28	70.75	69.59	71.89	70.45	*	*	69.09
Banque de Développement Local	77.44	77.53	86.00	86.42	61.52	87.62	83 96	42.61	75.39
Banque de l'Agriculture et du Developpement Rural	*	69.11	81.54	84.38	79.36	71.52	83.97	*	78.31
Banque de l'Habitat	*	76.28	65 03	73.03	72.74	76.51	76.25	92.28	76.02
Banque de Tunisie	*	77.73	77.06	74 84	77.14	76.12	64.52	80.30	75.39
Banque de Tunisie et des Emirates d'Investissement - BTEI	*	*	72.67	71.29	66.86	62.24	64.86	76.13	69.01
Banque du Sud	*	76.10	75 39	73.36	71.62	68 35	70.88	87.81	74.79
Banque Extérieure d'Algérie	70.25	70.59	70.79	66.55	75.13	87.67	86.25	93.35	77.57
Banque Franco-Tunisiénne	*	*	*	*	71.13	77.81	72.63	*	73.85
Banque Internationale Arabe de Tunisie - BIAT	*	78.19	77.14	73.47	70.60	67.59	65.34	91.52	74.83
Banque Marocaine du Commerce Extérieur - BMCE	*	*	68.03	63.54	62.49	27.31	40.48	96.03	59.65
Banque Marocaine pour le Commerce et l'Industrie BMCI	*	80.12	74.44	*	*	59.93	61.52	92.88	73.78
Banque Nationale Agricole	*	66.55	62.72	66.87	74.44	65.10	65.39	94.68	70.82
Banque Nationale d'Algérie	64.27	60.11	60.73	*	*	80.45	89.94	*	71.10
Banque Nationale de Développement Touristique	62.25	62.47	64 74	65.85	73.51	79.38	*	*	68.03
Banque Nationale pour le Développement Economique - BNDE	*	*	*	56.51	57.70	51.80	74.31	*	60.08
Banque Tunisiénne de la Solidarité	*	*	*	*	75.03	76.44	68.70	*	73.39
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	75.76	74.57	75.36	74.96	72.89	52.87	58.92	78.46	70.47
Banque Tuniso - Qatari d'Investissements	*	*	83.08	83.65	80.24	84.13	84.72	*	83.17
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	72.57	70.52	74 81	70.50	78.54	79 57	78.20	*	74.96
CAB-Compagnie Algérienne de Banques	*	*	*	*	*	*	83.24	18.35	50.80
Caisse Nationale de Crédit Agricole	*	*	*	*	*	*	93.60	86.73	90.16
Citibank NA (Branch)	*	*	*	*	*	*	80.64	67.02	73 83
Compagnie Internationale de Leasing	*	*	77.88	75.96	76.34	82.54	75.45	48.76	72.82
Crédit du Maroc	70.86	70.58	67.67	64.66	64.48	68.49	64.52	87.40	69.83
Crédit Immobilier et Hotelier	79.47	62.32	61.87	61.89	*	*	*	*	66.39
Crédit Populaire d'Algérie	74.12	70.62	84.19	84.20	76.99	86.33	30.53	*	72.42
General Leasing	*	*	*	*	72.79	79.44	80.24	48.55	70.25
North Africa International Bank - NAIB	72.43	71.88	73.81	79.57	75.00	76.91	82.17	*	75.97
Société d'Equipement Domestique et Menager	*	*	*	*	49.65	47.67	44.49	*	47.27
Société Générale Marocaine de Banques	67.15	70.17	65 89	64 34	64 71	53.47	51.36	83.92	65 12

Form\Year	1994	1995	1996	1997	1998	1999	2000	2001	Avg.
Société Tunisiénne de Banque	*	*	76.98	74.52	75.81	76.28	67.24	94.78	77.60
Tunis International Bank	*	80.88	76.88	74.00	76.15	77.01	75.79	54 93	73 66
Tunisie Factoring	*	*	*	*	*	84.67	84.10	46.71	71.83
Union Bancaire pour le Commerce et l'Industrie SA UBCI	*	62.79	57.20	68.31	73.21	74.60	72.53	77.30	69.42
Union Internationale de Banques	*	*	77.24	75.10	79.29	81.96	80.59	89.14	80.56
Wafabank	69.28	69.73	65.99	63 29	63.30	39 55	46.31	*	59.63
Average	**70.85**	**71.18**	**72.21**	**71.84**	**71.09**	**70.57**	**70.03**	**68.90**	**70.83**

Source: Author's own estimation

Table A3–4: The Most and Least Cost and Profit Efficient in our sample.

Cost Efficiency				
Year	The Least Efficient Bank		The Most Efficient Bank	
1994	46.77	Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	95.41	Crédit Populaire d'Algérie
1995	38.18	Albaraka of Algeria-Banque Al Baraka d'Algerie	95.03	Crédit Populaire d'Algérie
1996	41.99	Compagnie Internationale de Leasing	94.44	Crédit Populaire d'Algérie
1997	40.86	Compagnie Internationale de Leasing	95.91	Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur
1998	40.26	Banque Franco-Tunisiénne	96.65	Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur
1999	25.42	Arab Banking Corporation - Algeria	97.34	Banque de l'Agriculture et du Developpement Rural
2000	14.03	CAB-Compagnie Algérienne de Banques	96.35	Banque Marocaine du Commerce Extérieur - BMCE
2001	34.30	Alubaf International Bank	82.01	Banque Marocaine pour le Commerce et l'Industrie BMCI
Overall	**37.85**	**CAB-Compagnie Algérienne de Banques**	**93.52**	**Banque de l'Agriculture et du Developpement Rural**

Alternative Profit Efficiencies				
Year	The Least Efficient		The Most Efficient	
1994	53.79	Banque Commerciale du Maroc	79.82	Banque Algérienne de Développement - BAD
1995	49.90	Banque Commerciale du Maroc	80.88	Tunis International Bank
1996	46.04	Banque Commerciale du Maroc	86.00	Banque de Développement Local
1997	43.19	Banque Commerciale du Maroc	86.42	Banque de Développement Local
1998	43.77	Banque Commerciale du Maroc	80.24	Banque Tuniso - Qatari d'Investissements
1999	20.00	Banque Commerciale du Maroc	88.19	Banque Algérienne de Développement - B.A.D.
2000	19.37	Banque Commerciale du Maroc	93.60	Caisse Nationale de Crédit Agricole
2001	18.35	CAB-Compagnie Algérienne de Banques	96.03	Banque Marocaine du Commerce Extérieur - BMCE

Overall	**34.89**	**Al Rayan Algerian Bank**	**90.16**	**Caisse Nationale de Crédit Agricole**

Table A3–5: Scale Economies Estimates derived from the translog cost function for Algerian, Moroccan and Tunisian Banks over 1994-2001 – Individual Bank Estimates

Form\Year	1994	1995	1996	1997	1998	1999	2000	2001	Avg.
Al Rayan Algerian Bank	*	*	*	*	*	*	*	91.52	91.52
Albaraka of Algeria-Banque Al Baraka d'Algerie	*	48.26	94.16	96.66	91.14	91.15	92.42	62.98	82.39
Alubaf International Bank	48.38	72.33	48.73	94.10	95.25	78 67	75.03	96.54	76.13
Amen Bank	*	48.09	68.08	46.73	95.05	91.01	92.59	77.10	74 09
Amen Lease	*	*	*	67.55	46.90	87.21	89.65	95.83	77.43
Arab Banking Corporation - Algeria	*	*	*	*	*	44.14	95.73	41.69	60.52
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*	62 70	62.70
Arab Tunisian Bank	*	22.96	57.19	58.21	102.42	99.28	45.22	87.57	67.55
Arab Tunisian Lease	*	0.00	47.54	47.71	66.19	110.63	62.53	98.02	72.10
Banque Algérienne de Développement - B.A.D.	48.56	48.09	24.42	27.77	54 83	66 86	98.59	91.34	57.56
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	22.01	41.35	48.44	84.21	45.82	57.66	106.24	65.87	58.95
Banque Centrale Populaire	*	*	*	*	*	*	66.34	49.89	58.12
Banque Commerciale du Maroc	36.11	80.21	33.53	37.62	28.43	46.48	47.79	40.77	43.87
Banque de Developpement Economique de Tunisie	77.78	34.27	81.72	54.58	86.42	36.16	*	*	61.82
Banque de Développement Local	32.45	59.26	36.33	58.30	36.96	47.26	42.13	35.52	43.53
Banque de l'Agriculture et du Developpement Rural	*	65.31	56.53	50.90	53.91	33.65	28.77	*	48.18
Banque de l'Habitat	*	53 26	62.64	62.60	56.49	85.67	41.18	83.65	63.64
Banque de Tunisie	*	67.21	50.02	49.38	49.36	35.44	34.67	22 11	44.03
Banque de Tunisie et des Emirates d'Investissement - BTEI	*	*	63.09	42.66	56.05	54.16	84.13	55.58	59.28
Banque du Sud	*	53.97	53.07	61.23	51.31	52 71	36.22	31.73	48.61
Banque Extérieure d'Algérie	69.68	58.17	44.41	73.13	40.93	44.96	54.09	52.30	54.71
Banque Franco-Tunisiénne	*	*	*	*	60.40	56.46	35.49	*	50.78
Banque Internationale Arabe de Tunisie - BIAT	*	69.99	56.65	54.03	75.80	46.50	51.68	41.91	56.65
Banque Marocaine du Commerce Extérieur - BMCE	*	*	73.27	56.23	52.28	41.21	43.36	60.58	54.49
Banque Marocaine pour le Commerce et l'Industrie BMCI	*	63.47	54.08	*	*	58 90	58.11	41.99	55.31
Banque Nationale Agricole	*	82.17	75.81	70 41	56.17	75.47	43.26	37.47	62.96
Banque Nationale d'Algérie	70.18	73 47	74.13	*	*	49.12	37.92	*	60.96
Banque Nationale de Développement Touristique	75.51	60.33	67.32	71.75	70.97	54.79	*	*	66.78
Banque Nationale pour le Développement Economique - BNDE	*	*	*	59.59	70.32	77.49	52.32	*	64.93
Banque Tunisiénne de la Solidarité	*	*	*	*	59.42	69.05	50.90	*	59.79
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	48.47	46.06	45.47	45.50	42.96	54.12	53.31	53.28	48.65
Banque Tuniso - Qatari d'Investissements	*	*	61.99	63.33	65.52	42.05	81.41	*	62.86
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	61.98	62.66	67.46	68.61	75.24	65.75	68.43	*	67.16
CAB-Compagnie Algérienne de Banques	*	*	*	*	*	*	48.50	53.53	51.01
Caisse Nationale de Crédit Agricole	*	*	*	*	*	*	41.84	83.02	62.43
Citibank NA (Branch)	*	*	*	*	*	*	76.53	43 48	60.01
Compagnie Internationale de Leasing	*	*	78.06	71.61	74 90	76.65	73.69	39.45	69.06
Crédit du Maroc	65.06	65.34	54.10	53 12	34.60	76.42	30.43	75.65	56.84
Crédit Immobilier et Hotelier	86.06	85.53	36.79	35.83	*	*	*	*	61.06
Crédit Populaire d'Algérie	50.47	50.16	41.02	39.56	38.45	33.30	32.93	*	40.84
General Leasing	*	*	*	*	69.65	35.96	68.47	73.61	61.92
North Africa International Bank - NAIB	38.09	36.79	69.07	68.92	81.77	70.38	78.67	*	63.38
Société d'Equipement Domestique et Menager	*	*	*	*	34.78	89.81	28.31	*	50.97

Form\Year	1994	1995	1996	1997	1998	1999	2000	2001	Avg.
Société Générale Marocaine de Banques	43.02	42.92	82.49	80.59	27.77	30.26	49.53	28.41	48.12
Société Tunisiénne de Banque	*	*	37.64	36.22	95 69	24.34	27.55	83.81	50.87
Tunis International Bank	*	75.16	31.36	32.35	80.10	97.38	95.57	27.49	62.77
Tunisie Factoring	*	*	*	*	*	78.21	79.47	44.26	67.31
Union Bancaire pour le Commerce et l'Industrie SA UBCI	*	81.36	88.16	90.93	**102.80**	99.91	104.71	73.60	91.64
Union Internationale de Banques	*	*	72.62	76.59	98.88	100.56	88.86	61.20	83.12
Wafabank	85.03	28.37	100.50	98.72	94.80	94.15	93 67	*	85.03
Average		56.40	57.81	59.39	60.76	64.63	64.22	61.96	60.15

Source: Author's own estimation

Table A3–6: Scale Efficiency estimates derived from the translog cost function for Algerian, Moroccan and Tunisian Banks over 1994-2001 – Individual Bank Estimates

Form\Year	1994	1995	1996	1997	1998	1999	2000	2001	Avg.
Al Rayan Algerian Bank	*	*	*	*	*	*	*	99.99	99.99
Albaraka of Algeria-Banque Al Baraka d'Algerie	*	99.13	99.24	99.06	99.17	99.74	98.86	99.35	99.22
Alubaf International Bank	97.76	99.21	98.53	97.80	97.88	98.73	99.14	99.28	98.54
Amen Bank	*	96.96	96.47	95.58	95.18	94.28	94.02	94.18	95.24
Amen Lease	*	*	*	99.91	99.94	99.80	99.86	99.97	99.90
Arab Banking Corporation - Algeria	*	*	*	*	*	98.86	98.44	96.54	97.95
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*	98.69	98.69
Arab Tunisian Bank	*	96.63	94.62	95.12	95.11	94.79	94.43	94.49	95.03
Arab Tunisian Lease	*	*	99.92	99.97	99.80	99.81	99.86	99.82	99.86
Banque Algérienne de Développement - B.A.D.	98.77	99.02	99.17	99.38	99.54	99.49	99.37	99.33	99.26
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	99.52	99.48	98.80	97.98	98.42	98.61	98.26	98.25	98.66
Banque Centrale Populaire	*	*	*	*	*	*	89.10	87.71	88.41
Banque Commerciale du Maroc	90.00	89.56	89.56	89.22	88.78	88.31	87.22	86.41	88.63
Banque de Developpement Economique de Tunisie	96.34	96.47	96.34	96.60	97.00	97.04	*	*	96.63
Banque de Développement Local	93.18	92.50	92.33	92.34	91.58	91.29	91.23	90.46	91.86
Banque de l'Agriculture et du Developpement Rural	*	86.40	87.58	87.95	86.15	84.71	86.06		86.47
Banque de l'Habitat	*	96.01	97.31	95.86	95.82	94.63	93.18	91.74	94.94
Banque de Tunisie	*	95.79	95.19	94.74	94.58	94.64	94.62	94.97	94.93
Banque de Tunisie et des Emirates d'Investissement - BTEI	*	*	98.12	98.63	99.01	98.81	98.95	98.25	98.63
Banque du Sud	*	95.56	95.22	96.19	96.02	95.71	94.19	94.42	95.33
Banque Extérieure d'Algérie	87.99	88.66	89.40	89.84	89.62	89.09	89.36	83.72	88.46
Banque Franco-Tunisiénne	*	*	*	*	100.00	100.00	99.69	*	99.90
Banque Internationale Arabe de Tunisie - BIAT	*	94.42	93.59	93.83	93.42	92.18	91.70	91.25	92.91
Banque Marocaine du Commerce Extérieur - BMCE	*	*	89.85	89.36	88.85	87.15	86.37	86.04	87.94
Banque Marocaine pour le Commerce et l'Industrie BMCI	*	93.07	93.17	*	*	92.84	91.02	89.11	91.84
Banque Nationale Agricole	*	94.59	94.37	93.42	93.93	92.63	91.67	91.28	93.13
Banque Nationale d'Algérie	89.32	91.07	88.39	*	*	88.44	88.81	*	89.21
Banque Nationale de Développement Touristique	97.69	97.74	98.21	98.19	98.53	98.49	*	*	98.14
Banque Nationale pour le Développement Economique - BNDE	*	*	*	94.61	94.18	93.35	93.82	*	93.99
Banque Tunisiénne de la Solidarité	*	*	*	*	99.98	100.00	99.94	*	99.98
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	96.92	96.97	97.33	97.52	98.46	98.64	98.62	98.52	97.87
Banque Tuniso - Qatari d'Investissements	*	*	99.65	99.80	99.95	99.98	99.95	*	99.87
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	98.50	98.24	98.32	98.00	97.79	97.59	97.49	*	97.99
CAB-Compagnie Algérienne de Banques	*	*	*	*	*	*	99.95	99.96	99.96
Caisse Nationale de Crédit Agricole	*	*	*	*	*	*	93.46	91.97	92.72
Citibank NA (Branch)	*	*	*	*	*	*	96.45	96.48	96.46
Compagnie Internationale de Leasing	*	*	*	100.00	99.93	99.91	99.90	96.37	99.22
Crédit du Maroc	93.15	93.12	93.25	92.69	92.74	91.93	92.25	91.18	92.54
Crédit Immobilier et Hotelier	93.71	93.63	94.62	94.39	*	*	*	*	94.09
Crédit Populaire d'Algérie	83.68	84.10	84.74	86.15	86.42	89.34	86.56	*	85.86
General Leasing	*	*	*	*	99.99	100.00	100.00	99.61	99.90
North Africa International Bank - NAIB	99.44	98.45	97.59	97.57	97.68	97.79	97.50	*	98.01
Société d'Equipement Domestique et Menager	*	*	*	*	99.94	99.59	99.73	*	99.76

Form\Year	1994	1995	1996	1997	1998	1999	2000	2001	Avg.
Société Générale Marocaine de Banques	93.20	93.07	92.92	92.97	92.43	92.62	91.32	90.89	92.43
Société Tunisiénne de Banque	*	*	92.01	91.49	90.94	91.03	89.95	89.79	90.87
Tunis International Bank	*	98.08	97.44	97.35	97.12	97.23	97.14	97.06	97.35
Tunisie Factoring	*	*	*	*	*	99.72	99.90	99.81	99.81
Union Bancaire pour le Commerce et l'Industrie SA UBCI	*	97.29	96.56	96 46	95.08	95.18	95.54	96.06	96.02
Union Internationale de Banques	*	*	95.34	95.56	94.80	95.44	92 99	93.56	94.62
Wafabank	91.59	91.57	90.97	90.49	90.13	89.27	88.17	*	90.31
Average		94.16	94.72	94.75	95.17	95.54	95.32	94.80	94 63

Source: Author's own estimation

Table A3–7: DEA Efficiency Estimates for Algeria, Morocco and Tunisia Banks for the period 1994–2000, Individual Bank Estimates

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff
Al Rayan Algerian Bank	100.00	100.00	100.00	59.90	100.00	59.90
Albaraka of Algeria-Banque Al Baraka d'Algerie	98.27	15.85	15.55	89 07	98 27	90.80
Alubaf International Bank	90.37	38.11	37.14	83.14	90.37	91.97
Amen Bank	72.17	55.43	39.75	66.95	72.17	93.45
Amen Lease	86.58	21.28	17.95	47.98	86.58	53.20
Arab Banking Corporation - Algeria	100.00	31.20	31.20	100.00	100.00	100.00
Arab Banking Corporation - Tunisie	100.00	100.00	100.00	100 00	100.00	100.00
Arab Tunisian Bank	78.76	44.68	35.58	73.30	78.76	93.82
Arab Tunisian Lease	95.98	24.00	23.68	76.80	95.98	80.70
Banque Algérienne de Développement - B.A.D.	99.53	75.93	75.84	92.33	99 53	92.56
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	97.49	31.91	31.11	96.24	97.49	98.74
Banque Centrale Populaire	100.00	62.30	62.30	100.00	100.00	100.00
Banque Commerciale du Maroc	98.60	56.05	55.25	81.55	98.60	82.60
Banque de Developpement Economique de Tunisie	72.75	52.32	40.17	67.88	72.75	94.68
Banque de Développement Local	74.27	51.40	40.67	65.47	74.27	87.59
Banque de l'Agriculture et du Developpement Rural	94.32	97.36	92.44	76.74	94.32	81.48
Banque de l'Habitat	100.00	100.00	100.00	94.53	100.00	94.53
Banque de Tunisie	88.20	41.27	39.42	85.20	88.20	96.53
Banque de Tunisie et des Emirates d'Investissement - BTEI	97.40	58.52	58.22	85.08	97.40	87.30
Banque du Sud	81.47	38.38	31.82	79.75	81.47	97.40
Banque Extérieure d'Algérie	91.04	81.19	77.86	89.84	91.04	98.77
Banque Franco-Tunisiénne	100.00	85.73	85.73	90.93	100.00	90.93
Banque Internationale Arabe de Tunisie - BIAT	88.94	60.98	53.34	80.08	88.94	89.06
Banque Marocaine du Commerce Extérieur - BMCE	97.28	46.84	45.42	76.24	97.28	78.82
Banque Marocaine pour le Commerce et l'Industrie BMCI	80.10	47.30	39.90	63.98	80.10	80.76
Banque Nationale Agricole	85.98	90.34	79.96	78.42	85.98	90.82
Banque Nationale d'Algérie	85.70	84.16	71.70	80.56	85.70	91.42
Banque Nationale de Développement Touristique	100.00	58.80	58 80	100.00	100.00	100.00
Banque Nationale pour le Développement Economique - BNDE	76.83	23.70	22.07	73.80	76.83	95.27
Banque Tunisiénne de la Solidarité	93.60	70.23	69.57	85.63	93.60	90.53
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	91.87	26.42	24.30	83.13	91.87	90.20
Banque Tuniso - Qatari d'Investissements	100.00	83.13	83.13	77.10	100.00	77.10
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	90.62	50.23	46.15	82.20	90.62	91.28
CAB-Compagnie Algérienne de Banques	100.00	56.05	56.05	100.00	100.00	100.00
Caisse Nationale de Crédit Agricole	80.35	35.90	27.80	71.05	80.35	86.25
Citibank NA (Branch)	100.00	83.40	83.40	100.00	100.00	100.00
Compagnie Internationale de Leasing	77.20	20.23	15.08	42.58	77.20	50.30
Crédit du Maroc	97.77	27.68	26.68	80.37	97.77	81.95
Crédit Immobilier et Hotelier	100.00	30.78	30.78	86.60	100.00	86.60
Crédit Populaire d'Algérie	100 00	89.77	89.77	92.30	100.00	92.30
General Leasing	87.85	16.33	13.98	56.40	87.85	62.45
North Africa International Bank - NAIB	100.00	54.87	54.87	100.00	100.00	100.00
Société d'Equipement Domestique et Menager	59.30	16.55	9.80	57.25	59.30	96.55
Société Générale Marocaine de Banques	94.73	27.20	26.03	79.10	94.73	83.36

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff
Société Tunisiénne de Banque	93.95	73.38	68.50	75.60	93.95	80.58
Tunis International Bank	98 75	81.77	81.47	93.17	98.75	93.97
Tunisie Factoring	98.73	88.10	86.97	67.10	98.73	68.00
Union Bancaire pour le Commerce et l'Industrie SA UBCI	88.80	60.60	57.65	88.17	88.80	99.05
Union Internationale de Banques	78.18	41 60	36.63	76.53	78 18	97.63
Wafabank	93.93	30.50	29.08	70.38	93.93	75.22
Average	**91.15**	**54.79**	**51.61**	**80.41**	**91.15**	**87.93**

Source: Author's own estimation

Table A3–8: DEA Efficiency Estimates for Algeria, Morocco and Tunisia Banks for the year 1994– Individual Bank Estimates

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Al Rayan Algerian Bank	•	•	•	•	•	•	•
Albaraka of Algeria-Banque Al Baraka d'Algerie	•	•	•	•	•	•	•
Alubaf International Bank	100	87	87	100	100	100	-
Amen Bank	•	•	•	•	•	•	•
Amen Lease	•	•	•	•	•	•	•
Arab Banking Corporation - Algeria	•	•	•	•	•	•	•
Arab Banking Corporation - Tunisie	•	•	•	•	•	•	•
Arab Tunisian Bank	•	•	•	•	•	•	•
Arab Tunisian Lease	•	•	•	•	•	•	•
Banque Algérienne de Développement - B.A.D.	100	100	100	100	100	100	-
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	100	28.7	28.7	91.3	100	91.3	irs
Banque Centrale Populaire	•	•	•	•	•	•	•
Banque Commerciale du Maroc	100	100	100	78.6	100	78.6	drs
Banque de Developpement Economique de Tunisie	74.3	71.4	53.1	73.9	74.3	99.5	irs
Banque de Développement Local	93.2	64.7	60.3	77.5	93.2	83.1	drs
Banque de l'Agriculture et du Developpement Rural	•	•	•	•	•	•	•
Banque de l'Habitat	•	•	•	•	•	•	•
Banque de Tunisie	•	•	•	•	•	•	•
Banque de Tunisie et des Emirates d'Investissement - BTEI	•	•	•	•	•	•	•
Banque du Sud	•	•	•	•	•	•	•
Banque Extérieure d'Algérie	41.1	37.6	15.4	41	41.1	100	-
Banque Franco-Tunisiénne	•	•	•	•	•	•	•
Banque Internationale Arabe de Tunisie - BIAT	•	•	•	•	•	•	•
Banque Marocaine du Commerce Extérieur - BMCE	•	•	•	•	•	•	•
Banque Marocaine pour le Commerce et l'Industrie BMCI	•	•	•	•	•	•	•
Banque Nationale Agricole	•	•	•	•	•	•	•
Banque Nationale d'Algérie	84.2	82	69.1	81.5	84.2	96.8	drs
Banque Nationale de Développement Touristique	100	100	100	100	100	100	-
Banque Nationale pour le Développement Economique - BNDE	•	•	•	•	•	•	•
Banque Tunisiénne de la Solidarité	•	•	•	•	•	•	•
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	88.6	34.4	30.5	58.6	88.6	66.1	irs
Banque Tuniso - Qatari d'Investissements	•	•	•	•	•	•	•
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	100	40.5	40.5	71.7	100	71.7	irs
CAB-Compagnie Algérienne de Banques	•	•	•	•	•	•	•
Caisse Nationale de Crédit Agricole	•	•	•	•	•	•	•
Citibank NA (Branch)	•	•	•	•	•	•	•
Compagnie Internationale de Leasing	•	•	•	•	•	•	•
Crédit du Maroc	92.4	54	49.9	65.3	92.4	70.6	drs
Crédit Immobilier et Hotelier	•	•	•	•	•	•	•
Crédit Populaire d'Algérie	100	100	100	100	100	100	-
General Leasing	•	•	•	•	•	•	•
North Africa International Bank - NAIB	100	100	100	100	100	100	-
Société d'Equipement Domestique et Menager	•	•	•	•	•	•	•
Société Générale Marocaine de Banques	100	55.6	55.6	67.8	100	67.8	drs

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Société Tunisiénne de Banque	*	*	*	*	*	*	*
Tunis International Bank	*	*	*	*	*	*	*
Tunisie Factoring	*	*	*	*	*	*	*
Union Bancaire pour le Commerce et l'Industrie SA UBCI	*	*	*	*	*	*	*
Union Internationale de Banques	*	*	*	*	*	*	*
Wafabank	100	48.1	48.1	65.3	100	65.3	drs
Average		92.11	69.00	64.89	79.53	92.11	86.93

Source: Author's own estimation

Table A3–9: DEA Efficiency Estimates for Algeria, Morocco and Tunisia Banks for the year 1995– Individual Bank Estimates

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Al Rayan Algerian Bank	*	*	*	*	*	*	*
Albaraka of Algeria-Banque Al Baraka d'Algerie	100.00	7.80	7.80	76.50	100 00	76.50	irs
Alubaf International Bank	100.00	33.30	33 30	64.80	100.00	64.80	irs
Amen Bank	51.70	52.30	27.00	50.40	51.70	97.40	drs
Amen Lease	*	*	*	*	*	*	*
Arab Banking Corporation - Algeria	*	*	*	*	*	*	*
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*
Arab Tunisian Bank	57.40	24.60	14 10	56.60	57.40	98.60	drs
Arab Tunisian Lease	*	*	*	*	*	*	*
Banque Algérienne de Développement - B.A.D.	100 00	100 00	100.00	100.00	100.00	100.00	-
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	100.00	6.20	6.20	100.00	100 00	100 00	-
Banque Centrale Populaire	*	*	*	*	*	*	*
Banque Commerciale du Maroc	91.60	57.50	52.70	68.80	91.60	75.10	drs
Banque de Developpement Economique de Tunisie	58.30	31.20	18.20	56.90	58.30	97.60	irs
Banque de Développement Local	36.10	51.90	18.70	32.70	36.10	90.60	drs
Banque de l'Agriculture et du Developpement Rural	100.00	100.00	100.00	84.50	100.00	84 50	drs
Banque de l'Habitat	100.00	100 00	100.00	100.00	100.00	100.00	-
Banque de Tunisie	57.30	18.90	10 80	56.30	57.30	98.30	drs
Banque de Tunisie et des Emirates d'Investissement - BTEI	*	*	*	*	*	*	*
Banque du Sud	62.00	32.30	20.00	58.60	62.00	94.60	drs
Banque Extérieure d'Algérie	100.00	100.00	100.00	100 00	100.00	100.00	-
Banque Franco-Tunisiénne	*	*	*	*	*	*	*
Banque Internationale Arabe de Tunisie - BIAT	70.90	80.90	57.40	56.20	70.90	79.30	drs
Banque Marocaine du Commerce Extérieur - BMCE	*	*	*	*	*	*	*
Banque Marocaine pour le Commerce et l'Industrie BMCI	71.00	42.80	30.40	54 40	71.00	76 60	drs
Banque Nationale Agricole	77.20	93.60	72.30	59.10	77.20	76.50	drs
Banque Nationale d'Algérie	44.30	88.60	39.20	30.90	44.30	69.90	drs
Banque Nationale de Développement Touristique	100.00	52.20	52.20	100.00	100.00	100.00	-
Banque Nationale pour le Développement Economique - BNDE	*	*	*	*	*	*	*
Banque Tunisiénne de la Solidarité	*	*	*	*	*	*	*
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	81.60	20.50	16.70	74 60	81.60	91.40	irs
Banque Tuniso - Qatari d'Investissements	*	*	*	*	*	*	*
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	100 00	45.50	45.50	82.60	100.00	82.60	irs
CAB-Compagnie Algérienne de Banques	*	*	*	*	*	*	*
Caisse Nationale de Crédit Agricole	*	*	*	*	*	*	*
Citibank NA (Branch)	*	*	*	*	*	*	*
Compagnie Internationale de Leasing	*	*	*	*	*	*	*
Crédit du Maroc	95.10	35.70	33.90	70.80	95.10	74 40	drs
Crédit Immobilier et Hotelier	100.00	2.40	2 40	100.00	100.00	100 00	-
Crédit Populaire d'Algérie	100.00	100.00	100.00	100.00	100.00	100.00	-
General Leasing	*	*	*	*	*	*	*
North Africa International Bank - NAIB	100.00	60.70	60.70	100.00	100.00	100.00	-
Société d'Equipement Domestique et Menager	*	*	*	*	*	*	*
Société Générale Marocaine de Banques	92.90	35 60	33.10	65.00	92.90	69.90	drs

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Société Tunisiénne de Banque	*	*	*	*	*	*	*
Tunis International Bank	100.00	100.00	100.00	100 00	100 00	100.00	-
Tunisie Factoring	*	*	*	*	*	*	*
Union Bancaire pour le Commerce et l'Industrie SA UBCI	66.80	34.80	23.20	66.10	66 80	98.90	drs
Union Internationale de Banques	*	*	*	*	*	*	*
Wafabank	91.70	36.80	33.80	60.70	91.70	66.20	drs
Average	82.96	53.31	45.16	73.33	82.96	88.40	

Source: Author's own estimation

Table A3–10: DEA Efficiency Estimates for Algeria, Morocco and Tunisia Banks for the year 1996– Individual Bank Estimates

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Al Rayan Algerian Bank	*	*	*	*	*	*	*
Albaraka of Algeria-Banque Al Baraka d'Algerie	100.00	21.80	21.80	68.40	100.00	68.40	irs
Alubaf International Bank	67.30	9.10	6.10	59 60	67.30	88.60	irs
Amen Bank	61.10	66.30	40.50	60 60	61.10	99.10	drs
Amen Lease	*	*	*	*	*	*	*
Arab Banking Corporation - Algeria	*	*	*	*	*	*	*
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*
Arab Tunisian Bank	93.30	28.40	26.50	75.20	93.30	80.60	drs
Arab Tunisian Lease	100.00	48.20	48.20	38.90	100.00	38.90	irs
Banque Algérienne de Développement - B.A.D.	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	100.00	11.80	11.80	100.00	100.00	100.00	-
Banque Centrale Populaire	*	*	*	*	*	*	*
Banque Commerciale du Maroc	100.00	55.90	55.90	74.30	100.00	74.30	drs
Banque de Developpement Economique de Tunisie	66.70	15.10	10.10	65.70	66.70	98 60	irs
Banque de Développement Local	39.70	46.30	18.40	37.40	39.70	94.10	drs
Banque de l'Agriculture et du Developpement Rural	100.00	100.00	100.00	68.00	100.00	68.00	drs
Banque de l'Habitat	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque de Tunisie	71.90	10.80	7.80	66.30	71.90	92.30	drs
Banque de Tunisie et des Emirates d'Investissement - BTEI	100.00	82.70	82.70	82.30	100.00	82.30	irs
Banque du Sud	64.40	43.10	27.80	60.30	64.40	93.60	drs
Banque Extérieure d'Algérie	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque Franco-Tunisiénne	*	*	*	*	*	*	*
Banque Internationale Arabe de Tunisie - BIAT	78.50	56.10	44.00	63.50	78.50	81.00	drs
Banque Marocaine du Commerce Extérieur - BMCE	100.00	63.70	63.70	66.40	100.00	66.40	drs
Banque Marocaine pour le Commerce et l'Industrie BMCI	78 80	36.60	28 80	62.70	78.80	79.50	drs
Banque Nationale Agricole	52.70	64.70	34.10	49.80	52.70	94 40	drs
Banque Nationale d'Algérie	100.00	100 00	100.00	100.00	100.00	100.00	-
Banque Nationale de Développement Touristique	100.00	48.40	48 40	100 00	100.00	100.00	-
Banque Nationale pour le Développement Economique - BNDE	*	*	*	*	*	*	*
Banque Tunisiénne de la Solidarité	*	*	*	*	*	*	*
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	98 40	24.90	24.50	94.20	98 40	95.70	irs
Banque Tuniso - Qatari d'Investissements	100.00	100.00	100.00	55.80	100.00	55.80	irs
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	100.00	64.60	64 60	100.00	100.00	100.00	-
CAB-Compagnie Algérienne de Banques	*	*	*	*	*	*	*
Caisse Nationale de Crédit Agricole	*	*	*	*	*	*	*
Citibank NA (Branch)	*	*	*	*	*	*	*
Compagnie Internationale de Leasing	75.80	39.60	30.00	23.10	75.80	30.50	irs
Crédit du Maroc	100.00	31.10	31.10	73.70	100.00	73.70	drs
Crédit Immobilier et Hotelier	100.00	5.10	5.10	100.00	100.00	100 00	-
Crédit Populaire d'Algérie	100.00	100.00	100.00	100.00	100.00	100.00	-
General Leasing	*	*	*	*	*	*	*
North Africa International Bank - NAIB	100.00	44.50	44 50	100.00	100.00	100.00	-
Société d'Equipement Domestique et Menager	*	*	*	*	*	*	*
Société Générale Marocaine de Banques	90.20	26.70	24.10	66.00	90.20	73.20	drs

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Société Tunisiénne de Banque	100.00	100.00	100.00	73.80	100.00	73.80	drs
Tunis International Bank	100.00	100 00	100 00	100 00	100.00	100.00	-
Tunisie Factoring	*	*	*	*	*	*	*
Union Bancaire pour le Commerce et l'Industrie SA UBCI	66.00	17.90	11 80	62.90	66.00	95.40	drs
Union Internationale de Banques	66.80	32.40	21.70	62.70	66.80	93.90	drs
Wafabank	98.70	32.80	32 40	68.60	98.70	69.50	drs
Average	88.06	53.57	49.07	74.45	88.06	85.04	

Source: Author's own estimation

Table A3–11: DEA Efficiency Estimates for Algeria, Morocco and Tunisia Banks for the year 1997– Individual Bank Estimates

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Al Rayan Algerian Bank	*	*	*	*	*	*	*
Albaraka of Algeria-Banque Al Baraka d'Algerie	100.00	6.60	6 60	100.00	100.00	100.00	-
Alubaf International Bank	100.00	17.70	17.70	100.00	100.00	100.00	-
Amen Bank	81.40	60.70	49.40	64.90	81.40	79.70	drs
Amen Lease	100.00	27.50	27.50	44.80	100.00	44.80	irs
Arab Banking Corporation - Algeria	*	*	*	*	*	*	*
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*
Arab Tunisian Bank	*	*	*	*	*	*	*
Arab Tunisian Lease	100.00	18.50	18.50	67.40	100.00	67.40	drs
Banque Algérienne de Développement - B.A.D.	96.70	18.40	17.80	46.30	96.70	47.90	irs
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	100.00	100 00	100 00	100.00	100 00	100 00	-
Banque Centrale Populaire	100.00	24.60	24.60	100.00	100.00	100.00	-
Banque Commerciale du Maroc	*	*	*	*	*	*	*
Banque de Developpement Economique de Tunisie	100.00	79.80	79.80	75.90	100.00	75.90	drs
Banque de Développement Local	87.30	45.90	40.10	82.40	87.30	94.40	drs
Banque de l'Agriculture et du Developpement Rural	71.60	86.80	62.20	59.90	71.60	83.60	drs
Banque de l'Habitat	100.00	100.00	100.00	67.20	100.00	67.20	drs
Banque de Tunisie	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque de Tunisie et des Emirates d'Investissement - BTEI	100.00	24.50	24.50	68.60	100.00	68.60	drs
Banque du Sud	100.00	69.60	69 60	100.00	100.00	100.00	-
Banque Extérieure d'Algérie	96.20	30.70	29 60	87.90	96 20	91.40	drs
Banque Franco-Tunisiénne	100.00	100 00	100.00	100.00	100.00	100 00	-
Banque Internationale Arabe de Tunisie - BIAT	*	*	*	*	*	*	*
Banque Marocaine du Commerce Extérieur - BMCE	99.40	75.00	74 50	81.30	99.40	81.80	drs
Banque Marocaine pour le Commerce et l'Industrie BMCI	100.00	93.50	93.50	64.10	100.00	64.10	drs
Banque Nationale Agricole	*	*	*	*	*	*	*
Banque Nationale d'Algérie	100.00	100 00	100.00	99.60	100.00	99.60	drs
Banque Nationale de Développement Touristique	*	*	*	*	*	*	*
Banque Nationale pour le Développement Economique - BNDE	100.00	56.40	56.40	100.00	100.00	100.00	-
Banque Tunisiénne de la Solidarité	80.80	10.70	8.70	61.90	80.80	76.60	drs
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	*	*	*	*	*	*	*
Banque Tuniso - Qatari d'Investissements	*	*	*	*	*	*	*
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	100.00	64.00	64.00	100.00	100.00	100.00	-
CAB-Compagnie Algérienne de Banques	100.00	54.80	54 80	100.00	100.00	100.00	-
Caisse Nationale de Crédit Agricole	100.00	30 60	30.60	95.10	100.00	95.10	irs
Citibank NA (Branch)	*	*	*	*	*	*	*
Compagnie Internationale de Leasing	*	*	*	*	*	*	*
Crédit du Maroc	*	*	*	*	*	*	*
Crédit Immobilier et Hotelier	100 00	15.60	15.60	46.40	100 00	46.40	irs
Crédit Populaire d'Algérie	100.00	38.60	38.60	53.80	100.00	53.80	drs
General Leasing	100.00	15.70	15.70	86.10	100.00	86.10	drs
North Africa International Bank - NAIB	100.00	100.00	100.00	100.00	100.00	100.00	-
Société d'Equipement Domestique et Menager	*	*	*	*	*	*	*
Société Générale Marocaine de Banques	100.00	17.80	17.80	100.00	100.00	100.00	-

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Société Tunisiénne de Banque	*	*	*	*	*	*	*
Tunis International Bank	92.50	24 50	22.70	59.00	92.50	63.80	drs
Tunisie Factoring	96.20	91.40	88.00	70.60	96.20	73.30	drs
Union Bancaire pour le Commerce et l'Industrie SA UBCI	100.00	100.00	100.00	100.00	100.00	100.00	-
Union Internationale de Banques	*	*	*	*	*	*	*
Wafabank	100.00	27.10	27.10	88.10	100.00	88.10	drs
Average	97.12	53.74	52.23	81.51	97.12	83.81	

Source: Author's own estimation

Table A3–12: DEA Efficiency Estimates for Algeria, Morocco and Tunisia Banks for the year 1998– Individual Bank Estimates

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Al Rayan Algerian Bank	*	*	*	*	*	*	*
Albaraka of Algeria-Banque Al Baraka d'Algerie	100.00	6.00	6.00	100.00	100.00	100 00	-
Alubaf International Bank	87.30	6.60	5.70	85.00	87.30	97.30	irs
Amen Bank	73.90	58.30	43.10	72.00	73.90	97.40	drs
Amen Lease	90.30	19.70	17.70	23.90	90.30	26.50	irs
Arab Banking Corporation - Algeria	*	*	*	*	*	*	*
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*
Arab Tunisian Bank	75.20	60.40	45.40	73 80	75.20	98.10	drs
Arab Tunisian Lease	100.00	24.10	24.10	100.00	100.00	100.00	-
Banque Algérienne de Développement - B.A.D.	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	100.00	22.90	22.90	100.00	100.00	100.00	-
Banque Centrale Populaire	*	*	*	*	*	*	*
Banque Commerciale du Maroc	100.00	22.20	22.20	73 90	100 00	73.90	drs
Banque de Developpement Economique de Tunisie	67.80	64.90	44.00	67.60	67.80	99.60	irs
Banque de Développement Local	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque de l'Agriculture et du Developpement Rural	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque de l'Habitat	100.00	100 00	100.00	100.00	100.00	100.00	-
Banque de Tunisie	100.00	28.40	28.40	90.40	100.00	90.40	drs
Banque de Tunisie et des Emirates d'Investissement - BTEI	100.00	77.50	77.50	100.00	100 00	100.00	-
Banque du Sud	88.50	23.50	20.80	87.80	88.50	99.10	drs
Banque Extérieure d'Algérie	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque Franco-Tunisiénne	100.00	90.50	90.50	86.70	100.00	86.70	irs
Banque Internationale Arabe de Tunisie - BIAT	95.30	56.30	53.70	88.00	95.30	92.30	drs
Banque Marocaine du Commerce Extérieur - BMCE	100.00	28.60	28.60	63.20	100.00	63.20	drs
Banque Marocaine pour le Commerce et l'Industrie BMCI	*	*	*	*	*	*	*
Banque Nationale Agricole	100.00	100.00	100.00	97.60	100.00	97.60	drs
Banque Nationale d'Algérie	*	*	*	*	*	*	*
Banque Nationale de Développement Touristique	100.00	48.90	48.90	100.00	100.00	100.00	-
Banque Nationale pour le Développement Economique - BNDE	79.70	7.90	6.30	74 50	79.70	93.40	drs
Banque Tunisiénne de la Solidarité	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	91.60	21.10	19.30	91.20	91 60	99.50	irs
Banque Tuniso - Qatari d'Investissements	100.00	84.00	84.00	85.00	100.00	85 00	irs
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	71.40	56.40	40.30	67.80	71.40	95.00	irs
CAB-Compagnie Algérienne de Banques	*	*	*	*	*	*	*
Caisse Nationale de Crédit Agricole	*	*	*	*	*	*	*
Citibank NA (Branch)	*	*	*	*	*	*	*
Compagnie Internationale de Leasing	65.00	19.10	12.40	19.60	65.00	30.10	irs
Crédit du Maroc	99.10	17.90	17.80	78.00	99.10	78.60	drs
Crédit Immobilier et Hotelier	*	*	*	*	*	*	*
Crédit Populaire d'Algérie	100 00	100.00	100.00	100.00	100.00	100.00	-
General Leasing	100.00	13.80	13 80	33.50	100.00	33.50	irs
North Africa International Bank - NAIB	100.00	11.80	11.80	100.00	100.00	100.00	-
Société d'Equipement Domestique et Menager	60.70	16.30	9.90	58.00	60.70	95.60	irs
Société Générale Marocaine de Banques	88.70	16.20	14.40	71.40	88.70	80.60	drs

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Société Tunisiénne de Banque	91.40	55.30	50.50	81.50	91.40	89.20	drs
Tunis International Bank	100.00	95.50	95.50	100.00	100.00	100 00	-
Tunisie Factoring	*	*	*	*	*	*	*
Union Bancaire pour le Commerce et l'Industrie SA UBCI	100.00	56.80	56.80	100.00	100.00	100.00	-
Union Internationale de Banques	74 20	17.30	12.80	72.00	74.20	97.00	drs
Wafabank	90.70	19.80	17.90	64.80	90.70	71.50	drs
Average	92.07	49.95	47.26	82.24	92.07	89.00	

Source: Author's own estimation

Table A3–13: DEA Efficiency Estimates for Algeria, Morocco and Tunisia Banks for the year 1999– Individual Bank Estimates

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Al Rayan Algerian Bank	*	*	*	*	*	*	*
Albaraka of Algeria-Banque Al Baraka d'Algerie	100.00	35.20	35.20	100.00	100.00	100.00	-
Alubaf International Bank	78.00	13.10	10.20	72.60	78.00	93.10	irs
Amen Bank	77.70	45.10	35.00	76.30	77.70	98.20	drs
Amen Lease	56.00	25.70	14.40	23.20	56.00	41.50	irs
Arab Banking Corporation - Algeria	100.00	43.70	43.70	100.00	100.00	100.00	-
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*
Arab Tunisian Bank	79.00	59.70	47.20	76.30	79.00	96.60	drs
Arab Tunisian Lease	100.00	21.10	21.10	100.00	100.00	100.00	-
Banque Algérienne de Développement - B.A.D.	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	100.00	21.70	21.70	100.00	100.00	100.00	-
Banque Centrale Populaire	*	*	*	*	*	*	*
Banque Commerciale du Maroc	100.00	30.80	30.80	94.40	100.00	94.40	drs
Banque de Developpement Economique de Tunisie	69.40	51.50	35.80	67.30	69.40	96.90	irs
Banque de Développement Local	100.00	40.60	40.60	88.90	100.00	88.90	drs
Banque de l'Agriculture et du Developpement Rural	100.00	100.00	100.00	71.30	100.00	71.30	drs
Banque de l'Habitat	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque de Tunisie	100.00	33.40	33.40	98.20	100.00	98.20	drs
Banque de Tunisie et des Emirates d'Investissement - BTEI	100.00	96.40	96.40	100.00	100.00	100.00	-
Banque du Sud	100.00	26.80	26.80	100.00	100.00	100.00	-
Banque Extérieure d'Algérie	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque Franco-Tunisiénne	100.00	66.70	66.70	86.10	100.00	86.10	irs
Banque Internationale Arabe de Tunisie - BIAT	100.00	52.60	52.60	100.00	100.00	100.00	-
Banque Marocaine du Commerce Extérieur - BMCE	100.00	16.20	16.20	87.70	100.00	87.70	drs
Banque Marocaine pour le Commerce et l'Industrie BMCI	78.40	13.60	10.70	77.20	78.40	98.50	drs
Banque Nationale Agricole	100.00	93.40	93.40	98.50	100.00	98.50	drs
Banque Nationale d'Algérie	100.00	50.20	50.20	90.80	100.00	90.80	drs
Banque Nationale de Développement Touristique	100.00	44.50	44.50	100.00	100.00	100.00	-
Banque Nationale pour le Développement Economique - BNDE	50.80	6.80	3.50	46.90	50.80	92.40	drs
Banque Tunisiénne de la Solidarité	100.00	100.00	100.00	95.00	100.00	95.00	irs
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	96.70	19.60	19.00	93.90	96.70	97.00	irs
Banque Tuniso - Qatari d'Investissements	100.00	65.40	65.40	90.50	100.00	90.50	irs
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	72.30	30.40	22.00	71.10	72.30	98.40	irs
CAB-Compagnie Algérienne de Banques	*	*	*	*	*	*	*
Caisse Nationale de Crédit Agricole	*	*	*	*	*	*	*
Citibank NA (Branch)	*	*	*	*	*	*	*
Compagnie Internationale de Leasing	68.00	13.50	9.20	27.60	68.00	40.60	irs
Crédit du Maroc	100.00	7.80	7.80	94.80	100.00	94.80	drs
Crédit Immobilier et Hotelier	*	*	*	*	*	*	*
Crédit Populaire d'Algérie	100.00	100.00	100.00	100.00	100.00	100.00	-
General Leasing	62.90	20.80	13.10	22.50	62.90	35.80	irs
North Africa International Bank - NAIB	100.00	12.20	12.20	100.00	100.00	100.00	-
Société d'Equipement Domestique et Menager	57.90	16.80	9.70	56.50	57.90	97.50	irs
Société Générale Marocaine de Banques	91.30	14.80	13.50	89.40	91.30	97.90	drs

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Société Tunisiénne de Banque	100.00	43.90	43.90	81.50	100.00	81.50	drs
Tunis International Bank	100.00	70.60	70.60	100.00	100.00	100.00	-
Tunisie Factoring	100.00	73.30	73.30	47.00	100.00	47.00	irs
Union Bancaire pour le Commerce et l'Industrie SA UBCI	100.00	69.00	69.00	100.00	100.00	100.00	-
Union Internationale de Banques	71.70	16.70	12.00	71.40	71.70	99.60	irs
Wafabank	82.50	18.40	15 20	74 80	82.50	90.70	drs
Average	90.53	46.09	43.86	83.06	90.53	90.68	

Source: Author's own estimation

Table A3–14: DEA Efficiency Estimates for Algeria, Morocco and Tunisia Banks for the year 2000– Individual Bank Estimates

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Al Rayan Algerian Bank	*	*	*	*	*	*	*
Albaraka of Algeria-Banque Al Baraka d'Algerie	89.50	21.40	19.10	89.30	89 50	99.70	drs
Alubaf International Bank	100.00	99.20	99.20	100.00	100.00	100.00	-
Amen Bank	70.10	78 60	55.10	69.60	70.10	99.20	irs
Amen Lease	85.10	12.20	10.40	57.10	85.10	67.20	irs
Arab Banking Corporation - Algeria	100 00	50.10	50.10	100.00	100 00	100 00	-
Arab Banking Corporation - Tunisie	*	*	*	*	*	*	*
Arab Tunisian Bank	89.50	21.40	19.10	89.30	89.50	99.70	drs
Arab Tunisian Lease	100.00	99.20	99.20	100.00	100.00	100.00	-
Banque Algérienne de Développement - B.A.D.	70.10	78.60	55.10	69.60	70.10	99.20	irs
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	85.10	12.20	10.40	57.10	85.10	67.20	irs
Banque Centrale Populaire	100.00	50.10	50.10	100.00	100.00	100.00	-
Banque Commerciale du Maroc	*	*	*	*	*	*	*
Banque de Developpement Economique de Tunisie	75.70	81.90	62.00	71.20	75.70	94.00	drs
Banque de Développement Local	88.70	5.50	4 90	62.00	88.70	70.00	irs
Banque de l'Agriculture et du Developpement Rural	100.00	38.40	38.40	100.00	100.00	100.00	-
Banque de l'Habitat	76.00	19.80	15.00	67.10	76 00	88.30	irs
Banque de Tunisie	100.00	100.00	100.00	71.80	100.00	71.80	drs
Banque de Tunisie et des Emirates d'Investissement - BTEI	100.00	14.00	14.00	97.60	100.00	97.60	drs
Banque du Sud	*	*	*	*	*	*	*
Banque Extérieure d'Algérie	100.00	69.90	69.90	85.30	100.00	85.30	drs
Banque Franco-Tunisiénne	100.00	100.00	100.00	90.30	100.00	90.30	drs
Banque Internationale Arabe de Tunisie - BIAT	100 00	100.00	100.00	100.00	100.00	100 00	-
Banque Marocaine du Commerce Extérieur - BMCE	87.70	40.40	35.40	87.60	87.70	100.00	-
Banque Marocaine pour le Commerce et l'Industrie BMCI	100.00	84.90	84.90	100.00	100.00	100.00	-
Banque Nationale Agricole	74.70	47.30	35.30	74.20	74.70	99.30	irs
Banque Nationale d'Algérie	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque Nationale de Développement Touristique	100.00	66 60	66.60	68.50	100.00	68 50	irs
Banque Nationale pour le Développement Economique - BNDE	71.40	72 60	51.80	71.00	71.40	99.50	drs
Banque Tunisiénne de la Solidarité	100.00	13.30	13.30	86.30	100.00	86.30	drs
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	73.90	46.60	34.50	73.80	73.90	99.80	drs
Banque Tuniso - Qatari d'Investissements	97.50	78.20	76.20	88.10	97.50	90.30	drs
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	80.10	42.80	34.30	76.90	80.10	96.10	drs
CAB-Compagnie Algérienne de Banques	*	*	*	*	*	*	*
Caisse Nationale de Crédit Agricole	53.10	45.70	24.30	49.40	53.10	93.10	drs
Citibank NA (Branch)	100.00	43.60	43.60	100.00	100.00	100.00	-
Compagnie Internationale de Leasing	99.60	22.20	22.10	92.60	99.60	93.00	irs
Crédit du Maroc	91.90	81.50	74.80	70.00	91.90	76.30	irs
Crédit Immobilier et Hotelier	76.10	37.50	28.50	73.70	76.10	96.90	irs
Crédit Populaire d'Algérie	100.00	96.30	96.30	100.00	100.00	100.00	-
General Leasing	60.10	41.70	25.10	59.90	60.10	99.80	irs
North Africa International Bank - NAIB	100.00	100.00	100.00	100.00	100.00	100 00	-
Société d'Equipement Domestique et Menager	76.70	9.20	7.10	48.00	76.70	62.60	irs
Société Générale Marocaine de Banques	89.20	13.80	12.30	88.60	89.20	99.30	drs

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Société Tunisiénne de Banque	*	*	*	*	*	*	*
Tunis International Bank	100.00	84.80	84.80	85.60	100.00	85.60	drs
Tunisie Factoring	57.80	15.20	8.80	33.40	57.80	57.70	irs
Union Bancaire pour le Commerce et l'Industrie SA UBCI	100.00	12.40	12.40	100.00	100.00	100 00	-
Union Internationale de Banques	65.40	21.00	13.70	62.60	65.40	95.80	irs
Wafabank	94.20	14.40	13.60	88.70	94.20	94.10	drs
Average	100.00	90.60	90.60	100.00	100.00	100.00	-

Source: Author's own estimation

Table A3–15: DEA Efficiency Estimates for Algeria, Morocco and Tunisia Banks for the year 2001– Individual Bank Estimates

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Al Rayan Algerian Bank	100.00	100.00	100.00	59.90	100.00	59.90	irs
Albaraka of Algeria-Banque Al Baraka d'Algerie	89.60	17.70	15.90	89.50	89.60	99.90	-
Alubaf International Bank	100.00	100.00	100.00	100.00	100.00	100.00	-
Amen Bank	87.20	49.90	43.50	77.50	87.20	88.90	drs
Amen Lease	100.00	12.20	12.20	100.00	100.00	100.00	-
Arab Banking Corporation - Algeria	100.00	18.70	18.70	100.00	100 00	100.00	-
Arab Banking Corporation - Tunisie	100.00	100.00	100 00	100 00	100.00	100.00	-
Arab Tunisian Bank	88.90	50.30	44.70	84.60	88.90	95.20	drs
Arab Tunisian Lease	79.90	8.10	6.50	77.70	79.90	97.20	irs
Banque Algérienne de Développement - B.A.D.	100.00	13.10	13.10	100.00	100.00	100.00	-
Banque Arabe Tuniso-Libyenne de Développement et de Commerce Extérieur	82.40	32.10	26.50	82.40	82.40	99.90	-
Banque Centrale Populaire	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque Commerciale du Maroc	100.00	69.90	69.90	99.30	100.00	99.30	drs
Banque de Developpement Economique de Tunisie	*	*	*	*	*	*	*
Banque de Développement Local	63.60	10.40	6.60	39.40	63.60	62.00	drs
Banque de l'Agriculture et du Developpement Rural	*	*	*	*	*	*	*
Banque de l'Habitat	100.00	100.00	100.00	100.00	100.00	100.00	-
Banque de Tunisie	100.00	56.10	56.10	100.00	100.00	100.00	-
Banque de Tunisie et des Emirates d'Investissement - BTEI	87.00	11.50	10.00	74.50	87.00	85.60	irs
Banque du Sud	73.90	35.00	25.90	71.80	73.90	97.10	drs
Banque Extérieure d'Algérie	100.00	100.00	100 00	100.00	100.00	100.00	-
Banque Franco-Tunisiénne	*	*	*	*	*	*	*
Banque Internationale Arabe de Tunisie - BIAT	100.00	59.00	59.00	92.70	100.00	92.70	drs
Banque Marocaine du Commerce Extérieur - BMCE	87.00	50.70	44.10	82.60	87.00	95.00	drs
Banque Marocaine pour le Commerce et l'Industrie BMCI	72.30	50.00	36.10	61.50	72.30	85.10	drs
Banque Nationale Agricole	100.00	100.00	100.00	87.10	100.00	87.10	drs
Banque Nationale d'Algérie	*	*	*	*	*	*	*
Banque Nationale de Développement Touristique	*	*	*	*	*	*	*
Banque Nationale pour le Développement Economique - BNDE	*	*	*	*	*	*	*
Banque Tunisiénne de la Solidarité	*	*	*	*	*	*	*
Banque Tuniso - Kuweitiénne de Développement BTKD-Tunisian - Kuwaiti Development Bank	94.30	38.00	35.80	86.30	94.30	91.50	irs
Banque Tuniso - Qatari d'Investissements	*	*	*	*	*	*	*
Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank	*	*	*	*	*	*	*
CAB-Compagnie Algérienne de Banques	100.00	57.30	57.30	100.00	100.00	100.00	-
Caisse Nationale de Crédit Agricole	60.70	41.20	25.00	47.00	60.70	77.40	drs
Citibank NA (Branch)	100.00	83.40	83.40	100.00	100.00	100.00	-
Compagnie Internationale de Leasing	100.00	8.70	8.70	100.00	100.00	100.00	-
Crédit du Maroc	100.00	19.60	19.60	99.60	100.00	99.60	drs
Crédit Immobilier et Hotelier	*	*	*	*	*	*	*
Crédit Populaire d'Algérie	*	*	*	*	*	*	*
General Leasing	88.50	15.00	13.30	83.50	88.50	94.40	irs
North Africa International Bank - NAIB	*	*	*	*	*	*	*
Société d'Equipement Domestique et Menager	*	*	*	*	*	*	*
Société Générale Marocaine de Banques	100.00	23.70	23.70	94.10	100.00	94.10	drs

Form\Year	Tech. Effi	Alloca Effi	Cost Eff	TE CRS	TE VRS	Scale Eff	Area
Société Tunisiénne de Banque	84.40	94.30	79.60	65.60	84.40	77.80	drs
Tunis International Bank	100.00	100.00	100.00	100.00	100.00	100 00	-
Tunisie Factoring	100.00	99.60	99.60	83.70	100.00	83.70	irs
Union Bancaire pour le Commerce et l'Industrie SA UBCI	100.00	85.10	85.10	100.00	100.00	100.00	-
Union Internationale de Banques	100 00	100 00	100 00	100.00	100.00	100.00	-
Wafabank	*	*	*	*	*	*	*
Average	88.87	92.77	55.85	53.33	87.23	92.77	93.43

Source: Author's own estimation