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Market discipline, large bank dominance and bank valuation in an emerging market

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Market Discipline, Large Bank Dominance and Bank Valuation in an Emerging Market

BY
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TO MY HUSBAND NEDAL, MY MOTHER, MY UNDERSTANDING KIDS AND FAMILY

WITH LOVE AND GRATITUDE

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Abstract

This thesis comprises three papers that analyses important issues relating to the banking sector in an emerging market. In particular, we examine depositor discipline, large bank dominance and bank valuation issues focusing on the Jordanian banking system.

Paper 1 examines how depositors behave towards bank risk in emerging markets. It seeks to investigate whether depositors are able to recognise bank risks and penalise risky banks through the changes in deposits and interest paid to depositors. Taking into account the fact that effective depositors' discipline does not only involve depositors' reactions to bank risk, but also the subsequent response from the banks, the paper tests for bank's responses to depositors' signals in the market allowing for banks' asymmetric response to the loss of deposits. We find that depositors are able to discipline banks behaviour through both quantity and price. However, the results show that depositors' recognition of banks' behaviour is strongly influenced by financial crises. On the other hand, in contrast to other studies, the analysis suggests that the introduction of an explicit deposit insurance system has no strong significant influence on depositors' discipline. Moreover, we find that banks react to depositors' actions by improving bank earnings more than enhancing other fundamentals.

Paper 2 explores intra-industry information transfer in the banking sector and empirically assesses the large bank dominance issue within the framework of returns and volatility spillovers. Using two financial methodologies, Vector Error Correction (VEC) and Generalized Autoregressive Heteroscedastic (GARCH) models, we find evidence of significant intra-industry information channelled through not only the level of intra-industry returns but also through the common volatility returns without a clear dominance effect from large to small banks. This suggests that investors appear to be indifferent to the signal quality of information between large and small banks. These findings concerning return and volatility relations between large and small banks have important implication for regulators in emerging markets. Regulators should look for stabilizing potentially adverse effects of a negative event(s) at all banks in the system irrespective of their size.

Paper 3 aims to analyse the main reasons for the difference between market and book values in the banking industry. More specifically, it seeks to examine whether earnings and its components are relevant and sufficient to bridge the gap between these two values and if bank efficiency has incremental information content in this relation. This study applies the non-parametric Data Envelopment Analysis (DEA) approach to estimate the relative cost efficiency of banks, and employs the Truman's et al., (2000) valuation methodology. We find that the component items of net income are important in explaining bank market value. Furthermore; banks' operational efficiency adds incremental information in explaining the gap between market and book values. The results are robust to the inclusion of other explanatory) variables such as credit and solvency risks.

General Introduction

1. Introduction

There now seems to be a general consensus that financial intermediaries play a vital role in the process of economic growth by intermediating scarce financial resources in the economy (Levine, 1997). A key stylized fact of emerging countries is that most financial intermediation is carried out by commercial banks. Therefore, it is important for authorities in each emerging economy to create a stable environment that enhances the efficiency of banks, which in turn could lead to a higher volume of intermediation and improved financial services and products.

During the last few years many financial institutions in emerging countries have been undergoing drastic transformation. In particular, the influence of rapid and radical environmental changes is restructuring the banking industry, reallocating boundaries, and changing the basis of their operations. These changes in the banking system have attracted both practitioners and academics to examine different issues in emerging markets in order to strengthen the financial sector as well as improve the supervision and regulation of banking in order to embrace market forces and sustain economic stability and growth.

This thesis is concerned with the analyses of three issues in an emerging market banking sector, namely, Jordan. Particularly, it focuses on market discipline, large bank dominance, and bank valuation and efficiency. Before dealing with these issues one might address the following three questions: 1) Why emerging markets? 2) Why banks? And 3) Why the three issues outlined above have been chosen for study in this thesis?

In order to answer the first question, we can simply say that emerging markets are too important to ignore. Emerging markets are countries or markets that are not well established economically and financially, but are making progress in that direction (Beim and Calomiris, 2001). Emerging markets have attracted a considerable attention and are likely to become increasingly economically and politically important because they often exhibit high rates of GDP growth and also reflect a continuum of market conditions[1]. They represent an enormous opportunity for entrepreneurs, multinationals, and investors and pose a threat to established product market and demand for global

[1] Some emerging economies, for example China and India, achieved average growth rates of 4 to 7 percent during the 1980s and 1990s, and up to 10 percent in the early 2000s, compared with 1 to 3 percent for developed countries (Olsson, 2002).

resources. Although, such market have the potential to redefine the way business is done in many industries the functioning of emerging markets remain shrouded by myths (Levich, 2001). However, some markets are maturing and on course towards convergence and integration into the world of mature and developed financial markets.[2]

In finance, it is often argued that the gains from trade are enhanced when there is a greater difference in trading nations (Bekaert and Urias, 1996; Kohers, et al., 1998). Thus, economists have used this concept to assess the impact of bringing emerging financial markets into the picture of international investments. The greater the difference between the preconditions or the less the correlation in business cycles between countries, the higher the potential gains for investment. However, the investment thesis for this space is straightforward; investment in emerging markets not only has the potential to generate higher returns and diversification benefits, but also brings potential for a higher level of risk.

It is now generally recognized that emerging markets have paid a price for being too different. The broad meaning of being different than the developed markets is the idiosyncratic risks of these markets. Although one emerging market may be different from an anther, there are, however, a number of characteristics which in varying degrees are likely to be found in these countries. Less stability, weaker institutions, and poorer corporate governance are some of the common factors (Olsson, 2002).

Instability in emerging markets and the appearance of various financial crises[3] at the end of the 1990s encouraged many international investors to weight their portfolios domestically[4]. As a consequence emerging markets started to realize that their future lag in becoming more globally integrated. With more attention from the international institutions, such as World Bank, International Monitory Fund, and the Bank of International Settlements, many countries have attempted to reform their economies, institutions, and markets to encourage this integration process.

[2] For more discussion regarding growth in emerging markets see for example, Stiglitz, (2003) and Olsson (2002).
[3] For example the economics crises and market crashes in Asia, Eastern Europe and Latin America.
[4] Tesar and Werner (1995. pp.298-9) noted that home bias vary between developed countries, from very severe in Japan, only 5% foreign equity holdings, to less severe in the United Kingdom and Germany where foreign investment reached 20%.

From the crises that have occurred in emerging and developed markets, a debate has emerged as to the importance of strong national and international policies and financial institutions to enable countries to integrate successfully into the global financial community. The efforts of policy makers have been focused on the need to reduce financial fragility and systemic risk in both domestic and global financial markets. Enhancing financial markets transparencies, improving the financial systems, reforming financial supervision, and institutional incentives reorientation which require the involvement of the society in addition to the government, are some examples of financial reforms in emerging countries (Stiglitz, 2003).

Literature on comparative financial systems has traditionally focused on the relative size and power of the banking sector and investigates in particular two cases of financial structure, the bank-based and the market-based systems. Although, a comprehensive and widely accepted theory of financial structure is lacking, emerging markets are generally considered as bank-based economies (Beim and Calomiris, 2001). Therefore, banks are the most important part of the financial system in emerging markets, and this addresses the answer to the second question regarding why banks have been considered in our analysis. For many emerging markets, the economic function of the financial system is essentially performed by banks alone which make them the crucial part of a healthy financial system. In other words, banks are dominant in virtually all emerging financial markets. This is the direct consequence of legal frameworks and information institutions that are insufficient to support strong public capital markets. Also, banks are better able (compared to public markets) to survive in environments where legal foundations are insufficient as they are well adapted to private screening and monitoring in environments of imperfect information (Beim and Calomiris, 2001).

The third question as to why we chose the three areas of research that focuses on market discipline, large bank dominance, and bank valuation and efficiency is discussed below.

Given the advantages of banks and the uniqueness of banking institutions, the regulatory environment has become as an important factor in the theory of financial intermediation. A number of aspects of banking enhance the potential instability of the banking system and boost the need for financial regulation. Advocates of bank regulation have argued that regulation might be vindicated because of the transformation function of banks. Banks may be subject to banking panics which force them to stop their operations. In a worse case scenario, a bank's failure may propagate and generate other failures (systemic panic). Therefore, broad consensus between bankers, economists, and regulators is that banks are special and bank runs and failures are costly to the economy (see Bossone, 1999; Benston, 2004).

Since markets and supervisors both fail individually to protect the economy from banking crises; the new regulatory framework (Basel 2) relies on market discipline to complement bank regulation and supervision. Market discipline in banking is commonly interpreted as a situation in which banks' stakeholders face costs that are positively related to bank risk and they react on the bases of these costs (Berger, 1991). Various economic agents can exercise market discipline. Depositors, subordinated debt-holders, stockholders and credit rating agencies are the usual candidates (Llewellyn, 2005). However, in emerging markets, depositors are the most popular market participants who can effectively discipline bank behaviour. In paper 1 of this thesis, we attempt to contribute to the existing literature by providing additional evidence that depositors, even in emerging markets, are able to participate in minimizing banks risk-taking behaviour, and this helps complement rule-based regulations.

Several aspects of banking make this industry unique and require special attentions from regulators. In particular, the prevalence of asymmetric information and the extent to which a specific event, occurring at a particular bank, generates an influence on the banking system including contagion effects and potential systemic risk are some examples. However, recent trend towards competition, technological change, and deregulation have led to consolidate and an increased dominance of large banks in the financial services industry. The emergence of the large banks can have market power implications that are of concern to regulators (Solvin et al., 1999). Whether large banks need to be treated differently by regulators is a controversial issue. Thus, this issue is the focus of attention in the second paper namely; do large banks dominate the banking sector in emerging markets?

Effective bank regulation and policy making, should aim to ensure stability; however, another dimension that should be taken into consideration is the relationship between bank valuation and efficiency, particularly in emerging markets. According to Beck

(2000), policy makers should not assess banking policies only along the metric of stability. They also should examine which policies encourage banks to operate efficiently and to make sound capital allocation decisions. It is commonly believed that an economy with a more efficient financial system performs better. In addition, operational efficiency is an essential element for the soundness of the banking system that facilitates economic growth and monitors the soundness of the overall financial system (Molyneoux and Iqbal, 2005). For banks to succeed and survive it is always thought that they have to efficiently produce their outputs from inputs. In the banking literature, producing more outputs than competitors, for the same amount of inputs or consuming fewer inputs for the same amount of outputs, is a sign of efficiency. Hence, bank efficiency may used as a proxy for banks' ability to survive through competitive advantage that affects the firms current profitability and its future potential. Since capital markets might be the place where the signals of bank efficiency can be found, investors (current and potential) need to gather information about the bank for the purpose of investment decisions. Therefore, the third paper in this thesis concentrates on examining whether bank efficiency contains incremental relevant information that can be used in pricing a bank stock in order to help investors to take accurate decisions in the capital market.

The above three issues which define our research area and identify a specific interest in this thesis are recognised as the topical issues currently facing policy makers and investors in emerging markets. Erb, et al., (1997), and Garten (1997), indicate that emerging markets are complex and many factors in these markets need to be explained. They also emphasize that the evolution of an emerging market may be determined by characteristics that are unique to that particular country and its stage of economic development. That is why we believe it is important to analyse an emerging market, such as Jordan. The Jordanian financial system has embarked on various structural developments and has advanced a flexible pragmatic approach to investments and openness. In this respect, we think that the empirical findings reported in this study for Jordan are relevant because they might also be valid for other emerging markets of similar characteristics and stages of development.

Moreover, as is the case in most emerging markets, banks in Jordan are the dominant financial institutions; they control most of the financial flows and possess the bulk of the financial assets in the economy. Therefore, ensuring a safe and sound financial system along with an efficient functioning of the banking system is one of the cardinal and challenging missions of bank regulators in this market. Therefore, we believe that Jordan acts as a representative case study for analyzing market discipline, large bank dominance and bank valuation issues in emerging markets.

2. Research Questions, Methodology, and Thesis Structure

This thesis comprises three papers, each looking at one particular issue. While, the first paper provides a comprehensive analysis of depositors' behaviour towards bank risks, the second paper analyses the issue related to the stock returns and volatility dynamics within the banking sector. It examines the intra-industry information transmission and analyses if there is a dominant role played by one very large bank in the capital market. The third paper attempts to bring particular attention to the importance of economic information for accurate market valuation which is needed for bank monitoring and performance evaluation. In particular, we examine whether bank efficiency can be used as an additional variable in banks valuation models, and therefore may in a way or another create more incentives for bank managers to mange their bank in an efficient way and ensure overall bank stability.

In paper 1, market discipline has been examined. Regulators in most emerging markets have been required to implement appropriate regulation and supervisory practices for their financial sectors in order to minimize the likelihood of financial crises. Neither rule-based regulation nor market-based regulations have been, as far as we are aware, successful individually to prevent banks from taking high risks. Therefore, greater disclosure within the banking system and better informed public and homogeneous standards (all objectives of Basel 2) must be part of any recommendation set for policy makers (Lanzi, 2006).

However, market discipline not only involves depositors' reaction but also the subsequent response of banks. As argued by Hamalainen (2006), and Hamalainen et al., (2005), market discipline can only be considered effective if it makes banks act conservatively and limit their risk. The quiet life theory suggests that the lower the intensity of environmental pressures, the lower is the effort explained by managers to derive the maximum output from a given amount of inputs (Berger and Hannan, 1998). Therefore, depositor discipline may be treated as a pressure exercised on bank managers in order to drive those managers to work in a sound and safe manner.

In market discipline, information asymmetry between banks and market participants are taking one step further than other contracts. Information asymmetries are due to the bank's private information about its operations (adverse selection) and about hidden actions that borrowers can take to increase their personal well being at the bank's expense (moral hazard). Nevertheless, depositors can influence bank behaviour. They may have more information than regulators, and they may respond quicker than regulators to the changes of banks' conditions. Although depositors discipline is an easy and simple mechanism, the nature of the deposits contract (no extra benefits are expected from banks' high risk taking) makes depositors try to inform themselves about the conditions of the bank. Therefore, this feature of the deposit contract keeps banks on their toes (Calomirie and Kahn, 2000) and creates risk of contagious bank runs (Diamond and Dybvig, 1983). Park and Peristiani (2007) also note that the load of market discipline falls on the shoulders of debt holders (depositors). In contrast, shareholders incentives to increase their profitability may outweigh their desire to decrease bank risk (Tsuru, 2003).

After a discussion about the foundations and mechanisms of depositor discipline, the first paper in this thesis surveys the theoretical and empirical literature on market discipline and addresses the following questions: First, are depositors in emerging markets reliable enough to recognize bank risk-taking? In other words, can depositors in emerging markets penalize risky banks for bad behaviour? Second, is depositors' behaviour towards bank risk affected by the introduction of deposit insurance? Third, is depositors' behaviour towards bank risk different before and after the financial crises? And finally, are signals sent by depositors considered by banks to adjust their risk levels?

In the first paper, both the price (depositors punish banks through higher deposits cost) and quantity (where depositors punish banks by withdrawing their claims in the bank) approaches have been used to test for the existence of depositor discipline. Reduced form equations have been used to capture deposit demand and supply features. In addition, more than one estimation technique (Ordinary Least Squares (OLS), Two Stages Least Squares (2SLS), and Seemingly Unrelated Regression (SUR) methodologies) have been employed.

When depositor discipline issues are examined using a unique data from Jordanian banks over the period 1982 to 2005, the following main findings emerge. Evidence of depositor discipline through both quantity and price is found. In addition, the results show that depositor recognition of bank behaviour seems to witness a wake-up call after the financial crises. In contrast, depositors seem to be insensitive to the introduction of deposit insurance which may indicate that depositors treat the introduction of such a scheme as non-credible. Therefore, we find that depositors' incentives to monitor banks behaviour were not influenced by the introduction of a deposit insurance scheme. Furthermore, we argue that banks may respond asymmetrically to their loss of deposits and only improve their fundamentals when their deposits level is affected negatively. In contrast, banks will not have any incentives to change or improve their fundamentals if deposits are growing rapidly. The results support the view that banks respond to market signals by improving their profitability as a response to the loss of deposits in order to re-build depositor confidence.

Development in the banking industry including financial innovation, advances in information technology, deregulation, conglomeration and so on affect the structure of the banking industry in both emerging and mature markets. These changes have led to higher levels of interrelations between banking firms which have led regulators to be more concerned over expected market power, increased systemic risk and stronger moral hazard incentives. The overall effect of the new trends in the banking industry depends on whether or not the riskiness and returns of individual banks have become so closely correlated that adverse conditions with a subset of banks can quickly and strongly spillover to other banks within the industry, bringing about a system-wide problem (Elyasiani et al., 2007).

In paper 2, we analyse the intra-industry interdependence information transmission associated with returns and volatility within the banking sector. In particular, three main questions are examined: Is there returns causality from the large bank to smaller banks in the Jordanian banking sector? Is there volatility transmission from large to small banks? Does the 11^{th} of September event affect returns causality and volatility transmissions running from large bank to small banks?

The intra-industry information transmission literature in banking concentrate on examining the contagion effects using event study methodology (e.g Bessler and Nohel, 2000; Lang and Stultz, 1992; and Brewer and Jackson, 2002 among others). The second paper addresses the issue of returns and volatility transmission using two popular methods in finance, the Vector Error Correction (VEC) model and the Generalized Autoregresive Heteroscedastic (GARCH) Methodology. The VEC model has been chosen to incorporate any long-run relationship between banks in the sample while studying the short term relations between the bank returns. On the other hand, the GARCH modelling framework is widely used to incorporate second moment volatility effects. The results show that information transmission and predictability of returns and volatility exist between banks in the sample. However, a dominance role of the large bank is not clearly evident. Furthermore, the results indicate that the 11^{th} of September event had an important effect on returns interdependence and volatility spillover pattern within the Jordanian banking sector.

The research objective of the third paper is to investigate how investors and policy makers can go beyond accounting information to accurately value banks. In particular, we use estimates of bank efficiency for a sample of Jordanian banks in order to explain differences between book and market values.

Consistent with shareholder wealth maximization (creation), managerial performance and their efficiency needs to be assessed by shareholders from a valuation perspective (market performance). However, the market value of equity is a function of a range of information variables, including a firm's earnings, the book value appearing in the balance sheet and, perhaps, other contextual and economic variables as well (Tippett, 2000; and Burgstahler and Dichev, 1997).

In this context of bank performance (and therefore valuation) the concept of efficiency appears to be important. There has been a growing interest in estimating efficiency in the banking sector (Breger 1993; Berger and Hannan, 1998; and Ferrier, and Lovell 1990; and Tripe, 2004). In addition, a large number of studies concentrates on estimating cost efficiency (e.g. Berger e al., 1993; Resti, 1997; and Sathye, 2003), although a smaller number of studies examines the profit side of banks' operations (e.g. Berger and Master 1997; and Maudos and Pastor, 2003). The literature also relates efficiency to various aspects of banking market features and regulation (Altunbas et al., 2000; and Chang and Chiu, 2006). Various studies have also thought to relate X-efficiency measures to bank profitability (Elyasiani et al., 1994, Berger et al., 2000; and Kwan, 2006).

While the pervious literature mainly addresses the important relation between market performance and bank efficiency using 'direct valuation' theory (e.g. Becalli et al., 2006), the third paper in this thesis uses an 'inputs-to-equity-valuation' theory. In direct valuation theory, bank efficiency is intended to be associated with equity market value changes or levels. The book value of equity, under this theory, is assumed to be included in the equity market value. The results of such studies, based on direct valuation, only give insight about the relative stock price associations of bank efficiency (Holthausen, and Watts, 2001). However, in paper 3, we attempt to use inputs-to-equity-valuation theory in order to provide information that bank efficiency may be used as an input variable in the valuation model which can be used by investors when they value bank equity. This method enables us to examine whether bank efficiency can bridge the gap that may occur between market and book values, and help market participants to achieve better bank valuations. Therefore, we empirically examine the following two questions: is accounting information value relevant in evaluating banks in emerging markets? Can efficiency (as an economic performance measure) add more information in interpreting the gap between the bank book and market values in emerging markets?

The methodology applied in the third paper is similar to the value relevant studies in the capital market-based accounting research. Based on Ohlson (1995) we used the approach of Trueman et al., (2000) to study the impact of financial and non financial information. The estimated efficiency scores for each bank in our sample over the period from 1993 to 2005 were carried out using the Data Envelopment Analysis (DEA). The result supports the ability of efficiency to give additional information content in order to achieve improved bank valuation.

3. Contributions to the Literature

Overall, the main contributions of this study to existing work in banking are summarised according to each paper as follows:
In paper 1 we contribute to the growing literature which investigates the issue of depositors' discipline by providing additional evidence that the existence of depositors' discipline is not exclusive to developed markets and even in small economies depositors may exact a pressure on banks risk-taking behaviour. The importance of this evidence for policy makers is that it suggests that market discipline tools should be used to complement regulation in order to maintain stability in the financial system.

In paper 2, we contribute to the literature by examining if a large bank can extend its power by affecting smaller banks' returns and volatility in the capital market. The effect of size on systemic risk and the strength of spillover effects are also important because various authors suggest that a 'financial meltdown' generally starts with problems plaguing the largest institutions. However, our finding that large bank influence does not extend to the capital markets provides an insight that regulators should not treat large banks differently to smaller banks. Investors appear to recognise the relevant information that affect banks stocks irrespective of their size. We believe that the result of this paper is important not only for regulators, but also to further our understanding of banking behaviour in the capital market. The intra-market interdependence structure has implications for market efficiency, profitable investment opportunities, and risk diversification.

In paper 3 we further delimits the area of research by focussing on bank valuation. During the 1990's, the banking industry was deregulated almost everywhere and, consequently, banking institutions have become both more complex and market oriented making bank valuation a more difficult issue. In paper 3, we contribute to the banking literature by trying to join two separately developed areas of research (banking and accounting literature). We find empirical support for the view that bank efficiency can be considered as a relevant measure that can help to bridge the gap that may occur between banks' market and book values. Since the primary goal of investors in both emerging and developed markets is creating value, bank efficiency should attract the interest of managers, academics and regulators when analysing bank value.

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Paper 1

Market Discipline and Depositor Behaviour in Emerging Markets

Abstract

A broad consensus between bankers, economists, and regulators is that banks are special and bank runs and failures are costly to the economy; therefore banking stability is afforded the utmost importance. Since markets and supervisors both fail individually to protect the economy from banking crises; the new regulation framework (Basel 2) relies on market discipline to complement bank regulation and supervision. This paper examines how depositors behave towards bank risk in emerging markets. In particular, it seeks to investigate whether depositors are able to recognise bank risks and penalise risky banks through the changes in deposits and interest paid to depositors. Taking into account the fact that effective depositors' discipline does not only involve depositors' reactions to bank risk, but also the subsequent response from the banks, the paper follows Barajas and Steiner (2000) and tests for bank's responses to depositors' signals in the market allowing for banks' asymmetric response to the loss of deposits. When depositors' discipline in the Jordanian banking market has been examined using panel data for the period from 1982 to 2005, the following main findings emerge. Evidence of depositors' discipline through both quantity and price effects are found. Our analysis offers a fundamental building block for explaining how reactions towards bank fundamentals are sensitive to financial crises and deposit insurance. The results show that depositors' recognition of banks' behaviour is strongly influenced by financial crises. On the other hand, in contrast to other studies, the analysis suggests that the introduction of an explicit deposit insurance system has no strong significant influence on depositors' discipline. Moreover, we find that banks react to depositors' actions by improving banks' earnings more than enhancing the other fundamentals.

1. Introduction

Academic researchers increasingly question the role of market discipline in systemic stability (Crockett, 2002). In the absence of market discipline, depositors implicitly subsidise the risks taken by their bank. This raises the probability of bank failures, which are typically very costly, ranging anywhere from a few percentage points of GDP to as high as 50 percent of GDP (Acharya and Yorulmazer, 2007). On the other hand, risk-rating is a difficult task. Assessing bank risk requires access to reliable information (concerning banks). Therefore, practitioners think that as markets in emerging countries may not function well, then it must be the case that market discipline also does not work efficiently (Caprio and Honohan, 2004), and that these countries need to rely more heavily on capital and bank supervision.

Therefore, banks have been subject to more regulation than most other institutions in the economy, the main aim being to protect the depositors, or to deal with the negative externalities that arise from banking sector collapse. However, the banking sector has dramatically changed in recent years. Development in information technology, the proliferation of financial markets, the blurring of distinctions between banking and non-banking financial institutions and the continuous introduction and development of new products has fundamentally changed the financial services landscape. This more dynamic and competitive environment might not be compatible with traditional regulatory structures. Moreover, inappropriate regulation and supervision not only significantly affects financial sector development but also increases the probability of financial crises that might in the worst case scenarios, spread beyond national boundaries. Barth et al., (2001) who examined banking systems around the globe, find that, in countries where banks face a greater degree of regulation and restrictions there is a higher probability of a banking crisis.

Policy makers in emerging markets are faced with increasing globalisation pressure and this can have implications for the regulation of the banking system. Increased volume and volatility of capital flows, for instance, may endanger the financial stability needed for economic growth. The question which arises, therefore, (here) is how to adapt the regulatory framework to the increasingly competitive globalised environment.

Regulators in most emerging markets have been required to implement appropriate regulation and supervisory practices in the financial sectors. Traditionally, policy makers introduced various prudential and systemic regulations aimed at providing depositors with protection which could be explicit or implicit[1]. However, the evidence of a growing number of failed banks around the world, such as in the US, Latin America, Turkey, Asia and the Middle East among others, has illustrated that the safe and efficient operation of the banking system cannot be guaranteed by government regulation alone, regardless of how conscientious the regulators, or well intended the regulations. Government regulations need to be supplemented by market discipline (Kaufman, 2003). Nevertheless, evidence show that there is no systemic tendency for emerging markets to lack the pre-requisites for market discipline (see Caprio and Honohan, 2004).

Market discipline, the third Pillar of Basel 2, should play a role in regulatory regimes aimed at promoting systemic stability and a safe and sound banking system. As stated by the BIS (2001, p1) "market discipline has the potential to reinforce minimum capital standards (Pillar 1) and supervisory review process (Pillar 2), and so promote safety and soundness in banks and financial systems". Bank regulators in many developed and developing countries have discussed the possibility of adopting the new regulation aimed at enhancing transparency and to make information reliable and accessible for market participants (Ward, 2002). The primary focus of the new international capital adequacy regulations (Basel 2) is that the three pillars (capital standards, supervision, and market discipline) need to be satisfied and sufficiently well designed to regulate banks effectively. Otherwise, it is unlikely that Basel 2 will achieve its objective of maintaining a safe and sound banking system.

Market discipline in banking is commonly interpreted as a situation in which banks' stakeholders face costs that are positively related to bank risk and they react on the bases of these costs (Berger, 1991). Various economic agents can exercise market discipline. Depositors, subordinated debt holders, stock holders and credit rating

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[1] Explicit deposit insurance is contractual obligation, implicit insurance is only conjectural.

agencies are the usual candidates. However, in emerging markets, depositors are the most popular market participants who can effectively discipline bank behaviour[2].

Depositors penalise banks for poor performance. This may materialise via customers withdrawing deposits (quantity effect) or by them demanding higher yields (price effect) therefore making risk-taking more costly for banks. Depositors' discipline should reduce banks' incentives to take excessive risk and hence should contribute to the stability of the financial system. Although, it has not been suggested that effective market monitoring is sufficient to prevent banking crises, market discipline can limit their cost and likelihood (Caprio and Honohan, 2004).

The theoretical literature on bank runs is divided into two main views. Firstly, there are those who stress that depositors may cause a run on perfectly good banks when a bad bank in the same system is affected (Diamond and Dybvig, 1983). This strand of the literature explains how a run situation is reached because of information asymmetries between banks and depositors. Since depositors cannot comprehensively monitor banks performance they use imperfect signals to influence their behaviour. Consequently, any signal in the market, even if it is imperfect, may be used by depositors to review their perceptions about the solvency of banks. Hence, in extreme situations, solvent banks can close.

The second strand of the literature argues that depositors can discriminate between good and bad banks. This view is based on models of solvency theory that relate the crises in the financial sector to the consequences of real shocks in the market and the pro-cyclical behaviour of credit (Kindleberger, 1978). In the upturn of a business cycle, banks seem to extend credit extensively to the real sector and become highly leveraged. Then, when

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[2] As argued by Levy-Yeyati et al., (2004), banks in developing countries are not required to issue subordinated debt as a vehicle for market discipline due to the high cost of issuance and presence of illiquid markets. On the other hand, rating agencies may not be appropriate parties for exercising market discipline on banks because they do not have a direct economic stake in the financial firms and the only cost they might suffer is the loss in reputation in the case of market discipline. Furthermore, discipline by shareholders is hardly effective in reducing banks risk because shareholders and bank management prefer to seek upside risks (Tsuru, 2003). Therefore, depositors discipline has been chosen in this study for two reasons; first depositors are present in all banking systems, and they are not entitled to any special benefits even if bank's high risk precedes high returns. On the contrary, they might suffer substantial losses in the case of bank failure.

real shocks send the economy into a downturn, debtors' capability to honour their loans becomes dramatically reduced. If banks do not have adequate reserves to face their situation, insolvency problems can occur, and bank panics may ensue.

Empirically, there is a substantial literature that examines how depositors choose among different banks and whether they would effectively monitor bank management by punishing poorly managed banks for bad behaviour. However, market discipline not only involves depositors' reactions but also the subsequent response of banks. As argued by Hamalanian (2006) and Hamalanian et al., (2005), market discipline can only be considered effective if it makes banks act conservatively and limits their risk. The quiet life theory suggests that the lower the intensity of environmental pressures, the lower the effort undertaken by managers to derive the maximum output from a given amount of inputs (Berger and Hannan, 1998). Therefore, depositor discipline may be treated as a pressure exercised on bank managers in order to push those managers to work in a sound and safe manner.

While most of the studies on depositor discipline focused on developed banking sector experiences (e.g., Hannan and Hanweck, 1988; Ellis and Flannery, 1992; Murata and Hori, 2006; Tsuru, 2003; and Birchler and Maechler, 2001; among others), recent banking crises in developing markets have attracted researchers to address this specific issue. The question of the ability of these markets to exercise efficient and effective discipline on banks with regard to risk-taking has been increasingly assessed particularly in Latin American and Asian banking markets (e.g. Martinez Peria and Schmukler, 2001; and Barajas and Steiner, 2000). The results from these studies support the view that depositors are able to discipline banks' behaviour.

This study contributes to the small but growing amount of literature which investigates the issue of depositors' discipline in emerging markets, by providing more evidence on the existence of market discipline in less developed markets. It uses Jordan as a case study to explore the depositors' discipline issue. Drawing on a unique Jordanian commercial bank panel data set for the period 1982 to 2005 we investigate the mechanisms of depositor discipline and demonstrate that depositors are able to recognise risk and punish bank risk-taking through withdrawing their deposits or demanding higher interest rates. To investigate if there are any changes in depositors' behaviour before and after twin crises (that occurred in 1989)[3], two sample periods have been analysed. In addition, the influence of explicit deposit insurance on depositors discipline is also examined.

Overall, the empirical estimates enable us to conclude that depositors in Jordan punish banks for risky behaviour through both deposit withdrawals and higher prices (interest paid to depositors). Depositors also seem to change their behaviour as this factor altered substantially after the financial crises of 1989. This result is consistent with Martinez Peria and Schmukler 's (2001) evidence that shocks in the sector breed greater depositor vigilance. Regarding the results of the effect of introducing explicit deposit insurance on depositors' discipline, no clear evidence was found to support the idea that market discipline in Jordan has been harmed by the introduction of depositor insurance coverage. This result may be interpreted as a lack of credibility in insurance coverage introduced by the new scheme (namely, Jordan deposit insurance) that perhaps was perceived as being unable to cover all deposit liabilities. Alternatively, the recent introduction of the scheme and the lack of crises may mean depositors are not confident in the scheme and therefore are not pricing risks accurately.

Additionally, as argued by Calomiris and Powell (2000), a true test for market discipline should also involve a second test in which it is determined whether banks effectively respond to the signals provided by depositors. We build on this idea, and following Barajas and Steiner's (2000) methodology, this study finds that banks only respond to the changes in deposits levels by improving their earnings even when we allow banks to respond asymmetrically to banks' deposit loss. Our results are robust with regard to different estimation techniques, and the inclusion of a set of control variables that may affect the criteria used by depositors in choosing their bank.

The main motivation for investigating the market discipline issue in banking is related to a series of theoretical and empirical papers that have debated the possible effects of depositors' behaviour on bank risk-taking in emerging markets. This is an area that, as far as we are aware, has been studied and examined before but not for the case of Jordan.

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[3] Twin crises is the case where the country whiteness both of banking problem and currency devaluation. For the distinction between twin crises and pure banking or currency crisis (see Bauer, 2007).

Also, the issue of efficient bank regulation in emerging markets may have broader implications because of the scarcity of resources especially for saving. Furthermore, we believe that depositors are more able to share the burden of bank regulation than shareholders, because shareholders' incentives to increase bank profitability may outweigh their desire to decrease bank risk (Tsuru, 2003; and Park and Perstiani, 2007).

Depositor discipline is a relatively straightforward mechanism. The nature of deposit contracts (no extra benefits are expected from banks' high risk-taking) create strong incentives for depositors to try to inform themselves about the condition of banks. Therefore, this feature of the deposit contract keeps banks on their toes (Calomiris and Kahn, 1991) and also creates the risk of contagious bank runs (Diamond and Dybvig, 1983). The analysis presented in this paper demonstrates that complementarities between legal regulation (rules) and depositor forces may help to reduce banking risk. Finding evidence of depositors' discipline can provide important motivations for regulators and policy makers to think about market discipline issues and consider appropriate incentives, costs and rewards that result in safer banking systems. For complementarity between regulatory rules and market monitoring, banks' corporate governance and appropriate market conditions may play an important role in strengthening bank regulation and supervision. A combination of rules, corporate governance, and appropriate market conditions to enable adequate market discipline, should help to reduce undesirable consequences of bank failure and maintain financial stability.

It is important to note that the details related to the existence of market discipline in banking systems are very much a country specific issue. It will, to a large extent, be influenced by factors unique to the country concerned. Some factors, such as depositors' culture, may cause depositors to react differently in each country. Furthermore, the ability of depositors to analyse financial information differs between countries. Even if depositors are informed, they might be not sophisticated enough to utilise information. A study of the Jordanian banking system should help us identify whether depositor discipline has an impact on bank behaviour in the country.

In addition, the unique sample used in this study includes the period of the so-called Jordanian twin crises 'the Petra Bank and currency crises' of 1989. This period was followed by the introduction of various reforms that required banks to disclose more information in order to enhance market discipline. It seems appropriate to conduct a study of market discipline for Jordan since regulators here have made significant efforts to rely more on market discipline. In addition, it is of interest for researchers to examine whether depositors are ready to penalise banks for bad behaviour. During the study period, an explicit deposit insurance corporation was also established in Jordan. This 'safety net' scheme may affect the incentives of depositors to monitor their bank. The long time period of the study enables us to test the changes in depositors' reaction towards risk. Therefore, Jordan's experience may offer a good case study to examine the issue of market discipline and the deposit insurance effect.

The remainder of the paper is organised as follows. The conceptual framework of market discipline is analysed in section 2. Section 3 reviews the empirical literature and provides a critical evaluation of the existing evidence. Section 4 describes the Jordanian banking system, regulation, and deposit insurance scheme. Section 5 illustrates the methodology and data employed in the empirical analysis. Section 6 describes and evaluates the paper's main results, and section 7 is the conclusion.

2. Conceptual Framework for Market Discipline

Over the last few decades researchers have addressed the general question of banks' role as financial intermediaries, focusing on the development of theories explaining the need for banks to exist (eg., Akerlof, 1970; Diamond 1984; and Stiglitz and Weiss, 1981, among many others). Banks provide transaction and payment systems, credit, insurance services, risk-sharing services, and transform liquid liabilities into illiquid assets. They can have specific skills to monitor projects in order to be able to finance them. It is always thought that the existence of a banking system helps to overcome the problems associated with asymmetric information in an economy[4]. This in turn has shaped research into the need for an effective way of regulating banks.

[4] Asymmetric information is divided in the banking literature into moral hazard and adverse selection. In economic analysis moral hazard refers to hidden actions in a contractual relationship, where adverse selection arises when the customer knows more than the bank about the probability of the loss happening because of hidden information.

In recent years, both developing and developed countries have suffered significantly from banking crises. Banks' depositors as well as borrowers face potential losses in the face of bank failure. Generally, the economic impact of the insolvency of banks poses different problems for society compared to the insolvency of non-financial companies or other financial institutions[5]. Banks are different because the monitoring mechanism enables them to attract deposits for long-term investments. Mayes (2004) gives two causes for these differences. First, the holdings of deposits, and second the transmission of a problem between banks generating more widespread bank failures and systemic risk. Due to the widespread use of banks, not only for making payments but also as a store for savings, a bank's failure has a far greater effect throughout the economy[6]. Therefore, in the case of bank failure, many parties in the economy will share the loss[7].

The question of bank failure prevention and control has long played a central role in banking and economic theory. Historically, Adam Smith, in his seminal text *The Wealth of Nations*, effectively supports the unregulated market. He wrote: " ... free competition too obliges all bankers to be more liberal in their dealings with their customers, lest their rivals should carry them away. In general, if any branch of trade, or any division of labour, be advantageous to the public, the freer and more general the competition, it will always be the more so" (Smith 1776, p. 353). Adam Smith used the term 'invisible hand' to describe the natural force that guides unregulated markets (free-markets) through competition for scarce resources as a part of a self-regulating system. According to Adam Smith, in a free market each participant will try to maximise self-interest, and the interaction of market participants, leading to the exchange of funds, enables each participant to be better off than when simply producing alone. Furthermore, he states that in a free market, no regulation of any type would be needed to ensure the mutually beneficial exchange of funds, since this "invisible hand" would guide market participants to trade in the most mutually beneficial manner. In other words, Smith accepted competition between banks in the market place as the best discipline due to its

[5] Furthermore, the failure of a bank has an adverse effect on non-financial firms precisely because individual bank- firm relationships are valuable (Petersen and Rajan, 1994).
[6] As argued by De Ceuster and Masschelein (2003), the transmission of the failure information can happen through, institutional inter-linkages, informational effects or the macro economic environment.
[7] Caprio and Klingebiel (2003) report 117 episodes of systemic banking crises in 93 countries since the late 1970s. Between 1980 and 1996, 133 out of 181 IMF countries had experienced serious problems in their banking sector. The fiscal cost of banking crises in developing countries alone exceeded $ 1 trillion in the 1980s and the 1990s.

ability in creating incentives for efficiency. Thus, he saw no need for central or governmental bodies to regulate or monitor banks' behaviour.

Later, Adam Smith's view was supported by schools of thought called the 'free banking' school (laissez-faire) . The main ambition of the school was to prohibit government intervention in the financial system supporting the free functioning of the financial system. The Scottish banking system between 1716 and 1844 is considered a model of 19^{th} century free banking. The banks operated with virtually no restrictions imposed by government authorities. Advocates of free banking, such as Dowd (1992, 1996), Cameron (1972), White (1990), and Economopoulos (1988, 1990), support the stability of the free banking; they argued that free banking helps to promote economic growth because of the intense competition between the banks, which forced them to innovate. In addition, Kareken and Wallace (1978) find that under certain assumptions there are no bank failures under *laissez-faire* banking. In their model, failures are induced by the non-optimal pricing of government deposit insurance. Fama (1980) argues that, under competitive banking, "...portfolio management activities...fall under the Modigliani-Miller theorem on the irrelevance of pure financing decisions. It follows that there is no need to control the deposit creation or security purchasing activities of banks to obtain a stable general equilibrium with respect to prices and real activity" (p. 39). Moreover, McCulloch (1981) argues that the maturity transformation activity of banks borrowing short and lending long is not a natural function of financial intermediaries. It is a malfunction that is a by-product of several forms of government intervention that encourages what he calls "misintermediation" (p. 103).

In summary, the "free banking" school theorists (such as White 1984, Selgin 1988, Glasner 1989, and others) have provided a theoretical basis and offered historical evidence for the soundness of a free banking system. One of the major arguments is that competition in the supply of money forces banks to maintain either their brand names or convertibility of their liabilities (banknotes or deposits) into specie or real commodities, which in turn prevents banks from over-issuing money. In contrast, a self-correcting mechanism does not exist under a system where the supply of money is monopolized by the government. Therefore, free banking is more stable than central banking.

The latter argument goes further to suggest that close monitoring of bank operations is best performed by depositors because depositors would lose funds in the case of bank failure. Depositors would adapt to the competitive nature of the banking sector. Given that bank management is always eager to have more deposits and they need to maintain a good reputation in order to attract deposits, incentive based strategies to correct management behaviour through depositors' pressure is, the argument goes, all that is needed to discipline banks.

During 1772 to 1823, David Ricardo expanded on the benefits of free trade (unregulated market view) and introduced the theory of comparative advantage[8]. Ricardo referred to the ability of individual bankers to adjust their own note-issue to the demands of the market. He advocated competition in banking. However, the only restriction in addition to convertibility which Ricardo saw fit to impose was that banks deposit securities against their note issues. Insuring the *quality* of notes and protecting poor participants (borrowers) against bankruptcy was his main argument; however, Ricardo set the foundations for discussing the role of competition as a tool of regulation.

Theoretically, with perfect information, market forces will induce good banking practices because, as argued by Karken and Wallace (1978), profit maximising banks would choose strategies with zero probability of bankruptcy. Hence, competition exhibits a beneficial effect, for instance, competition may minimise long-run production costs for goods and services, reduce resource waste, improve productivity and banks' efficiency, and also maximise social welfare. In addition, a competitive regulatory system is seen as advantageous for the promotion of innovations in the banking system. It is accepted that in a world of no transaction costs where governments maximise social welfare, and where there is well defined enforceable property rights, markets will achieve efficient outcomes (Coase, 1960). Furthermore, if the prerequisites for this laissez-faire 'invisible hands' theory holds, government regulation of banks would be at best irrelevant, however, the prerequisites for 'invisible hands' to work sufficiently do not exist (Barth et al., 2006).

[8] See Ricardo's book "The Principles of Political Economy and Taxation". According to Ricardo's theory, even if a bank could produce everything more efficiently than another bank, it would reap gains from specialising in what it was best at producing and trading with other banks.

The traditional view of free unregulated banking has been criticised. Free or unregulated banking is inherently unstable because of market failures arising from such factors as externalities, natural monopolies, and information asymmetry. Free banking causes counterfeiting, wildcat banking, fraudulent banking, over-issue of banknotes and overexpansion by banks. Free banks are therefore prone to failures and lead to systemic banking instability. Economic and non-economic reasons have been given to justify banking regulations, such as to protect small depositors, to maintain monetary stability, to protect the payments system, to assure safety and soundness of financial institutions, to avoid or to limit the effects of failed institutions, and to encourage efficiency and competition in the financial system (Chu, 1996).

Pigou's (1938) classical treatment of regulation argues that where the market is imperfect, Adam Smith's "invisible hands" will not work. In reality, market perfection and market competition in the sense of pure competition do not exist. Asymmetric information and the costs of information are among the main reasons for market imperfections. Banks often have strong incentives to avoid providing information. Therefore, early economists[9] acknowledged the need for an alternative plan, hinting that this might be in the direction of central banking; they emphasised that banking markets could not function efficiently without a central bank.

One argument against self regulatory banking is that banks will collapse because of externalities due to market imperfection and asymmetric information. The imperfections that can impede the functioning of the market and that creates a potentially constructive role for government to enhance social welfare include monopoly which could harm competition, externalities[10], and/or information asymmetries in property rights and contract enforcement. The latter will impede the creation, verification, and enforcement of contracts to correct these market failures. Under this view Goodhart (1990) asserts that it is very difficult to know the reason behind a relatively high interest rate offered by a bank whether it will be offered because of greater efficiency or riskier strategies. In

[9] See for example, Tooke, T. (1848), A History of Prices, Vol. IV Tooke T. and Newmarch, W. (1857), A History of Prices, Vols. V, VI.

[10] Externalities induce markets to produce too many goods with negative social consequences such as banks extending excessive credit, and too few goods with positive social consequences such as information about borrowers.

other words, depositors are uninformed and unable to monitor banks because of information asymmetry.

Asymmetric information leads to 'free rider' and externality problems as well as contagious bank runs because depositors, particularly small ones, cannot discriminate between healthy and unhealthy (or problematic) banks. Consequently, there is no guarantee that competitive pressure would enforce good banking practices and a central bank is required to correct for market failure due to information asymmetry, which is the essence of a central bank (Sayers 1957, p.1). In general, theoreticians in the 19th century disagreed as to whether banks were best disciplined by competition or by a central bank. For instance, Goodhart (1989) argued that central control performed by the central bank can provide beneficial functions such as preventing financial crises in the banking sector that might arise from information problems associated with a bank's risk-taking. The emphasis of Goodhart's argument was on three possible reasons for the need for an inter-bank loan organisation (such as a central bank). The transaction and monitoring costs of inter-bank loans would be less if arranged centrally, the central authority would require banks to hold enough (socially optimum) amounts of reserves, and these reserves would protect the banking system from external influences that might be subject to contagion effects.

Hence, the argument went that as a result of countries lurching from one financial crisis to another and public concern over the soundness of the financial system, as well as to the rejection of competition as a means of controlling bank's behaviour, tight supervision and prudential regulation are necessary in order to check excessive risk taking. Coase (1988) argued that unregulated private actions create outcomes whereby social marginal costs are greater than private marginal cost. Social marginal costs occur due to the fact that bank failures have a great effect on the whole economy, whereas private marginal cost is directly related to the negative effect on shareholders' and employees' wealth. In this context, Chari and Jagannathan (1988) show that a little uncertainty about the nature of a bank run may trigger a system-wide collapse or a panic. Their view is that a number of the depositors, who are uninformed about the true value of their bank's assets, can only learn about the state of the bank by observing the line of depositors making withdrawals. However, they cannot distinguish whether there is a long line because of consumption needs or because informed depositors are getting out early. They may then infer (correctly or not) that the bank is about to fail and withdraw. This' panic' view is based on asymmetric information and a signal extraction problem, as the information is imperfectly revealed to depositors by the withdrawal decision of other depositors.

Theoretical literature on bank runs stresses that depositors are able to run from a solvent bank when insolvent ones are "attached". Diamond and Dybvig (1983), following Bryant (1980), develop a model in which bank runs are conceived as a random event originating as shifts in agents' beliefs. Now, Diamond and Dybvig's theorem has become a benchmark framework to study the issue of bank runs. In their view, a bank panic is not necessarily related to events in the real economy. Bank runs may be created by any event associated with any modification of customers' (depositors) expectations of the bank. In this situation, information asymmetries between the bank and its depositors may aggravate the problem. Since depositors cannot perfectly monitor bank performance, they may use imperfect signals from other investors to revise their expectations about the solvency of the bank. In other words any bad news, such as withdrawal signals or limited deposit insurance, may signal that a bank is in trouble and consequently depositors act in the same way resulting in massive deposit withdrawals and a solvent bank run[11]. Jacklin and Bhattacharya (1988) view bank runs as a result of rational revisions in beliefs about the riskiness of the bank's portfolio performance. Jacklin and Bhattacharya, argue that information about bank's investment in risky long-lived assets causes depositors to prefer early withdrawal, a demand that the bank cannot support with its assets, leading to 'information based' bank runs.

Therefore, one could argue that restrictions on competition would improve bank profitability, reduce failure rates and hence safeguard stability (Keeley, 1990). Under these circumstances, Dewatripont and Tirole (1993) stress the importance of protecting

[11] The "first come first served" rule in banking and the illiquidity of bank assets are two critical reasons for depositors' panics. Depositors will always choose to step to the head of the queue to avoid receiving less than they are promised and lose some or all of their deposits. On the other hand, it is important to distinguish between bank panics and runs. Where bank runs mean sudden waves of withdrawals, bank panic occurs when bank debt holders in all or many banks in the banking system suddenly claim their cash to such an extent that the banks suspend convertibility of their debt into cash (Calomiris and Gorton, 1991). In some cases, banks would suspend convertibility. Suspension, however, only occurs when depositors panic because of expectations formed conditional on observing the noisy indicator, but would not panic if they had full information (Gorton, 1985).

small depositors who do not have the sophistication or the incentives to analyse bank accounts or monitor their behaviour.

They place an emphasis on the role of well informed parties and regulators to control and monitor bank behaviour in order to protect depositors. Furthermore, Fama (1980) and Baltensperger and Dermine (1991) argued that regulation to prevent bank failure is warranted due to the unique services provided by banks. Thus, monitoring banks cannot be solved in a socially acceptable way by shifting this task to each depositor separately. Regulators attempt to prevent bank runs in different ways including for example: funding banks with equity rather than demand deposits; using central banks as lenders of last resort (LLR); and offering government deposit insurance (DI).

Nevertheless, the role of the LLR and DI are the two main examples of banking sector regulation used in the literature[12]. The main purpose of providing the central bank the role of LLR is to prevent the collapse of banks which are experiencing financial difficulties, protect depositors, and avoid any expected panic within the financial system. Central banks provide liquidity support directly to financial institutions if they cannot obtain finance from other sources. The classical conditions for an effective LLR are that the central bank should freely lend to solvent banks against good collateral and at a penalty interest rate (Freixas and Rochet, 1997). However, the LLR has been under attack from two different fronts (Freixas, 2003). First, the distinction between solvency and illiquidity may not be clear in a crisis, and second, as Goodhart (1995) points out, banks that require the assistance of the LLR are already under suspicion of being insolvent.

In recent years, the introduction of explicit DI systems has also become a widespread event. The potential vulnerability of deposit-funded banks to runs and the banking system's vulnerability to panics are often used as motivation for deposit insurance schemes (Diamond and Dybvig, 1983). DI is a solution to avoid bank runs. It is an implicit or explicit guarantee given to depositors in which all or part of their deposits

[12]Some suggest reforms to establish "narrow banks" which goes back to Simons (1948), which is a proposal banking system that would eliminate bank runs, as well as the need for deposit insurance provided by central bank. It would restrict banking institutions to hold liquid and safe government bonds, risky loans would be made by other financial institutions (see Litan 1987).

amount in a bank will be paid in the event of bank failure[13]. While complete government deposit insurance will protect banks from runs because there will be no need for depositors to react to banks' problems quickly, because there will be no fear of loss, this type of insurance is socially costly. The government will have to tax other sectors of the economy in addition to the banking sector, in order to be able to cover any expected depositors' payments (Barth et al., 2006).

In fact, while systemic regulation [14]can protect both depositors' wealth and the banking system from crises, the actual application of regulation has proved to be limited to correct for identified market imperfections and failures. A study by the International Monetary Fund (IMF, 1998) shows that banking crises are expensive and the cost, however, of resolving such crises can amount to 55% of an economy's GDP[15]. The main serious drawback of banking systemic regulation is that, for example, deposit insurance safety nets create moral hazard problems[16]. This is because their existence provides increased incentives for bank risk-taking that might result in insurance pay offs, and as such insured depositors have no incentive to adhere to market discipline when they suspect banks from taking on excessive risks (Mishkin, 1997).

In addition, deposit insurance increases the problem of adverse selection as depositors are not affected if loans are unpaid. Furthermore, moral hazard problems associated with regulation safety nets, that induce too-big-to-fail, too-important-to-fail, and regulatory forbearance behaviour are considered as further evidence of the limited

[13]DeCuster and Masschelein (2003) define explicit deposit insurance as an insurance prescribed by law, in contrast to implicit deposit insurance which is not laid down by rules but it is generally believed to exist. Before the actual existence of deposit insurance schemes, many governments had implicit deposit insurance through government intervention in the case of bank runs.

[14]In the banking literature, usually there is a distinction between three different types of regulation, prudential, systemic and conduct of business regulation. Where prudential regulation is mainly concerned with monitoring and supervision of financial institutions with more emphasis on asset quality and capital adequacy, Goodhart et al., (1998) define systemic regulation as regulation concerned mainly with the safety and soundness of the financial system. On the other side, conduct regulation focuses on the ways that financial institutions conduct their business. (See Casu et al., 2006 for more discussion on different bank regulation).

[15] In this study a distinction between currency crises and banking crises has been made. Currency and banking crises were identified for a group of over 50 countries for the period 1975–97.

[16] The safety net, defined as the protection of banks' creditors against losses resulting from bank failures, is motivated in the first place by the short maturity structure of bank liabilities and the private information characteristic of their longer-maturity assets, reflecting banks' unique liquidity creation and intermediation functions (Diamond and Dybvig , 1983).

benefits of bank regulation[17]. In this context, Bhattacharya et al., (1998) argue that because of the appearance of deposit insurance, banks are tempted to take on excessive risk and hold fewer reserves. Demirguc- Kunt and Detragiache (2002) find that explicit deposit insurance schemes tend to increase the probability of systemic banking problems and significantly increase the probability of a banking crisis[18]. Similarly, Milhaupt (1999) has argued that the existence of implicit deposit insurance results in even worse outcomes than explicit insurance. Implicit deposit insurance is more costly than explicit deposit insurance. As argued by Demirguç-Kunt et al., (2006) explicit deposit insurance can formally curtail the size of guarantees previously conveyed to banks that were government-owned or granted emergency blanket coverage.

It is recognized that deposit insurance and the existence of a central bank acting as a LLR to an insolvent banking system can encourage too much bank risk-taking and also can create the need for bank regulations to reduce moral hazard incentives. [Regulators have also instituted regulations historically with the same justifications that protect banks from competition by introducing restrictions on banking operations such as capital adequacy requirements (De Custer and Masschelein, 2003)][19].

Capital adequacy requirements were based on the risk weighted assets held by banks. The main belief here was that bank capital helps prevent bank failure and the amount of capital affects returns for the owners (equity holders) of the bank. In addition, capital adequacy ratio requirements serve to protect depositors and promote the stability and efficiency of the financial system (see Berger et al., 1995 for more discussion on the importance of capital in financial institutions).

In 1981, the first formal capital requirements were based on bank size but not on bank risk (introduced in Japan US and Europe). In 1988, regulators (the Basle Committee) adopted risk-based measures for the determination of capital adequacy namely Basel 1[20].

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[17] Government forbearance is an example of time inconsistency. It refers to a problem that it may not be optimal ex post (after the event occurs) to implement regulations that when optimal ex ant (before the event occurs. For further discussion on these practices see Mishkin (1997), and Casu et al., (2006).

[18] Demirguc- Kunt and Detragiache (2002) used a large sample of 61 developed and developing countries over a period from 1980 to 1997.

[19] Restrictions on entry and branches are other types of regulation. For further information on these types of regulation see Heffernan (2000).

[20] The Basel Committee was established by central bank governors of the Group of Ten countries (G10) in 1974 to foster cooperation on bank supervisory matters among the member countries.

Banks were forced to have sufficient capital believing that if a bank is forced to hold a large amount of equity capital, the bank will have less incentive to hold risky assets, because owners will have more to lose in the case of failure especially as capital is a costly source of funds. In other words, capital requirements reduce incentives to 'gambling' and moral hazard by putting bank equity at risk. Accordingly, the first international capital agreement, Basel 1, had two primary objectives: first, to increase bank capital and reduce credit risk, and to provide a level playing field for competition between banks of different countries through implementing uniform rules within countries (Palia and Porter, 2004).

However, even with the implementation of Basel 1, the regulatory authorities could not guarantee that banks would not take-on excessive risks since banks have a great incentive to hide their risk-taking activities in order to lower their required capital requirements. Banks' capital ratios calculated using the original Basel 1 may not provide a good indicator of a bank's financial condition because the systems created a structure that could lead to capital arbitrage[21]. Also, capital requirements have been perceived to reduce banks' franchise value and were not longer enough to yield efficient outcomes (Hellman et al. 2000). Basel 1 has also failed to maintain soundness in the banking system or to protect banks from failure. During the 1990s, many countries, such as, Mexico 1994, Asian countries 1997, Japan 1990, Turkey 1999, and Sweden 1991, among many others, faced banking crises which had a substantial impact on their economies (IMF, 1998).

Kaufman (1998), and Dowd (1996; 1998; and 2003) have contested the arguments in defence of bank regulation. They claim that capital adequacy regulation is both unnecessary and incapable of improving banks' capital position more than the banks could do on their own. Where Dowd argues that shareholders can enforce proper risk-

[21] Capital arbitrage arises when a bank chooses to sell, or simply chooses not to acquire, safer assets whose economic or market capital charge is less than the regulatory charge, while remaining or acquiring assets whose regulatory capital charge is less than the economic or market capital requirement. That is, banks can keep their regulatory capital ratios looking better than their portfolio risks might suggest. Capital arbitrage is mainly conducted by global banks. The internationalisation situation (when foreign firms play a critical role in a domestic financial sector encouraged by world financial liberalisation), and increasing international activities and trade of multinational corporations persuade banks to go global and operate cross borders. All this increases the development of ways of delivering financial services and produces innovative financial products, such as securitisation and derivatives, challenging the traditional approach to capital adequacy regulation.

taking behaviour, both authors think that capital adequacy can only help to counter the negative effects of other government interventions, such as moral hazard created by deposit insurance and bailouts of large banks (under the policy of too-big-to-fail).

Jones (2000) criticised Basel 1 by showing that banks can use financial innovation to increase their reported capital ratio without truly enhancing their soundness. Peek and Rosengreen (1997) also argued that well capitalised banks are just as likely to require regulatory action as under-capitalized banks. As argued by Matthews and Thompson (2005), Basel 1 has been criticised on a number of accounts: it is difficult to implement because of the differences in taxes and accounting rules between countries. Second, Basel 1 concentrated only on credit risk ignoring other types of risks in banking. Third, the Accord ignores the risk diversification issue in the calculation of required capital. Finally, it neglected the market value of assets, except for foreign exchange and interest rate contracts.

In response to the above concerns, considerable attention has been paid to reforming bank regulation in order to create a healthy and competitive financial services sector that is minimally affected by regulation, and simultaneously is a source of stability and strength to the economy at large. Accordingly, regulators have started to rethink the regulations by creating the right foundation for external (informal) forces which act on banking operations, namely market discipline. The main objective here is that although market participant (e.g. depositors) runs are very costly, if banks know that depositors may run, they should take appropriate action to abort depositors' reactions.

Hence, Basel 1 was adjusted to move from a rigid to a more flexible view of capital requirements. As stated by Molyneux (2002) "A convenient and accurate label for these supervisory changes is the 'marketisation' of capital adequacy supervision. Basel 2 recognises that external market discipline and rapid managerial responses in risk management to market innovations cannot be handled adequately via capital adequacy supervision based on the mandatory imposition of largely unchanging (or slowly changing at best) ratios and similar rules" Molyneux (2002, p2).

In April 2003, the Basel Committee on Banking Supervision released to the public the New Basel Capital Accord (Basel 2) which is expected to be implemented by the end of

2007. It takes into account other kinds of risk, considers heterogeneity between countries and concentrates more on market forces. Banks are now allowed to rely on their own internal models to assess and control risk. More emphasis is placed on reinforcing regulators to add disclosure requirements to bank institutions, in order to increase transparency and foster market discipline aiming to provide more risk sensitivity to capital requirements. Basel 2 advances three regulatory pillars: minimum capital requirements, supervision and market discipline. It allows banks to choose between different approaches to measure three types of risks: credit, market and operational risk.[22, 23] The main perspective of Basle 2 is that regulation should proceed using rules in addition to creating incentives for appropriate behaviour. This view is consistent with solvency theory which states that crises in the financial sector are a consequence of real shocks and depositors can distinguish between bad and good banks and a bank run depends on bank fundamentals (Kindleberger, 1978). Market discipline is a market-based approach which regulates banks by the 'invisible hand' as opposed to the very visible hand of direct government regulation and enforcement. The invisible-hand approach to regulation aims to align the incentives of market participants with the objectives of the regulator, thereby harnessing the same powerful forces that allow markets to work so efficiently. Hamalainen (2006) has noted that using cost benefit analysis for introducing incentive based solutions for bank regulations, rules and incentives may be the only solution to effective bank regulation. He argues that regulatory policies with incentives that induce behavioural responses can be created for all bank stakeholders and this enhances corporate governance mechanisms.

Consequently, market discipline mechanisms are seen as one of the main ingredients of maintaining a sound banking system (Vives, 2001). Bernanke (2007, p 8) has stated that: "as opposed to the very visible hand of direct government regulation and enforcement. The 'invisible-hand' approach to regulation aims to align the incentives of market participants with the objectives of the regulator, thereby harnessing the same powerful forces that allow markets to work so efficiently". While Levine (2005) suggests that strengthening official supervisory powers hurts bank development and

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22 For more about the New Accord see http://www.bis.org/plupl/bcbsca.htm.

23 The broad classification of required disclosures are: scope of application, capital structure, capital adequacy, credit risk exposure and assessment, credit risk mitigation, market risk exposure and assessment, operational risk exposure and assessment, equity exposure and assessment, securitisation exposure and assessment, and exposures to interest rate risk in the banking book.

leads to greater corruption in bank lending without any compensating positive effects, he argues that market based regulations that require informational transparency and strengthen the ability and incentives of the private sector to monitor banks tends to promote sound banking. Because, if the risk position of the bank can be assessed (for instance by depositors or shareholders) a bank cannot increase its market share and profits by taking on more risk because investors will discount this risk. Furthermore, disclosure requirements may help to make the risk position of banks better assessed and this should increase the tendency towards credit rationing of wealth and also increases the cost of borrowing for high risk-taking banks. In other words, markets may contain disciplinary mechanisms that reward banks that manage risk effectively and penalise those whose risk management is inept or imprudent. Thus, some economists and regulators assume that market forces will reinforce bank capital regulation and supervision to ensure safety (Distinguin et al., 2006).

2.1. The Concept of Market Discipline

The idea of market discipline is not new in banking. Leathers and Raines (2000) trace it back to the free banking era in Scotland. The recent increase in academic attention to market discipline has been bolstered by the Basel Committee on Banking Supervision when in 2003 it emphasised the role of market discipline in Pillar 3 of proposed revised capital framework (Basel 2). Market discipline in the banking sector can be defined as a situation in which private sector agents[24] face cost increases as banks undertake risks, and take action on the basis of these costs (Berger, 1991). It refers to what is called a market-based incentive scheme in which banks depositors (or debt holders) punish banks for greater risk-taking by demanding higher yields on those liabilities. Although banks are required to hold capital buffers against adverse outcomes in their investment of creditors wealth (mainly depositors) in risky assets (loans default), their solvency target may not take into account the interests of lenders or even society as a whole. Hence, market discipline can be expressed as a tool for safeguarding the integrity of the financial system by making risk-taking more costly which curbs the incentive to take excessive risks (Nier and Baumann, 2006).

[24] Greenspan (2001) defined market discipline as private counterpart supervision.

Market discipline tends to be beneficial for the banking system in different ways. First, by penalising high risk-taking banks, increased market discipline may reduce moral hazard incentives (Martinez-Peria and Schmukler, 2001). Second, market discipline may improve the efficiency of banks (through a change in management or bank mergers) by putting pressure on relatively inefficient banks to become more efficient or exit the industry (Berger, 1991). In other words, market discipline appears to increase competition and decreases monopoly power (Vives, 2001). Third, as argued by Ghosh and Das (2003) and Hamaliainen (2006), markets give signals about the credit standing of financial firms which can be combined with inside information gained by supervisory procedures and then increase the efficiency of the overall supervision process. Flannery (1998) suggests that market information may improve two features of the overall process for regulators by enabling them to identify incipient problems more promptly. In addition, it provides them with an incentive and justification to take action more quickly as soon as a problem has been identified. In this sense, market discipline may be able to supplement the traditional supervisory assessments to distinguish good banks from bad banks therefore; it is more likely to lower the overall social costs of bank supervision (Flannery, 2001). Particularly, the market is difficult to lobby for forbearance and reacts more quickly than regulators to increased bank risk-taking and thereby reduces systemic risk. Market price information more accurately detects the actual risk in banking firms by providing incentives for rational market investors who are at risk from bank failure.

Fourth, as illustrated in Hamaliainen (2006), informed market participants who can conduct market discipline tend to be able to reduce regulatory pressures imposed on the financial institutions. For example, a recent proposal by the UK's Financial Services Authority (2001), to create only wholesale deposit-taking banks, allows them to reduce regulatory controls over these banks and enables them to concentrate on those banks that are in more need of protection. Because, wholesale depositors are able to make informed assessments of the firms they deal with, they will be in less need of regulatory protection, or they may even help regulators adopt stricter regulatory control when it is needed. Wall (1989) and Evanoff (1991) suggest market discipline mechanisms which act as triggers for bank closure, lead to prompter action by the authorities and, as a consequence, fewer claims on the deposit insurance fund.

Using market discipline within a regulatory framework for the financial system is not without its cost. Goodhart et al., (1998) argue that greater emphasis on market discipline may increase the probability of bank runs and may have knock-on effects within the financial system (Diamond and Dybvig,' 1983), because of the existence of asymmetric information in the banking industry and the lack of a secondary market in bank loans. To the extent that sophisticated savers have an advantage in recognising and reacting to market information, it is possible that small uninformed savers might be at greater risk of incurring proportionately greater costs if failures occur (VanHoose, 2007). In addition, the resources needed to provide enough information in the market in order to help with appropriate market discipline functioning may enable large banks to have cost advantages over smaller banks. With inaccurate information and unqualified market participants, regulators may receive misleading signals which can lead to inappropriate reactions.

Therefore, Lane's (1993) conditions for effective market discipline require some degree of regulatory agency monitoring in order to be effective[25]. This suggests that market based regulatory policies needs some rules in order to create efficient and effective supervision. Hamaliainen (2006) suggests that market discipline is unlikely to be a substitute for supervisory monitoring. While the existence of insured funds by supervisors is necessary to ensure that banks do not take-on excessive ex ante risk, market discipline is important in assessing whether the regulatory authority has met its goals.

2.2. The Relevant Monitors

Market discipline appears justified by the aforementioned arguments and it therefore seems legitimate to encourage the monitoring of banks by professional investors and financial analysts as a complement to banking supervision (Decamps et al., 2004). But, incorporating market discipline in the regulation process poses an important question. Which participants have enough disciplinary power to influence bank behaviour, and then are able to influence future bank decision-taking? Generally speaking, all parties that provide funding to banks have good incentives to monitor banks.

[25] See section 2.3 for the conditions and process of effective market discipline.

However, it should be recognized that monitoring is a costly activity hence; if the expected monitoring costs outweigh the expected benefits no effective monitoring will take place (De Ceuster and Masschelein, 2003). In other words, monitors need to face costs that increase as firms undertake risks and to take action as a result of these costs (Berger, 1991). Llewellyn (2002) develops the concept of a "stakeholder monitor". Stakeholders, as the name implies, have something at stake in the relative success or failure of the firm. Stakeholder monitors are all those private agents who have an interest in the outcome of the monitoring process, such as investors or equity holders, and debt holders such as depositors.[26]

According to Hamalainen et al., (2005), market discipline occurs when a deposit-taking institution can receive signalling from the stakeholders to assess the risk of their activities. Depositors can withdraw their deposits and move them to a safer bank, debt holders are able to demand a higher yield thereby increasing the cost of funds for riskier institutions, and equity holders can sell their shares and may put downward pressure on share prices which may place management under increased checks (Berger, 1991).

Debt holders are usually insured or secure the bank's debt over the assets of the bank, thus they do not have the same risk as depositors or other unsecured liability holders. Furthermore, equity holders are potential monitors since they have a large or small stake in the bank, they can exercise various corporate governance mechanisms to influence bank managers. Then managers have incentives to act in a way consistent with the equity holder's interests (Cannella et al., 1995), because equity holders can influence managerial turnover. Sufficiently unsatisfied equity holders can create an environment that facilitates a hostile takeover (Jensen and Ruback, 1983), but they cannot directly cause a run on a bank (Horvitz, 1983)[27].

In fact, shareholder monitoring has been criticised, since shareholders and bank management prefer to seek upside risk where on the downside, equity holders' loss is limited to the extent of their investment. Evanoff (1993) argued that equity holders have an incentive to select high risk-taking banks (moral hazard problems) and this is

[26] Some monitors do not have a direct economic stake in the financial firm such as rating agencies: the cost they suffer if they fail to rate banks according to their risk is primarily in reputation.
[27] They may react by selling stock in secondary markets.

inconsistent with the regulatory authorities' incentives for monitoring, as such they are unsuitable market discipline instruments. On the other hand, as argued by Tsuru (2003), depositors are not entitled to any special benefits if the high risk-taking bank succeeds, depositors will suffer from losses in the case of bank failure therefore depositors should have greater incentives to suppress banks' excessive risk-taking activities[28]. Although regulatory authorities monitor banks to represent the interests of small depositors, who are not themselves experts in bank monitoring, Murata and Hori (2006) argue that the options of depositors to shift their deposits from risky banks to safer ones (rationing their investment) may be able to perform a disciplinary role by means of 'exit' not 'voice', as defined by Herschman (1970).

Depositor discipline is not only an important pillar of a sound banking system, but also of overall economic efficiency, since market discipline is an element for financial efficiency and in the absence of discipline, depositors implicitly subsidise the risk taken by their banks and this raises the probability of failure. Bank failure, through contagion effects, imposes potential costs on a banking system or on the economy as a whole and so using depositor discipline to reduce the likelihood of such outcomes will benefit the economy overall (Birchler and Maechler, 2001). In this context, D' Amato et al., (1997), for example, show that contagion in depositor behaviour may have played an important role in the 1994-95 banking crisis in Argentina. Depositors usually discipline the behaviour of banks through two channels, cost (price) and quantity.

Economists believe that small and insured depositors cannot play an important role in monitoring since they have no incentives to react in the market. Therefore, they should be insensitive to bank risk. In contrast, uninsured depositors would be the primary monitors of banks because they are exposed to bank risk-taking behaviour and may lose their deposits above the deposit insurance ceiling if their bank fails (Park and

[28] Besides equity holders and depositors, subordinated debt holders can also serve as potential monitors. Subordinated debt holders lose their stake when the bank defaults but they do not have any benefits of any upside gain when the bank takes-on excessive risk, so subordinated debt holders have even stronger incentives than equity holders to monitor the bank to limit risk-taking (see e.g. Gorton and Santomero, 1990; Karacadag and Shrivastava, 2000; Sironi, 2001; and Caldwell, 2005). In addition, Flannery and Sorescu, 1996) stated that the premium on subordinated notes and debentures is related to balance sheet measures of risk of bank holding companies In addition, specialised information firms such as auditors and rating agencies assess the condition of banks. Their incentives are not directly linked to the future value of the banks' securities, but instead depend on their own reputation and accreditation.

Persistiani, 1998)[29]. However, some studies also suggest that insured depositors (e.g. Davenport and McDell, 2006) are sensitive to a bank's condition. Similarly, Martinez-Peria and Schmukler (2001) also find that even insured depositors have acted to discipline banks in developing countries such as Argentina, Chile and Mexico during the 1980s and 1990s. Depositors are concerned not only about the solvency of individual banks, but also about the solvency of their deposit insurance fund and the actual willingness of governments to support failed banks.[30]

Since deposits are the most important source of banks financing in emerging markets, and depositors are sensitive to any increase in bank risk due to the nature of deposit contracts (no upside gain on an existing deposit), depositors seems to be the critical market player to practice discipline on bank risk-taking in emerging markets.

2.3. The Process of Market Discipline

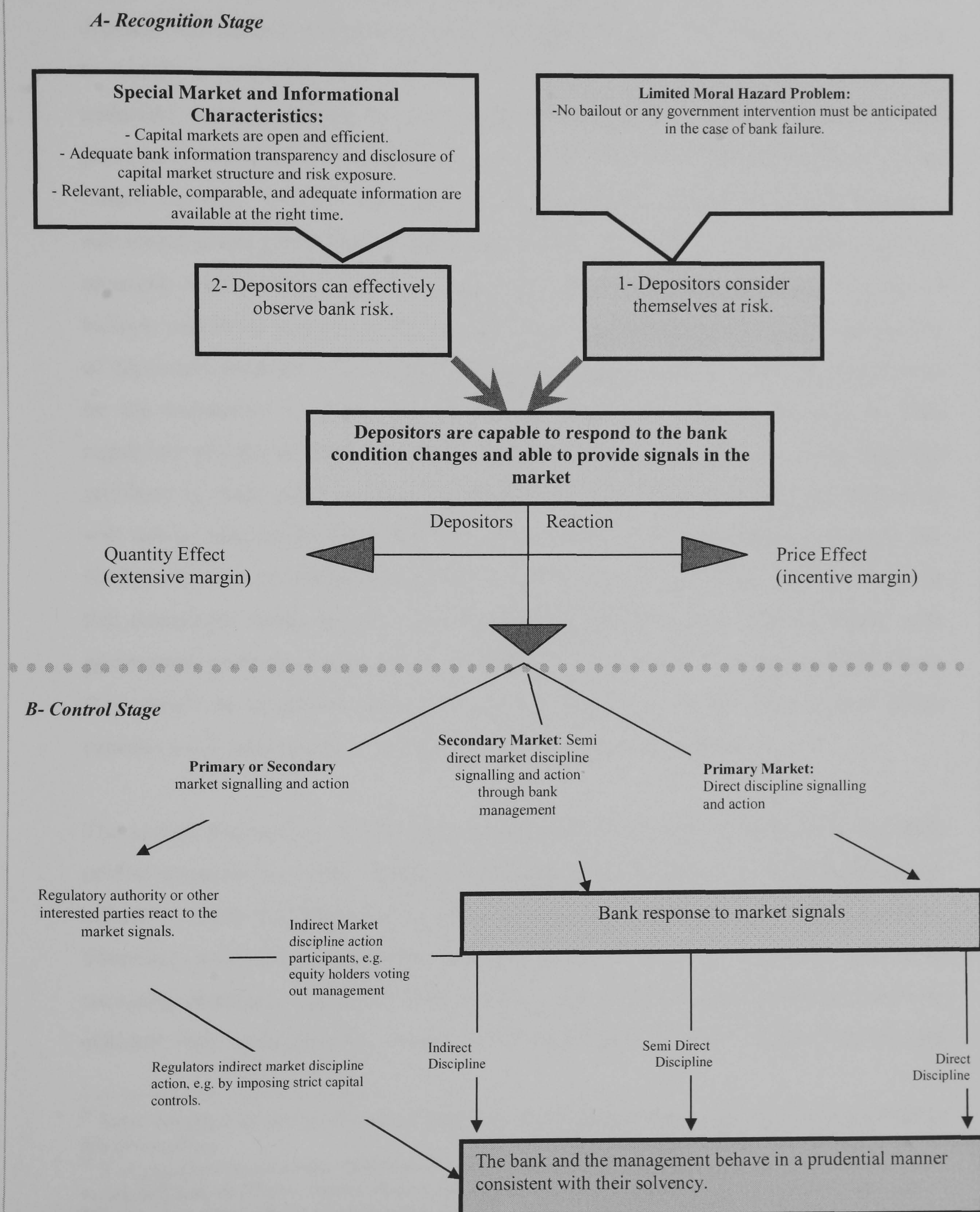
Market discipline is thought to be a multi-dimensional concept (Hamalainen et al., 2005). In order for market discipline to be a complementary regulatory tool, and therefore operate effectively in safeguarding the financial system and the economy from crisis, market participants need to act according to two distinct procedures. First, they have to monitor the risk, and then they have to influence the banks risk-taking behaviour (Flannery, 2001). A recent study by Hamalainen et al., (2005) suggests a two stage process, the recognition and the control stages. The control stage proposed by Hamalainen et al., (2005), and the influence stage proposed by Flannery (2001) have the same meaning, namely, the ability to have an effect on bank behaviour. However, Hamalainen et al., (2005) distinguishes the recognition stage from the monitoring stage, the former describes the process of checking bank behaviour, the latter means successful checking or a successful way of monitoring. The sequential process of market discipline is summarised in Figure (1.1). The analysis discussed in the following

[29] Certificates of Deposit (CDs) holders seem to be a good source of market discipline because usually CDs have a high denomination (in most cases more than 100,000$ and, unlike other deposits, they can be traded on the secondary market (see e.g. Hannan and Hanweck 1988, James 1988, 1990; Cargill, 1989, Jagtiani and Lemieux, 2001; and Keeley 1990, among many others).

[30] In the following sections, we will concentrate on depositors since they have the most monitoring incentive power, particularly in emerging markets where most banks depend on depositors as a financial source rather than financial markets' source of funds.

sections draws on the discussion suggested in Hamalainen et al., (2005), and Hamalainen (2006).

Figure 1.1: The Process of Market Discipline



Source: Adopted from Hamalanian 2006, and Hamalanian et al (2005), adapted by the author.

2.3.1. The Recognition Stage

In this stage, two pre-conditions should be satisfied in order to enable investors (or depositors) to recognize or monitor bank risk[31]. The first precondition is that investors must first consider themselves to be at risk, (see Morgan and Stiroh, 1999). In this case, depositors should not expect any explicit or implicit support if the bank cannot manage to sustain a particular safe risk position and they should have high incentives to undertake effective monitoring. Conversely, the incentives for the depositors (market participants) to monitor are weakened when the losses likely to be incurred from a bank failure are low. A supervisory regime which provides guarantees cannot expect a substantial amount from market discipline, for instance: where too-big-to-fail issues are apparent, where there is full cover deposit insurance, where has been a history of bailouts and so on (Llewellyn, 2005). The greater the probability of rescue or protection of depositors from the consequences of excessive risk-taking by banks the weaker will be the incentives for depositors to monitor bank behaviour. In the case of high regulatory protection, deposits may be attracted to high risk banks, to cover liquidity problems in some cases, without affecting prices. Thus, bank moral hazard behaviour will not be affected by depositor behaviour or risk-taking may actually be increased. Banks will take on riskier investments or reduce capital and liquid reserves knowing that depositors' funds are protected if excessive risk-taking fails. On the whole, with government protection, risky banks are enabled to continue excessive risk-taking where they should be penalised directly by market participants or the latter should signal excessive risk-taking to the regulators for subsequent intervention[32].

The second precondition is that depositors should process the information of the bank profile correctly (Crockett, 2002). Unrestricted open capital markets are required for effective market discipline and to enable depositors to access the needed information. Therefore, proposals that enhance bank disclosure may improve depositors' ability to recognise changes in bank condition, thereby market discipline works earlier and in an efficient way, increasing the incentives for banks to raise their internal controls and

[31] Since this paper focuses on depositors' discipline, we will concentrate on depositors as the main market discipline player.

[32] It is important to note here that there are some depositors/ individuals that need to be protected for social, political, or ethical reasons. Hence, for a successful policy proposal a trade-off between protection costs and benefits needs to be evaluated (see Lane, 1993 and Calomiris, 1999). Recently new designs of deposit insurance have been aimed at achieving such aims including: co- insurance, risk related deposits insurance premiums and restricting protection to "Widows and Orphans" (Hamalainen et al., 2005)

monitor bank management practices. In this context, information that is relevant, reliable, sufficient, and of the appropriate quality, is needed at the right time (Berger 1991, Lane 1993 and Hamalainen et al., 2005). At this stage, if market discipline is effective, depositors monitor the risk profile of the financial institution and without delay impound any changes in the firm's condition in deposit rates demanded. This is termed the "price effect" by Park and Peristiani (1998, p 349). This may also correspond to adjusting the results of the amount of deposits held at banks causing what is termed the "quantity effect".

On the other hand, if depositors cannot effectively assess bank risk, inaccurate signals will be transmitted to banks. Cordella and Levy-Yeyati (1998) illustrate the effects of limited or no disclosure and deposit insurance on banks' risk-taking behaviour. They find that if depositors cannot observe bank risk, they will be unable to practise market discipline. They cannot reward low risk banks with lower interest rates and therefore banks will have less incentive to spend resources on monitoring or selecting their customers in order to obtain high quality loan portfolios. In addition, they show that deposit insurance affects price competition and reduces risk-monitoring by banks. On the other hand, depositors who can recognise more risky banks will ask for higher interest rates or compensation. Good disclosure will help in pricing bank risk-taking and this will force banks to move towards quality competition that lowers their risk profits.

VanHoose (2007) argues that the response or reaction of depositors may take one of two forms. First, depositors can respond to changes in banks' conditions by reducing the quantity of fund supplied to the bank or be willing to continue supplying the same quantity of fund at a higher rate of return, which is what VanHoose term as an incentives margin. Second, they may react by cutting off their supply of funds to the insolvent bank, known as the extensive margin.

However, it is important to note here that for effective market discipline, the market should process information efficiently. Markets need to be efficient in the sense that prices reflect the risk characteristics of individual banks. As noted by Llewellyn (2005), bad bank regulation, such as the imposition of inappropriate capital requirements, may create distortions in the banking industry, such as mis-pricing of risks or mis-allocation of capital, which can affect efficiency and consumer welfare.

2.3.2. The Control Stage

If market participants effectively recognise that they are at increased risk due to bank risk taking behaviour, and then they react to adjust the cost and availability of funds in a manner that reduces underlying bank risks, the market will achieve what is called the control stage. In this stage, market participants will affect the financial institution directly or indirectly. Consequently, the true risk control, as argued by Lane (1993), depends on whether the bank responds to the market signals and responds in a way consistent with their solvency. Flannery (2001) defines this stage as a market influence which is the ability of market participants to affect a firm's financial decisions. Hamalainen (2006) argues that the influence of market participants on bank risk-taking should be analysed with regard to the relationship between market participants and the bank. He proposes three market discipline signals (and actions) that can be used to explore the effectiveness of market discipline.

First, direct market discipline is the direct pressure that occurs in the primary market caused by market participants. The action involves a direct response from market participants through the cost and the quantity of funding. In this market discipline the signalling and the action occur concurrently and are carried out by the same market participants. Hence, investors (debt or equity holders) would be successful in exercising market discipline if the bank's cost or ability of funding is affected.

Second, semi-direct market discipline exists through internal parties (bank management). In this type of market discipline action, current investors aim to control bank management risk-taking through signalling changes in price or selling (withdrawal) of their investments. Unlike direct action, the existing debt holders will have more ability to influence management behaviour than primary market participants (potential investors). For instance equity holders have voting rights, and bond holders may have covenants attached to their holdings.

Third, indirect market discipline occurs when the recognition of risk results in signals that are used by other parties (e.g. regulatory authorities) to initiate disciplinary action against banks. Hamalainen (2006) describes this stage further as the ability of the third party to extract signals that initiate action from either the primary market (changes in yield spreads), or secondary market discipline (the availability of new funds).

Additionally, signalling and actions are performed by different market participants in this type of discipline. On the other hand, market discipline signals and the supervisors' reactions may complement each other. Although supervisors and regulators may have more confidential information reported to them about the bank, they may lack the fine transactional information that comes from repeated market interaction. Thus, depositors' reactions towards insolvent banks can push supervisors to act appropriately and stop bank runs quickly.

Actual risk control and the successful control stage depends heavily on whether the bank and its management react to the signals and behave in a manner consistent with the banks overall solvency. So there is a need for managers to respond to market prices and quantity signals. Lane (1993) suggests that borrowers may not respond to market signals Nevertheless; if managers do not respond to signals received from the market and then do not change behaviour, market discipline will not be effective. Such management incentives and responses may be induced by the incentive structures faced by bank managers (Llewellyn, 2005).

For example, incentive structures may be affected when managers adopt short-term behaviour or when management rewards depend on generating business volume. Incentive structures aim to ensure that the responsibility for the prudent management of banks lies firmly with management, and will ensure that bank stakeholders will have the ability to impose conditions that restrict or control these activities. Furthermore, a strong corporate governance environment should also ensure that bank management has the right incentive contracts to manage the bank in a responsible fashion (BIS, 1997).

On the whole, for market discipline to work effectively, depositors (market participants) and managers should have adequate incentives to respond to the changes in bank condition and market signals, respectively. The incentives of both parties may be induced by timely publication of relevant, reliable and high quality information about the condition of the bank. In addition, any factors that reduce the incentives of depositors to conduct monitoring, such as regulatory rescue in the case of bank failure, should be removed, and strong corporate governance would be recommended to boost management response. An active market with sufficiently well informed players will result in accurate signals being absorbed directly or indirectly by the bank management to correct the bank risk profile.

2.4. Market Discipline in Emerging Markets

The occurrence of various emerging market banking crises has motivated regulators to investigate the use of policies based on market discipline in order to encourage banks to behave in a prudent way. Demirguc-Kunt and Detragiache (1998), in their cross country study for instance, have found that the risk of hosting a banking crisis is influenced by factors such as macroeconomic imbalances (slow growth, high inflation), inadequate market discipline (which they attribute to the presence of deposit insurance and weak institutions), and liberalisation (as an indication of the removal of interest rate controls). In addition, financial instability may also have arisen as a consequence of financial globalisation. Many emerging markets have realised the positive effects of financial globalisation on economic growth by reducing capital transactions costs and increasing the amount of capital availability. International organizations such as the International Monetary Fund (IMF) and the World Bank (WB) in addition to the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO), promote globalisation in emerging markets. (See Mishkin (2007) for a recent analysis of globalization in emerging markets).

However, among the negative consequences of globalisation have been the emergence of contagion effects, expected outflows of investment capital, and the increased risk of foreign exchange crises (Kim, 2003). Maintaining sound financial regulation through market discipline may therefore be one of the important steps to reduce possible negative effects of globalisation.

Although, evidence suggests that market discipline may exist in emerging markets (see, for example, Martinez-Peria and Schmukler, 2001), whether it works well as a tool for controlling banks risk-taking behaviour is open to debate. This is because policies and recommendations relating to the implementation of market oriented regulation may appear straight forward in emerging markets, but a successful implementation of such policies may prove more difficult (Levy-Yeyati et al., 2003).

Vives (2006) suggests that in emerging market economies the asymmetric information problems are more real. He argues that the production of information is more problematic due to special institutional factors[33]. Lack of sufficient information, weak disclosure rules and accounting standards, small bank size and relatively high fixed costs of information production all aggravate asymmetric information problems. Such asymmetries affect the development of the financial system.

The traditional deposit and lending functions of banks is typically more important in emerging economies (Allen and Santomero, 2001) than the developed economies and banks remains central to the financial system overall. In fact, in emerging markets, the main source of external financing is bank loans. This issue has a direct effect on the relationship between banking system development and economic development. Bank fragility, therefore, can have a bigger effect on emerging economies[34].

In emerging economies, debt and equity issuance is likely to be less than in the developed economies and the secondary markets tend to be thin (Levy-Yeyati et al., 2004). Also, the responsibility for the generation of information and the role of contract enforcement lie relatively more on financial institutions than markets (Vives, 2006). Thus, price and quantity signals from market participants may become noisy signals of the underlying bank condition, reducing their potential as a market discipline tool. Accordingly, many practitioners think that as markets plainly do not function well in low income countries, then it must be the case that where market discipline also does not work these countries need to rely more heavily on capital and regulatory supervision. In this context, Caprio and Honohan (2004) have argued that offsetting factors to the weaker market and formal information infrastructures in emerging markets are due to the less complex character of banking business in low-income countries, the growing internationalisation of these markets through the presence of foreign banks involved in

[33] Llewellyn (2005) divides market impediment factors into structural and policy induced factors. Structural factors are institutional factors, policy induced factors refer to monitors' protection that may affect the market discipline functioning.

[34] In fact, since banks are the main creators of liquidity, they will be more in danger of deposit runs. At the base of a bank run is the coordination problem of depositors who may be able to turn a sound bank into a failed one when they decide to call back their short term deposits. The banking literature summarises two views of crises: the multiple equilibrium panic view (Diamond and Dybvig, 1983) which relates bank run to events unrelated to bank fundamentals, and the information based view (Gorton 1985, and 1988, and Jaklin and Bhattacharya (1988) which relates bank runs to bad news about the assets of the bank. Recently, these views have been developed by linking the probability of a run to the strength of fundamentals (Morris and Shin 2000, and Goldstein and Pauzner, 2005).

international trading of the debt and equity of locally-controlled non-government banks; and, the smaller size of the business and financial community. For these reasons, most existing studies of market discipline in emerging economies focus on the behaviour of depositors.

Moreover, given the disappointing record of governments around the world as monitors of their self-owned banks, the continuing dominance of the public sector in some emerging economies limits the likely development of market monitoring. (Caprio and Honohan, 2004)[35]. Furthermore, Levy-Yeyati et al., (2004) suggest that government ownership of banks is an institutional factor which affects market discipline for a number of reasons, firstly government owned banks restrict stockholder monitoring and they are not publicly held. Secondly, due to the size of state banks and their role as vehicles for political lending, state banks are usually assumed to be protected by implicit government guarantees or even explicit protection.

Regulatory policies may play a critical role in reducing market discipline. In general, the aim of regulation is to provide the banking and financial system with stability and avoid the negative effects associated with failing institutions and systemic crises, and to protect small investors from losses. On the other hand, if the losses that are likely to be incurred with the failed bank are low due to regulatory protection policies, incentives for depositors and banks to incur costly monitoring are also weakened. As previously noted, too-big-to-fail protection, generous deposit insurance schemes, forbearance and a policy history of bailouts seem to be more prevalent in emerging economies because of their high systemic risk and expected contagion effects. However, because this protection tends to be under-funded, their creditability is likely to be questioned especially at a time of systemic crisis. In this context, Martinez Peria and Schmukler (2001) find evidence of comparable market responses among insured and uninsured depositors in Argentina, Chile, and Mexico which they attribute to the lack of confidence in the existing insurance schemes or implicit guarantees due to lack of funding or long delays in repayments.

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[35] As stated in Levy-Yeyati et al., (2003) using data collected by Barth, et al., (2001), the percentage of banking system assets that are 50% or more government -owned average 23% among emerging economies, while the corresponding statistics are 11% for high income OECD countries and 8.5% for high income OECD countries.

Generally, the ex-ante involvement of bank regulators (mainly central banks) in emerging and developed markets in dealing with banking sector problems usually takes the following forms: the central bank may want to commit to closure if bank returns are low, signalling a solvency problem, and help the bank if returns are only moderately low, signalling a liquidity problem. Such a commitment provides incentives to bank managers to behave prudently in managing bank risk. However, costly liquidations may not be optimal so regulators may neglect the choice of carrying out bank closures, therefore damaging their credibility. Vives (2006) argues that it is difficult for central banks in emerging markets to build a reputation for disciplining banks because the central banker's effective horizon is short as a result of political instability and the lack of protection for banks supervisors who attempt to impose discipline.[36]

Another distinctive factor affecting market discipline in emerging markets is the high uncertainty relating to economic volatility. Emerging countries experience greater macroeconomic volatility with greater swings in external flows and higher vulnerability to external shocks. Also, these countries are typically exposed to larger exchange rate risks, more systemic (non-diversifiable) risks in their bank loan portfolios which require more skilful management and monitoring by banking system supervisors[37]. Moreover, weak domestic currencies can often lead to the dollarisation of domestic savings or to the shortening of deposits ready for foreign currency transformation. This link between exchange rate and currency rollover risks tends to cause systemic financial fragility (Vives, 2006).

Additionally, emerging markets economies tend to have a weak supervisory structure. According to Vives (2006, p.10), 'Supervisors are either more easily corrupted, because of the lack of resources and low salaries, or more vulnerable to retribution if they do not acquiesce to the demands of lobbies, because of the lack of effective legal protection.' On the other hand, conventional government regulation of banks may backfire because regulators maybe incompetent or corrupt. Instead of protecting the public interest, regulators often end up saving the banking industry and its political supporters. This is

[36] Cukierman (1992, Chapter 19) gives an example of Argentina in the 1980s where the average term in office for a central bank governor was less than a year while the legal term was 4 years.

[37] For more information of regulation in emerging market (see Vives, 2006; and Levy-Yeyati et al., 2003).

illustrated by the fact that about two thirds of low and medium income countries have experienced major banking crises over the last 30 years costing their governments as much as 50% of their GDP (for example, a study by IMF (1998) indicates that the Argentina crises which occurred in 1980 and 1985 cost up to 55% of the country's GDP)[38].

In this context, Barth et al., (2006) support the view that increasing the powers of official bank supervisors in developing countries does not reduce the likelihood of banking crises nor does it compensate for reduced private sector monitoring caused by deposit insurance. So the question arises here is: Is there any chance for market discipline to work and support capital requirements and supervision in emerging markets in order to derive a safer and sounder banking system?

It has been noted that while there are clear limitations to the usefulness of market discipline (for example due to, institutional factors, inadequate regulatory policies, lack of accurate information), still there is a chance for the market to participate in improving the condition of banks as a complement to capital requirements and other types of supervision. (See the next section for some empirical evidence on market discipline).

The global trend is towards placing increased emphasis on market discipline in the supervisory process (Ward, 2002). Given that capital markets are underdeveloped probably the best channel to discipline banks is via the role of depositors who are present in all countries and should be more aware of the riskness of banks that operate in volatile economic environments. A key factor in assessing the likely effectiveness of depositor monitoring is the nature of the informational environment. Timely and accurate information to guide market participants is an essential prerequisite for effective market discipline[39]. Flannery (2001) specifies that market information may help to produce a more efficacious application of supervisory influence either by supplementing supervisors' assessments of bank condition, or by replacing supervisory

[38] Bank crises, of course, also occur in high income countries, such as the US Savings and Loan crises in the United States in which around 3000 banks failed costing about $180 billion.

[39] The third pillar of the new Basel Accord (Market discipline) emphases disclosure should be made on a semi-annual basis and includes (among others): structure of the capital, and risk exposures and assessment.

discretion with a legislated rule. Additionally, disclosure requirements are almost certainly beneficial. Barth et al., (2001) find that regimes with higher levels of bank information disclosure have significantly lower levels of government corruption. On the other hand, disclosure may not have the desired disciplinary effect. A supply of accurate and timely information is necessary, but is not in itself sufficient to discipline bankers (Karacadag and Taylor, 2000). Therefore, one should realize that the importance of making market discipline more effective within the context of market safety nets is strongly influenced by the role played by public safety nets that obviously temper market discipline solutions.

Bankers' incentives are the most important. Thus, public intervention should be designed so that bankers fear failure. 'Risk-sensitive' capital requirements are neither necessary nor sufficient for incentive-compatibility. The stake of the government and market participants in the financial system are not perfectly aligned. Neither supervisors nor market participants are unambiguously more timely and accurate in their assessment of risk than others. All groups produce valuable complementary information that contributes towards improving the performance of banks (Berger et al., 2000). The idea is not that market monitoring can effectively replace official supervision, but that it has a potentially powerful role within the overall regulatory regime. In particular, it has the advantage of increasing the efficacy of the overall supervisory process.

3. Literature Review

Considerable efforts have been paid by researchers and supervisors to examine the existence of market discipline. In the market discipline framework, debt holders, depositors, and shareholders can put pressure on banks, decreasing the quantity of funds or raising the funding premium on debt, deposits, and equity. Since depositors are common to all banks in developed and developing countries, there is an argument in the literature that depositors may have the ability to share the burden with regulatory supervisors to increase the safe operation of the financial system. In contrast, shareholders incentives to increase their own profitability may outweigh their desire to decrease bank risk (Tsuru, 2003). The main reason for this is that the more risks banks take, the higher the expected return for shareholders. Park and Peristiani (2007) argue that shareholders can either be considered as 'enemies' of regulators, by condoning increased risk-taking on the part of banks with option values that exceeds their charter values, or 'allies' for regulators by punishing risky strategies of low option value institutions. As a bank's risk of failure increases, equity holders may switch from ally to enemy status. Park and Peristiani use Tobin's Q to infer bank charter values, and argue that the burden of market discipline generally falls on the shoulders of debt holders. Therefore, the market discipline literature typically focuses on the reactions of private debt holders to bank actions[40]. In the following sections, previous evidence of market discipline will be analyzed

3.1. Review of Empirical Evidence Concerning Market Discipline

As long as there is heterogeneity across banks in terms of asset quality, earnings, liquidity, and capital structure, depositors can attempt to distinguish ex ante between healthy and weak banks. In general, early studies of market discipline extensively analysed the U.S. financial system (see Table 1 in Appendix 1.1 for a brief summary of previous studies). These studies can be divided into three main groups. The first group of studies (e.g. Crane, 1976; Hanan and Haweck, 1988; Goldberg and Loyd- Davies, 1985; Baer and Brewer, 1986; Gilbert et al., 2001; Cargill 1989; Jajtiani and Lemieux 2000; Morgan and Stiroh, 1999; and James, 1988) examine whether banks are penalised for increasing the default risk in their debt, in particular, they analyse how the yield on deposits responds to the changes in bank conditions (price based approach). This strand of the literature has largely concentrated on developed countries banking systems. The literature provides evidence that the interest rate paid on unsecured deposits is sensitive to various bank risks related to bank fundamentals, measured by items such as the level of non-performing loans, various liquidity indicators or bank profitability. Furthermore, evidence of market discipline has been indicated indirectly. For example, Berger et al. (1995) found a positive relationship between capital and earnings of US banks in the 1980s.

The second group of studies (such as, Goldberg and Hudgins, 1996; Crabbe and Post 1994; Billet et al., 1998, and Calomiris and Wilson, 1998) examined whether changes in bank fundamentals caused withdrawal's of debt (quantity approach). This approach is based on the assumption that if asymmetric information exists, prices may fail to reflect

[40] Since our study focus is on depositors' discipline we will pay more attention to this type of market discipline literature.

the degree of riskiness and banks may tend to be disciplined by quantity rather than price effects. When bank fundamentals suggest greater risk-taking, depositors tend to withdraw their funds from riskier banks, which make it difficult for them to raise additional funds (deposits). Again the aforementioned studies support the existence of this type of discipline.

The third group of studies combines the two approaches. Studies which use this approach demonstrate that riskier banks offer higher deposit rates but they are able to accumulate smaller amounts of deposits. Park and Peristiani (1998) show evidence of market discipline in the U.S. thrift industry throughout the 1980s, as depositors were shown to demand higher interest rates and deposit growth was shown to be lower as banks' activity became riskier.

More recent studies (Morgan and Stiroh, 1999; Evanoff and Wall, 2000; Jagtiani et al., 2002; Krishnan et al., 2003) follow the above approaches and test the correlation between market risk premiums on deposits, subordinated notes and debentures, and accounting measures of risk such as non performing-loans to total loans, loan loss-provisions, capital asset ratios, exposure to junk bonds, variability of return on assets, ratio of real estate loans to total loans, return on assets and variance to stock returns (Martinez Peria and Schmukler, 1998). Most of these studies find some evidence supporting the existence of market discipline by depositors.

On the other hand, various studies used different statistical approaches to identify the existence of depositors' discipline. For example, Maechler and McDill (2006) used the Generalized Methods of Moments (GMM) methodology to examine the dynamic relation between deposit quantity and the price of uninsured deposits using U.S. banks quarterly data from 1987-2000. They find that 'good' banks can raise their level of uninsured deposits by increasing prices while weak banks cannot. They suggest that depositors discipline not only raises the cost of choosing a high level of risk but also may effectively restrict bank managers' behaviour. In fact, all previous studies examine the issue of market discipline by analysing the effects of bank risk and solvency (independent variables) on deposit growth or interest paid to depositors' (dependent variables) individually or together using one or two equation structural models. In most cases, bank fundamentals are used for the purpose of estimating the probability of default.[41]

Additionally, the market discipline literature has been expanded from contemporaneous affirmation to forecasting, in order to explore whether information in current-prices corresponds to future outcomes. Some researchers have argued that the prices of subordinated debentures reflect not only the current condition of financial firms, but also their future condition. Evanoff and Wall (2001), for example, argue that analysis of the forecasting ability of subordinated debenture credit spreads demonstrates that these can explain next quarter regulatory ratings better than capital ratios. Furthermore, Krainer and Lopez (2004), added that subordinated debentures can improve the forecasting accuracy of supervisory rating models four quarters prior to inspection, and they are more closely correlated with bank risk measures in the 12 months prior to bank failure.

Jagtiani and Lemieux's (2001) study focused on pricing behaviour when bank organisations face financial difficulties. Their sample consisted of banks that failed during the period 1980 to 1995, whose parent bank holding company had publicly traded bonds outstanding during the recent quarters prior to failure. This study found that bond prices were related to the financial condition of the issuing bank holding companies, and that bond spreads started to rise as early as six quarters prior to failure as the issuing firm's financial condition and credit ratings deteriorated. On the other hand, Jagtiani and Lemieux found no evidence of market discipline in the uninsured CD market for a sample of bank holding companies (BHCs) with failing subsidiaries.

Besides the literature that has examined market discipline in the US financial system, the literature on evidence of market discipline in other countries has become more widespread recently. Birchler and Maechler (2001), for example, study the presence of market discipline in Swiss banking. They empirically test if depositors exert market discipline by monitoring their banks and by withdrawing uninsured deposits whenever their bank risks increase. Using data from 250 Swiss banks for the period from 1987-1998, their results support the existence of depositors' discipline. Additionally, they

[41] Bank fundamentals which indicate bank risk and solvency are related to CAMEL variables: non performing loans as a ratio of total loans, loan loss provisions, the capital to assets ratio, management efficiency ratio and liquidity ratios.

find that depositors respond to changes in deposit protection and they are sensitive to institutional differences across banking groups.

Moreover, the existence of depositor discipline in Japan has recently been studied following the Big Bang reforms in 1996. Using data from 1991 to 2001, Hosono (2003) finds that there is a relationship between interest rates, the growth of deposits and factors affecting bank-specific risks. He found that among regional banks, both interest rates and growth of deposits are significantly correlated with bank risk measures. However, for major Japanese banks, interest rates are not significantly correlated and growth rates of deposits are weakly correlated with risk measures. More recently, Murata and Hori (2006) focus on small Japanese banks. Their findings show that riskier institutions attract smaller amounts of deposits and are required to pay higher interest rates; they also find that changes in deposit maturity structures also occur in response to increases in risks. Additionally, Spiegel and Yamori (2007) have studied the impact of Japanese regional bank market pricing decisions on the intensity of depositors discipline using the quantity approach. They find that market discipline was greater for banks that adopted market price accounting.

Overall, the bulk of the empirical evidence appears to suggest that market discipline is apparent in developed banking systems; however, it is not entirely clear that it is present in developing countries. In particular, banks in the developed countries might be subject to greater market discipline than in developing countries since they are subject to more stringent reporting requirements and their debt holders might be more sophisticated.

Given the substantial number of financial crises, that have occurred in developing countries over the last two decades, there has been growing policy and academic interest in the role of market participants (particularly depositors) acting as monitors of bank risk-taking behaviour[42]. The history of relatively weak regulatory and supervisory systems, and the recurrence of banking crises in the developing world, it has been argued, may in fact increase debt holders' incentives to monitor their banks. Consequently, researchers have begun to investigate evidence of depositor discipline in these markets. While some studies use country level data (e.g. Levy-Yeyati et al., 2004;

[42] For instance, the Mexican Crisis in 1995, Asian crisis in 1997, Japan in late 1990s, and Turkey during early 2000s.

Calomiris and Powell 2001; D'Amato et al., 1997, Barajas and Steiner 2000) others undertake cross-country studies (e.g. Martinez Peria and Schmukler 2001; Arena 2003, and Galindo et al 2005).

The conclusion of the ability of depositors to discipline bank behaviour has been supported by a series of studies on various developing countries. For example, depositors' behaviour towards bank's risks has been found in Bolivia (Ioannidou and de Dreu, 2006), Colombia (Barajas and Steiner, 2000), India (Ghosh and Das, 2003), Turkey (Ungan and Caner, 2006), Russia (Karas et al., 2006), and Uruguay (Goday and Gruss, 2005), [see Appendix 1.1 Table 1 for a brief summary of these studies].

In contrast, Arena (2003) estimates depositor behaviour and market discipline for a range of Latin American and Asian emerging economies. He estimated bank risk as a measure of various bank fundamentals and considered market discipline as the reaction of depositors to bank risk-taking in the form of either demanding higher interest rates or deposit withdrawals. The study finds mixed evidence for the existence of market discipline. Additionally, Martinez Peria and Schmukler (2001) analysed depositors' behaviour in Argentina, Chile and Mexico. They examined two issues. First, they examined depositors' discipline and its relation to deposit insurance schemes in these countries. They found evidence of depositor discipline for both small and large insured deposits as well as for uninsured deposits. Second, they link market discipline and banking crises, showing that large systemic effects take place during crises, affecting deposits and interest rates across banks regardless of their fundamentals. They find that banking crises are a "wake-up call" for depositors exerting a greater impact on their behaviour. Moreover, Gruben et al., (2003) study six countries (Argentina, Canada, Mexico, Norway, Texas and Singapore) and find evidence that market discipline and bank risk were persistently inversely related and measures of bank risk increased significantly in the aftermath of liberalization (but only where depositors fail to discipline banks). Galindo et al., (2005) used a more comprehensive bank data set from 13 Latin American and Caribbean countries during the period 1992 to 2002 finding evidence consistent with the existence of market discipline in those countries.

Cross-country studies such as those by Demirguc-Kunt and Huizinga (2004), and Hosono et al., (2004) find that many countries around the world retain some degree of depositor discipline; however the level of that discipline depends on bank regulation, deposit insurance and the level of financial development. They show that the quantity based approach is more appropriate for developing economies because of the lack of transparency and information asymmetry problems in markets, which makes interest rates less likely to reflect information about bank risk. In contrast, they recommend that both price and quantity effects are more likely to be important in developed countries.

Consistent with this argument, Karas et al., (2005, 2006) uses data from Russian banks during 1999 to 2002 and demonstrates the existence of strong market discipline by quantity but only weaker price effects. When Wilson et al., (2004) limited their analysis to depositors' price effects they failed to find evidence of depositors' discipline. In contrast, Hess and Feng (2006) find that risky non-bank financial institutions in New Zealand have to offer higher interest premiums with higher insolvency probability, on the other hand they find that depositors tend not to reward these institutions for better quality of information disclosure.

While most of the previous literature concentrates on examining depositor discipline by uninsured depositors few studies recognize that even small insured depositors have the ability to encourage banks to reduce risk-taking behaviour. According to Flannery (1998), depositors are concerned not only with the solvency of individual banks but also with the solvency of the deposit insurer. In many emerging markets, depositors do not perceive that insured deposits are perfectly safe. Hence, even insured depositors may penalise riskier banks by requiring higher interest rates or withdrawing their deposits due to exposure to greater bank-risk taking (Calomiris and Kahn, 1991)[43].

3.2. Market Discipline, Deposit Insurance and Crises

Theoretically, there are two opposing debates regarding the need to insure depositors. Diamond and Dybvig (1983) have argued that the main objective of deposits insurance is to protect the system from bank runs. An alternative view from Kareken and Wallace (1978) claims that, under certain assumptions, there is no need for deposit insurance if creditors are fully informed and can know what portfolios banks are holding, and then

[43] Zarruk (1989) indicates that bank's spread increase with the amount of equity capital and decrease with deposits variability. Using a theoretical model he shows that bank's spread is an increasing function of the deposit insurance premium for the case of non decreasing absolute risk aversion.

bank runs will not exist. However, if creditors do not have full information, a bank can increase risk without necessary increases in costs. Due to fact that obtaining information is costly, creditors cannot reduce this asymmetric information.

Consequently, some studies examine the role of deposit insurance systems and their influence on the bank deposit market. While financial systems are liberalised and rely more on market forces, deposit insurance (following the Diamond and Dybvig view) can lower the probability of systemic bank runs. Deposit insurance systems might be an efficient tool in preventing bank runs, as they can reduce the incentives to withdraw deposits. On the other hand, it has been argued that deposit insurance systems reduce incentives for depositors to monitor banks and this reduces the degree of deposit discipline. Thus, the main problem created by deposit insurance is a problem of moral hazard. Even those depositors who are able to exercise pressure on banks would not do so because of the expected repayments in the case of bank failure. In this context, Demirgus-Kunt and Detragiache (1998) have investigated the importance of bank fragility when the extent and coverage of deposit insurance increases. Based on a sample of 61 countries, exhibiting varying degrees of coverage in their deposit insurance systems for 1980-1997, they find that bank fragility increases as deposit insurance schemes becomes more explicit and extensive. This suggests that moral hazard effects may dominate the stabilising effects deposit insurance has on the risk of banks runs. In addition, Demirguc-Kunt, and Huizinga (2004), suggest that explicit deposit insurance reduces required deposit interest rates, while at the same time it lowers market discipline with regard to bank risk-taking.

In fact, deposit insurance schemes vary widely in their coverage, funding, and management. Therefore, the effect of deposit insurance may vary across countries. For example, Gropp and Vesala (2000), in contrast to the aforementioned studies, find that moral hazard was reduced after deposit insurance was introduced in the EU, since depositors had previously held expectations of a much more extensive implicit safety net. Calomiris and Mason (2003) noted that the functioning of depositor discipline was improved in the U.S. during the era of the Great Depression (1929 to 1933), compared to the 1997 Asian crises or the crisis in Japan during the 1990s, because of the absence of deposit insurance. They argued that US banks had to improve their asset portfolios rapidly by shifting toward low-risk assets while substantially cutting dividends (Calomiris and Wilson 1998)[44].

Nevertheless, the reduction of market discipline by the introduction of deposit insurance systems is the main empirical finding from the aforementioned literature. However, the main argument under this view is that with deposit insurance, depositors do not distinguish a safe bank from a risky one and hence do not pressure bank managers to avoid excessive risks. Thus, deposit insurance is blamed for increasing the incentives of banks to handle high risk because it reduces the link between a banks' risk of default and its funding costs since the deposit insurer will be available to pay for depositors in the case of bank failure (Kane, 1989).

However, this assumption is questionable. If the restitution procedure takes a considerable amount of time and effort, or if there is a risk that deposits are not reimbursed, then depositors who are protected by deposit insurance may behave sensitively to bank risk (Cook and Spellman, 1994). For example, in a case study of the Comptroller of the Currency's corrective actions against the U.S. Hamilton Bank between 2000 and its failure in 2002, Davenport and McDill (2006) argue that holders of uninsured deposits were particularly sensitive to news of the bank's conditions.

Imai (2006) found that deposit insurance reform in Japan in 2002 (from full to limited insurance) worked well in increasing market discipline. However, he argued that failure to eliminate the too-big-to-fail policy partially reduced the positive effect of the deposit insurance reform. Nier and Baumann (2006) estimate the amount of deposit discipline across 32 countries between 1993 and 2000, they found that when banks enjoy high degrees of government support the effect of uninsured funding is reduced and only limited market discipline appears to exist.

Although some argued that even fully insured depositors will respond to bank risk if deposit insurers face financial difficulties (e.g. Kane, 1987; Cook and Spellman, 1991; Park and Peristiani, 1998), others, such as Ioannidou and Dreu (2006), noted that "overly generous" deposit insurance systems (or open ended implicit guarantees) have

[44] Calomiris and Mason (2003) noted that the direct cost of bailing out insolvent banks during the U.S Great Depression was 3% of GDP, compared to 20% during Asian currency crisis in 1997 and 30% for Japan loan write off problems during the late 1990s.

the potential to eliminate depositor discipline completely (especially if this occurs in a weak environment of bank regulation and supervision systems). This weakness in the financial system may lead to substantial social costs as a result of serious financial crises. Ioannidou and Dreu examined the direct effect of deposit insurance design on market discipline and show that the effect of deposit insurance depends on the coverage rate. When the coverage exceeds 60% of depositors discipline significantly reduces.

One can wonder here if the findings of a negative effect of deposits insurance on market discipline are common to all banks or whether it is affected by institutional factors specific to individual countries. In this context, Budnevich and Franken (2003) find evidence supporting the argument that deposit insurance does not appear to reduce market discipline because of the institutional arrangement of deposit insurance (e.g. length of payment, credibility and coverage).

Regarding the relation between depositor discipline and crises, research results have conflicting conclusions. Martinez Peria and Schmuckler (2001) and Hosono et al., (2005) have argued that market discipline increased after the Asian crises. In contrast, Urgan and Caner (2006), found evidence of market discipline before the crisis in Turkey (which occurred in 2001) but not after the crisis. They argued that the reliance on government support after the crisis limited the depositors' incentives to monitor banks' behaviour. Nier and Baumann (2006) find that in countries which experience crises, the presence of market discipline provides strong incentives for banks to manage their risks and market discipline is more effective in curbing risk-taking incentives in countries where competition among banks is strong. Particularly, they find that disclosure requirements boost banks' capital positions.

Recent studies have concentrated on the importance of reliable information in encouraging effective market discipline. Podpiera (2006), for instance, finds evidence using panel data from 65 nations' banking systems during the 1998 to 2002 period that improved systems for disclosure of financial information do appear to promote safer banking systems. A clear understanding of how banks adjust their condition in response to changes in their environment is an important issue for regulators and policy makers. Hence, depositors may have the power to constrain default risk on deposits. The literature on bank modelling identifies that depositors not only emphasize pricing default risk, but also act to limit it (Calomiris and Powell, 2001). In other words they are 'risk-tolerant' in addition to being "risk-averse" (Calomiris and Wilson, 1998). Bank depositors delegate the monitoring of bank borrowers to their banks. However, as the level of default risk on deposits increases, depositors become less liquid, which may increase the agency problems inherent in delegated monitoring. Naturally, these problems will cause a type of quantity rationing. Depositors will penalize risky banks by withdrawing their deposits. Banks which suffer these shocks face a strong incentive to reduce asset risk or increase the quality of their assets and capital in order to avoid disciplinary withdrawals of funds by depositors (Calomiris and Wilson, 1998).

3.3. Bank Response to Depositor Discipline

In fact, as has been argued by Berger (1991), Bliss and Flannery (2002), Hamalainen et al., (2005), and Hamalainen (2006), the previous literature focuses primarily on whether bank liability prices or quantities are affected by changes in bank risk. However, the extent to which the existence of effective market discipline actually influences bank behaviour (the so called control stage) has taken a back stage; (see Figure 2.1 for illustration of the control stage). While Bliss and Flannery (2001) and Billet et al., (1998) fail to find any evidence of management response to changes in bank holding companies' security prices, and bond ratings (respectively), Calomiris and Powell (2001), Crabbe and Post (1994), and Nier and Baumann (2006), find evidence that bank management respond to market discipline by decreasing their risk. Calomiris and Powell (2001) argue that even if there is evidence that depositors choose banks according to their financial fundamentals, it does not necessarily mean that market discipline exists. It must also be true that banks are effectively disciplined in that they react appropriately by adjusting their fundamentals in response to the signals provided by depositors. Barajas and Steiner (2000) tested the direct response of various bank fundamental variables for a study of Colombian banks and they suggest that the existence of market discipline where depositors' behaviour responded to bank fundamentals and this sends signals to banks who then adjust their positions accordingly.

While most of the empirical literature finds evidence of market discipline, the degree to which depositors can exert an influence on bank behaviour and impact of deposit insurance arrangements is likely to be country specific. The issue of whether market discipline exists or not is an empirical question and we cannot assume that it exists within a specified- banking system without such evidence. Some factors, such as depositors' culture, may affect depositors' reactions differently in each country. Furthermore, the ability of depositors to analyse financial information may vary between countries. Even if depositors are informed, they might not be sophisticated enough to utilise such information. One may expect market discipline to be more prevalent in developed countries because of the greater sophistication of depositors and easier access to financial information. Given these factors, we would argue that country specific studies are likely to be more accurate (and preferred) compared with cross country analysis.

The reminder of this paper aims to contribute to the above literature by providing a comprehensive view of the role of market discipline in the Jordanian banking system. First, we will provide a brief overview of the key characteristics of the Jordanian banking system. Second, we will examine whether depositors discipline banks in Jordan. Third, following Calomiris and Powell (2001), we will examine whether banks efficiently respond to the signals provided by depositors. Therefore, this study will analyse whether depositor discipline is sufficient to ensure the appropriate risk decisions of bankers. Finally, we aim to test for the effects on market discipline from the introduction of a deposit insurance scheme, and the effects of the twin financial crises (currency devaluation and the Petra Bank failure in 1989) on depositors' behaviour will be examined.

4. Jordanian Banking System, Regulation, and Deposit Insurance

4.1. Jordanian Banking System and Regulation

Three different groups of domestic banks operate in Jordan, commercial banks, investment banks, and Islamic banks. All banks are subject to similar regulatory and market conditions, and operate under the universal banking principle[45]. As of 2005, the

[45] The introduction of the banking system in Jordan dates back to the early 1920s when the British entity, the Ottoman Bank, opened in Jordan and acted as a fiscal agent to the government before establishing the Central Bank of Jordan. Then the Arab Bank was established in 1936. The next foreign bank was the British Bank of the Middle East in 1949. After the number of bank offices operating in Jordan reached five steps were taken to establish a currency board to create a local currency that would replace the Palestinian Pound (Mohammed 1994). Between 1955 and 1960 three additional banks were established, the National Bank, the Cairo Amman Bank, and the Bank of Jordan. By 1970, the number of banks

banking system comprised 21 banks (including five branches of foreign banks), five investment banks, two Islamic banks and one Industrial Development Bank (IDB). All banks are permitted to accept deposits and extend loans and credit facilities in domestic and foreign currencies. Commercial banks practise all banking business; investment banks practise financial investment and commercial activities in addition to brokerage services on the Amman Stock Exchange (ASE) (Isik et al., 2004).

However, investment banks are not permitted to extend overdraft facilities. Islamic banks accept deposits and extend loans, but do not pay interest on deposits and collect no interest on loans. Instead they make equity investments in companies and share profits and losses with depositors. In this framework, Islamic banks are essentially an equity based system, where equity capital is provided by the depositors who receive no fixed interest on their funds but a dividend out of the bank's profit (Hassan, 1999).

Moreover, the IDB specialises in the provision of medium-term financing (including project finance) to industry. Banks in Jordan have a total of around 470 branches in 2005 serving a population of 5.3 million, approximately one branch for every 10,000 inhabitants. The Arab Bank, the Housing Bank, and the Jordan National Bank are the three largest banks in the country, accounting for 73% of banking sector assets at the end of 2004. The Central Bank of Jordan (CBJ), established in 1964, is the banking system's regulatory authority. Banks' total assets in 2003 amounted to 222.5% of GDP (CBJ 2004, p 25). However, Jordanian banks hold a large proportion of their assets in currency deposits in foreign banks. This indicates that Jordanian banks are conservative in managing their resources.

The main source of banks' funds is deposits. As is apparent in Table 1.1 deposits represented 75.52% of total banks balance sheet in 2005. Deposits during the past decade have risen dramatically. The increase was mainly in the deposits of the private sector (residents) which accounted for about 74% of total deposits. However, during the twin crisis in 1989 depositors lost confidence in the banking system and this reflected in a decrease of deposits between 1989 and 1990[46]. Moreover, demand deposits increased

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operating in Jordan amounted to eight commercial banks with about 41 total branches. Twenty years later, the number of banks has increased threefold, the total number of branches exceeded 500 in year 2006.

[46] In July 1989, the Jordanian government signed the first agreement with the IMF and the World Bank. Policy makers in Jordan have been encouraged to liberalise the financial sector, capital accounts, and the

in proportion relative to saving and time deposits. This may indicate that depositors preferred to hold shorter-term deposits when they felt their funds were at risk. Considering the recent maturity structure of deposits for 2004 and 2005, one can notice the increase in time deposits (10%) to 73.3% of total deposits in 2005. This was attributed to the increase in rates on time deposits which surpassed those on other types of deposits. It is important to note that in the early 1990s the CBJ issued orders canceling any limitations or restrictions in relation to deposit rates. All licensed banks in Jordan are now free to specify interest rates that apply to deposits (CBJ, 2006).

When analysing the structure of deposits in terms of depositors, one can note that the rate of residents' deposits increased at a faster rate than for non-residents depositors. This indicates that Jordanian banks still depend primarily on residents' liquidity despite the substantial number of non- residents living in the country. Concerning interest rates on deposits, generally the interest rate on all types of deposits decreased between 2000 and 2005 which may be due to a more stable economic environment. This fall in rates increased the incentive for households to look to alternative sources of investments to boost yields.

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exchange rate regime. In response, interest rates have been liberalised resulting in an increase in interest rates that put more pressure on banks' profits and increased competition among institutions. In the same year, two types of crises occurred. First, the Jordanian currency lost 50% of its value. Secondly, the banking sector witnessed a large increase in nonperforming loans, followed by a failure in the banking system and bank insolvency problems. The second largest bank at that time period (Petra Bank) collapsed. The worse aspect of this story is that Jordanian Government committed itself into paying nearly 300 million JD to bank depositors and the government was forced to cover the large amounts of funds, equivalent to 10% GDP, to settle the foreign obligations and to meet the run on insolvent banks (Akel, 1994; Chalk et al., 1996).

Table 1.1

Deposits with Licensed Banks

A- (JD Million)

Item	1964	1970	1980	1985	1989	1990	2000	2001	2002	2003	2004	20
Banks Total Assets	63.2	76.4	1070.5	2392.1	3780	4090	12913.5	14153.6	15119.3	15701.5	17821.1	210
Banks total Deposits	48.7	57.7	808.5	1747.2	2625.4	2642.7	8224.5	8721.3	9367.7	9969.4	11564.1	120
Private sector deposits (residents)	28.2	43.4	580.6	1274.4	1979.3	1956.4	5075	5509.3	6094.8	6973.2	8097.8	973
Private sector deposits (non- residents)	1.6	2.5	133.2	294.3	400.4	386.9	1735.7	1798.2	2003.5	1808.9	2163.0	199
Demand Deposits	23	30.8	288.1	316.4	455.4	538.7	1313.7	1529.3	1920.4	2338.8	3244.1	321
Saving and Time Deposits	25.7	26.9	520.4	1331.7	2116.1	2103.9	6910.8	7192	7447.3	7630.6	7320	884

B- (Percentage)

Item	1964	1970	1980	1985	1989	1990	2000	2001	2002	2003	2004	2005
Bank total Deposits / Banks Total Assets	75.52%	75.53%	73.04%	69.46%	64.61%	63.69%	61.62%	61.96%	63.49%	64.89%	57.19%	75.52%
Private sector deposits (residents)/ Total Deposits	57.91%	75.22%	71.81%	72.94%	75.39%	74.03%	61.71%	63.17%	65.06%	69.95%	70.03%	74.22%
Private sector deposits (non- residents) / Total Deposits	3.29%	4.33%	16.47%	16.84%	15.25%	14.64%	21.10%	20.62%	21.39%	18.14%	18.70%	15.21%
Demand Deposits/ Total Deposits	47.23%	53.38%	35.63%	19.20%	17.71%	20.39%	15.97%	17.54%	20.50%	23.46%	30.71%	26.68%
Saving and Time Deposits/Total Deposits	52.77%	46.62%	64.37%	80.80%	82.29%	79.61%	84.03%	82.46%	79.50%	76.54%	69.29%	73.32%

Source: Central Bank of Jordan (2003, Special issue) different pages. Percentages are calculated by the author.

The banking system has two main features. First, despite a reasonable number of banks the banking sector is highly concentrated with the three largest firms accounting for over 60% of total deposits. Secondly, while the savings rate is high, bank lending policies and practices are exceedingly risk averse and typically avoid long-term investments (Euro Med Partnership, 2006, p.11).

Regarding banking sector regulation, the CBJ is the only supervisory body in Jordan. Maintaining and monitoring stability, and ensuring the safety and soundness of the banking system (despite the surrounding political instability in the region) are the main objectives of the central bank. However, the main aim of the CBJ in the early 1990s was to curb the growth of liquidity using loans to deposits ceilings. To attract foreign exchange, especially in the form of workers' remittances, foreign banks are allowed to offer foreign currency investment portfolios for non-residents, interest rates have been liberalized and foreign currency transfers have been freed from any restrictions. In addition, there are no restrictions on the flow of foreign currency for commercial and capital transactions. Entry of foreign banks is subject to licensing (approval from central bank) and the usual array of prudential regulations.

In 1991 Treasury bill auctions were introduced in order to bring about a wider role for market forces and to facilitate the use of indirect techniques for monetary control (CBJ, 1997). Weekly auctions of certificates of deposits (CDs) were introduced in 1993. In 1996, swap operations in foreign exchange were permitted to enhance efficiency in the foreign exchange market, the central bank liberalised all transactions in foreign exchange, and all banks have been required to publish their prime lending rates.

The failure of Petra Bank in 1989[47] prompted the central bank to follow a more strict approach regarding the capital adequacy of Jordanian banks. The deficiency a more prudential regulation and supervisory capacities were among the reasons for the banking system crisis (Al Jarrah, 2002).

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[47] Three other bank failure cases have disturbed the financial sector in Jordan In the late 1980s: (1) the Jordan Gulf Bank suffered a serious liquidity problem, (2) malpractice of the Mashreq Bank forced its closure, and (3) the Islamic Investment House was liquidated because of quality problems of its portfolio and divergence from the terms of its license. The three cases were met with firm decisions from the CBJ which restored confidence in the banking system (Dihel and Kardoosh, 2006).

Although it took a while, various steps have been taken to maintain adequate capital in the banking system. In 1993 The CBJ adopted the main features of Basel Accord (Basel 1) requiring banks to hold capital adequacy ratios of 10%, and this is higher than the international minimum standard of 8%. In 1997, the CBJ raised the risk-weighted capital adequacy ratio from 10 percent to 12 percent.The central bank believed that the higher ratio was more consistent with the operating environment at that time.

In addition to the Basel capital adequacy requirements, the CBJ imposed a minimum capital requirement of JD 40 million (to be reached by 2007) for all banks[48]. Only cash and government securities can be used to increase capital. Commercial banks are also required to place 14% of their deposits in an interest free account at the CBJ, whereas investment banks also have to hold only 9%. Furthermore, the capital to deposits ratio was set at a minimum of 7.5%, and banks are not permitted to make loans to companies in which they hold more than 10% of capital. A new Banking Law (no 28) came into force in 2000 to protect depositors' interests and later the same year the CBJ established a separate and independent Deposits Insurance Corporation (DIC). Deposits up to JD 10000 ($14000) were insured.

In addition, the DIC act as the liquidator of banks as directed by the CBJ. Besides deposit insurance, bank liquidity is also regulated to ensure adequate ability of banks in meeting depositors demand. The minimum liquidity requirement for Jordanian banks stood at 30% in 2005. The assets that satisfy liquidity or reserve requirements include: domestic currency and coin, balances held with the Central Bank, net credit balances with other licensed banks in Jordan, net credit balances in foreign exchange with banks abroad, government securities with one year maturity or under, foreign securities negotiable in international financial markets denominated in a convertible currency and maturing within a maximum of one year; and any other assets considered as liquid assets by the Central Bank, such as commercial bills and others.

In order to enhance the strength of the banking system, the CBJ adopted a number of additional procedures and measures to organise banks' operations and increase their capability to face the developments engendered by the new Basel 2 requirements. In

[48] It has been rumoured that the CBJ is going to raise this limit to JD 100 million, possibly by as early as 2010.

order to boost the confidence in the banking system, the CBJ set down standards for good corporate governance and required banks to follow those standards. In addition, from 2004 the Jordan Securities Commission adopted strict rules of disclosure and required all listed companies to file quarterly reports (since all the local banks are listed they are covered by this requirement).

Additionally, the CBJ is paying more attention towards public communication relating to bank regulation. One way in doing this is by announcing relevant information about banks' operations through the publication of monthly reports, in addition to the *Monthly Statistics Bulletin.* The CBJ and the government are committed to enhancing efficiency in data dissemination by promoting the adoption of international accounting standards by commercial banks in order to increase the competitiveness of the banking system. In addition, banking institutions are required to publish their financial statements and audit reports in two national daily newspapers at the end of the fiscal year. The Exchange Commission Law (established in 1997) has now strengthened the capacity of the Jordan Securities Commission to enforce reporting requirements. The standards of reporting by banks are improving as well. An Electronic Data Distribution system has been initiated in year 2000 to improve the comprehensiveness and timeliness of information on commercial banks, and this should also develop the data reporting by banks to the central bank and general supervision of the banking system (Oxford Analytica, 2006, p.9). In addition, bank directors are legally responsible for misleading information about bank performance. All banks are also subject to physical examination by the central bank of Jordan at least once a year. If examiners find any deficiencies in the bank's activities and accounts from a regulatory perspective, moral suasion is typical.

The target date for implementing Basel 2 was January 2008 although various problems may face the implementation of the new Accord, particularly the ability of Jordanian banks to supply accurate information to the market (the information that may provided by a bank might not reflect the actual bank position). Therefore, the CBJ is preparing banks for the implementation of the new Accord by undertaking the following steps. First, supervisors are starting to cooperate with banks and other regional supervisors in preparing for a flexible adoption of the new Accord by offering training in banks or the CBJ or both. Second, a new information system is being developed to build banking data bases in order to manage bank risk. Third, the CBJ is establishing new procedures to determine the most appropriate level of capital adequacy, consistent with Pillar 2 of the new Accord because national supervisors are free to modify the capital regulation for their jurisdictions if such a modification is reasonable and conservative given the specific local risk experience. One challenging issue relates to the treatment of Islamic banking, which is not specifically covered in the new Accord. It is obvious that in the interests of the CBJ banks need to actively adopt new capital framework so that the country's supervisors' process will be recognized by other bank regulators and will not put Jordanian banks at a competitive disadvantage.

An important question may arise here as to whether all the above preparations are enough to achieve market discipline or whether the deposit insurance schemes that commenced in 2000 is going to affect the incentives of depositors to monitor bank risk.

4.2. The Deposit Insurance System in Jordan

If any emerging market faces a collapse in its banking system, regulators will be advised to create a protection scheme for depositors to stop bank runs. Therefore, the introduction of an explicit deposit insurance system has become common not only to eliminate financial instability but also to help in limiting the open-ended implicit guarantees that are widespread in developing countries (Ioannidou and Dreul, 2006). According to Demirguc-Kunt and Sobaci (2001), the number of countries with explicit insurance increased from 12 to 71 between 1974 and 1999[49]. Jordan was not an exceptional case; it has introduced explicit deposit insurance. A deposit insurance corporation (DIC) was established in the country with the passage of law No 33 in 2000.

Only Jordanian banks and branches of foreign banks are required to contribute to the deposit insurance fund. Branches of Jordanian banks operating outside the country are excluded from the insurance scheme. On the other hand, Islamic banks operating in Jordan have the option but not the obligation to join. The deposit insurance coverage is limited. The corporation covers up to a maximum deposit of 10,000 JD (approximately USD 14,000). All types of deposits are covered except government deposits, intra-bank deposits, and cash collaterals within the limits of the value of the extended facilities

[49] While DI is widespread in Europe and Latin America, it is less common in the Middle East, 29 percent, and Sub-Saharan Africa, 11 percent (Demirgüç-Kunt et al., 2006).

guaranteed by the said collaterals and credit facilities balances in overdraft facilities (JODIC report 2005 note 11:10). Depositors are expected to be paid instantaneously; however, the insurance sum should be paid to the insured depositors within 30 days from submitting a deposit claim (JODIC law 2000, Article 62).

Although, the corporation is publicly sponsored and administrated, it is privately financed and enjoys a corporate entity status with financial and administrative independence. The fees charged to banks include: first, a 100,000 JD (approximately USD 140,000) fee paid upon the establishment of the bank (paid in two instalments by banks established prior to passage of the law) and second, an annual fee equal to 0.25 percent of the bank's aggregate deposits. This is subject to an increase of up to double the amount in the case that the CBJ finds that the degree of bank risk exceeds a certain level (See Table 1.2 for comparisons between the deposit insurance in Jordan and other countries). The deposit insurance corporation in Jordan is managed and supervised by a board of directors chaired by the governor of the central bank and only the CBJ can decide to liquidate a member bank. One of its duties is to examine banks' operation and financial results included in the financial reports which are available at the CBJ.

Table 1.2 compares the deposit insurance scheme in Jordan with those of Germany, the EU, U.S., Colombia and the world average. The European Union Deposit Insurance Directive was established in 1994 in order to harmonize minimum depositor protection throughout member countries, although it can be seen that deposit insurance was in a place in Germany before that date. Other schemes such as US and Colombia were also established earlier. Apparently, from the table the deposit insurance scheme in Jordan is comparable to those of developed countries as well as to the other countries in the world. Given the above features of the Jordanian deposit insurance scheme, the following analysis will examine market discipline in the Jordanian banking system and will examine where deposit insurance eliminates incentives (if they exist) for depositors to monitor banks behaviour (see Demirguc-Kunt et al., 2006) for a good discussion about deposit insurance schemes around the world).

Table 1.2

Cross Country Comparison of Deposit Insurance Schemes

	Germany	EU	US	Colombia	World average	Jordan
Coverage Limits	30% of equity*	ECU $20000	US$ 100000	COL$10 million**	3 times per capita GDP	JD10000 (US$14000)
Coinsurance	No	10%	No	25%	Yes, in 17	No
Foreign currency Deposits cover	Yes	Can be excluded	Yes	n.a***	Yes, in 48	Yes
Intra bank deposits Covered	No	No	Yes	No	Yes, in 18	No
Funding	Funded but additional fund callable	Not regulated	Funded	Funded	Funded, in 58 cases	Funded
Source of Funding	Banks only	Not regulated	Joint	Private	Private 15 Joint 51 Public 1	Banks, the corporation returns, and loans and grants.
Management	Private	Not regulated	Public	Public	Private 11 Joint 24 Public 33	private
Membership	Voluntary	Compulsory	Compulsory	Compulsory	Compulsory in 55 cases	Compulsory
Risk adjusted Premiums	Yes	Not Regulated	Yes	Yes	Yes, in 21 cases	Yes

Notes:

* All non-bank deposits are covered up to a limit of 30% of the liable capital of the troubled institution.
** As of July 2000, this is around US$4600, or 2 to 3 times per capita GDP.
*** Colombia's financial system does not allow for foreign currency deposits.
Source: Adapted from Beck (2000), and Barajas and Steiner (2000) and adjusted by the author.

5. Empirical Methodology and Data

In order to assess if depositors react to bank level fundamentals in such a way that deposit withdrawals could be considered an action of market discipline in the country, we test if riskier banks attract fewer deposits. The null hypothesis is that deposit withdrawals and deposit interest rates do not respond to observable weaknesses in individual banks, traceable to ex-ante bank characteristics. If bank level fundamentals (described in the data section) explain significantly the growth rate of real deposits and/ or interest paid to depositors, this will be evidence for the existence of depositors' discipline.

5.1 Testing for Depositor Discipline

As illustrated by Park and Peristiani (1998), there are two ways in which discipline may be tested in the market for bank deposits, through price (the interest paid to depositors) or quantities (level or growth of deposits) or using both methods. The aforementioned author estimated the following models:

$$\Delta Deposit_{i,t} = \alpha^1{}_i + \beta^1 \times d_{i,t+1} + \lambda^1 Controls_{i,t} + \mu_{it} \qquad \textbf{(1)}$$

$$Interest_{i,t} = \alpha_i^2 + \beta^2 \times d_{i,t+1} + \lambda^2 Controls_{i,t} + \varepsilon_{it} \qquad \textbf{(2)}$$

Where, $\Delta Deposit_{i,t}$ is the growth rate of deposits in bank i at time t, $Interest_{i,t}$ is the interest rate on deposits in bank i at time t. $d_{i,t+1}$, is the expected probability of default or failure of bank i in the following period, representing the risk or expected loss assumed by depositors. $Controls_{i,t}$ is a vector of control variables, μ_{it} and ε_{it} are disturbance terms.

The above equations 1 and 2 test for the existence of market discipline by testing for the significance of β^1 and/ or β^2 . If depositors tend to demand fewer deposits from riskier banks, then β^1 should be negative and significant, and signalling the existence of depositor discipline. Similarly, if depositors demand a higher interest rate from banks with a higher probability of default (higher risk), then β^2 will be positive and significant, and one may conclude that depositors are practising discipline over banks. However, two important issues arise in the specification of equations 1 and 2, first, the issue of how to measure the probability of default $d_{i,t+1}$. Secondly, what are the appropriate variables which should be included in the model as control variables.

Regarding the first issue of how to estimate the probability of default, Park and Peristiani (1998) used a two step method. In the first step, they estimate the probability using a logit model as a function of bank performance indicators or fundamentals (defined in the next section), and use the estimated probability directly as an explanatory variable in equation 1 and 2. However, this two step estimation of bank default methodology has been criticised by Martinez Peria, and Schmukler (1999, 2001). They point out that this approach may fail to detect whether changes in the dependent variables (deposit growth or interest paid to depositors) were caused by some particular bank feature or because of the possibility that the probability of failure is not estimated accurately. Furthermore, by including the probability of default directly, it is not possible to determine which of the bank indicators may be providing the strongest signal to depositors that banks are in fact taking on high risks. In addition, Barajas and Steiner (2000, p.14) state that "it may not always be possible to estimate the probability accurately, especially in a period when there are not many actual observations of bank failures". Hence, a one step model has been suggested to explicitly and directly examine the relationship between bank fundamentals and deposits growth and/ or interest paid to depositors. Building on this argument, we use one step method using the bank fundamentals directly. First we estimate the changes in deposit levels as a reaction to the changes in bank fundamentals. Secondly, we establish the relation between deposit interest rates and the selected bank specific variables. We estimate the reduced form equations model for the equilibrium deposits and interest paid by trying to confirm that depositors shifted their deposits from risky banks to safer ones, and also that they demand a higher interest rate when they realise that their bank has a higher probability of default.

In other words we assume that market discipline exists if an increase in bank risk leads to a decrease in the supply of deposits and therefore, holding other factors constant, market discipline will lead to a lower level of deposits and higher interest paid. As such we estimate the following equations:

$$\Delta Deposit_{i,t} = \alpha^1{}_i + \beta^1 \times Bank_{i,t-1} + \lambda^1 Controls_{i,t} + \mu_{it} \tag{3}$$

$$Interest_{i,t} = \alpha_i^2 + \beta^2 \times Bank_{i,t-1} + \lambda^2 Controls_{i,t} + \varepsilon_{it} \tag{4}$$

Where, $\Delta Deposit_{i,t}$ is the growth rate of deposits in bank i at time t, $Interest_{i,t}$ is the interest rate on deposits in bank i at time t. $Bank_{i,t-1}$ represents a vector of bank fundamental variables that takes a higher value when bank i is in good shape in the last year, this vector is included with a lag to account for the fact that balance sheet information is available to the public with a certain delay. $Controls_{i,t}$ is a vector of control variables, and ε_{it} and μ_{it} are disturbance terms[50].

Concerning the second specification issue, previous studies use a wide range of control variables to explain other factors that exert an influence on depositors' behaviour. Murata and Hori (2006), for instance, include only bank size as a control variable whereas Park and Peristiani (1998) include macroeconomic variables to control for the overall size of the market, bank-specific controls relating to bank market share and size, and a number of regulatory dummy variables. Demirguc-Kunt and Huizinga (1999) include two controls in their individual country estimation: bank overhead and size. On the other hand, Martinez Peria and Schmukler (2001), include two sets of control variables; systemic and macroeconomic variables, both of which vary over time but not across individual banks, and they test for the effect of bank size on depositors' behaviour, (but they do not include the size variable within the set of bank fundamental variables since it is not considered to be directly linked to riskiness). Calomiris and Powell (2001) include period effects as time varying controls. Moreover, Barajas and Steiner (2000) argued that market discipline tests may be considered weak in the case of not adding appropriate and sufficient control variables. They point out that the main short-coming of the specifications used in market discipline studies is that, while they may control the effects of economy-wide factors, they do not incorporate additional individual bank variables that should play a key role. Therefore, they suggest non-fundamental variables that may affect perceived risk to depositors, adding the number of branches to indicate the benefits in terms of easing transaction costs, to the extent that bank deposits are used for payments purposes.

Building on the above studies, we include two sets of control variables, first, non-fundamental variables (these are explained in more detail in Section 5.3), and secondly macroeconomic and systemic variables. In addition, the period of our study sample allows us to explore the impact of financial crises on market discipline by estimating equations 3 and 4 for the periods before and after the 1989 twin crises (of the Jordanian

[50] This method of testing for market discipline has been used by Ioannidou (2005), Murato and Hori (2006), Semenova (2006), Barajas and Steiner (2000), and Ghosh and Das (2003), among others.

Dinar devaluation and the Petra Bank failure). The period from 1982 to 1988 represent the pre-crises period, whereas as the post-crises period is from 1991 to 2005.

Furthermore, to analyze whether the introduction of explicit deposit insurance introduced in Jordan in 2000 affected the way in which depositors discipline their banks, we estimate equations 5 and 6 as follows:

$$\Delta Deposit_{i,t} = \alpha_i^1 + \beta^1 \times Bank_{i,t-1} + \lambda^1 Controls_{i,t} + \phi^1 Bank_{i,t-k} * DI_{t-k} + \varpi_{it} \qquad (5)$$

$$Interest_{i,t} = \alpha^2 + \beta^2 \times Bank_{i,t-1} + \lambda^2 Controls_{i,t} + \phi^2 Bank_{i,t-k} * DI_{t-k} + v_{it} \qquad (6)$$

Where, DI is deposit insurance dummy variable equals to one before the year 2000 and zero otherwise[51]. If the added interaction variable coefficient occurs with a significant opposite sign (compared with the fundamental risk variable), this will indicate the negative effect of introducing the deposit insurance system on depositor discipline. Therefore, a negative and significant estimate for ϕ^1 and a significant and positive estimate for ϕ^2 would signify the reduction of depositor discipline as a result of introducing explicit deposit insurance. The joint significance test of the interaction variables will be examined in order to detect any important effect of deposit insurance on deposits growth or interest paid to depositors.

To estimate the above models, this study uses OLS estimation for each equation separately. In addition, we allow for fixed effects (FE) and random effects (RE) estimation, and identify the preferred model according to the Lagrange Multiplier and Hausman tests. Moreover, the correction techniques of White (1980) for unknown heteroskedasticity have been used since our sample includes multi-year observations. Furthermore, Wald restriction tests have been applied to examine the importance of all fundamental variables coefficients in affecting the growth rate of deposits or interest paid to depositors. In the sensitivity analysis, we experiment with alternative estimation techniques. First, we use the Two Stages Least Squares (2SLS) estimation technique to address the possible endogeneity issue between bank capital and other fundamentals. Bank capital is included as an instrument for bank size (bank size affects access to

[51] A deposit insurance dummy has not been added separately to avoid multicolinearity problems, for more discussion see Gujarati (1995).

capital) estimated by the natural log of total assets; the current profit (estimated as the return on assets ratio which may be viewed as an exogenous variable affecting the policy of the bank to increase its capital base through retained earnings), and the ratio of total loan to total assets (more risky banks may be required to hold more capital). We then enter the predicted value for the capital as a regressor in the deposit growth, and interest paid equations, in addition to the other fundamentals. Secondly, the Seemingly Unrelated Regression (SUR) methodology has been used. This estimation technique will consider the contemporaneous correlation between the two structural equations for deposit growth and interest paid equations.

5.2 Testing for Bank Response

Consistent with Barajas and Steiner's (2000) approach, whether depositors are sensitive to bank fundamentals is only the first step in determining if there is market discipline. For effective market discipline to exist, a second step should involve understanding whether banks respond positively to the signals provided by depositors. Therefore, we develop our test to understand whether banks respond positively to the signals provided by depositors. If deposits decreased as a result of weaker bank fundamentals, then banks must take a corrective action to ensure that deposit growth increases again by improving their fundamentals.

We use the response model suggested by Barajas and Steiner (2000) to examine the direct reaction of bank fundamentals and changes in deposits. In this study we define what is called 'fundamental' growth in deposits (Depofun) as the key explanatory variable for bank response, and we zero in those changes that are attributable to an individual bank's performance fundamentals in relation to other non-fundamental, macro economic, and systemic variables.

Bank response to the signals received from depositors have been assumed to firstly represent a symmetric response, when banks respond to the changes of deposits growth irrespective to the sign of change (positive or negative), and secondly, as an asymmetric response, where distinction between negative and positive changes in deposit growth have been considered.

The first test (symmetric response) consists of regressing each fundamental variable on lagged values of the calculated 'fundamental' deposits growth (Depofun), to determine whether this period's fundamentals are sensitive to depositors' preference for strong fundamentals in the previous period. A significant coefficient of Depofun indicates that effective depositor discipline exists.

In the second test (asymmetric response), we allow for a possible asymmetry in bank response to the depositors' signals by assuming that the banks adjust their fundamental variables in the case of deposit losses. In contrast, banks will not have any incentive to change or improve their fundamentals if deposits are growing rapidly. Two definitions of deposits loss are used, deposit losses 1 (Dloss 1) and deposit losses 2 (Dloss 2).

Dloss1 occurs when the fundamentals deposit growth rate of a given bank is negative, so it defines an absolute loss of deposits owing to weak fundamentals. On the other hand, the second loss (Dloss 2) defines deposit loss as any situation when a bank exhibits a fundamental growth rate below banking sector average deposits growth, thus indicating that this bank could increase deposits by moving its fundamentals closer to the sector average.

Formally we define two dummy variables for each bank i and period t as shown below:

$$\mathrm{Doss1}_{it}\begin{cases}1, Depofun_{it} \prec 0\\ 0, otherwise\end{cases} \qquad \mathrm{Dloss2}_{it},\begin{cases}1, Depofun_{it} \prec SysGrowth\\ 0, otherwise\end{cases}$$

Where, SysGrwth is the banking sector average deposits' growth.

In each case, individual fundamental variables were regressed against the interaction variable (the interaction between the lagged value of the calculated deposit fundamental and one of the estimated dummies each time) in order to examine banks' asymmetric response to depositors' signals.

5.3 Data and Variables

To conduct our analysis on depositor discipline, we have constructed a panel data set which contains yearly data for 13 out of 16 domestic commercial banks from 1982 to 2005. The rest of the commercial banks were excluded because of an insufficient amount of available financial information. This study focuses on the commercial banks to ensure the comparability between banks in the sample. This does not involve any significant loss in the data because commercial banks capture a dominant part of the domestic market (about 80% of the total number of banks)[52]. The data are limited to yearly observations instead of monthly or quarterly data due to the absence of such information for Jordanian banks. The panel data used in this study has been obtained from individual banks' annual reports audited and submitted to the central bank and announced to the public. We believe that this data is sufficient for this study since we are concentrating on the reaction of depositors who are informed about the banks' condition through this information. The panel data used in this study is unbalanced in the sense that the number of observations per bank varies across years. The choice of the period of study can be justified on the grounds that it is the period for which data on the relevant variables are available on a consistent basis. During the sample period, there were no government owned banks, and there are no de novo banks.

The sample covers the period when the twin collapse of the currency and the banking system occurred. Hence, to examine the effect of the Petra Bank failure and the currency devaluation in late 1989 and the introduction of the deposit insurance scheme in 2000, on depositors' behaviour towards banks risk, the period of analysis has been split into two separate periods. First, for the crises effect two periods are examined: from 1982 to 1988, and from 1991 to 1999. Second, to examine the effect of the introduction of the deposit insurance scheme on market discipline we use a dummy variable which takes the value of zero from 1982 to 1999 (before the introduction of deposit insurance) and one for the sample period from 2000 to 2005.

The variables which are included in the analysis can be divided into two categories. The dependent variables namely: the changes in total deposits, calculated as year on year percentage changes, and the implicit interest rate, measured by the ratio of total interest payments to total deposits[53]. The second category is the explanatory variables classified as bank fundamentals and control variables.

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[52] Foreign branch data were eliminated from this study because of the lack of information. All foreign branches are not listed in the stock market and are not required to be disclosed in the annual reports.

[53] We have no opportunity to obtain the rate offered by the banks due to the availability of such information, so this ratio seems to be an appropriate for estimation.

5.3.1. Indicators of Bank Fundamentals and Control Variables

Following Martinez Peria and Schmukler (2001), Ghosh and Das (2003), Ioannidou and Dreu (2006), and Birchler and Maechler (2001), CAMEL rating indicators are used to capture bank risk characteristics. The CAMEL abbreviation can be defined as: Capital adequacy, Asset quality, Management, Earnings, and Liquidity. These indicators have some connection with the risk of bank failure (see Table 1.3 for the description of variables and the expected sign). This particular fundamental variables choice has been selected because they follow the choice of bank-specific variables that have been used in earlier studies on bank risk.

Following Barajas and Steiner (2000), we also include a number of bank characteristics that may capture bank risk or why deposits may grow more rapidly in one type of bank compared to another. The two groups of control variables are included in this study. First, the non-fundamental variables which include, bank size and the number of branches. Bank size measured as the natural log of total assets, might be able to capture market power or reputation. On the other hand, bank size may also capture the lower probability of failure due to too-big-to-fail arguments, better access to funds, and diversification benefits. Bank size is expected to enter with a negative sign in the interest rate equation and with a positive sign in the deposit growth equation (see for example Hess and Feng, 2007; Murata and Hori, 2006; and Barajas and Steiner, 2000). Moreover, we proxy the level of bank transaction services by the number of branch offices, we expect the number of branches to reflect the quality of payments services offered by banks, all else being constant, as deposits should grow faster and interest payments decrease in those banks that lower transaction costs or offer more payments services by providing more branches.

Secondly, we include additional controls for macroeconomic and systemic effects. One of the important factors influencing market discipline in emerging economies is the relative importance of systemic risk. Levy-Yeyati et al., (2004) suggest that relatively large real shocks combined with a strong dependence on highly pro-cyclical international capital flows, coupled with narrow domestic markets, yield large output volatility and this creates a propensity for such economy's to fall into deep recession. This may deteriorate the repayment capacity of bank depositors and in turn, bank solvency. Thus, systemic sources may overshadow the informational content of observed bank fundamentals. To the extent that banks are subject to large systemic risks that might threaten the value of their assets, depositors and investors will respond to fluctuations in those risks no matter how healthy bank fundamentals are.

Table 1.3

Bank Fundamentals and Control Variables:

Variable [2]	Expected Influence[1]	Interpretation
A- Fundamental Variables		
Capital Adequacy: -Capital to total assets ratio	+ (-)	Represents the bank's asset risks and indicates the banks health, the higher the ratio the more reliable the bank is considered to be (see for example, Galindo and Powell, 2005; Cook and Spillman, 1994; Hanna and Hanwech, 1988; Park and Peristiani, 1998; Martinez Peria and Schmuckler, 2001; Hosono et al. 2005; and Karas, 2006; Calomiris and Powell, 2001).
Asset Quality: -Loan loss provisions to total loans	- (+)	Represents the amount of funds set aside to absorb expected losses of non-performing loans, so the higher this ratio the higher the credit risk (see for example, Barajas and Steiner, 2000; Nier and Baumann, 2006).
-Total loans to total Assets	- (+)	Measures the level of credit risk. The higher the level of credit risk, the less the expected growth of deposits and the more the expected interest payments (see for example Calomiris and powell, 2001; Tsuru 2003).
Management efficiency: - Non interest expenditures to total assets	- or + + or -	The relation is ambiguous. The rise of this ratio may be caused by a decline in efficiency of management (in this case the relation will be negative, and positive with deposits growth, and interest paid, respectively). However this relation may be inversed if the increase of this ratio was as a result of new services developments, improvements in service quality or advertising new products (see for example, Karas, 2006; Ghosh and Das, 2003)
Earnings: -Return on assets ratio	+ (-)	The higher the ratio the more profitable the bank is considered to be. Hence, the more the expected deposit growth and the less the interest paid to depositors (see for example, Levy-Yeyati et al., 2004; Galindo et al., 2005; Karakas, 2005).
Liquidity -Cash plus balances with other banks to total assets ratio	+ (-)	The higher the ratio the more the ability of the bank to meet unexpected withdrawals, and the safer the bank is considered to be (see for example, Tsuru, 2003; Hosono et al., 2005; Murata Hori, 2006).

B-Non-Fundamental Variables		
-Bank size (natural logarithm of bank's asset)	+ (-)	The bigger the bank, the more bank reliability and the lower the failure probability. Therefore, larger banks are expected to attract more deposits, and access cheaper sources of funds from other sources (e.g. inter-bank credits market), and hence offer low interest rates to depositors. Depositors, in turn, are likely to see the large bank as more reliable and accept lower deposit interest rates (see for example, Arena, 2005; Murata and Hori, 2006; Spiegel and Yamori, 2007).
-Number of branches	+ (-)	Banks with a larger number of branches network are able to spread geographically and able to attract more deposits with lower interest (see for example, Spiegel and Yamori, 2007; Barajas and Steiner, 2000; Calomiris and Mason, 2003) .
C- Macroeconomic and Systemic Variables:		
-GDP Growth	+ (-)	The higher this ratio the stronger the economy the more the expected growth in deposits and the less the interest paid (see for example Ghosh and Das, 2003; Martinez Peria and Schmukler, 2001; Hosono et al., 2005; Ioannidou and Dreu, 2006).
-Inflation rate (Changes in Consumer price index)	- (+)	The higher the inflation the higher the consumption and the lower the saving. Therefore, if there is an increase in the inflation rate, the lower the expected growth in the deposits and the higher the compensation of interest rates (see for example Ghosh and Das, 2003; Martinez Peria and Schmukler, 2001).
-Cash outside banks to system deposits	- (+)	This ratio gives an indication of the individual preferences for holding currency relative to bank deposits. A negative (positive) effect may prove the probability of contagion effect in the deposit growth (interest paid) equation (see for example Ghosh and Das, 2003; Karas, 2005)
- Bank deposits Concentration ratio.	+ (–) - (+)	This ratio may reflect the banking system risk. The effect is ambiguous, see discussion for the interpretation (see for example, Goldberg and Hudgins, 1996).
Other Control Variables		
-Three months U.S. Treasury bills	- (+)	A significant relationship proves the integration between the local market and the global market.

Notes:

1 The expected influence represents the expected relation between the variable and the deposits growth (interest paid to depositors).
+ denotes a positive effect, and – indicates a negative effect.
2 All variables are collected from banks annual reports and ratios are calculated by the author.

In order to control for the behaviour of the overall banking sector, our estimations include the ratio of cash outside banks to system deposits (CASH). This variable provides a preliminary way of testing for contagion effects. Contagion refers to the situation in which individual depositors at a given bank act according to what the rest of the banking system appears to be doing, after controlling for bank-specific and macroeconomic factors. Cash outside banks over system deposits reflects individuals' preference for holding currency relative to bank deposits. If depositors perceive an increase in systemic risks, they might decide to withdraw their deposit from banks regardless of their fundamentals. The value of cash outside banks over system deposits will increase and individual bank deposits will fall. Therefore, a negative correlation between individual bank deposits and cash can be interpreted as evidence of contagion effects. A reverse argument holds between the interest payment variable and cash variable. This variable for testing the contagion effect has been used by Ghosh and Das (2003).

To capture the behaviour of depositors, we control for banking sector concentration (CON). The effect of banking sector concentration on depositor behavior is ambiguous, however, some theoretical arguments and country comparisons suggest that a less concentrated banking sector with many small banks is more prone to financial crises compared with concentrated banking sectors with a few large banks,[54]

An opposing view, however, is that a more concentrated banking structure enhances bank fragility so that large banks may receive larger net subsidies more frequently than small banks through implicit "too-big-to-fail" policies. This greater subsidy for large banks may in turn intensify risk-taking incentives, increasing the fragility of concentrated banking systems (Boyd and Runkle, 1993; Mishkin, 1999). Additionally, a few large banks may not be easier to monitor than many small banks. If size is positively correlated with complexity, then large banks may be more opaque than small banks, which would tend to produce a positive relationship between concentration and fragility.

Finally, Boyd and De Nicolo (2003) stress that banks with greater market power tend to charge higher interest rates to borrowing firms, which induces them to assume greater risk. To the extent that the concentration is positively associated with banks enjoying greater market power, the Boyd and De Nicolo (2003) model predicts a positive

[54] Allen and Gale, (2000) give reasons supporting this argument, first, large banks can diversify better so that banking systems characterized by a few large banks will be less fragile than banking systems with many small banks. Second, concentrated banking systems may enhance profits and therefore lower bank fragility. High profits provide a "buffer" against adverse shocks and increase the franchise value of the bank, reducing incentives for bank owners to take excessive risk (Hellmann, Murdoch, and Stiglitz, 2000). Third, some hold that a few large banks are easier to monitor than many small banks, so that corporate control of banks will be more effective and the risks of contagion less pronounced in a concentrated banking system.

relationship between concentration and bank fragility. From the above argument, we could conclude that it is important to test for the effect of concentration on depositors' behaviour. Furthermore, following the traditional Structure-Conduct-Performance (SCP) paradigm more concentrated market are believed to be less competitive (see, for example, Berger and Hannan 1989; Molyneux and Forbes, 1995). We expect a positive relationship between deposit concentration levels and the growth rate of deposits and a negative relation with interest paid on deposits.

To account for environmental effects, macroeconomic variables are included in our model. Unexpected macroeconomic shocks undermine the viability of financial institutions. The variables included in the empirical implementation in this study not only capture the effects of economic activities, but also the external effects on the local market. With respect to economic activities, the inflation rate (consumer price index changes) and real GDP growth have been included because they have a common effect on all banks in the sector (see Ioannidou and Dreu, 2006; Hosono et al., 2005; Martinez Peria and Schmukler, 2001).

Regarding external effects, the US risk-free-rate (3 month US Treasury bill rate) has been added to test for the integration level with the global economy and the openness of the local deposit market, a significant sign on this variable indicates that the local market is integrated with foreign markets and vulnerable in the context of foreign capital inflows and outflows. A negative effect on deposit growth and a positive effect on interest rates are expected to indicate the integrated level with the global market.

6. Estimation Results

After describing the sample set, the estimation results are organised as follows. First, we attempt to answer the following question; do depositors discipline their banks in Jordan? Then, we analyse the second question of whether depositors' reactions towards bank risk differs before and after the crises that occurred in 1989. In addition, we also analyse how the introduction of a deposit insurance system in 2000 affected market discipline. Finally, we aim to investigate whether banks respond to depositor discipline (if it exists).

6.1 Data Description

An overview of the data used in this study is provided in Table 1.4. The names of the variables are provided in column 1. The remaining columns present the summary statistics for the variables over the entire 1982-2005 sample period. Deposit growth has been positive across banks during the sample period (14.13% annually but varied during the sample period and across banks), the standard deviation is about 22.17% with a substantial difference between minimum and maximum values (-79.86% and 105.83% respectively). On the other hand, the interest paid to depositors does not change much over time (standard deviation 1.62%) and average equals 5.09%. There is one bank in our sample (the Jordan Gulf Bank) that reported negative capital at least once during the period under consideration before it was restructured and converted into the commercial bank in 2004.

As is apparent from Table 1.4 macroeconomic variables record relatively high volatility during the period of study, this may provide a good justification for including macroeconomic variables in our study. The inflation rate varies between -0.20% to 25.7% over the study period, the same ups and downs was recorded for GDP growth which varied between an upper rate of 12.99% and lower rate of -16.46 %. The banks in the sample had high average levels of liquidity 39.24% of their total assets on average) which perhaps reflects a conservative strategy to investment. This liquidity ratio reached as high as 81.17% of total assets for some banks in the sample. Given their liquidity, it is surprising to notice a high level profitability for Jordanian banks, the average return on assets amount to1.04% with variation of 23.52%[55].

Profit growth for the Jordanian banks appears to have been stimulated by high interest rate spreads, as well as stock market development, the latter by generating brokerage fees as well as special interest charges from margin trading (Dihel and Kardoosh, 2006).

[55] Demirguc-Kunt and Huizinga (1999) report average return on asset (during 1990-1997) for Australia, Canada, Chile, and Germany, as 0.8%, 0%, 0.4%, and 0.2% respectively. On the other hand liquidity of the same countries was 9.7%, 19.6%, 31%, and 27.2% respectively. These figures indicate that during our sample period Jordanian banks profitability and liquidity were relatively high. In addition 1.04% return on assets for the Jordanian banks is comparable with UK banks average return on assets between 1999 and 2004 (which was equal to 1.035%) (See Figueira et al., 2007).

Although, some Jordanian banks during the sample period had a relatively large proportion of loan investments (reaching above 90% of total assets) the average value at 36% appears low. The banks also seem to hold modest levels of loan-loss-provisions (which reached a minimum level of 0.01%, for some banks in the early years of this sample period).

Table 1.4

Descriptive Statistics

Variable	Mean	Median	St Dev	Minimum	Maximum	ADF (level)	ADF (D1)
Dep	14.13	11.13	22.17	-79.86	105.83	-14.0109 0.0000	-
Int	5.09	5.28	1.62	0.87	9.85	-16.6497 0.0000	-
Cap	6.26	4.03	6.63	-5.97	39.08	-2.0959 0.2467	-5.0326 0.0000
Liq	39.24	40.53	15.26	3.65	81.17	-2.1014 0.2445	-5.9326 0.0000
Pro	1.92	0.66	4.86	0.01	36.43	-4.5795 0.0002	-
Tl	36.00	39.08	17.98	9.73	96.65	-4.3225 0.0005	-
Manag	0.97	0.76	0.68	0.07	3.64	-0.1949 0.9358	-
ROA	1.04	0.90	2.02	-7.40	0.16	-6.4258 0.0000	-
Inf	4.27	3.30	5.09	-0.20	25.70	-2.8460 0.0533	-
GDP	1.34	3.00	5.50	-16.46	12.99	-8.7772 0.0000	-
CASH	22.53	19.96	8.18	13.37	40.19	-17.9903 0.0000	-
Log No.B	1.19	1.279	0.49	0.00	2.2923	-3.0135 0.0350	-
Size	8.41	8.38	0.51	6.95	9.8335	-4.4184 0.0003	-
US RFR	4.98	5.01	2.35	1.01	10.60	-6.5671 0.0000	-
CON	65.10	65.79	9.38	50.53	87.80	-6.0531 0.0000	-

Notes:

-All numbers in the table are in percentages except Log No.B and Size.

- Total number of observations is 273. Data are obtained from banks' annual reports. Macroeconomic variables are obtained from the central bank of Jordan data base. The US RFR% is obtained from the US Board of Governors of the Federal Reserve System from: http://research.stlouisfed.org/fred2/data/TB3MS.txt.

-Dep is the yearly percentage change in deposits; Int is the total interest paid on deposits to total deposits; Cap is the capital adequacy ratio estimated as the capital to total assets ratio; Liq is the liquidity ratio calculated by dividing liquid assets(cash and bank deposits) to total assets; Pro is the ratio of loan loss provision to total loans, Manag management efficiency ratio estimated as non interest expenses to total assets; ROA is the return on assets ratio; Inf is inflation rate; GDP is the growth rate in the real GDP; Tl is the ratio of total loans to total assets; CASH is the cash outside the banking system to system deposits; CON is three bank deposits concentration ratio. US RFR is three month US treasury bills risk free rate. log No.B is the natural logarithm of total number of branches. Size is the natural logarithm of total assets.

ADF is the Augmented Dickey Fuller test for stationary (Dickey and Fuller, 1979). The basic objective of the test is to examine the null hypothesis that the series contains a unit root versus the alternative hypothesis that the series is stationary. In order to include the variable in our models the stationarity condition must be achieved. Our results indicate that all variables are stationary in their levels, except liquidity and capital, thus, we include these two in their first difference.

D1 defines the first difference.

6.2 Depositor Reaction Towards Bank Risk

To study the effect of bank fundamentals (characteristics) on depositors' behaviour and to examine the existence of market discipline, we estimated the reduced form regressions (3) and (4) including each of the fundamental variables and also all the variables together. The three estimation approaches of OLS, fixed effects and random effects were used; however we used the LM and Hausman tests results to identify the preferred (best fit) models and these are reported. The estimates for the deposits growth equation (3) are reported in Table 1.5. The dependent variable (deposits growth) is regressed against a variety of bank fundamentals, and non fundamentals, as well as macroeconomic and systemic variables and other control variables. We report seven equations, these are numbered 1 to 6, include all the variables but only one fundamental is included each time. In equation 7 the results include all the fundamental variables. The aim of estimating equations that include only one fundamental variable is to see if these assert individual influence in deposit growth compared to when they are combined with all other fundamental values as reported in column 7.

The results provide evidence that market discipline is at work in Jordan. Most of the bank fundamental variables enter the deposit growth equations in a manner consistent with the hypothesis that market discipline exists. A bank with relatively more liquid assets experiences a rise in its deposits base (positive coefficient value of 0.2381 and significant at the 1% level). Regarding assets quality, loan-loss provisions coefficient (1.0074) significantly affects banks deposits growth at the 10% significance level. The higher the level of loan-loss provisions the more the expected growth in bank deposits. This result indicates that depositors in Jordan penalise risky banks by withdrawing risky assets. Likely, the coefficient of management efficiency is negative (-5.6318) and significant at the 1% level, and this suggests that inefficient management practices affect deposit growth negatively. Meanwhile, the return on assets variable has a negative sign and significant in the individual equation (coefficient value equals to (-1.9924) which suggest a negative relation between deposits and growth, indicating that profitable banks fail to attract more deposits.

Table 1.5

Factors Affecting Deposits Growth Results- Full Period (1982 -2005)

Variable	(Dependent variable: Deposits Growth)						
Banks' fundamental and non-fundamental variables							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Size	-.6105 .3709	-.0472 .0354	-.2316* .0757	-.0911+ .0391	-.2986* .0801	-.0916+ .0376	-.1033+ .0480
Log No.B	-.0002 .0006	-.2842 .5922	-.0003 .0016	.0104 .0169	.0005 .0016	.0007 .00064	-0.0001 0.001
Δ Cap$_{t-1}$	.1708 .1999						-.2112 .2759
Δ Liq$_{t-1}$		.2381* .0475					0.2733* 0.0703
Pro$_{t-1}$			1.0074† ..5387				0.2633 0.2952
TL$_{t-1}$				-.0709 .0510			-0.0018+ 0.0635
ROA$_{t-1}$					-1.9924+ .8491		0.5594 0.8667
Manag$_{t-1}$						- 5.6318* 1.4160	-6.7914* 1.9187
Macro economics and systemic factors							
Cash	-.1433 .2780	-.1431 .2647	-.40374 .3460	-.1494 .2899	-.5972† .3397	-.01128 .2839	0.0250 0.2766
CON	.0174 .2202	.06797 .2081	.2296 .2506	-.0911 .0391	.3272 .25719	.16186 .2308	0.1727 0.2165
INF	-.0025 .0036	-.0029 .0034	-.00013 .0038	-.0003 .0037	.00035 .0038	.00016 .0036	-0.0026 0.0034
GDP	-.0089+ .0035	-.0089* .0033	-.0052 .0035	-.0043 .0036	-.00550 .0035	-.00427 .0035	-0.0083+ 0.0033
Other control: **US Rf**	-.0008 .0108	.0016 .0103	-.0021 .0110	.0031 .01085	-.0024 .0110	.0061 .0106	0.004 0.0103
Estimation Method	OLS	OLS	FE	OLS	OLS	OLS	OLS
F- Statistic	2.16 .03823	5.12 0.000	1.42 .1123	1.46 .0962	1.53, .0711	3.38 .0011	3.60 0.000
R-Sq	.0603	.1484	.1076	.1102	.11505	.0983	0.169
LM **(p-value)**	2.40 (.5247)	4.22 (.6406)	11.63 (.0427)	0.24 (0.6242)	1.41 (.5196)	.32 (.5726)	1.24 (.2652)
Hausman Test **Chi-Sq. Statistic** **(p-value)**	12.58 (.0828)	11.99 (.1517)	20.27 (.0024)	14.67 (0.066)	12.36 (.1360)	13.05 (.1101)	14.34 (.3501)
DW							2.08
Wald Test							16.15 (0.000)

Notes for Table 1.5:

- Dep is the yearly percentage change in deposits; Int is the total interest paid on deposits to total deposits; cap is the capital adequacy ratio estimated as the capital to total assets ratio; Liq is the liquidity ratio calculated by dividing liquid assets(cash and bank deposits) to total assets; Pro is the ratio of loan loss provision to total loans, Manag management efficiency ratio estimated as non interest expenses to total assets; ROA is the return on assets ratio; Inf is inflation rate; GDP is the real growth rate in GDP; Tl is the ratio of total loans to total assets; CASH is the cash outside the banking system to system deposits; CON is three bank deposits concentration ratio. US RFR% is three month US treasury bills risk free rate. Log No.B is the natural logarithm of total number of branches. Size is the natural logarithm of total assets.
- In each model the first value is the estimated coefficient, the second is the standard error for each variable included.
- Dependent variable in all models is deposits growth rate calculated as the percentage changes in deposits level from year t-1 until year t.
†, +, * indicate significance at the 10%, 5% and 1%, respectively.
- FE, RE, OLS, stand for Fixed Effect, Random Effect, and Ordinary Least Square estimations, respectively.
-LM is the Lagrange Multiplier test. This test was originally developed by Breusch and Pagan (1980). It compares between pooled regression and random effect models based on Maximum Likelihood estimation under the null hypothesis the efficient estimators are pooled least Squares.

$$\tau = \frac{nT}{2(T-1)}\left[\frac{\sum_{i=1}^{n}\left[\sum_{t=1}^{T} e_{it}\right]^2}{\sum_{i=1}^{n}\sum_{t=1}^{T} e_{it}^2} - 1\right]^2 = \frac{nT}{2(T-1)}\left[\frac{\sum_{i=1}^{n}(T\bar{e}_i)^2}{\sum_{i=1}^{n}\sum_{t=1}^{T} e_{it}^2} - 1\right]^2 \quad ; \quad \tau \sim \chi^2(1) \text{ if H0 is true}$$

- Hausman Test is a test to choose between fixed or random effects specification. The null hypothesis is that both the fixed and random specifications are consistent and the alternative hypothesis is that fixed effect is better estimator than Random effect. Values between brackets are p- values.

$$W = \chi^2\left[\frac{(\hat{\beta}^{fe} - \hat{\beta}^{re})^2}{Var\left[\hat{\beta}^{fe}\right] - Var\left[\hat{\beta}^{re}\right]}\right] \qquad \tau \sim \chi^2(1) \text{ if H0 is true}$$

-DW is Durbin and Watson's (1951) test of H_0: no serial correlation in the residuals (e) versus H1: residuals are serially correlated. The test statistic is calculated using the residuals from the estimated full model based on the following equation:

$$\tau = \sum_{t=2}^{n}(e_t - e_{t-1})^2 / \sum_{t=1}^{n} e_t^2$$

- Wald Test is the Wald Test for Coefficient Restrictions. This test computes a test statistic based on the unrestricted regression. The Wald statistic measures how close the unrestricted estimates come to satisfying the restrictions under the null hypothesis. If the restrictions are in fact true, then the unrestricted estimates should come close to satisfying the restrictions. This test has been used to examine the null hypothesis that the sum of the fundamental variables (Capital, Liquidity, loan loss provision, total loans, and management efficiency) coefficients, included in the deposit growth model, equal zero.

The only variable that is not statistically significant and does not show any effect on deposits growth is the capital ratio variable and this suggests that depositors do not consider bank capital levels in their choice of banks (may be because they believe that this item is already regulated). However, it is worth noting that in the full model the only significant fundamental variables are liquidity, total loans, and management (See Table 1.5 column 7).

Most control variables were not important in affecting banks' deposit growth. Except for bank size, the negative coefficient of -0.1033 in the last column in Table 1.5 indicates that, all other things being equal, bigger banks demand fewer deposits, either because they have access to other sources of finance or because they are expanding less than smaller banks (Ioannidou et al, 2005).

Although the inflation level does not appear to affect deposits growth, the growth rate of real GDP alters deposit growth significantly. GDP growth in Jordan is included to control for the business cycle. The results indicate that, *ceteris paribus*, the higher the growth rates in GDP, the lower the demand for deposits. To some extent, this result is surprising because one would expect that the better the state of economy, the higher the lending opportunities for banks, and hence the higher the demand for deposits. This relation may be reversed in the case of an availability of substitutions towards other sources of investment choices.

Regarding the interest rate equation, Table 1.6 summarises the results from estimating equation 4. In Table 1.6 the dependent variable (interest paid to depositors) is regressed against a variety of variables: bank fundamentals, non-fundamentals, macroeconomic and systemic variables, in addition to other control variables. Again, the first 6 columns in the table represent the results when each fundamental variable has been included one at a time.

Banks with higher liquidity can successfully reduce their interest expenses. on the other hand, banks with risky assets (higher loans to total assets) and higher earnings (higher ROA) pay higher interest to depositors, this increase in interest paid to depositors is maybe due to the fact that more risky banks that can generate higher earnings may offer more competitive interest rates to depositors in order to maintain deposit levels. In addition, banks with higher non-interest expenses relative to total assets are found to pay more interest for depositors. This is may be related to the signaling of inefficient management practices.

While bank capital has no effect on deposits levels, it is related positively and significantly to interest paid to depositors. This relation seems to be inconsistent with the depositors' discipline hypothesis; however, it might be interpreted as depositors assuming that banks only increase their capital when they face higher risk.

Table1. 6

Factors Affecting Interest Paid Results- Full Period (1982 - 2005)

Variable	(Dependent Variable: Interest Paid to Depositors)						
Banks' fundamental and non-fundamental variables							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Size	-.0624 .04437	-.1027 .3044	.0635 .3296	.3961 .30212	.2399 .3406	.3694 .2865	0.1234 0.2733
Log No.B	-.00016 .00066	.0982† .0051	.8282 .0056	-.0012 .0054	.0071 .0061	.0049 .0050	0.0047 0.0046
Δ Cap_{t-1}	.1081 .2694						4.3890* 1.502
Δ Liq_{t-1}		-3.416* .4138					-3.287* 0.3976
Pro_{t-1}			-1.1185 2.7004				-0.656 2.207
TL_{t-1}				2.5144* .3762			0.7969† 0.4718
ROA_{t-1}					32.5411* 5.9401		15.449+ 6.440
$Manag_{-t-1}$						92.5712* 10.7430	50.49* 15.5700
Macro economics and systemic factors							
Cash	-.1679 .2921	.9184 2.232	.4802 2.4611	.0097 2.214	.2626 2.285	-1.1677 2.1195	-0.8200 1.993
CON	-.0516 .2400	.0014 .0370	.0061 .0403	.0040 .0371	.0031 .0360	.0141 .0353	0.0026 0.0318
INF	-.0004 .0038	.0314 .0293	.0258 .0321	.0183 .0295	.0279 .0301	.0086 .02824	0.0181 0.0253
GDP	-.0046 .0036	.0565+ .0289	.05201† .0303	.0375 .0280	.0532 .0284	.0418 .02663	0.0419† 0.0249
Other control: US Rf	.0028 .0109	-.0360 .0808	-.0253 .0839	.0052 .0775	-.0082 .0792	-.0160 .0737	-0.0192 0.0695
Estimation Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS
F- Statistic	1.34 .2236	9.79 0.0000	1.12 .3522	6.87 .000	4.76 .000	10.70 .000	14.10 0.000
R-Sq	.0415	.2410	.0345	.1803	.1323	.2551	.4601
LM (p-value)	8.68 (.3696)	.40 (.994)	1.12 (.9973)	11.43 (.1786)	13.19 (.1054)	13.06 (.1098)	11.16 (0.5152)
Hausman Test Chi-Sq. Statistic (p-value)	.76 (.3837)	.97 (.3235)	1.65 (.1992)	.05 (.8266)	.34 (.5585)	08 (.7812)	.78 (.3760)
DW							2.06
Wald Test (p-value)							19.15 0.0000

See Table 1.5 for notations.

The capital ratio is a proxy for capital sufficiency. Traditionally, depositors may consider highly capitalised banks as more credible and therefore agree to earn lower deposit interest rates. However, the opposite tendency appears to occur in our results and may be explained, as argued by Peresetsky et al., (2007), as a consequence of banks with excessive capitalisation operating less efficiently. Less efficient banks may seek to attract depositors by offering higher deposit interest rates therefore a positive sign on the capital ratio coefficient in the regression may exist. This result is in line with Akerlof's (1970) model of rational behavior by market participants in case of information asymmetries. If buyers (depositors) cannot adequately observe the quality of products, they will demand a discount to bear the risk of such uncertainties. Consistent with the market discipline hypothesis banks with higher liquidity are considered to be safer and pay a lower interest rate, and banks with poor management are required to pay more interest.

The results pertaining to the interest paid to depositors' variable tells a different story about banks' size. The size of banks does not seem to have a significant effect on the interest paid to depositors, and banks with larger numbers of branches are not able to decrease the interest paid to depositors even though the number of branches may be considered a good proxy for services rendered by banks to their clients. On the other side, the only added control variable which affects interest paid to depositors is the growth in GDP.

The Wald coefficient test supports the importance of the joint bank fundamentals coefficient. In both cases, in equations 3 and 4 the null hypothesis that bank fundamentals are not important in explaining banks' deposits growth and interest rate, respectively, were rejected (see Tables 1.5 and 1.6).

To summarise, we find that depositor discipline is at work not only through deposit growth but also through interest paid to depositors. Our results are inline with Martinez Peria and Schmukler (2001), who find that market discipline exists in emerging markets through deposits growth and interest paid. In contrast, our results are not consistent with Karas's et al., (2005) argument that depositors discipline their banks mostly by reducing the amounts of their deposits. Our results also support the notion that deposit growth falls as bank risk taking increases. Moreover, the evidence suggests that depositors require higher interest rates when banks undertake risk.

In addition, we tested for the robustness of our estimates comparing OLS and 2SLS (see Table 1.7). We address the possibility of endogeneity between deposit growth, interest rates and bank fundamentals by employing the 2SLS procedure. Although, the Hausman test supports the 2SLS procedure in the interest rate equation, OLS was preferred in the deposits growth equation (these results are presented in panel A of Table 1.7). Additionally, we re-examine the relationship between bank fundamental, deposit growth and interest rates using Seemingly Unrelated Regression (SUR) estimation which considers the contemporaneous correlation between the deposits and interest paid equations. These results are presented in Table 1.7 Panel B.

Generally, despite using different estimation approaches the previous results hold. The respective fundamentals continue to be jointly significant in explaining deposit growth and interest paid to depositors irrespective of the estimation method used.

Table 1.7

The Effect of Bank Fundamentals on Deposit Growth and Interest Paid to Depositors using more than One Estimation Method

Panel (A): *OLS and 2SLS Estimations*

Variable	Dependent Variables			
	(Deposits Growth)		(Interest Paid)	
	(1) OLS Estimation	(2) 2SLS Estimation	(3) OLS Estimation	(4) 2SLS Estimation
Δ Cap $_{t-1}$	.0902 .2360	1.5991* .5709	3.4310+ 1.7720	-10.0140+ 4.3640
Δ Liq$_{t-1}$	.2282* .0673	.15368+ .0769	-2.2100* .5030	-1.5730* .5873
Pro $_{t-1}$	.3973 .3190	-.3427 .4257	-2.0760 2.3981	4.5080 3.2721
TL $_{t-1}$	.02871 .0581	-.0103 .0640	1.166* .4371	1.524* .4955
ROA $_{t-1}$	-1.0244 .9201	-1.4379 1.0023	18.9380* 6.878	22.5690* 7.6960
Mang $_{t-1}$	-4.756* 1.7664	-4.0524+ 1.9202	53.265* 13.2920	47.071* 14.8420
R-Sq	0.0975	0.0770	0.2970	0.1368
Hausman Test Chi-Sq. Statistic (p-value)	8.43 (0.2085)		11.37 (0.0777)	
Wald Test Chi-Sq. Statistic (p-value)	8.70 (0.0035)	4.79 (0.0295)	31.84 (0.0000)	19.66 (0.0000)

Notes:
2SLS estimation technique addresses the possible endogeneity between bank capital and other fundamentals. Bank capital is shown to respond significantly to prior changes in fundamentals when we include it as an instrument for the bank size, current profit estimated as the return on assts ratio and the ratio of total loan to total assets. We then enter the predicted value of capital as a regressor in the deposit growth and the interest rate equations, using the specification in which liquidity, loan-loss provision, total loans, return on assets and management are included as fundamental variables. The Hausman test compares the two estimations (2SLS and OLS), H_0: differences in coefficients are not systematic. The Wald test tests the hypothesis that the corresponding group of fundamental variables is equal to zero. +, * indicate significance at the 5% and 1%, respectively
See Table 1.5 for variables definition.

Panel (B): SUR *Estimations*

Variable	Dependent Variables			
	(Deposits Growth) SUR Estimation		(Interest Paid) SUR Estimation	
	(1) Coefficients	(2) Standard Errors	(3) Coefficients	(4) Standard Errors
Δ Cap $_{t-1}$	0.090	0.233	3.526+	1.757
Δ Liq $_{t-1}$	0.228*	0.066	-2.264*	0.501
Pro $_{t-1}$	0.397	0.315	-2.191	2.375
TL $_{t-1}$	0.029	0.057	1.167*	0.433
ROA $_{t-1}$	-1.024	0.908	19.293*	6.851
Mang $_{t-1}$	-4.756*	1.742	53.149*	3.152
R-Sq	0.098		0.299	
Wald Test Chi-sq Statistic (p-value)	27.76 (0.001)		109.85 (0.000)	

Notes:
The Table reports the regression results of growth rate of deposits (column 1, 2) and Interest paid to depositors (column 3, 4) on bank fundamentals (Risk Characteristics) using SUR estimation.
SUR is Seemingly Unrelated Regression. This estimation technique corrects for any contemporaneous relation in errors across equations. The regression coefficients, standard errors, R^2's, etc. are different in SUR estimation from those in the standard regressions. This is due to the consideration of any correlated errors in the two equations.
Wald Test tests the null hypothesis that the corresponding group of fundamental variables is equal to zero. †, +, * indicate significance at the 10%, 5% and 1%, respectively.
See Table 1.5 for variable definitions

6.3. Depositor Discipline Before and After the Twin Crises in 1989

The changes in depositors' behaviour towards risk before and after crises are examined in this section. Tables 1.8 to 1.11 report the results of equations 3 and 4 for two separate non-overlapping periods, the pre-crises period from 1982 to 1988 and the post-crises period from 1991 to 2005. First, for the results of the pre-crises period, we refer to Tables 1.8 and 1.9 for deposit growth and interest paid, respectively. It is apparent that depositors' discipline during this period is limited in both the deposit growth and interest paid equations. While, size was a significant factor affecting deposits growth in the pre-crises period, coefficient equals to 0.5925 which significant at the 5% level, return on assets (bank profitability) was the only bank fundamental determining interest paid to depositors during the same period, significant coefficient value at the 5% significance level (see Table 1.9 column 7). This may provide evidence that banks are weakly affected when they attain fewer earnings by being required to pay more interest to depositors. In addition, bank size seems to have an effect on the amount of interest paid to depositors, larger banks during the pre crises periods seem to take advantage by paying less interest (in Table 1.9 the size variable was negative and significant in 4 out of the 7 estimated equations) .

In contrast, bank liquidity, assets quality or capital adequacy plays no role in depositors' choice of their banks. Moreover, depositors during this period were more sensitive to the level of inflation (see column 7 in Table 1.8). The inflation rate negatively affected deposit growth but banks did not respond to the increase in inflation by increasing deposit rates (see the last column of Table 1.9)[56]. The variable that captures the potential spillover effect (contagion effect), the measure of cash outside the banking system divided by systemic deposits, has the expected sign and is significant in the deposit growth equation (see Table 1.8) and negative (but not significant) in the interest rate equation (see Table 1.9), alluding to the fact that deposits with the entire banking system grew at a slower rate than cash outside banks. The rapid growth of cash outside banks might be a consequence of increases in system wide liquidity in the face of declining interest rates on banks deposits and limited alternative avenues for parking funds by depositors. In both equations, the Wald test reveals that bank fundamental factors are jointly not significant in both specifications.

[56] Accounting data are not adjusted for inflation.

Table 1.8

Factors Affecting Deposit Growth Results- Pre Crises (1982 - 1988)

Variable	Parameter Estimate (Dependent Variable : Deposits Growth)						
Banks' fundamental and non-fundamental variables							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Size	.4558† .2394	-.0656 .04576	-.0814† .0459	-.0793† .04597	.4651† .2746	.5123† .2846	.5925+ .2671
Log No.B	-.0041 .06406	.0009 .1087	-.00019 .00093	.00057 .00108	.00364 .2926	.00092 .0029	-.00375 .00458
Δ Cap $_{t-1}$	-1.1193 1.0465						-.5119 1.1489
Δ Liq$_{t-1}$		.2210 .1411					-.4749 .4464
Pro $_{t-1}$			-1.8069 1.5333				-3.5910 2.208
TL $_{t-1}$				-.0898 .0857			.3523 .4084
ROA $_{t-1}$					-.7863 1.3456		-.76027 1.1719
Manag $_{t-1}$						-3.3890 4.0964	.1715 4.501
Macro economics and systemic factors							
Cash	5.8018† 3.1380	1.1138 2.0723	1.2631 2.0891	1.3328 2.0962	1.2480 2.0406	1.1587 2.0367	6.8739+ 3.2242
CON	6.214† 4.487	3.1082 3.6833	3.5540 3.7058	3.5097 3.7148	1.2056 3.7250	.9866 3.731	7.476 5.096
INF	-.0175+ .0086	-.00543 .0067	-.00543 .0067	-.0060 .0067	-.00653 .0065	-.0059 .0065	-.0199+ .0088
GDP	.0082 .01013	.001586 .0078	.0020 .0079	.0019 .0079	.0006 .0076	.00081 .0076	.0114 .0104
Other control: US Risk Free Rate	-.0260 .02317	.0053 .0206	.0014 .0209	.0038 .02087	.0189 .02169	.0196 .0215	-.0288 .0248-
Estimation Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS
F- Statistic	1.99 .0382	1.41 .2194	1.36 0.2348	1.60 .1023	1.08 0.3946	1.65 .0880	1.74 0.0937
R-Sq	.4308	.5227	.1553	.3345	0.0456	.3417	0.3613
Hausman Test Chi-Sq.Statistic (p-value)	29.28 0.000	8.75 .3638	4.50 0.7768	2.58 0.9767	7.51 .26576	4.21 .7875.	11.28 0.0543
DW							1.9648
LM	.09 .7653	.15 .6985	.25 .6169	.05 .8249	0.00 0.9940	0.00 0.9724	.88 .3487
Wald Test							1.75 0.1937

See Table 1.5 for notations.

Table 1.9

Factors Affecting Interest Paid Results- Pre Crises (1982-1988)

Variable	Parameter Estimate (Dependent Variable : Interest Paid to Depositors)						
Banks' Size and Fundamentals							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Size	-.0087 .00916	-.01558* .00551	-.0171 .0075	-.0168* .0063	-.1659+ .00722	-.0164+ .0071	-.0191 .0045
log No.B	-.00003 .00013	.00014 .00011	.00001 .00013	.00058 .0001	-.00003 .00013	.000043 .00012	.00103 .00074
Δ Cap $_{t-1}$	.0966 .0669						0.0648 0.0628
Δ Liq$_{t-1}$		.0375+ .0152					.0159 .0117
Pro $_{t-1}$			.0443 .1239				.0456 .0953
Lag TL $_{t-1}$				-.0173 .0106			-.0054 .0065
ROA $_{t-1}$					.0951 .0773		.1057† .0583
Manag $_{t-1}$						-.2602 .1979	-.0094 .1193
Macro economics and systemic factors							
Cash	-.0750 .0508	-.0886† .0499	-.0867† .0507	-.0807 .0504	-.0908† .0503	-.0889* .0503	-.0310 .3885
CON	-.00029 .00019	-.00013 .00199	-.4297* .00163	-.00418+ .00163	-.00038+ .00017	-.00043* .000161	-.00002 .00014
INF	.00013 .00016	.00014 .00016	.1516 .1662	.00015 .0002	.0002 .0002	.00019 .00016	.00015 .00012
GDP	-.0002 .00018	-.00015 .00018	-.00022 .00018	-.0002 .00018	-.00018 .00019	-.00021 .18428	.7922 .00014
Other control: US Risk Free Rate	.00049 .00094	.00061 .0009	.0006 .0010	.00059 .0010	.00035 .00096	.0006 .9495	.0010 .0007
Estimation Method	RE	RE	RE	RE	RE	RE	RE
F- Statistic	16.87 .0000	11.29 .0000	11.28 .0000	11.26 .0000	11.53 .0000	11.46 .0000	16.67 .0000
R-Sq	.4458	.5908	.7763	.7761	.7801	.7791	.8121
Hausman Test: Chi-Sq.Statistic (p-value)	7.14 .5213	10.92 .2062	7.65 .4684	9.81 .2788	7.00 .5369	6.84 .5535	2.54 .9965
LM	69.79 .0000	16.01 .0000	82.15 .0000	36.92 .0000	72.37 .0000	71.20 .0000	3.10 .0738
Wald test							0.44 0.5090

See Table 1.5 for notations.

Secondly, Tables 1.10 and 1.11 summarise the after crises results for the deposit growth and interest paid equations, respectively. It is clear that depositor discipline improved in the second period (fundamental variable are more significant compared with the pre-crises period in both of quantity and price equations results presented in Tables 1.11 and 1.12). Hence, the crises seem to have had a positive effect on market discipline. The twin crises of the Petra Bank failure and the currency devaluation possibly worked as a 'wake-up call' for depositors, as noted by Martinez Peria and Schmukler's (2001) study on the effects of the Latin American crises. They argue that traumatic episodes during severe crises may act as a "wake-up call" for depositors, increasing their awareness of the risk of their deposits. Our results seem to be consistent with this argument. Where assets quality and earnings affect deposit growth (see Table 1.11), bank capital adequacy, liquidity, assets quality, management efficiency and earnings determine interest paid to depositors (see Table 1.11). Moreover, bank fundamental variables were jointly significant in both cases. In addition, banking system deposit concentration has an important effect on deposits growth. The coefficient of banks deposits concentration ratio was positive and significant in the deposit growth and interest rate equations indicating that a more concentrated banking system stimulates more deposit growth and increased deposit rates. Additionally, a more healthy economy has promoted a higher deposit growth in the post banking crises sample period. This may be interpreted as a build-up of confidence in the banking system especially as the Jordanian government undertook substantial reforms aimed at building a sound and safe financial system. Interest rate and trade liberalisation effects during the 1990s may have induced one of the findings of the regressions reported in Tables 1.9 to 1.12. The impact of greater market openness to outside depositors who found the Jordanian banking system a relatively safer haven for their savings due to the instability in the region, as well as being influenced by the globalisation trend. Perhaps these factors are reflected in the negative significant coefficients on the U.S risk free rate variable in the post crises period (Table 1.11), whereas the impact of US rate had no influence on the Jordanian deposit rate or growth prior to the crises. This may indicate that with more open markets investors or depositors may choose to place their funds overseas if offered attractive returns. On the other hand, this result may provide some explanation for the existence of market discipline which may be induced by foreign investment in local market 'external discipline' (Vives, 2002).

Table 1.10

Factors Affecting Deposit Growth Results- Post Crises (1991 - 2005)

Variable	Parameter Estimate (Dependent Variable : Deposits Growth)						
Banks' Size and Fundamentals							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Size	.4588*	.51149*	.1026†	.0614	.43710*	.4550*	.1634+
	.1238	.1340	.0598	.0606	.12979	.1269	.0721
log No.B	.0045	.00437	-.00212	-.0003	.00460	.00454	-.00069
	.0029	.0029	.0096	.0010	.0029	.0029	.0012
Δ Cap $_{t-1}$	.0561						.0811
	.2979						.3193
Δ Liq$_{t-1}$		.07714					.0468
		.1103					.0965
Pro$_{-1}$			1.1408+				1.6893*
			.4390				.5084
Lag TL$_{-1}$				-.0512			.09798
				.0731			.1273
ROA$_{-1}$					-2.0114+		-4.463*
					1.1058		1.7256
Manag$_{-1}$						-1.1086	2.3572
						2.461	4.686
Macro economics and systemic factors							
Cash	.9364	1.0497	.2240	.0908	.90748	.98753	.1120
	.6444	.6420	.5934	.6012	.6347	.6329	.6276
CON	2.5771*	2.5968*	3.1582*	3.2208*	2.6926 *	2.6616*	3.0737*
	.3963	.3873	.3637	.3836	.4017	.4026	.3881
INF	-.2815	-.02995	-.03508†	-.0399+	-.0296	-.3013	-.0251
	.0195	.0187	.0186	.0188	.1869	.1873	.0194
GDP	.0166+	.01549+	.01479+	.14912+	.01522+	.01564+	.01454+
	.0067	.0065	.6475	.0066	.0065	.0065	.0066
Other control: US Risk Free Rate	-.0631*	-.0619*	-.0743*	-.0732*	-.6534*	-.0632*	-.0777*
	.0199	.0199	.0195	.0199	.0198	.0198	.0198
Estimation Method	OLS	FE	OLS	FE	FE	FE	OLS
F- Statistic	13.54	14.06	33.79	31.91	14.07	14.02	11.39
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0000
R-Sq	.6229	.6260	.6003	.5864	.6262	.6254	.6521
Hausman Test: Chi-Sq. Statistic (p-value)	8.68	16.55	19.81	14.46	14.31	11.63	10.81
	(.3696)	(.0352)	(.0111)	(0.0705)	(.0380)	(.0427)	(.0509)
DW							1.96
LM	1.40	4.69	2.58	4.31	14.46	4.28	.88
	0.2373	.0302	.1080	.0380	.0705	.0385	.3487
Wald test							13.79
							(0.0003)

See Table 1.5 for notations.

Table 1.11
Factors Affecting Interest Paid Results- Post Crises (1991- 2005)

Variable	Parameter Estimate (Dependent Variable : Interest Paid to Depositors)						
Banks' Size and Fundamentals							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Size	.5856 .8772	-.1814 .3762	.0359 .4240	.7546 .4649	-.0452 .3945	.5261 .3655	1.233 .7727
log No.B	-.0193 .2034	.1112† .6119	.9254 .0069	-.0047 .0082	.0100 .0065	.0042 .6016	-.0301 † .0161
Δ Cap $_{t-1}$	5.8262 + 2.8906						6.5611* 2.4575
Δ Liq$_{t-1}$		-3.3800* .46262					-4.076* .75936
Pro$_{-1}$			-.7791 3.1148				11.3076+ 4.5746
TL$_{-1}$				2.8109* .4784			.9872 .7832
ROA$_{-1}$					32.0724 7.2850		29.6079+ 11.6404
Manag$_{-1}$						103.97* 13.6334	88.608* 21.1351
Macro economics and systemic factors							
Cash	1.5993 4.4641	2.1954 3.7977	2.5915 4.2107	2.3754 3.6922	2.5410 3.9856	-1.0845 3.6799	.03575 .10452
CON	8.8751* 2.7974	8.1221* 2.3118	9.2056 2.5814	5.3398+ 2.3689	7.5265 2.4827	5.3158+ 2.3019	2.4390 2.3491
INF	-.0272 .1327	.0254 .1207	-.0414 .13198	-.0426 .11473	-.0539 .12479	-.2592 .11414	-2.085 3.6166
GDP	.0511 .0046	.6190 .0417	.5566 .4595	.0509 .0401	.0646 .0437	.0435 .0400	.0463 .3636
Other control: US Risk Free Rate	.1925 .1401	.1582 .1230	.1993 .1385	.2051† .1211	.2087 .1316	.1036 .1211	.0597 .1128
Estimation Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS
F- Statistic	2.93 .0042	10.02 .0000	2.64 .0092	6.88, .0092	5.34 .0000	10.76 .0000	6.66 .0000
R-Sq	.1153	.3129	.1051	.2341	.1918	.3234	.5054
Hausman test Chi-Sq. Statistic (p-value)	2.80 .9460	3.19 .9218	2.28 .9713	4.20 .8385	2.80 .9460	12.25 .1404	3.19 .9218
LM	.70 .4018	.59 .4417	1.43 .2323	.87 .3500	.73 .3935	.22 .6389	.52 .4695
DW							1.93
Wald test							30.00 0.0000

See Table 1.5 for notations.

6.4. Deposit Insurance and Market Discipline

Having found a relationship between bank fundamentals and deposit growth as well as interest paid to depositors signifies that market discipline is at work in Jordan. However, we need to find out at this stage how the mechanisms of market discipline were influenced by the introduction of a deposit insurance system. Specifically, to examine whether the introduction of explicit deposit insurance, introduced in Jordan in 2000, affected the way in which depositors discipline their banks. We estimate equations 5 and 6. The results of both estimations are presented in Panels A and B (1 and 2) of Table 1.12.

Panel A in Table 1.12 summarises the results of estimating the deposit growth equation (equation 5), when the interaction of bank fundamentals and the deposit insurance dummy variable have been added to the model. The results show that depositors' sensitivity to bank size existed with the introduction of the deposit insurance system. However, this size effect may indicate that the too-big –to-fail policy does not help banks attract more deposits or pay lower interest rates. In fact, it could be that large banks, in general, are treated as the most risky therefore they have to offer greater returns for existing depositors. Overall, the results indicate that the introduction of deposit insurance was not responsible for eliminating market discipline. In the deposit growth estimation (Panel A Table 1.12), the only significant interaction variable is the liquidity variable, however, the sign of the coefficient (0.5247) signifies that market discipline through liquidity increased after the introduction of deposits insurance. The total effect of liquidity and the interaction between liquidity and the deposit insurance dummy variable tend to be positive signifying the large influence of bank liquidity has on depositors' behaviour after introducing deposit insurance. However, not all the indicators of bank risk which were previously found to reflect market discipline are significant. One exception appears from these estimations results. Bank capital appears to affect deposit growth with the expected positive sign (coefficient value of signalling that the stronger capitalised banks attract more depositors). When deposit insurance was introduced, depositors' discipline through quantity has not been affected by the explicit insurance. It is likely that with, the effect of asset quality, earnings were not significant in the deposit growth equation.

Table 1.12

The Effect of Deposit Insurance on Depositor Discipline

$$\Delta Deposit_{i,t} = \alpha_i^1 + \beta^1 \times Bank_{i,t-1} + \lambda^1 Controls_{i,t} + \phi^1 Bank_{i,t-k} * DI_{t-k} + \varpi_{it} \qquad (5)$$

$$Interest_{i,t} = \alpha^2 + \beta^2 \times Bank_{i,t-1} + \lambda^2 Controls_{i,t} + \phi^2 Bank_{i,t-k} * DI_{t-k} + v_{it} \qquad (6)$$

Variable	Panel (A) (Deposits Growth)		Panel (B) (Interest Paid)	
	Parameter Estimate		Parameter Estimate	
	Coefficient(1)	Standard Error(2)	Coefficient(3)	Standard Error(4)
Fundamental Variables				
Δ Cap $_{t-1}$	.6379†	0.3565	7.990†	4.1009
Δ Liq$_{t-1}$	.2174+	0.1057	-0.3279	0.8091
Pro$_{-1}$	1.1262+	0.4767	-1.6069	3.9961
TL$_{-1}$	0.0786	0.0837	-0.2983	0.6640
ROA$_{-1}$	1.7263	1.2054	-5.1610	9.5876
Manag$_{-1}$	0.2429	2.5342	10.8181	19.20379
Δ Cap $_{t-1}$* DI	0.3616	0.2838	-2.5784	4.1523
Δ Liq$_{t-1}$* DI	0.5247*	0.1273	-2.8247*	0.9720
Pro$_{-1}$* DI	-1.0608	0.5506	-0.7139	4.8149
TL$_{-1}$* DI	-0.0691	0.1318	0.0537	1.0129
ROA$_{-1}$* DI	-1.4890	1.9623	21.8294	14.5219
Manag$_{-1}$*DI	-2.7869	4.9826	77.3906+	37.7531
Non Fundamental Variables:				
Size	-.08013 †	0.0456	0.5907†	0.3455
log No.B	0.0003	0.0006	0.0057	0.0047
Systemic and Macroeconomic				
Cash	0.0279	0.0279	1.1891	2.0311
CON	.4323†	0.2258	-6.3007	3.1620
INF	0.0018	0.0032	0.0073	0.0243
GDP	.00549†	0.0032	0.0175	0.0245
US Risk Free Rate	0.0120	(0.011)	0.0938	0.0728
Estimation Method	OLS		OLS	
Wald Chi Sq (ϕ+β) (P value)	83.68 (0.000)		268.81 (0.000)	
R-Sq	0.2729		0.4618	
LM	0.50 0.4791		0.01 0.9079	
Hausman Chi-Sq.Statistic (p-value)	15.50 (0.6904)		9.76 (0.9394)	
Interaction variables coefficient test (p-value)	0.84 (0.359)		25.27 (0.000)	

Notes

Δ Deposits is the year by year percentage changes in deposits level, interest is the interest paid to depositors, Bank fundamentals are estimated using CAMEL (Capital, Assets Quality, Management Efficiency, Earnings, and Leverage), Control is a vector of control variables to capture the effect of macroeconomic and systemic factors, DI is a deposit insurance dummy variable that takes the value of one after the introduction of deposit protection and zero otherwise. The standard errors have been corrected for heteroscedasticity. Panel A reports the results of equation 5 which regress the deposits growth on bank fundamentals, Interactions between each fundamental and the estimated dummy variable (which takes the value of 1 after introducing the deposit insurance and zero otherwise) in addition to the other control variables (columns 1 and 2). Panel B represents the results of equation 6 which includes the same former independent variables but interest paid to depositors as a dependent variable.

*, +, †, indicate significance at the 1%, 5% and 10%, respectively

Regarding the interest paid to depositors (Table 1.12 Panel B), the results indicate that two interaction variables (liquidity and management efficiency) were significantly affected by the introduction of deposit insurance. In the case of the liquidity interaction variable, it shows that depositors' sensitivity to liquidity has been improved after the introduction of deposit insurance (-2.8247, negative coefficient sign). In addition, market discipline through management efficiency has also been promoted. While the management fundamental variable is not significant in the interest estimation results, and enters the equation with a positive sign, the interaction variable is found to be positive indicating an improvement in depositors' penalising bad management after the introduction of deposit insurance. The reasons for this increased attention to management efficiency may be because depositors believed that deposit insurance was not enough to stop mis-management within banks. All in all, the results do not support the hypothesis of a negative effect of insurance on depositors' incentives to monitor banks risks.

Furthermore, to examine whether there is market discipline after the introduction of deposit insurance, we test whether the combined coefficients ($\phi+\beta$) are statistically significant in both equations 5 and 6. We find that in both cases $\phi+\beta \neq 0$ indicating the existence of market discipline after the introduction of deposit insurance. Moreover, the joint significance of the interaction variables supports the limited contribution of the interaction variables in determining deposit growth. On the other hand, the significance joint coefficient test on the overall interaction variables in the interest rates equation may be due to the improvement in recognition of management efficiency. On the whole, this insensitivity towards the depositors' coverage of loss may be interpreted as the deposit insurance scheme offered in Jordan was not generous enough to stop depositors' incentives to recognise banks risk (Ioannidou and Dreu, 2006)[57]. Another explanation for the existence of market discipline along with depositors' coverage is the creditability of the deposits insurance system which is not visible yet to depositors because the Jordanian banking system has not faced any failures since its creation. Our results find that the introduction of deposit insurance does not have an adverse impact on depositor market discipline is consistent with the findings of other studies, such as Cook and

[57] We mean by generous that depositors are not fully covered, where some countries such as Mexico, Turkey promise 100% coverage, Jordan deposit insurance limit individual depositor reimbursements to amounts less than their full claims.

Spellman (1994), Kane (1987), and Park and Peristiani (1998) and with Demirgüç-Kunt's et al., (2006)[58]. However, they contrast with Ioannidou and Dreu (2006), and Demirgüç-Kunt and Huizinga (2004).

6.5. Bank Response to Depositors' Reactions

As discussed in the theoretical discussion, market discipline can only be effective if both depositors both recognise bank risk (recognition stage) and banks respond to signals sent by depositors' actions towards this risk (control stage). Banks are assumed to respond to depositors' actions through reducing their risk. The previous results only support the first part of market discipline. These results suggest that depositors are sensitive to bank risk, and reactions to banks risk are stronger in the post-crises period (between 1991 and 2005). Depositors' behaviour has not been very sensitive to the introduction of explicit deposit insurance. Therefore, in this section we analyse whether effective market discipline is at work in Jordan and describe the responses of banks to depositors' reactions.

Following Barajas and Steiner (2000), we measure to what extent bank fundamentals change in response to past changes in deposits. The component of deposit growth that is directly attributable to bank fundamentals we term "fundamental deposit growth" (Depofund). The fundamental deposit growth is calculated as the real growth of deposits explained by fundamental variables from the full regression (equation number 7 in Table 1.5). This is shown as follows:

$$Depofun_{it} = -0.2112\, Cap_{t-1} + 0.2733\, LIQ_{t-1} + 0.2633\, LLP_{t-1} - 0.0018\, TL_{t-1} + 0.5594\, ROA_{t-1} - 6.7914\, Mang_{t-1} \quad (7)$$

Thereafter, two tests are employed to detect the reactions of banks. First, we assume that banks respond to the aggregate decrease in deposits levels by having a 'symmetric response' by examining whether the current period's fundamentals are sensitive to depositors' preference for strong bank fundamentals in the previous period. Hence, each fundamental variable (response variables) is regressed on the lagged value of fundamental deposit growth (independent variable). Table 1.13 shows the results of regressing the lagged value of fundamental deposit growth against the current

[58] Demirgüç-Kunt et al., (2006, p.10) stated that: "even if a country's safety net covered all bank balances, depositors would remain at risk for the opportunity costs of claiming and reinvesting the amounts they are due and also for costs occasioned by delays in receiving deposit-insurance disbursements. This means that government guarantees never completely extinguish market discipline. Still, stability can be undermined if deposit-insurance managers displace more discipline than they are able to exert"

fundamental variables one at a time (univariate regressions). For market discipline to hold, a positive sign is expected for management efficiency and a negative sign for each of the bank capital, assets quality, liquidity and earnings. The reason behind these expected signs is that if depositors punished a bank in the last period for weak fundamentals (fundamental deposits growth falls), then banks are supposed to react in the following period by improving its fundamentals, increasing their capital base, liquidity, profitability, and assets quality and decreasing management inefficiency. The results of these tests are reported in Table 1.13 Panel A. Only earnings (ROA) and capital behave in a way consistent with market discipline. This indicates that, holding other factors constant, if banks face a deposits fall, they react in the next period by trying to increase their earnings and improve their capital. On the other hand, banks seem to ignore management efficiency in their response. Instead of decreasing their non-interest expenses to total assets (management efficiency measure), these tends to increase even more. Similarly, banks' loan-loss provisions ratio responds statistically but in the opposite direction. We expected in that if banks realize less deposit growth, they may react by improving their provision and reducing expected loan-losses, but instead banks react by decreasing their loan-loss provisions ratio even more.

Second, we allow for asymmetric bank responses to signals received by depositors. By asymmetric bank responses, we mean that banks may respond differently to different types of deposit loss. As argued by Barajas and Steiner (2000), bank managers only react to the downside of a business cycle when they feel that the banks will be harmed. Thus, the two types of deposits loss that have been proposed ($Dloss1_{it}$ and $Dloss2_{it}$) are supposed to account for such asymmetry in banks' responses (see the methodology section for the description of creating these variables).

These variables constitute two extremes in deposit losses. In the total sample of 273 observations, *Dloss1* defines only 81 observations as having experienced fundamental deposit losses, therefore it captures only the most extreme cases of individual banks being out of line with their fundamentals. On the other hand, *Dloss2* encompasses a greater number of observations (166) in which individual banks were simply exhibiting sub-par fundamentals in relation to the rest of the banking sector. For the interaction between *Dloss1* and Depofun_{t-1}, bank behaviour appears to be more consistent with market discipline. Banks now tend to improve their profitability (see Table 1.13 Panel

B1) when depositors have discriminated against them in the previous period. Nevertheless, banks tend to improve their capital (significant at 10% level) when they continue to decrease management efficiency, but do not appear to adjust their loan-loss provision or their liquidity levels. Where the results of banks asymmetric response to Dloss1 are very similar to the previous results, but one defence occur bank response through earnings improvements increased strongly to reach a 1% significance level with an increase in the explanatory power (R^2 increased from 0.4% to nearly 14%). In addition, banks liquidity has an estimated negative sign but it fails to approach statistical significance. Based on these results, we can say that banks are more biased to respond to deposits losses (negative growth of deposits) by improving their profitability. Section (B2) in Table 1.13 summarises the results of the effect of interaction between *Dloss2 (*relative losses) and Depofun$_{t-1}$ on the next period fundamentals, we can draw nearly the same conclusion from the results regarding strong evidence of bank response through earnings improvements. Other fundamentals do not behave in a manner consistent with market discipline. Banks do not appear to adjust or improve their capital, efficiency, or even asset quality when they face losses in their deposits relative to overall system deposits. Overall, from the above results, we can infer that while depositors are recognise bank risk and discipline bank behaviour, this effect does not appear to be strong. Under these circumstances, more needs to be done in order to reap the benefits of depositors' discipline. Such findings should provide Jordanian's bank supervisory authorities cause for concern, especially regarding changing banks' attitude towards risk-taking.

Table 1.13: Response of Banks to Fundamental Growth of Deposits

			Response in Fundamental Variables (Dependent Variables)		
Estimation	**Provision**	**Liquidity**	**ROA**	**Capital**	**Management**
Panel A- Symmetric Response					
Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Depofun$_{t-1}$	.0611* .0203	.2584 .1767	-.0263† .0151	-.1049† .0572	-.0177+ .0073
LM	269.31 .0000	39.52 .0000	14.86 .0001	115.84 0.0000	14.86 .00012
Hausman Test P-value	.29 .5897	3.29 0.0697	2.29 .1303	.03 .8681	2.29 .1303
Estimation Approach	RE	FE	RE	RE	RE
R^2	.0048	0.0361	.00424	0.007	.0042

Panel B - Asymmetric Response

Estimation	(1) Provision	(2) Liquidity	(3) ROA	(4) Capital	(5) Management
		1- Banks only respond when their fundamental deposit growth's negative			
Lag Depofun*Lag Dloss1	.0451 .0319	-.1016 .2742	-.1557* .0220	-.07516† .0399	-.0689 * .01093
LM	252.90 0.0000	66.03 0.0000	26.90 0.0000	14.13 0.0002	39.10 0.00
Hausman Test P-value	4.529 0.018	3.59 0.0582	0.00 0.9796	0.01 0.9299	5.30 0.0214
Estimation Approach	FE	FE	RE	RE	FE
R^2	0.0028	0.0013	0.1372	0.0083	0.1555
		2- Banks only respond when their fundamental deposit growth is below the banking sector average			
Lag Depofun* LagDloss2	.07802* .0265	.40880† .2240	-.0863* .019762	-.0883 .07410	-.05379* .0094
LM	263.97 0.000	51.19 0.000	21.27 0.000	116.35 0.000	35.87 0.000
Hausman Test P-value	7.655 0.023	0.54 0.4618	14.55 0.0001	0.00 0.934	1.54 0.2148
Estimation Approach	FE	RE	FE	RE	RE
R^2	0.0412	0.0257	0.0233	0.0007	0.1603

Notes:

The table reports the results of testing banks' response to the changes in deposit growth. First, Panel A represents symmetric response where we assume that banks react to the previous period changes in deposit growth, without distinguishing between positive or negative changes, by adjusting their fundamentals. In order to examine whether banks respond to changes in deposits, we regress each of the fundamental variables on the lag value of Deposfun which explains the real growth of deposits, this value is estimated using fundamental variables and calculated as follows:

$$Depofun_{it} = -0.2112\,Cap_{t-1} + 0.2733\,LIQ_{t-1} + 0.2633\,LLP_{t-1} - 0.0018\,TL_{t-1} + 0.5594\,ROA_{t-1} - 6.7914\,Mang_{t-1}$$

In columns 1 to 5 (Panel A), the values in the highlighted rows represents the coefficients and the standard errors proceed from regressing the lag value of deposit fundamentals (Depfun t-1) against the current period loan loss provision ratio, liquidity, ROA, capital, and management efficiency, respectively. The only significant values which are consistent with the hypothesis that banks adjust their fundamentals following the changes in their deposits are the ROA (column 3) and capital (column 4) variables. However, the rest of the variables are either not significant (liquidity) or indicate incorrect bank response (management, and provisions). For example, the coefficient value of the management regression in column 5 (-0.0177) is significant at the 5% level, but the negative sign means that banks respond by decreasing (instead of improving) their efficiency.

Panel B (1 and 2), show the regression results of regressing each fundamental variable on the interaction between the calculated deposits fundamental (Depfun) and the estimated dummy variables Dloss1 and Dloss2 to account for asymmetric response assuming that banks only respond to the losses arising from negative deposit growth or deposit growth less than the systemic growth of deposits, respectively. The two types of deposit loss dummy variables are defined as follows:

$$\text{Doss1}_{it}\begin{cases}1, & Depofun_{it} \prec 0\\ 0, & otherwise\end{cases} \qquad \text{Dloss2}_{it}\begin{cases}1, & Depofun_{it} \prec SysGrowth\\ 0, & otherwise\end{cases}$$

Where, SysGrwth is the average banking sector deposit growth.

*, +, †, indicate significance at the 1%, 5% and 10%, respectively

In each regression the estimation technique was selected using the Lagrange Multiplier (LM) and the Hausman tests.

7. Conclusions

This paper examines the hypothesis of effective depositors' discipline. It presents evidence that depositors can practise disciplinary effects with regard to banks operating in an emerging market. The results confirm that depositors, as the main market participants in emerging financial systems, can share the burden with regulators in maintaining a sound and safe banking system which may reduce moral hazard problems in those markets. The results are in line with those found by Martinez Peria and Schmukler (2001) on Argentina, Chile and Mexico; Ioannidou and de Dreu (2006) on Bolivian banking; Barajas and Steiner (2000) on Colombia; Ghosh and Abhiman (2003) on India; Ungan and Caner (2006) on Turkey; and Goday and Gruss (2005) on Uruguay. These results are encouraging to bank regulators who are currently tackling the adoption of the Basel 2 Accord which requires more market intervention in addition to capital regulation and bank supervision.

This study contributes to the existing literature by applying the existing methodologies and extends the current evidence on depositor discipline, using a unique data set from an emerging market. The use of a single country data set reflects our view that market discipline is best examined on a country-by- country basis as it is very much a country-specific issue. In addition, while most of the previous literature focuses on testing for the recognition of market discipline (typically focusing on the quantity approach), substantially less research has tackled the issue of market influence and control on banks[59]. This paper extends the previous literature by empirically testing for the existence of effective market discipline, analysing both the recognition and control stages using both price and quantity approaches.

Two initial questions have been investigated in this paper, first, do depositors react to bank risk-taking behaviour, and is this reaction affected by financial crises or the introduction of explicit deposit insurance? Second, is depositor discipline effective enough to force banks to respond to the signals sent by depositors to the market? In order to analyse these questions, a comprehensive panel data was collected from the Jordanian banking sector for the period from 1982 to 2005. Answers to the first question

[59] Market control means whether market pressures change bank risk taking or not, beyond the analysis on "market monitoring" (Bliss and Flannery, 2001).

come from the estimations of reduced form equations, in which dependent variable (deposits, as proxied by yearly percentage growth rates in total deposits; and price proxied by implicit interest rates which are interest expenses divided by total deposits) are modelled as a function of bank fundamentals, systemic and macroeconomic variables, as well as other control variables.

Furthermore, in order to analyse depositors' sensitivity to financial crises, two non-overlapping periods (namely pre- and post-crises) have been examined, as well as the effect of the introduction of deposit insurance. Overall, the estimation results enable us to conclude that depositors in Jordan punish banks for their risky behaviour through both withdrawals of deposits and higher deposit prices. Depositors seemed to witness a "wake-up call" effect after the financial crises (where market discipline effects strengthened). Regarding the results of the effect of introducing the explicit deposit insurance on depositors' discipline, no clear evidence was found to support that market discipline is harmed by new depositors' insurance coverage. This result may be interpreted as a perceived lack of deposits protection coverage by the new insurance scheme - that is, the system may be viewed as being not credible. Depositors may have no or little confidence in the new deposit insurance arrangements. This view is supported Marinez Peria and Schmukler's (2001) argument that deposit insurance has no effect on depositors' behaviour towards risk. Another interesting finding of our study, in contrast to Levy-Yeyati et al., (2004), is that we find that macroeconomic variables tend to have a limited effect on market responses. Furthermore, deposits sensitivity to the global market seems to be effective in the post-crises period and this may also be limited to the economic reforms during the same period and the globalization trend. This result may signify that external discipline could play a role in strengthening domestic market discipline in the post-crises period. The limited effect of macroeconomic factors on market discipline is supported by the study of Caprio and Klingebiel (1997) who conclude that microeconomic factors have played the major part in recent banking crises in emerging markets.

In order to answer our second question we employ Barajas and Steiner's (2000) methodology by examining the response of banks to the signals provided by depositors. We assume that banks respond to the decrease in deposit growth by taking corrective action regarding bank fundamentals. Furthermore, we allow for asymmetric responses by in banks. In all cases, we find that banks respond only by improving their profitability, rather than adjusting other fundamental variables. This result may indicate (implicitly) that bank managers "gamble for resurrection" generating more income for owners which makes them more able to pay higher interest to depositors. However, this conclusion may indicate that policy makers and regulators should improve bank incentives to improve other fundamentals and therefore decreasing banks risk and improving safety.

Various policy implications appear from these results. Financial regulators could rely more on elements of private market discipline as a complement to deposit insurance schemes and allow market participants (e.g. depositors) to assess banks' ability to absorb aggregate shocks and remain solvent. Furthermore, the results open the door for more discussion at the policymaker level in emerging markets as to the relevance of greater financial information disclosure (by both market participants and regulators) in order to build-up more effective discipline as components of evolving regulatory frameworks. Timely and accurate dissemination of information combined with greater transparency of reporting and accountability within banks could go a long way to reduce weaknesses detracting from effective market discipline and help enable depositors (private participants) to assess banks' ability to absorb aggregate shocks and remain solvent. Additionally, it is important to note here that market monitoring in emerging markets cannot effectively replace official supervision, but that it has a potentially powerful role within the overall regulatory regime. In particular, it has the advantage of exploiting the synergies between supervision and market discipline and thereby increasing the efficacy of the overall supervisory process. Until recently, depositor discipline has not grown strong enough to affect banks risk-taking behaviour. The implementations of Basel 2's new three pillars may provide a broader role and help emerging markets protect the banking system from excessive risk-taking and therefore reduce bank failure. [60] Finally, debate regarding the ability of depositors to efficiently

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[60] Another suggested strategy which may be applicable here is that it is worth making banks seeking a credit rating and making that credit rating public to ensure outside agencies that are not supervisors but have high skills in risk analysis to give an objective opinion regarding the risk of the bank. The credit ratings agencies should be authorised international agencies that would suffer too much loss of reputation and devalued rating if they rated inaccurately and such agencies could be used in order to control rating quality.

and effectively monitor bank risk in emerging markets due to their low level of sophistication is questioned in our findings. We argue that those depositors are able to participate directly or indirectly to reduce weaknesses of the official regulation and supervision of banks operating in such markets.

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Appendix 1.1: Table 1
Summary of Main Market Discipline Empirical Studies.

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data period	Number of institutions				
Crane (1976)	1974	24 US banks	Price Effect (Factor Analysis)	Factor that reflects locations (for example profit or capital ratio)	CDs	No evidence of market discipline found
Hannan and Hanweck (1988)	1985	300 US banks	Price Effect (OLS)	The likelihood of bank insolvency, the variability of assets, and bank's capitalization ratio	Jumbo-CDs	Evidence supports the existence of market discipline
Goldberg and Lloyd- Davies (1985)	1976-1982	10 largest US banks	Price effect (OLS)	The proportion of bank SLCs outstanding to some of gross loan plus SLCs	Jumbo Negotiable CDs	No evidence was found to support the existence of market discipline.
Baer and Brewer (1986)	1979-1982	37 US. BHCs	Price Effect (OLS)	Measure of level and Variability of stock prices	Uninsured CDs	Positive evidence of depositors discipline
James (1988)	1985	300 US banks	Price Effect (OLS and GLS)	Credit Risk (loan loss provision/ total loans), Financial Leverage (assets/ Market value of capital (OLS). Variance of bank's stock returns, financial leverage (GLS)	Jumbo CDs	Positive evidence of market discipline
Gilbert et al., (2001)	1991-1996 (yearly)	6852-7255 US banks	Price Effect (Logit)	Downgrades of CAMEL ratio	Large time deposits	No evidence of depositors discipline found

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Number of institutions				
Cargill (1989)	1984-1986	58 US banks	Price Effect (OLS)	CAMEL ratings	Jumbo CDs	Positive evidence of marke discipline.
Jajtiani and Lemieux (2000)	1980-1995	5 failing US banks	Price effect (Fixed Effect)	Credit risk measures (bad loans to total assets); return on assets; percent of insured to total deposits; leverage ratio; bank regulators' ratings; and Moody's bond rating.	Bonds spread	Positive evidence of marke discipline
Morgan and Stiroh (1999)	1993 and 1998	4,104 new public bonds issue in the U.S banks and BHCs.	Price effect (OLS, fixed effect)	bond spreads, ratings, and bank portfolio	bonds	Positive evidence of mark t discipline exists. Investors also look beyond the ratings, as spreads on the bank issues depend on the underlying portfolio of loans and other assets.
Goldberg and Hudgins (1996)	1986-1989	2813-2998 US. S&L's	Quantity Effect (Logit, OLS)	Failure probability, interest paid on deposits to total deposits	Uninsured deposits	Evidence support market discipline, in addition. The empirical results indicate that uninsured deposits were sources of market discipline and suggest that reducing the insurance limits on deposits will increase market discipline on S&L's.

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Number of institutions				
Crabbe and Post (1994)	1986-1991	41 US. BHCs	Quantity Effect (OLS)	CD rating downgrade	Jumbo CDs	No evidence of market discipline found. They suggest that FDIC insurance of large CDs may have removed market discipline from the CD market.
Billet et al., (1998)	1990-195	109 Downgraded US BHCs	Quantity Effect (OLS)	Changes in bank credit risk and the use of insured deposits.	Insured Deposits	The evidence supports the idea that banks raise their use of insured deposits following increases in risk. On the other hand, the study failed to find evidence of management response to changes in bank's holding companies' security prices.
Calomiris and Wilson (1998)	1920-1939 (yearly)	32-55 publicly traded US banks	Quantity Effect (Logit OLS)	Deposit default premium estimated using: capital, surplus, deposits, cash, securities, loans, and total assets.	Deposits	Positive evidence of market discipline exists.
Jagtiani et al., (2002)	1992-1997	100 largest US banks and BHCs	Price effect (Fixed and random effect)	Leverage ratio, None performing loans ratio, the ratio of insured deposits to total deposits, regulatory rating, size and return on asset.	Bonds Spread	For both of banks and BHCs evidence supports the existence of market discipline.

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Number of institutions				
Park (1995)	1985- 1992	11435-9582 US banks	Price and Quantity effect (Logit and OLS)	Failure probability, maturity, total assets, large time deposits/assets	Large time deposits	The evidence supports th view that riskier banks pa higher interest rates an attract less time uninsure deposits.
Park and Peristiani (1998)	1986-990	2023-4218 US Thrift institutions	Price and Quantity effect (Logit and OLS)	Failure probability and size	Jumbo CD	Positive evidence that riskie banks pay higher interes rates and attract less time uninsured deposits
Jordan (2000)	1989-1995	65 failing banks in New England	Price and quantity effect (ANOVA)	Deposits Level, total Deposits to total liabilities, and interest rate spread.	Deposits and CDs	Uninsured depositors react to the deterioration in bank health. The evidence show that failing banks increased their use of insured deposits enough to offset much of the shortfall created by the decline in uninsured deposits.
Krishnan et al., (2003)	1994 - 1999.	185 banks and BHCs, 3, 265 non banks firms.	Price effect (3-factor model)	ROA, Loan assets, Non performing loans, Net charge-offs, Leverage (Total assets/ Total equity capital)	SND	No strong evidence of market discipline was found

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Number of institutions				
Flannery and Sorescu (1996)	1983-1991 Yearly	36-65 US banks	Price effect (Fixed effect)	Non accrual loans to total assets, accrual loans to total assets, real estate owned to total assets, ratio of liability to total equity, total assets, return on asset and absolute value of bank assets.	SND	Positive evidence of market discipline Investors can realize changes in a bank risks
Krainer and Lopez (2004)	1990-1998	58 -1,034 US unique BHCs	Price effect (Logit model)	BOPEC ratings	Stocks and bonds	Positive evidence of market discipline found.
Birchler and Maechler (2001)	1987-1998	250 Swiss banks	Price and Quantity effect (Fixed effect)	CAMEL rating	Uninsured Deposits	Evidence were consistent with market discipline
Hosono (2003)	1992-1999	160 major Japanese banks, and 1016 regional Japanese banks	Price and quantity effect (OLS)	Return on assets, disclosed non performing loan ratios, real estate - related loan share	Deposits	Evidence was consistent with market discipline in regional banks. On the other hand, no clear evidence of market discipline using major banks data, and depositors discipline exist even under unlimited deposit insurance if the restitution procedure takes time and effort.
Hosono et al., (2004)	1992- 2002	32 Korein banks, 96 Indonesian banks, 39 Malaysian banks, 15 Thai banks	Price effect (OLS)	Equity and liquidity to total assets.	Deposits	Evidence of market discipline exists in all countries even with the existence of deposit insurance. However, only in Indonesia was the walk-up-call effect seen after the Asian crises exists.

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Number of institutions				
Murata and Hori (2006)	1990-2002	694 Shinkin banks and Credit cooperatives in Japan	Price and quantity effect (OLS)	Capital asset ratio, log of total assets, liquid assets to total assets, operating profits to total assets	Small deposits	Evidence of market discipline was found. However depositors seem to be sensitive to the changes in the deposit insurance scheme.
Spiegel and Yamori, (2007)	2000-2001	116 Regional banks in Japan	Quantity effect (Probit estimation, OLS)	Capital ratio, size, dividends, and indicators of the intensity of domestic competition (ratio of deposits in the home prefecture over the number of bank branches in the prefecture).	Banks' security holdings	Statistically significant evidence of depositor discipline was found among banks that use market pricing accounting
Levy- Yeyati et al., (2004)	2000-2002	Failed banks in Argentina and Uruguay during the crisis.	Price and Quantity effect (fixed-effects regressions GMM and VAR to estimate the effect of systemic risk)	Non-Performing Loans/total loans, capital/assets, and return on assets	Deposits	Evidence support the existence of market discipline and systemic risk can affect market discipline both regardless of and through bank fundamentals.

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Number of institutions				
Calomiris and powell (2001)	1992-1999	52 Argentenian banks	Price and quantity effect (OLS, fixed effect, time effect and random effect)	Capital to total assets ratio, loan interest rate, loan to other assets ratio, cash to government bonds, and non performing loans to total loans ratio.	Deposits	Evidence support the existence of market discipline and the reliance on market discipline has played an important role in prudential regulation. Moreover, market discpline encourages banks to respond to increases in default risk by limiting asset risk and lowering leverage.
D'Amato et al., (1997)	1994	Banks operate during the Argentine banking crisis,	Quantity effect (VAR, Random effect)	The average interest rate paid by the bank on its liabilities in dollars and peso, and the capital ratio of the bank (capital divided by total assets).	Daily deposits	The results indicate that, although bank 'fundamentals' were extremely important in driving the dynamics of deposits as well as 'macro' effects of the shock, there was also evidence of 'Contagion' effects.
Martinez Peria and Schmukler (2001)	1991-1996 Monthly	Argentina (57-155 banks) Chile (21-37 banks), Mexico (10-34 banks)	Price and quantity effect (OLS)	CAMEL	Insured, uninsured, time, and medium term deposits.	Evidence supports the market discipline hypothesis in all types of deposits. Deposit insurance does not appear to affect market discipline. However, depositor discipline increased after the crises.
Tsuru (2003)	1999-2002	120 Japanese banks (115 regional, and 5 city banks)	Price and quantity effects (OLS, Fixed and random effect)	Capital assets ratio, loans to total assets, risk management loans to total loans , liquidity ration , return on assets , and bank size	Deposits	Evidence supports the existence of market discipline, however, the effectiveness of deposit discipline weakened by the existence of the deposit insurance system.

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Number of institutions				
Barajas and Steiner (2000)	1985-1999	709 observations from Colombian banks	Price and Quantity effects (Fixed and random effect, 2SLS)	Non performing loans to total loans, Non performing loans to total assets, loan loss provisions to total assets, capital to assets, return on assets, and total reserves to assets	Deposits	The study found evidence of depositors discipline. On the other hand, banks seems to respond to the signalling received from depositors and then adjust their key fundamentals. Moreover limited effect of deposit insurance on market discipline was found.
Arena (2003)	1994-1999	444 banks and financial institutions (89 in Indonesia, 55 in Korea, 74 in Malaysia, 36 in the Philippines, 41 in Thailand, 139 in Hong Kong, 57 in Singapore, and 46 in Taiwan)	(Logit model and Survival Time Model)	CAMEL	Deposits	The results support that bank-level fundamentals not only significantly affect the likelihood of bank failure, but also account for a significant proportion of the likelihood of failure for failed banks.
Galindo et al., (2005)		97- 375 banks from 13 countries in Latin America	Price and quantity effects (bank fixed effect and country time effects, panel -VAR)	Non performing loans to total assets, capital to total assets, cash reserves as a percentage of total assets, and return on assets ratio.	Deposits	Market discipline is only strong in countries with higher Basel Core Principles of Banking Supervision (BCP) compliance. Only private banks found to respond to market discipline. Moreover, no clear evidence found regarding more generous deposit insurance results in less market discipline across these countries.

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Nmber of institutions				
Karas (2005)	1999-2002	1400 Russian banks	Price and quantity effects (Generalised Method of Moments)	Current liquidity ratio, excess reserves deposited by the central bank to total assets, credit risk (loans to non banks) to total assets, and the share of individuals in loans to domestic non banks, and the growth in bad loans measured as the growth of non performing loans/ total loans) and the maturity structure of deposits, Management efficiency measured by personal expenses to total assets, and return on assets.	Deposits	Evidence of market discipline through quantity and prices was found.
Karas (2006)	1995-2002	382- 1656 Russian banks	Price and quantity effects (OLS, GMM)	Capitalisation, liquidity, changes in loan quality, return on assets, loans to non-banks to total assets, loans to households to loans to non banks, term deposits to total depositors, personal expenses to total assets.	Deposits types (household, firm or bank)	Evidence for the standard form of price discipline is weak, however, the study demonstrates the presence of quantity- based discipline of weaker banks by both firms and households.
Ioannidou and Dreu 2006	1998-2003	12-16 Bolivian banks	Quantity and price effect (OLS)	CAMEL variables	Deposits	Evidence found to support the existence of market discipline, however, most of the market discipline comes from large depositors. Moreover, the introduction of deposit insurance negatively affects the level of market discipline.

Author(s)	Sample Characteristics		Method	Explanatory Variables	Instruments	Evidence
	Data Period	Number of institutions	(Estimation technique)	(Bank specific Risk)		
Ghosh and Das 2003	1995-2002	72 Indian banks	Quantity and Price effect (OLS)	CAMEL variables	Deposits	Evidence of market discipline exists and the introduction of deposi insurance has limited impact oı market discipline.
Ungan and caner (2006)	1997-2003	40-60 banks in Turkey	Quantity and price effects (fixed effect)	CAMEL variables	Deposits and uninsured debt holders	The evidence supports the existence of market discipline before the financial crisis of 2001 in Turkey However, blanket guarantee announcements found to affec depositor discipline in the country.
Goday and Gruss (2005)	1998- 2004	Private banks and cooperative Uruguayan banks	Quantity and price effect (GMM)	Equity capital as a percentage of total assets, liquid assets as a percentage of short term liabilities(to be claimed within the next 30 days), non performance loans as a percentage of total loans, return on assets, non financial losses as a percentage of total assets, the exposure to the government as a percentage as a percentage of loans to public sector plus holdings of government bonds to total assets, the total business with non- residents as the percentage of loans plus deposits of non residents on the total loans and deposits.	Foreign nominate deposits	Strong evidence supports the hypothesis of depositor discipline through changes in deposits level was found. However, only weak evidence supports the hypothesis that depositors require higher interest rates and reduce the maturity of their deposits. In general, the results show that the discipline behaviour becomes stronger after the 2002 financial crises. Moreover, the study finds that banks react to depositors' actions effectively especially after in the post crisis period.

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Number of institutions				
Cook and Spellman (1994)	1987-1988	233-210 observations of thrifts	Price effect (OLS)	Bank asset risk, Domestic loans to capital ratio, foreign loans to capital ratio	Jumbo CDs	Positive evidence of market discipline exist. The study also shows that market assessment of risk exists even with the claims guarantees.
Davenport and McDill (2006)	2001-2002	The failed Hamilton Bank	Price and quantity effect (descriptive analysis)	Bank's deposit accounts	Insured and uninsured deposits	The results suggest that although uninsured deposits exited at a greater rate than insured deposits, the vast majority of deposits withdrawn were fully insured.
Imai (2006)	2001-2003	50 Japanese banks	Price and quantity effect (Fixed effect)	Proxy of bank default risk (Moody's bank deposit rating), and bank's size	Deposits	Positive evidence of market discipline found and deposit insurance seems to influence the level of market discipline.
Nier and Baumann (2006)	1993-2000	729 individual banks from 32 countries.	Structural model of bank capital	Bank's Asset risk (estimated by the standard deviation of a bank's asset measured by the volatility of the banks weekly equity returns, and loan loss provision to total loans), bank's size, and return on equity.	Banks' Capital	Market discipline resulting from uninsured liabilities and disclosure results in larger capital buffers. In addition, the study found that government support decreases the effectiveness of market discipline. However market discipline found to be more effective in curbing banks incentives of risk taking in countries where competition among banks is strong.

Author(s)	Sample Characteristics		Method (Estimation technique)	Explanatory Variables (Bank specific Risk)	Instruments	Evidence
	Data Period	Number of institutions				
Hress and Feng (2006)	2003-2004	62 new New Zealand Non- Bank Institutions (57 finance companies and 5 building societies)	Price effect (OLS)	Credit risk (SQP score), Asset size, Growth, Discount index.	Deposits	The evidence of this study suppor the existence of market discipline In addition, investors found tc reward the non-bank financial institutions for disclosure by accepting lower interest rates foi better transparency.
Maechler and McDill (2006)	1987-2000	5552 US banks and thrift institutions.	Quantity and Price effect (G MM)	Assets, Assets growth, equity capital to total assets, loans made for the purchase of residential real estate as a percentage to total loans, the percentage of loans that are non current (90 days or more past due)	Uninsured deposits	Positive evidence of market discipline exists, only good banks found to be able to rise uninsured deposits by raising their price. The study concludes that market discipline can effectively constrain bank managers' behaviour.
Wilson et al., (2004)	1999-2002	23 banks in New Zeland	Price effect (Event study)	Bank's Tier 1 Capital	Retail depositors	No evidence was found to support the existence of Market discipline.

Source: Author's own preparation.
CDs is Certificates of Deposits
SND syndicated Loans
SLCs is the bank's Standby Letter of Credits
BHCs Bank Holding Companies
S&L's Saving and Loans associations
BOPEC ratings for BHCs stand for Banks, Other, Parent, Earnings, and Capital.
SQP score is a relative ranking measure available for all Non-banks financial institutions. This score takes value in a range between 0 and 9, available at www. Interest.co.nz.

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Paper 2

Do Large Banks Dominate the Banking Sector in Emerging Financial Markets?

Abstract

Recent trends including competition, technological change, and deregulation have led to the emergence of dominant banks in many economies. The costs and benefits of these developments depend critically on whether or not the returns and riskiness of large banks can significantly influence relatively small banks within the same sector, bringing about a higher potential for systemic risk. The effect of bank size on systemic risk and the strength of spillover effects are also of interest because a 'financial meltdown' is generally expected to start with serious problems at large banks and because the character of spillover may differ between banks of different sizes (Elyasiani et al., 2007). The increase trend toward larger banks observed in the financial services industry give this issue added importance and encourage regulators to place greater concern over the emergence of dominant banks (Solvin et al., 1999). The main objective of this paper is to examine intra-industry information transfer in the banking sector by empirically assessing the large bank dominance issue within the framework of returns and volatility spillovers in an emerging capital market. In order to examine the large bank spillover issue, we apply the Vector Error Correction (VEC) and Generalized Autoregressive Heteroscedastic (GARCH) methodologies over the period spanning 1998 to 2005 to examine spillover effects in the Jordanian banking system. Our results suggest significant intra-industry information channelled through not only the level of intra-industry returns but also through the common volatility returns without any clear dominance effect from large to small banks. This suggests that investors appear to be indifferent to the signal quality of information between large and small banks. These findings concerning return and volatility relations between large and small banks have importance for regulators in emerging markets. Regulators should look for stabilizing potentially adverse effects of negative event(s) at all banks in the system irrespective of their size (see, Rajan, 1992).

1- Introduction

A particularly important feature concerning the stability of financial systems is the banking sector. Banks play a central role in the money creation process and in the payment system. Moreover, bank credit is an important factor in the financing of investment and growth. Therefore, regulators have a special interest in assessing banking system stability (Hartmann et al., 2005).

Although banking activities are regulated and monitored by government authorities, the reasons for this regulation and its impact on bank industry structure remain controversial. A central issue of this controversy is the extent to which an event occurring at a specific bank can be transferred to affect the rest of the banks in the system. This issue can be at the origin of the bank contagion phenomenon which is directly related to systemic risk. The term contagion refers to the transmission of an idiosyncratic shock that affects one bank or possibly a group of banks and how this shock is transmitted to other banks or the banking sector overall (Edwards, 2000; Eichengreen and Rose, 1999; Forbes and Rigobon, 2002; and Kaminsky and Reinhart, 1999). Defined in this way contagion is a subset of the broader concept of systemic risk which may result from contagion or from a common shock affecting all banks simultaneously. Hence, information transmission and possible systemic risk is the main rational for financial regulation and prudential supervision that aims to preserve the stability of the financial system.

Banks' role as collectors of private information for credit assessment creates various interdependencies. In the presence of information asymmetry, the position of banks as information intermediaries leads to higher industry-wide correlation due to homogeneous risk profiles (Bessler and Nohel, 2000). Developments in the banking industry (including financial innovation, increased competition, advances in information technology, deregulation, globalization, conglomeration and consolidation) are likely to have strengthened interdependencies among individual banks, affecting the structure of the industry, heightening bank sensitivity to shocks, and exposing the banking system to greater risks (Elyasiani et al., 2007).

Boyd and De Nicolo (2005) note that the increasingly competitive environment has forced banks to become much larger, and an additional outcome is that it also increases a bank's linkages with other banks. The increased exposure that other banks have to one another results in an increasing risk of catastrophe associated with large bank failure. These trends have attracted serious scrutiny from regulators and researches because the sheer size of large banks has led to greater concerns over heightened market power, increased systemic risk, stronger moral hazard incentives, and the rising costs of the 'too-big-to-fail' doctrine (Elyasiani et al., 2007).

Proponents of the 'too-big-to-fail' doctrine argue that there is a need for regulators to stabilize potentially adverse effects of negative events at a large bank which are not present in similar small banks. In effect, regulators attempt to enhance welfare by foreclosing the possibility of failure of a large bank. Alternatively, Sharpe (1990) and Rajan (1992), argue that there is no need to provide special protection to large banks, because effective competition among financing sources minimizes the effect of the failure of a single large bank. Given the aforementioned conflicting views concerning the influence of large banks in the banking system, it is interesting to examine whether large banks are able to dominate the banking sector and therefore regulators need to consider large banks as being special.

In general, a firm may become dominant if it has sufficient market power to enable it to affect prices or act independently of its rival, smaller price-taking firms (Pilloff and Roades, 2000). Baca et al., (2000) and Cavaglia et al., (2000) argue that industry factors have become an increasingly important component of security returns in most of the capital markets around the world. A broad empirical literature in banking relies on market data to assess bank risk and its future prospective. A key assumption in this literature is that information conveyed by market prices about bank's prospects and risk is reliable (Crouzille et al., 2004).

Therefore, the main objective of this paper is to examine intra-industry information transfer in the banking sector by empirically assessing the large bank dominance issue within the framework of the returns and volatility spillover in the capital market. The main argument behind this objective comes from the costs and benefits of the banking industry developments noted before which depend critically on whether or not the returns and riskiness of large banks (or one large bank) can significantly influence relatively smaller banks within the same sector, bringing about a higher potential for systemic risk.

Previous empirical research concentrates on intra-industry information transfer in the banking sector and examines the effect of the information release from one bank to its rivals. The pioneer work by Aharony and Swary (1983), and Swary (1986) has examined the effect of specific bank failures or bad news on other banks share prices (see also e.g., Docking et al., 1997; and Sloven et al., 1999). Other studies, for example, Dickinson et al., (1991), Akhigbe and Madura (2001), and Karafiath et al., (1991) examine the information transmission in the banking sector and find that contagion effects are influenced by bank size. Finally, the effect of different types of bank information release has been examined. For instance, announcement of loan loss reserves (Docking, 2000), down-grading of debt (Schweitzer et al., 2001), and dividends reduction (Christie, 1994) have all been shown to provide some information content in relation to bank stock returns.

Studies related to banking information transfer mainly adopt event study or simple regression methodology. However, recent developments in time series analysis, mainly applied to financial markets, have permitted researchers to undertake more rigorous analysis with regard to information transfers. The literature in this area emphasises on short and long-run comovments and volatility spillover among a number of developed and emerging financial markets. See for example, Ederington and Lee (1993), Harvey and Huang (1991), Darrat and Benkato (1999), and Bekaert et al., (2005), and Abraham and Seyyed (2006), Choudhry (1997), Eun and Shim (1989), Francis and Leachman (1998), Piesse and Hearn (2002), Westermann, (2004), and Moor (2007).

However, there are only a handful of studies which apply this type of analysis specifically to the financial sector. For example, there has been research on integration of volatility spillover across the banking industry and other financial institutions in Europe (Kleimeier and Sander, 2000), in the US (Elyasiani et al., 2007) and among different countries (Elyasiani and Mansur, 2003). The results of theses studies provide evidence supporting the existence of returns and risk interdependencies across financial firms in different markets.

However, none of previous studies, to the best of our knowledge, have focused directly in examining the effect of the returns of large bank stocks on the returns of small bank stocks within the context of interdependence and volatility spillover. Therefore, the aim of this study is to investigate intra-industry information flows and to examine if there is a dominant (leader) role of large banks over smaller banks based on the information transmission mechanism[1].

In this paper we use financial data from 1998 until 2005 for nine banks listed on the Amman Stock Exchange (ASE), Jordan. We employ a Vector Error Correction (VEC) model to study the return interdependencies as well as a Generalised Auto-Regressive Conditional Heteroscedastic (GARCH) model to investigate volatility spillovers. We also examine information transmission between large and small banks pre-and-post 11th of September, 2001 to see whether this event led to a significant change and shift in information transmission within the banking sector[2]. The results from the above empirical tests will help us to answer the following important questions: (1) Are risk and returns of Jordanian banks tightly linked? (2) Does the large bank dominate the returns and volatility linkages in the banking sector? (3) Has the 11th of September US event influenced banks' returns and volatility patterns?

Information flows in ASE and between listed Jordanian banks, in particular, provide an interesting case, because Jordan has a relatively open economy with a small banking system comprising one major international bank, Arab Bank, with the remainder being relatively smaller national and foreign banks. Recent liberalization of interest rates in the Jordanian system has led to a more competitive environment and stimulated foreign investment. The stock market has developed rapidly and Arab Bank is the major component of the market. This had led some researchers to suggest that the Arab Bank dominates the banking sector in Jordan, and has led others to comment on the importance of examining this large bank effect within the banking sector in this emerging market (Saadi-Sedik and Petri, 2006). Nevertheless, the critical role played by the Jordanian financial system in the region emerged after the 11th of September US attack event. Portfolio inflows have been stronger than usual. Net inflows became

1 This study will use interchangeably the terms leadership and dominance to indicate the strong return and volatility spillover between large bank and relatively smaller banks within the system.

2 Previous studies have looked at the impact of 11th of September 2001 (e.g Ito and Lee, 2005; and Nikkinen et al., 2007).

significantly positive reflecting the favorable economic conditions in Jordan. The relative reluctance of Arab nationals to invest in overseas markets, the abolishment of most restrictions on foreign ownership of domestic assets and the progress made by policy makers in Jordan to improve transparency and efficiency of the financial system have contributed further to foreign investors' interest (Saadi-Sedik and Petri, 2006).

Our results show that the dominant role of the large bank in explaining other smaller bank risks and returns is not clearly evident. One explanation for this result is that market-wide information is incorporated into the prices of the large bank stock at the same time as being impounded into the prices of small bank stocks without considering the signal quality between these stocks (Chan, 1993). Regarding the effect of 11th of September event, it increased the volatility of Jordanian bank share prices, and appears to have resulted in a more integrated Jordanian banking system with higher levels of return causality and volatility spillover within the banking sector.

Our results have implications for regulators, investors and portfolio managers. Regulators are particularly concerned with the potential for a widespread loss of public confidence in the soundness and safety of banks that could be triggered by the negative information release from large banks. However, our evidence suggests that any actions by regulators should be directed to industry-wide difficulties or interdependence among individual banks rather than large bank-specific idiosyncratic problems. Additionally, investors and portfolio managers should not highly concentrate on the large bank stock returns movement when they forecast the returns and risk of other bank stocks in the sector.

The paper is arranged as follows; section 2 provides a brief overview of the Jordanian financial system. This is followed by a discussion of the theoretical and empirical literature of intra-industry information transmission in section 3. We then explain the data and methodology employed in Section 4. Section 5 contains the results and Section 6 is the conclusion.

2. Preliminary Background

Emerging markets are complex and interesting. Jordan is no exception. Among emerging markets, Jordan is one of the most open to foreign investors and the most sophisticated among Arab countries. In 1997, Jordan introduced a modern securities law by which separated regulatory functions from the technical side of the market. It created a regulatory body, the Jordan Securities and Exchange Commission (JSEC), to organize, develop and monitor the securities market according to internationally accepted and proven standards. This led to an increase in investors' confidence as well as in stock market activity. The maintenance of a transparent flow of information among market institutions, participants and investors and the creation of sophisticated, professional and efficient organizational and administrative functions of market institutions helped to develop Jordan's financial sector (Gentzoglanis, 2007).

An ongoing reform programme has taken place over the last couple of decades[3]. For instance, interest rates were fully liberalized in the early 1990s. In 1996, a new investment law was passed, allowing equal treatment for domestic and foreign investors to transfer funds in and out the country, permitting for free capital movements aimed at opening the financial system to foreign participation. These reforms have resulted in a well-developed financial sector, placing Jordan among the Middle East and North Africa countries (MENA) with the highest financial development indicators in most areas (see Appendix 2.1 Tables 1 and 2).

The main components of the Jordanian financial system comprise banking institutions and the capital market (Saadi-Sedik and Petri, 2006). While Jordan has a relatively open economy, it has a highly concentrated banking system characterised by one large international bank, Arab Bank, and a number of small national and foreign banks. The three bank concentration ratio for total assets, total deposits, and total equity amounted to around 75% over the period 2002-2005 (see Appendix 2.1 Table 3). More importantly, the concentration ratio of the largest bank (Arab Bank) relative to all listed banks exceeds 50% (see Appendix 2.1 Table 3).

There are considerable variations in the character of Jordanian banks. The Arab Bank, comprising half the banking sector, is the largest bank in Jordan, with an asset-base of nearly JD 17 billion at the end of 2005. Arab Bank was the first national bank in Jordan established in 1930. The difference between the asset size of Arab Bank and other banks operating in Jordan is due to the substantial difference in their scope of operations; the

[3] See for example Jordan Securities Commission at: http:/www.jsc.gov.jo/main.asp.

Arab Bank has a worldwide presence, while the other Jordanian banks prime focus is in the local market. Arab Bank accounted for almost 61% of the total assets, 62% of total deposits, and 59% of total equity of the nine banks in our sample in 2005 (See Appendix 2.1 Table 4).

The banking sector constitutes the largest part of the ASE. With 17 listed banks, the value traded for the banking sector constitutes 44% of the total value traded of listed companies compared with only 28% for industrial stocks, 1% for insurance, and 27% for services companies stocks as of 2004. However, despite the fact the banking sector comprises 64% of total market capitalization, the total value traded for the industrial sector in 2005 outperformed that of the banking sector due to the implementation of various privatizations (see Appendix 2.1 Table 5 and Figure 1), which increased investors' confidence in industrial firm stock investments (ASE, Data Base, 2005).

Based on the trading information of the ASE in Appendix 2.1 Table 6, stock transactions in the banking sector are dominated by Arab Bank. On the other hand, the number of traded shares and contracts for Arab Bank were, during the same period, less than other banks which is mainly due to the high market value of this stock compared with the market value of other bank stocks; this high market value limits small investors' appetite for the stock. The number of contracts for Arab Bank (see Appendix 2.1 Table 6) accounted for 53% of the total contracts in 2005, compared with only 21% in 2002.

The importance of the banking sector can be recognized through the substantial percentage of foreign investments in ASE that are absorbed by the banking sector. Figures 2 and 3 illustrate the movements of foreign investments at ASE, as well as the banking sector share of foreign investments in ASE in 2005. Foreign investment increased sharply in 2004 for two reasons: first, the instability in the other Arab countries, and second, the efforts made by policy makers in the market to attract foreign investment into Jordan.

Hence, it is interesting to examine whether the significant market position of Arab Bank in the Jordanian banking sector is sufficient to make it the leader or dominant in the stock market, and whether this bank influences other banks listed in the market in the context of returns causality and volatility spillover.

3. Theoretical Background and Information Transmission: A Literature Review

3.1. Theoretical Background

Information spillover effects have been described in the banking literature within the context of market contagion. The term contagion is interpreted differently within the banking literature (see for example Aharony and Swary 1983, 1996). It can refer specifically to fear of a bank run (see Diamond and Dybvig, 1983). Conversely, it can refer more generally to "any transmission of information across banks; as a given amount of information pertaining to one bank may be contagious to other banks" (Akhigbe and Madura, 2001, p1).

When a banking system does not work well, there is a potential for financial instability. Northcott (2004) argues that banks have traditionally been considered to be more vulnerable to instability than other industries, for various reasons: first, a bank's balance sheet consists of short-term deposits on the liability side and long-term assets that can be difficult to liquidate quickly. Secondly, highly leveraged firms have an incentive to engage in risky behaviour. If the firm achieves excess profit, shareholders benefit; if it does not, they will bear the cost. This agency problem is particularly strong for banks because banks tend to be very highly leveraged; a large share of the debt holders are depositors who have small claims, are widely dispersed, and may not be well informed of a bank's activities and potential risks; and the existence of deposit insurance further lessens depositor's incentives to monitor the risk-taking behaviour of the bank (See Paper 1 in this thesis). Moreover, De Bandt and Hartmann (2000) emphasise that banks share a complex network of exposures and face interrelated risks that can result in debilitating effects if bank failure occurs.

Furthermore, the problems in the banking sector may have systemic effects on the economy. The nature of the contracts banks hold (short-term deposits and longer-term loans) exposes them to the possibility of runs; and linkages between banks combined with information asymmetries between counterparties and banks make them vulnerable to contagion (Jackson and Perraudin, 2002).

In the theoretical literature, contagion in the banking sector arises from the propagation of asymmetric information because investors do not have the information to distinguish between bank-specific developments and systematic phenomena (Slovin et al., 1999). Diamond and Dybvig (1983) demonstrate that bank runs developed from random shocks that induce some investors to withdraw funds even when no fundamental change in a bank's prospects or asset values has occurred. Expectations about the condition of the banking sector may be affected by investors' perceptions about the ability of a specific bank to meet its obligations. As investors observe withdrawals, they respond similarly, generating a bank run that may force liquidation of longer-term investments at a loss. Gorton (1988) and Chari and Jagannathan (1988) contend that the 'first come first served' nature of bank liabilities, together with the severity of asymmetric information about loan quality, implies that major adverse bank information alters the market's assessment of the value of rival banks.

In addition, researchers have examined the transfer of shocks through the interbank market. Allen and Gale (2000) show that the possibility of contagion depends strongly on the completeness of the structure of interregional claims. They find that complete claims structures are shown to be more robust than incomplete structures. Freixas et al., (2000) investigate the ability of the banking sector to withstand the insolvency of one bank and whether the closure of one bank generates a rippling effect throughout the system. They find that contagion arises from unforeseen liquidity shocks, i.e. banks withdrawing interbank deposits from another bank.

In summary, we can say that information that might cause a shock, which initially affects institutions or a particular region of an economy, can spread by contagion to the rest of the financial sector and this can then infect the larger economy. Thus, contagion effects are at the centre of systemic risk and occur through direct linkages between participants. Also, contagion can arise from indirect linkages, where firms have similar exposures, so that a single shock can affect multiple firms.

Systemic risk, therefore, is a key concern for regulators who are charged with safeguarding overall financial stability (Dow, 2000). Systemic risk arises when the weakness of multiple banks imposes costs on the financial system and ultimately on the economy as a whole. Despite the fact that the precise meaning of systemic risk is ambiguous, the literature reveals three frequently used concepts one at a macro level where the other two concepts are focused more at the micro level (Kaufman and Scott, 2003). Under the first concept, systemic risk occurs when a large macro shock affects most or all of the economy or system adversely and simultaneously. Bartholomew and Whalen (1995) point out that systemic risk refers to an event having effects on the entire banking, financial, or economic system rather than just one or few institutions. Mishkin (1997) defines systemic risk as "the likelihood of a sudden, usually unexpected event that disrupts information in financial markets, making them unable to effectively channel funds to those parties with the most productive investment opportunities". However, Kaufman (1994), and Crockett (1997) define systemic risk focusing on that only one bank needs to expose indirect causation to the initial shock where all other banks along the transmission chain may be unexposed to this shock. Finally, systemic risk's third definition focuses on spillovers from an initial exogenous external shock but it does not involve direct causation and depends on weaker and more indirect connections.

Inter-bank relations, can therefore, serve as a channel through which problems in one bank can spread to another. In this context, Allen and Gale (2000) use simple examples to show that the extent of fragility of the system depends on the structure of these inter-bank linkages. If each bank is connected to all other banks, a shock to one bank can be absorbed within the system since each bank bears a small share of the shock (Nier et al., 2007).

On the other hand, the effect of large banks on systemic risk and the strength of spillover effects are interesting to study because a 'financial meltdown' is likely to start with problems related to the largest banks and because the nature of a spillover differs between banks of different sizes. In this context, Aharony and Swary (1996) examine informational contagion in five large bank failures that occurred in the Southwest region of the US during the mid-1980s, and found that size affects information contagion positively.

Moreover, the recent consolidation trend has resulted in large banking institutions giving the size effects added importance. It is worth noting that, from a theoretical perspective, firm size can either reduce or increase a firm's risk. Risk reduction can be achieved because increased size allows banks to diversify more extensively and to benefit from economies of scale in management of risk. In contrast, forces increasing financial institutions risk include increased moral hazard incentives and/or agency problems associated with managing more complex institutions. Boyd and De Nicolo (2005) provide a theoretical explanation based on moral hazard and contracting theory for why bank risk-taking can actually increase as bank assets become more concentrated with fewer banks. Their analysis suggests that the consolidation of the US banking industry might lead to increased risk at the individual bank and system levels. Berger et al., (1999) report that the growing size of banks has increased market power in some areas, improved profit efficiency, created more diversified financial institutions, and increased systemic risks. Demsetz and Strahan (1995; 1997), show that there are significant differences between large and small banks in their diversification and financial leverage strategies. They assert that large banks are better diversified but highly leveraged and less liquid which increases systematic risk.

As early as 1955, Edwards proposed that size enabled big firms, regardless of local market shares and structural conditions, to affect the markets in which they operated in a manner that smaller firms could not. He proposed that access to "deep pockets" may provide big firms with the resources to engage in predatory or disciplinary pricing behaviour in a particular market. The size of market players in the banking sector is proposed to affect competition and may create dominance in the market. In the banking literature, it has been assumed that any competitive advantages that large and diversified banks have over other smaller banks and depository institutions in a market enable them to be dominant (Pilloff and Rhoades, 2000). A bank may be dominant for a variety of reasons. It may be more efficient than rival firms, it may have grown larger as a result of economies of scale or its products may be regarded as superior to that of its competitors.

While smaller firms can achieve increases in profitability by competing aggressively with dominant firms they may face the threat of an overwhelming reaction by the dominant firm, which can act as a significant deterrent. Thus, rather than challenging the dominant firm across the board, smaller firms are likely to confine their activities to specialist niches, thereby not posing a major threat to the dominant firm (Pilloff and Rhoades, 2000). While a large market share may, in some circumstances, indicate that a firm has a dominant position, of itself, market share is neither a necessary nor a sufficient condition to establish dominance. Furthermore, it is not only a firm's absolute size or market share that matters in terms of establishing dominance but its size relative to its competitors.

Having said this, however, market share has been used by some researchers as an indicator of a firm's competitive success. Mueller (1985), for instance, uses market share changes as a sign of the success of mergers which are often claimed to yield cost efficiencies, synergies, and other beneficial results. Factors such as financial strength, multi-market links, diversified operations, too-big-to-fail implicit guarantees, and economies of scale and scope are cited as reasons why large banks may have an undue influence on the competitive environment.

Where some studies empirically address the question of the presence of large banks and the effect of these on competition (e.g. Hanweck and Rhoades, 1984; Wolken and Rose, 1991; Pilloff, 1999), none of the previous studies (as far as we are aware) examine the effect of large banks in financial markets and specifically that market information is important for predicting banking problems. Curry et al., (2005) document the importance of incorporating securities market data into models that forecast banking problems. They argue that such information can improve predictions relative to traditional models. However, their analysis is conditional upon the effectiveness of the market in monitoring banks and accurately interpreting their prospects from financial data. Moreover, the presence of intra-industry effects would indicate information asymmetries in the market that could have negative repercussions in the context of specifying such models.

As a consequence, we suggest that intra-industry research can offer a timely perspective on the issue of asymmetric information in banking markets. Understanding the interrelations between banks in financial markets and the effect of large banks in these relations will help us better understand potential contagion channels and therefore should help us inform regulators whether they have to focus on large banks when setting policies.

3.2. Empirical Evidence on Contagion and Information Transmission

Studies of information transfer initially focused on industrial firms. The research in this area investigated the issue of intra-industry transmission or spillovers of information focusing on the influence of firm announcements on non-announcing firms within the market (see for example Szewczyk, 1992; Lang and Stulz, 1992; and Akhigbe et al., 2005). The central result of these studies is that intra-industry contagion effects can be significant.

The banking intra-industry information transfer literature concentrates on examining contagion effects. It has been acknowledged that a bank which experiences operational difficulties will have various impacts on other banks in the sector. Swary (1986) focused on an individual bank failure and determined negative valuation effects of other bank rivals as a result. Several other studies offer evidence that information about a single bank can be transmitted throughout the banking industry. Gay et al., (1991) found that bank failures cause a decline in stock returns of rival banks in Hong Kong. Aharony and Swary (1996) assessed southwestern US banks in response to five large bank failures and found evidence of contagion effects.

Other studies examine additional types of announcements. Docking et al. (1997), for instance, find that loan-loss reserve announcements have negative effects on rival banks. In addition, Slovin et al., (1999) find dividends reductions are negative events for both announcing money-centre and regional banks, but only reductions at money center banks have negative contagion type externalities. In another study, Bessler and Nohel (2000) bring evidence regarding the adverse effect of dividends reduction announcement of money-centre and regional banks on the stock returns of non-announcing banks. Akhigbe and Madura (1999) narrow down the research on information transfers to the banking industry, where they try to determine if acquisition announcements made by banks in the U.S. have any intra-industry effects. Through cross-sectional analysis of announcements, they find that the created valuation effects extended to non-announcing banks, and were positive on average. The authors go on to conclude that while intra-industry effects do exist where bank acquisitions are concerned, these effects are conditional upon characteristics specific to the event and the rival banks.

Brewer and Jackson (2002) extend the banking information transfer literature by investigating inter-industry contagion between US banks and life insurance companies and find strong evidence of both intra and inter industry contagion. In another study, Stringa and Monks (2007) assess the significance of inter linkages from the UK life insurance sector to the UK banking sector and conclude that contagion occurs during events that have hit the life insurance sector as a whole.

The aforementioned studies of information transfer in the banking sector used event study methodologies based on the assumptions of linear returns independence and constant conditional variance of return. It is noteworthy that the use of the traditional linear model in the presence of heteroscedastic and leptokurtic residuals can lead to parameter standard errors which are too large, possibly leading to an erroneous conclusion that a parameter is not significantly different from zero (Elyasiani and Mansur, 2003).

Nevertheless, the information transmission literature has been extended to employ time series econometrics models such as a Vector Error Correction (VEC) model and Generalised Auto-Regressive Heteroscedastic (GARCH) systems to analyse information flow dynamics across financial markets. These studies examine interrelations across markets or exchanges located in different countries through examining integration or market interdependence (e.g., Ederington and Lee, 1993 Bekaert and Harvey, 1995; Harvey and Huang, 1991; Claessens and Forbes, 2001; Koedijk et al., 2002; Darrat and Benkato, 2003; Ng, 2000; and Masih and Masih, 2001; Chen et al., 2003; Cotter, 2004). Most of these studies find significant interdependence of price changes and volatility across international stock markets.

Moreover, a number of these studies suggest that major stock markets lead emerging markets. For example, Hamao et al., (1990), Copeland and Copeland (1998), Jeong (1999), Baca et al., (2000), and Syriopoulos (2006) examine the dominance (leader) role of one market over other markets by testing the asymmetric relations between these markets. The asymmetric relation arises when there is a unidirectional causality or volatility spillover from the leader market to other markets. The results of this strand of research indicate there is a dominant role of the US equity market on other markets. In addition, information transmission across European markets have been investigated previously (e.g. Linne, 1998; Jochum, et al., 1999; and Voronkova, 2004) and examined the dominant role of the UK and Germany within European countries. Rockinger and Urga (2001), for instance, investigate the relative importance of the German and UK equity markets for Central European (CE) markets and conclude that the influence of UK was stronger than that of Germany[4].

Recent studies which examine inter-industry information transmission across banks and other financial institutions have started to apply the aforementioned methodologies of VEC and GARCH. These methodologies are more elaborate than the basic event study as the aforementioned considers the short and long term relationships among different economic units, and allows for dynamic return interdependence and time-varying volatility. Generally, the results of these studies support interdependence and volatility spillover across financial institutions (see e.g. Jokipii and Lucey, 2007; Elyasiani and Mansur, 2003; and Elyasiani et al., 2007).

On the other hand, the issue of financial institution size and its influence on contagion effects within the banking sector was first empirically introduced by Dickinson et al., (1991) who found that contagion effects in the volatility of stock prices in the banking sector was limited to regions and size. Furthermore, according to Karafiath et al., (1991) banks with larger size are more likely to carry contagion effects across the US banking system; however, Temzelides (1997) finds that the opposite-probability of observing a panic increases as the size of banks decreases[5].

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[4] Furthermore, studies provide evidence regarding information transmission across sectors within or across countries (e.g. Wang et al., 2003, Yang, 2003; Taing and Worthington, 2005; and Cummins and Wei, 2006). The risk return spillover between firms has been studied with more focus on industrial firms. Yu and Hsu (2002) explore the return dynamics between the world's major computer firms and their corresponding companies in Taiwan by adopting a VAR test methodology. They find existence of dynamic relations between the stock returns of own brand firms and corresponding firms. Hammouddeh et al., (2003), on the other hand, used a Vector Error Correction model (VEC) to examine the time series properties of daily spot and futures prices for the three petroleum types (heating oil, gasoline, and crude-oil) traded at five commodity centres within and outside the United States. They found some evidence supporting the existence of return and volatility spillover between the three petroleum products prices.

[5] In addition, the information transmission literature documents the existence of cross correlation between large and small stocks within a market. This strand of the literature shows that these cross correlations are asymmetric: the returns of small stock portfolios tend to be correlated with the lagged returns of large stock portfolios while the returns of large stock portfolios tend to be uncorrelated with the lagged returns of small stocks (Kanas, 2002; Lo and Mackinlay, 1990; and Harris and Pirsedtasalasai, 2006; Eun and Huang, 2003; Hameed and Kusnadi, 2003; and Gebka, 2006). In general they find that small firm stocks adjustments to the information from the market are different from large firms stocks.

Finally, Elyasiani et al., (2007) study the risk and return linkages across US financial institutions using the GARCH approach. They find evidence of strong spillovers among large firm securities compared with smaller stocks. They explain their results as a consequence of the lower ability of smaller financial institutions in diversifying their product set and their stronger connection with local economic conditions. This finding is supported by DeYoung and Ronald (2001), and Stiroh (2004), who argue that larger banks have greater exposure to systemic risk and lower idiosyncratic risk related to local factors.

In summary, a substantial number of empirical studies relating to information transfer suggest that interdependency exists between markets, industries or firms. However, studies on movements of share prices or return causality and volatility spillover within the banking industry are limited, especially in emerging markets. In addition, the effect of large banks on smaller banks has, as far as we are aware, been unexplored.

This paper aims to advance the established literature by firstly providing evidence on returns and volatility transmission for banks stock in an emerging market (Jordan). It also takes another direction by testing whether any return causality and volatility transmission in the banking sector is influenced by a dominant bank. In particular, we will seek to investigate to what extent small bank stock prices movements can be explained by large bank stock prices in the emerging capital market. Additionally, we analyse returns causality and volatility transmission patterns between large and small banks in the Jordanian ASE. Finally, we investigate whether the 11th of September event influenced the returns causality and volatility transmission relations in the banking sector.

4. Data and Methodology

4.1. Data Description

The data used in this study comprises daily and weekly figures of aggregate closing stock prices for nine banks operating in the Jordanian banking sector (JBS), namely: Arab Bank (AB), Housing Bank (HB), Jordan National Bank (JNB), Cairo Amman

Bank (CAB), Bank of Jordan (BJ), Jordan Kuwait Bank (JKB), Union Bank (UB), Arab Jordan Invest Bank (AJIB), and Arab Banking Corp (ABC)[6].

Weekly analysis was performed based on the data for Wednesday closing prices in order to avoid problems of the weekend effect[7]. All prices are expressed in local currency (Jordanian Dinar). The data covers eight years, spanning from 6th of May 1998 to 31 of March 2005 collected from the ASE data base, for a total of 358 weekly observations. Additionally, we compare the information transmission in the periods before and after 11th of September. This political effect may influence the financial markets by either changing the patterns of relationships or the degree of interaction between the banks' returns and volatility. Although the 11th of September attack occurred in the US, its impact is not limited to only US markets. Ito and Lee (2004) argued that this attack had significant economic repercussions internationally. Previous literature has found that after a shock market volatility tends to increase (Engle and Mustafa, 1992; and Schwert, 1990), and returns may fall (Nikkinen, et al., 2007).

The 11th of September US attack led to some changes in the Arab region. In Jordan, a large amount of Jordanian investments abroad returned back to the country. Many Arabian and foreign investors have been attracted to the Jordanian banking system as a safe haven for their savings and ASE as a profitable choice for their investments (ASE, 2005).

Hence, this study will use two panels of periods to test whether this flow of money into both the financial market and banking sector will give different explanation for the role of a large dominant bank in terms of return and volatility transmission. Considering that new restructuring rules were adopted in ASE in late 1997, we define two non-overlapping sample periods; the first period is from 6th of May 1998 to 6th of September 2001, and the second from 13th of September 2001 until 31st of March 2005.

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[6] The choice of banks came from the continuity of trading information available during the study period. The main reason for choosing the period starting in 1998 is that the Amman Stock exchange adopted new restructuring rules in September 1997.

[7] Weekends in Jordan start from Friday morning until Saturday evening.

4.2. Methodology

Following the methodology of Elyasiani et al., (2007), Darrat and Benkato (2003), Syriopoulos, (2005), Hammoudeh et al., (2003), and Moor (2007) among others, we test for return causality and volatility spillover between Jordanian banks using both the Multivariate Vector Error Correction (VEC) model for testing causality, and the Generalized Autoregressive Hetroscedastic (GARCH) approach for explaining time varying volatility. Whereas the VEC model is applied here because of its ability to examine short and long run relationships between the Jordanian bank stock prices, the GARCH methodology is employed due to its ability to capture volatility clustering or excess Kurtosis in the returns series[8].

We calculate stock returns in this study using the following formula (see Darrat and Benkato, 2003):

$$R_{it} = \ln\left[\frac{P_{it}}{P_{it-1}}\right] \qquad (1)$$

Where R_{it} is the weekly (daily) returns series for the closing prices of each bank i at time t, and P_{it} is the price of the bank i at time t, and P_{it-1} refers to the price of bank i in at time t-1, and ln is the natural logarithm.

4. 2.1. Testing for Stationarity

An important ingredient in any analysis of parametric models is to check the stationarity of the time series in the models. As Diebold and Killian (1999) argue, the presence of a unit root is a necessary prelude to investigating the degree of integration. Therefore, we begin our empirical analysis by testing for unit roots in the bank stock prices[9].

A stationary time series is one whose mean (expected value) and variance are constant over time; a non-stationary series is whose mean and/or variance change over time. A trended series is obviously non-stationary because its mean changes over time due to the

[8]In this study, we apply a univariate GARCH model because for a given number of units in the sample (nine banks), it is extremely challenging to correctly specify a multivariate GARCH model while avoiding over-parameterisation. Specifically, we need to estimate a large number of parameters which require a long iteration process (see Gebka and Serwa, 2007; Fujii, 2005; and Ng, 2000).

[9] As is customary, all bank stock prices are expressed in natural logarithms prior to estimation. This is a convenient transformation since logarithmic first differences (percentage changes) approximate stock returns (Darrat and Benkato, 2003).

time trend. Frequently employed tests for determining whether a time series (X_t), is non-stationary (unit root) are the Augmented Dickey-Fuller (ADF) and the Philips Perron (PP) tests. In this study, the unit root test is performed for each of the nine banks stock prices included in the sample to investigate whether these stock prices are integrated using the ADF test (Dickey and Fuller, 1979; 1981)[10]. The results are double checked by performing the Philips-Perron PP (Philips and Perron, 1988). The null hypothesis for both tests is that the series has a stochastic trend (unit root). The model for the ADF test consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms, and optionally, a constant and a time trend. This can be expressed as:

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \alpha_2 Y_{t-1} + \sum_{P=1}^{K} \delta_{Pp-1} \Delta Y_{T-P+1} + u_t \tag{2}$$

Where Y_{t-1}= ln (P_{t-1}) is the natural logarithm of the price of each bank stock at time *t-1*, Δ is the first difference operator. *P* is the number of additional lags to use. The optimal number of lags *K* is chosen using the Akaike Information Criterion (Akaike, 1973). The test for a unit root is conducted on the coefficient of y_{t-1} in the regression. If the coefficient (α_2) is significantly different from zero then the hypothesis that y contains a unit root is rejected. Rejection of the null hypothesis implies stationarity. If the calculated ADF statistic is lower than the critical value then the null hypothesis is not rejected and it is concluded that the considered variable is non-stationary, i.e. has at least one unit root.

One of the basic assumptions of the ADF test is that the disturbances are independently and identically distributed (IID), where PP (1988) relaxes the assumptions of IID, in other words PP and ADF tests use the same model and distribution, except that the PP test generalizes the ADF procedure by allowing for fairly mild assumptions concerning the distribution of errors from the autoregressive regression estimation to cope with potential serial correlation. The PP test equation can be expressed as follows:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 (t - T/2) + \sum_{i=1}^{m} \alpha_i \Delta y_{t-1} + \mu_t \tag{3}$$

[10] The ADF is considered to be more accurate than the simple Dicky Fuller test because it contains lagged terms to account for the fact that the underlying data generating process may be more complicated than a simple first order autoregressive process AR(1).

Where T is the number of observations and μ_t is the disturbance term which is not required to be serially uncorrelated or homogeneous. y_t is the natural log of the bank share prices in period t, α_0 is a constant term, $t - T/2$ is a time trend. m is the optimal lag length to ensure serially uncorrelated residuals, decided according to Newey-West's (Newey and West, 1987) suggestions.

The two tests will be carried out in the natural logarithms of the levels of the variables and first differences of the logarithms. The null hypothesis of stationary time series is rejected if α_2 and α_1 in ADF and PP models, respectively, are statistically significant for each series.

4.2.2. Cointegration and Error Correction

The assessment of bank stock return interdependencies is based on the joint testing for the presence and number of cointegrating vectors as well as scrutinizing the relevant VEC model for causal relationships between these bank returns. Cointgration allows for the description of stable long run stationary relationships between integrated variables (bank returns or prices), as is defined as independent linear combinations of these non-stationary variables achieving stationarity. It implies that the series do not drift apart but are moving together by some long-run equilibrium relationship[11] (Syriopoulos, 2005).

There are many possible tests for cointegration; the most general of them is the multivariate test based on the autoregressive representation discussed in Johansen (1988) and Johansen (1991), this procedure provides more robust results when there are more than two variables (Gonzalo, 1994) and when the number of observations is greater than 100 (Hargreaves, 1994). The Johansen (1991) test is estimated as follows:

$$\Delta Y_t = \alpha_0 + \sum_{p=1}^{k-1} \Gamma_p \Delta Y_{t-p} + \Pi Y_{t-1} + \varepsilon_t \qquad (4)$$

Where, Yt is a column vector of the nine banks log share prices, Δ denotes the first difference operator, ε_t is a 9x1 vector of residuals. The VEC specification contains

[11] The cointegration technique pioneered by Engle and Granger (1987), Hendry (1986), made a significant contribution towards testing Granger causality. The term equilibrium in this case suggests a relationship which, on average, has been maintained by a set of variables for a long period (Hall and Hendry, 1988).

information on both the short and long adjustment to changes in *Yt*, via the estimated parameters Γ and Π, respectively.

Consistent with Johansen (1991), the coefficient matrix Π contains the essential information about the relationship between the nine banks in the sample. Specifically, if rank Π = 0, then Π is 9x9 zero matrix implying that there is no cointgration relationship between the banks. In this case the VEC model reduces to a VAR model in first difference. If Π has a full rank, that is rank (Π) = 9 then all variables in Yt are I (0) and the appropriate modelling strategy is to estimate a VAR model in levels. On the other hand if Π has a reduced rank, that is the rank of Π= n-1, then there is a cointegration relationship between the nine banks, which is given by any raw matrix Π and the expression ΠY_{t-1} is the error correction term (Kavussanos and Visviks, 2004)[12]. The Johansen method provides two different likelihood ratio tests, the trace and the maximal eigenvalue test, to determine the number of cointegrating vectors (Hendry and Juselius, 2001).

$$\text{Trace test statistic} = -T \sum_{i=r+1}^{n} \ln(1-\lambda_i) \qquad (5)$$

Where T is the number of usable observations or time periods and λ_i is the eigenvalues obtained from the estimate of the Π matrix. And the maximal eigenvalue test can be calculated as follows:

$$\text{The Maximal Eigenvalue statistic} = \quad -TIn(1-\lambda_{r+1}) \qquad (6)$$

In the trace tests the null that there are at most r cointegrated vectors, against the alternative that the number of cointgrating vectors is greater than r, and the maximal tests the null that the number of cointgrating vectors is r, against the alternative of $r+1$.

If bank prices are cointegrated then causality must exist in at least one direction (Granger 1986, 1988) either unidirectional (single direction) or bidirectional (both directions). Although cointegration indicates the presence or absence of causality, it does not indicate the direction of causality between variables. This direction of the

[12] If only one long run relation exist among the variables, then those variables will share a single route of convergence towards the equilibrium path, but if there is more than one long run relation, there exist multiple forces pushing towards convergence paths among the variables.

temporal causality can be detected through the VEC model derived from the long-run cointegrating vectors (Masih and Masih, 1998). In this case causality can identify whether two variables move one after the other contemporaneously. When they move contemporaneously, one provides no information for characterising the other. Hence, it is appropriate to examine whether bank X causes Y by observing how much of the current return of bank Y can be explained by its own past return and whether the block of lagged values of bank X returns can improve the explanation of bank Y return. In other words, we can say that X causes Y if the changes in X should proceed changes in Y. Therefore, the VEC model specification can be written as follows:

$$\Delta Y_t = \alpha + \sum_{i=0}^{r} \beta Z_{i,t-1} + \sum_{i=1}^{p-1} \upsilon_i \Delta Y_{t-i} + \sum_{i=1}^{p-1} \theta_i \Delta X_{t-i} + \varepsilon_{it} \qquad (7)$$

Where Y_t is an $m \times 1$ vector of variables cointegrated of order r, ΔY_{t-i} is the bank lagged return at time $t-i$, ΔX_{t-i} is a vector of the lagged returns of the other eight banks in the sample, these two variables interpret the changes of each bank as a result of the short run effects from past ΔY_t (bank returns) and ΔX_t (the rest of the eight banks returns), Z_{t-1} is the error correction term which is calculated as $[Y_{t-1}-(a+bX_{t-1})]$. The error correction term is included in the model to capture the deviation from the long run cointegration equilibrium in the last period. The order of lags is determined by the likelihood ratio (LR) test supplemented by the Akaike Information Criterion (AIC) and the Schwarz Bayesian Information Criterion (SBIC)[13]. Unidirectional causality from bank X to Y (X Granger causes Y) requires that some of the coefficient θ_i, i=1,2....p-1 are non zero. If both variables Granger cause each other, then it is said that there is a two-way feed back relationships between Bank X and Y. These hypotheses can be tested by applying Wald test's on the joint significance of the lagged estimated coefficients of ΔX and ΔY.[14] Based on the VEC model, we can infer the dominance role played by the large bank (Arab Bank) if there are casualty relations running from this bank stock returns to the majority of relatively smaller bank's stock returns, but not vice versa.

[13] The LR is the ratio of the restricted to unrestricted model and is distributed as $\chi^2(k)$, where k is the number of parameters. However, to distinguish between the improvements in the model due to an increase in the number of parameters, the AIC and SBIC criteria can be calculated. These criteria are functions of the log likelihood values as well as the number of free parameters in the estimation.

[14] The above technique or formulation has been used in mainstream macroeconomic analysis in order to test for causal chains implied by the major paradigms in macroeconomic theory (Masih and Masih, 1995). or the causal relations between some emerging financial markets and more developed market to test for the leading role of those markets (Elyasiani et al., 1998, and Kavussanos and Visviks 2004, among others).

However, the VEC model provides tests to discern within sample causality. These tests can only indicate Granger causality of the dependent variable within the sample period. They do not provide an indication of the dynamic properties of the system, nor do they allow gauging the relative strength of the Granger causal chain or degree of exogeneity amongst the variables beyond the sample period (Yang, 2003). However, Variance Decomposition (VDC) may account for the out-of-sample causality tests. Thus, for the robustness of the results, Variance Decomposition will be applied to have more understanding of the effect caused by a shock of one bank on the rest of the banks operating in the Jordanian Banking Sector (JBS) by partitioning the variance of the forecast error into proportions attributable to innovations (or shocks) in each bank in the system including its own. This procedure can provide an indication of these relativities. The results of VDC estimation may be used to indicate the importance of the large bank (Arab Bank) to explain the returns of other Jordanian banks. The VDC moving average system describes the dynamic interdependence of the banks included in the model. The response patterns are simulated by introducing one standard deviation shocks to each of the banks in the sample over different time horizons. The VDC test may provide an indication regarding the dominance role (information asymmetry pattern) of the large bank in the short run dynamic sense. If a large bank informationally leads other smaller banks, this bank's returns should most significantly be explained by its own innovations and not as much by other smaller banks' innovations. Instead, innovations from the large bank should be able to significantly explain other relatively small banks returns.

4.2.3. Testing for Volatility Spillover

Econometrics literature has evidenced that most financial time series contain a heterogeneous error term that has time varying variation (e.g., Engle, 1982). Furthermore, economists have discovered that volatility is an important factor linking firms within the same industry (Yu and Hsu, 2002), and volatility of asset prices relates to the rate of flow of information in the market (e.g. Ross, 1989, and Clark, 1973). In this section, we will try to examine the methodology of volatility spillover between large and relatively small banks within the JBS.

Many studies show that financial time series are conditionally heteroskedastic (Bollerslev et al., 1992; and Park, 2001). This indicates that large price changes tend to be followed by large changes and small changes tend to be followed by small changes (volatility clustering). When different stocks are traded on the market at different frequencies, this is known to generate autocorrelation in the market index (Lo and Mackinlay, 1990). Thus, the impact of any particular information shock in the market has a lagged effect through its impact on stocks that trade at different times. This means that for a bank's stock price the effect of any shock will die out more slowly than the ideal one-time change in the level.

The suitability of any proposed statistical model depends largely on its ability to describe and account for notable empirical observations in sets of data (Nicholls and Tonuri, 1995). Thus, in order to assess the distribution properties of daily returns and daily squared returns in our sample.

Given the common heteroscidasticity, non-normality and interdependency behaviour in financial time series, we follow several recent studies by modeling the stock returns using Generalized Auto-Regressive Conditional Heteroscidastic (GARCH) processes that parameterize time varying conditional variances (Bollerslev et al., 1988; Darrat and Benkato 2003; Elysiani and Mansur 1998; and Brewer et al., 2006, Elyasiani et al., 2007; and Darrat and Zhong, 2000). This model was originally introduced by Engle (1982) as Auto-Regressive Conditional Heteroscidastic (ARCH) and generalized as GARCH by Bollerslev (1986). For these models to best detect the volatility long time series are recommended. Therefore, daily time series are used for modeling the volatility models.

Engle (1982) developed the ARCH model to conveniently account for the volatility clustering commonly observed in financial time series, and capture the temporal dependence in the second moment of time series data. The structure of the ARCH models consists of two linked equations: the mean equation and the variance equation, which expresses how the variance changes over time.

The ARCH model is as follows:

$$R_{it} = \alpha_{i0} + \alpha_{it} \sum_{k=1}^{p} R_{t-k} + \varepsilon_i \qquad (8)$$

With

$$h^2{}_{i,t} = \alpha_{i,0} + \sum_{k=1}^{p} \beta_{i,1} \varepsilon^2_{i,t-k}$$

And

$$\varepsilon i, t / \omega_{t-1} \rightarrow (0.h)$$

$$\alpha \succ 0, \beta_i \geq 0, \sum_{k=1}^{p} \beta_{i,1} \prec 1 (k = 1,2....p) \qquad (9)$$

In this ARCH (p) model, the conditional variance h^2 at time t is a positive function of squared errors in the last p period. R_t is the rate of return of a particular bank from day t-k to day t. and, ω_{t-k} is the past information set containing the realised values of relevant variables up to time t-k. Since investors know the information in ω_{t-k} when they make their investment decisions at t-k, the relevant expected return and volatility to the investors are the conditional expected value of R_t , given ω_{t-k} , and the conditional variance of R_t given ω_{t-k}.

However, the ARCH model does not allow the conditional variance at time t to have a stochastic component. Bollerslev (1986) extended the ARCH model and developed the Generalized ARCH (GARCH) model, in which the current conditional variance is a function of not only the squared errors in the last p periods, but also the conditional variances in the corresponding periods. The GARCH (p,q) model can be represented in the following form:

$$R_{it} = \alpha_{i0} + \alpha_{it} \sum_{k=1}^{p} R_{t-k} + \varepsilon_i \qquad (10)$$

With

$$h^2{}_{i,t} = \alpha_{i,0} + \sum_{k=1}^{p} \beta_{i,1} \varepsilon^2_{i,t-k} + \sum_{k=1}^{q} \beta_{i,2} h_{i,t-k}$$

And (11)

$$\varepsilon i, t / \omega_{t-1} \rightarrow (0.h)$$

$\alpha \succ 0, \beta_{i,1} \geq 0(k=1,2...p), \beta_{i2} \geq 0(k=1,2....q)$

Where, $\beta_{1,1}, \ldots, \beta_{1,p}$ and $\beta_{2,1}, \ldots, \beta_{2,q}$ are ARCH and GARCH parameters, respectively. The GARCH model is an infinite order ARCH model. The advantage of GARCH model is that it captures the tendency in financial data for clustering. In the GARCH model, the effect of a return shock on current volatility declines geometrically over time. Empirically, the family of GARCH models has been very successful. Of these models, the GARCH (1, 1) is preferred in most cases (see the survey by Bollerslev *et al.*, 1992).

In the ARCH family of statistical models, the values of the parameters are usually estimated by maximizing the likelihood function using numerical techniques based on the Berndt-Hall-Hall-Hausman (BHHH) (1974) algorithm [15]. For stability of the volatility process, the coefficients of the lagged errors squared and lagged conditional variances must sum to less than one. The specification test for the model involves the Ljung-Box statistics for the lack of serial correlation in the model residuals and their squares. [16] Because our paper main interest is discovering the volatility spillover between banks rather than modelling only volatility, this study follows Hammoudeh et al., (2003), Hamo et al., (1990), Park (2001), Harris and Pirsedtasalasai (2006), and employs a GARCH (1,1) model which expresses the conditional variance of a given time series (h^2) as a linear function of one lagged squared of errors and one lagged variances. In the GARCH model, exogenous variables can be included in the conditional variance equation as follows:

$$R_{it} = \alpha_{i0} + \alpha_{it} \sum_{k=1}^{p} R_{t-k} + \varepsilon_i \qquad (12)$$

With

$$h^2{}_{i,t} = \alpha_{i,0} + \sum_{k=1}^{p} \beta_{i,1} \varepsilon^2_{i,t-k} + \sum_{k=1}^{q} \beta_{i,2} h_{i,t-k} + \sum_{j=1}^{m-1} \beta_j \varepsilon^2_{j,t-1}$$

And (13)

$$\varepsilon i,t / \omega_{t-1} \rightarrow (0,h)$$

[15] Marquardt maximum likelihood and BFGS (Broyden–Fletcher–Goldfarb–Shanno) has also been applied, however, BHHH algorithm is found to have better performance (Gannon and Au-Yeung, 2004).
[16] Before estimation any ARCH models, The LM test is used to ascertain whether the ARCH effect is present and that the use of ARCH and GARCH model was warranted.

The above model describes the return series as an AR process while capturing both the GARCH (1, 1) effect and the effect in the equation of conditional volatility. In this model we assume that banks stock return (R_{it}) are explained by a constant, plus it's lagged returns.

In the GARCH (1,1) model, the conditional stocks return volatility of each of the nine banks are explained by their historical movements (GARCH effect, $h_{i,t-1}$); it's lagged shocks (ARCH effect, $\varepsilon^2_{i,t-1}$) and lagged innovations of other eight banks returns ($\varepsilon^2_{j,t-1}$), where i denotes the return of the bank under study, j refers to the other banks in the sample. The conditional variance is denoted by h_i, and ε_i is the error or innovation. The set of information contained in the errors of the conditioned mean is represented by ϖ. In addition, the parameter β_j measures the partial impact of bank j past volatility shocks (volatility spillover) to the eight remaining banks. Furthermore, this study will examine whether the 11th of September event led to a greater degree of volatility within the JBS by applying this model for the two sub-periods, before and after the 11th of September. Based on the GARCH model, we can infer the dominance role played by the large bank if in most cases there is a volatility spillover running from this bank's stock returns to the majority of the other relatively smaller banks stock returns in the banking sector, but not vice versa.

5- Empirical Results

The empirical analysis of the relationship between the Jordanian bank stocks is presented as follows. First, we describe the descriptive statistics and correlation analysis, and secondly we present the results of the stationary test. The third part illustrates cointegration and error correction results. Finally, the volatility spillover results are presented.

5.1 Descriptive Statistics

In Table 2.1, we present summary statistics for the stock returns of the Arab Bank (AB) and other eight Jordanian banks in the sample for the entire period and the two sub-periods before and after 11th of September. Regarding the descriptive statistics, investors are interested in the mean and standard deviation of these returns, as indicators of the expected returns and the volatility of their investment portfolios. The standard deviations of the returns represent volatilities of investment portfolios which along with the mean provide the risk return trade off, respectively.

For the entire period the average weekly returns for the eight Jordanian banks was approximately 0.4 % compared to the Arab Bank average weekly returns of 0.3%. Over the first sub-period (Panel B) the average weekly stock return for the eight Jordanian banks was -0.1 percent lower than Arab Bank stock returns. For the second sub-period (Panel C) the average weekly stock returns for the eight Jordanian banks was 1.8 % compared to the Arab Bank average weekly returns of 0.7 percent.

Based on the above results it is clear that Arab Bank's returns are not the highest across all banks. This is presumably because of the relatively stable share prices and may due to the lower number of shares traded in the market (compared with other banks in the sample). The market value of AB is relatively high and not attractive for individual small investors who search the market for short term profits. Therefore, it is not surprising to find AB returns also exhibit the lowest variability among the nine banks measured by the standard deviation of returns (around 3% in all periods). The range of fluctuations of the Arab Bank weekly returns, in all periods, is also quite low as evident by a relatively small disparity between minimum and maximum returns.

The distributions of Arab Bank and other banks stock returns in all periods have non symmetric distributions as represented by the skewness and kurtosis. It appears that returns of most banks are far from normality, some have positive skewness, to the right, (AB, JNB, CAB, HB) whereas others are negatively skewed (BJ, JKB, ABC, UB, AJIB). For normal distributions the kurtosis value is equal to 3. Therefore, the excess kurtosis of each bank returns series confirms that the distributions of all bank returns are leptokurtic. Hence, all of the series have fat-tailed distributions relative to the normal distribution. Furthermore, the Jarque –Bera statistics confirms the non-normality for all returns series. Clearly, the null hypothesis of normal distribution in bank stock returns can be rejected for all series at the 1% significance level.

The data further suggests that Jordanian bank stock prices appear to behave differently in the periods before and after September 11th 2001. As Table 2.1 (Panels A and B) show, in general, all banks average returns are higher in the second period (influenced by greater foreign money flow in the region), which also may be the reason for slightly higher volatility of bank returns[17]. Other interpretation for increasing banks average returns in the second period may result from the introduction of new financial services and products delivered by the Jordanian banks In addition, the effect of changes in regulations that allowed the foreign investors to increase their participation in the ASE may also explain increased returns in the second period.

Table 2.1

Descriptive Statistics for Bank Returns in the Sample

Variable	Mean	Maximum	Minimum	S.D	Skewness	Kurtoisis	Jarque-Bera	Observation
Panel A	***Full Period (1998- 2005)***							
AB	0.003	0.143	-0.094	0.030	0.812	5.859	(160.773)*	357
JNB	0.003	0.220	-0.165	0.048	0.509	5.974	(147.060)*	357
CAB	0.004	0.226	-0.293	0.055	0.487	8.173	(412.105)*	357
BJ	0.005	0.207	-0.270	0.051	-0.038	8.563	(460.419)*	357
HB	0.004	0.154	-0.140	0.038	0.556	5.277	(95.500)*	357
JKB	0.006	0.231	-0.272	0.044	-0.092	11.955	(1193.231)*	357
ABC	0.003	0.239	-0.242	0.052	-0.016	9.975	(723.764)*	357
UB	0.006	0.232	-0.523	0.053	-1.878	32.906	(3514.070)*	357
AJIB	0.002	0.179	-0.404	0.044	-1.662	25.947	(8015.289)*	357
Average	0.004	0.209	-0.289	0.044	-0.109	15.174		
Panel B	***First Sub-period (1998-2001)***							
AB	0.001	0.117	-0.094	0.027	0.435	6.289	(83.441)*	173
JNB	-0.002	0.154	-0.165	0.042	0.272	5.773	(57.563)*	173
CAB	-0.003	0.163	-0.163	0.047	0.099	6.437	(85.428)*	173
BJ	0.002	0.207	-0.174	0.027	0.622	7.916	(185.344)*	173
HB	-0.002	0.138	-0.140	0.038	0.281	4.991	(30.866)*	173
JKB	0.003	0.231	-0.211	0.044	0.090	11.989	(582.727)*	173
ABC	-0.004	0.236	-0.241	0.053	-0.462	11.076	(476.231)*	173
UB	-0.001	0.232	-0.523	0.056	-3.940	47.868	(4971.05)*	173
AJIB	-0.003	0.148	-0.188	0.034	-0.712	12.768	(702.103)*	173
Average	-0.001	0.233	-0.174	0.041	-1.070	11.944		
Panel C	***Second Sub-period (2001-2005)***							
AB	0.007	0.143	-0.071	0.033	0.946	5.230	(65.221)*	186
JNB	0.006	0.221	-0.150	0.054	0.504	5.487	(54.93)*	186
CAB	0.011	0.226	-0.293	0.061	0.536	8.276	(219.953)*	186
BJ	0.008	0.192	-0.270	0.049	-0.416	9.908	(340.287)*	186
HB	0.088	0.154	-0.094	0.037	0.917	5.473	(72.295)*	186
JKB	0.008	0.205	-0.272	0.045	-0.254	12.276	(657.100)*	186
ABC	0.009	0.239	-0.182	0.049	0.615	8.231	(220.143)*	186
UB	0.011	0.186	-0.116	0.047	1.076	5.709	(91.252)*	186
AJIB	0.006	0.179	-0.404	0.051	-1.965	25.212	(3879.955)*	186
Average	0.018	0.200	-0.223	0.049	0.127	10.072		

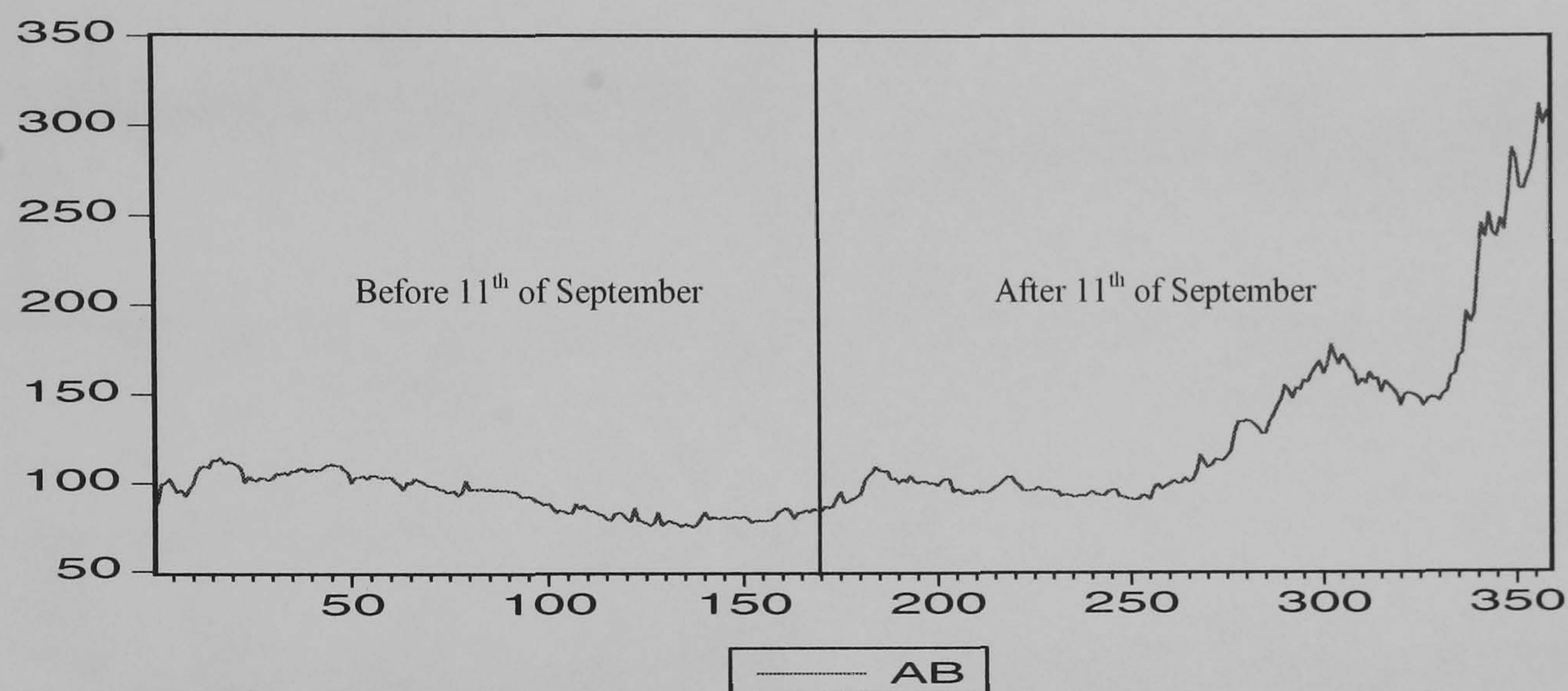
Notes:
Weakly returns for the nine banks are calculated based on the conventional first difference of logarithm prices.
AB= Arab Bank, JNB=Jordan National Bank, CAB= Cairo Amman Bank, BJ= Bank of Jordan, HB= Housing Bank, JKB= Jordan Kuwaiti Bank, ABC=Arab Bank Corporation, UB= Union Bank, AJIB= Arab Jordan Investment Bank.
S.D = Standard Deviation.
Average is the average value for the mean, maximum, minimum, and standard deviation excluding the Arab Bank values.
* is the1% significance level.

[17] Except for the Housing Bank, Arab Bank Corporation and Union Bank.

A time plot of the nine banks share prices and returns is presented in Figure 2.1 A and B, respectively. Where Figure 2.1(A) presents the large bank (AB) stock prices, the rest of the banks stock prices are illustrated in Figure 2.1 (B). One can clearly see also that the Jordanian banks witnessed a higher level of volatility post 11th of September.

Figure 2.1
Share Prices during 1998 to 2005

A-Arab Bank Share Prices During 1998 to 2005



B- Other Sample Banks Share Prices during 1998 to 2005

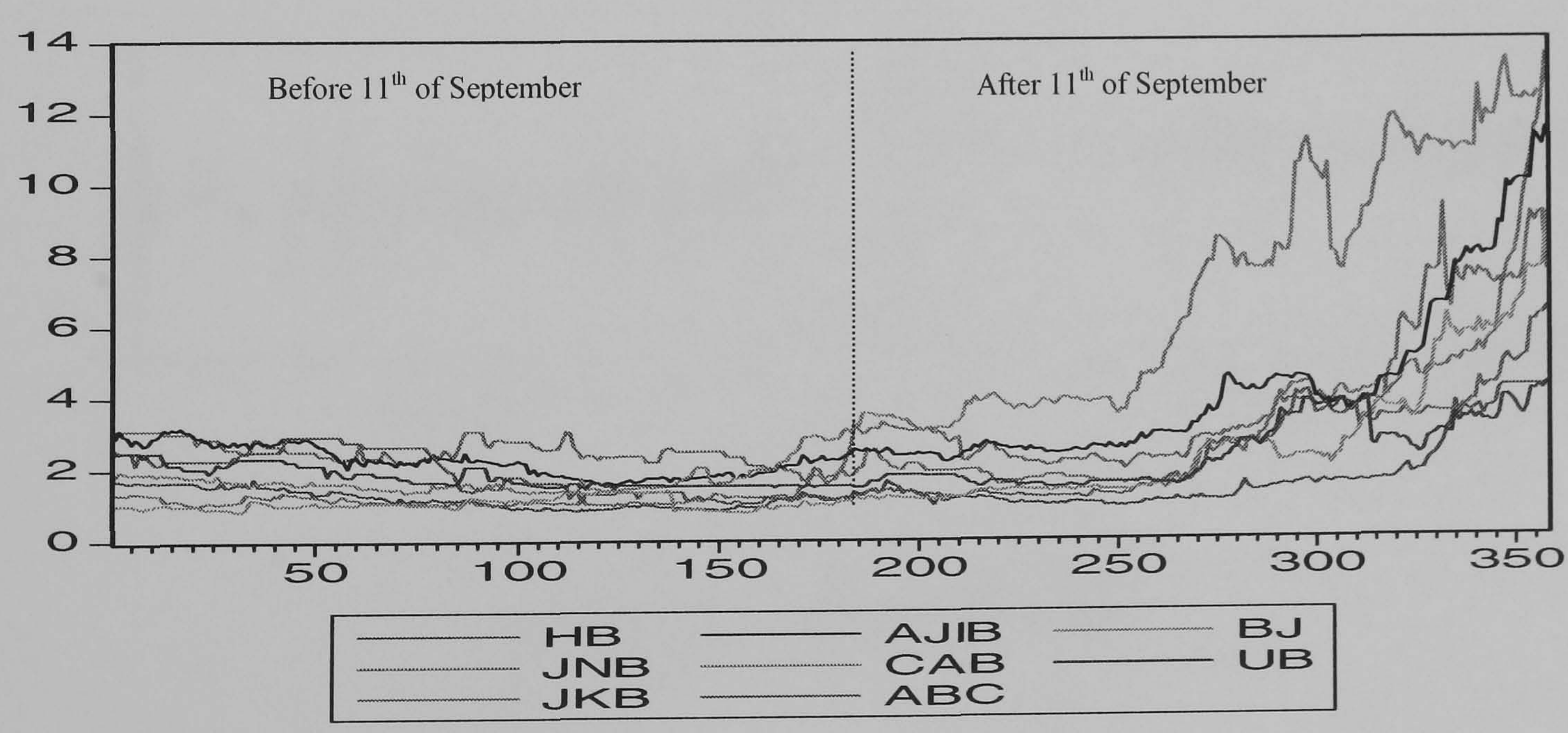
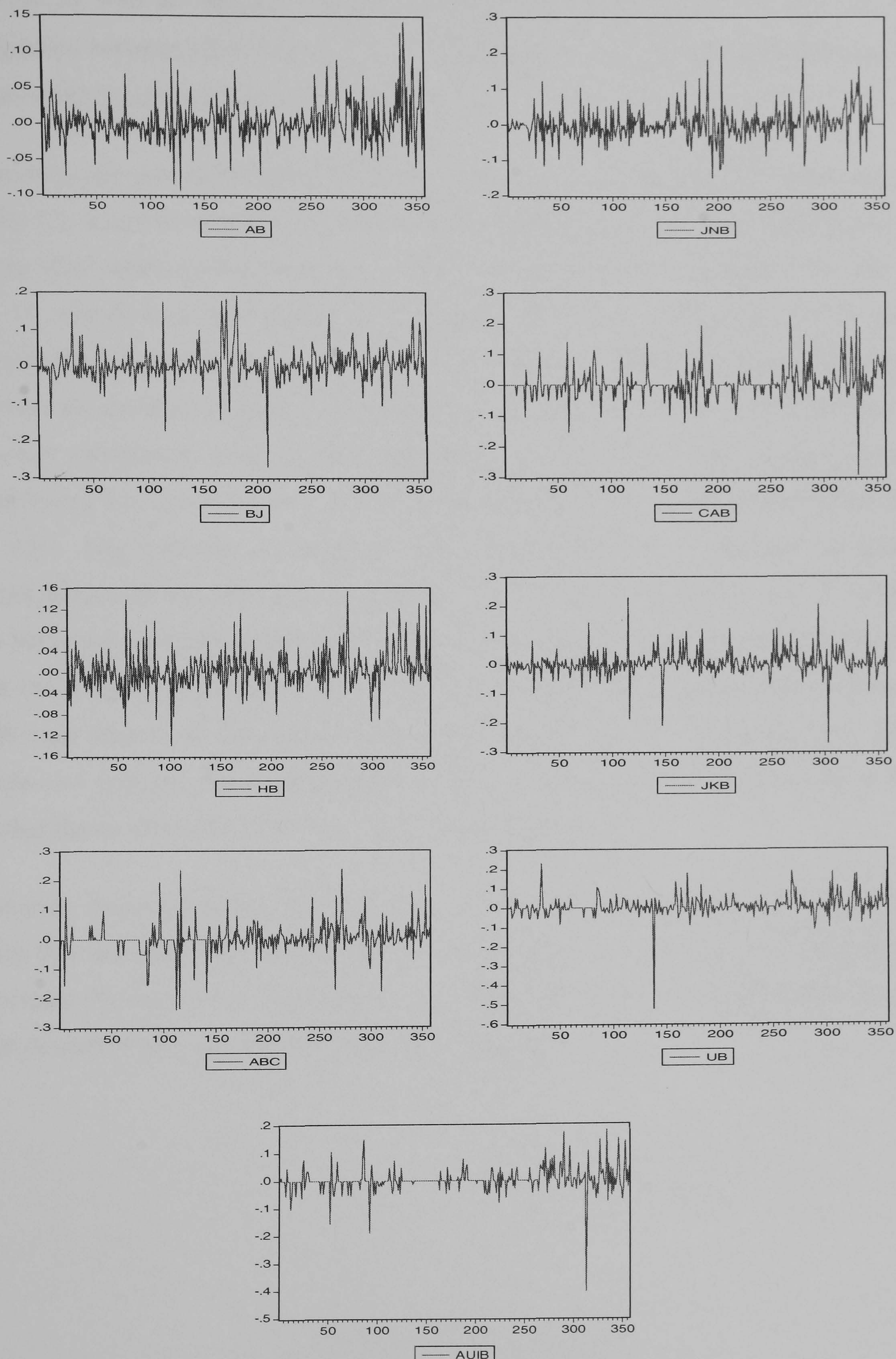


Figure 2.2
Weekly Return of the Nine Jordanian Banks during 1998 -2005



While the descriptive statistics reported in Table 2.1 provide a general comparison for both the Arab Bank and the other banks in the sample, these measures do not however provide us with an indicator to estimate bank stocks integration. A simple test for integration between bank stock returns is to consider the correlation coefficients across bank weekly returns (Vinh and Daly, 2005).

Therefore, the correlation matrix between bank returns is estimated, and presented in Table 2.2. It can be seen that the correlation of returns between the Arab Bank and most of the other relatively smaller banks are positive and significantly different from zero at the 1% significance level during the full period (Panel A). Comparing the two sub-periods (Panels B and C), one can determine whether the Jordanian bank stocks have become increasingly integrated. Comparison of the mean correlation coefficient across the two sub-periods between the Arab Bank and the other eight Jordanian banks collectively indicate an increase in the correlation from 0.05 (sub-period one in Panel B) to 0.19. The majority of Jordanian bank stocks recorded an increase in return correlations with the AB stock, over the first and second sub-periods. Also of interest are the return correlations between all banks in the sample. Overall, the results indicate that the majority of Jordanian bank stocks in the study have become more correlated with each other over the second sub-period compared with the first sub-period. This result may indicate that Jordanian banks tend to move together simultaneously to the market forces and the arrival of new and relevant information.

However, these correlation findings are univariate and provide only a partial picture since they are only short-run indicators. In the next section indicators of long-run co-movement between bank stock returns can provide more appropriate indicators of long-term co-movements between the banks in our sample.

Table 2.2
Correlation among Jordanian Banks Stock Returns

Variable	AB	JNB	CAB	BJ	HB	JKB	ABC	UB
A. Correlations between Bank returns for the Full period (1998-2005)								
JNB	0.222*							
CAB	0.059	0.035						
BJ	0.195*	0.223*	0.019					
HB	0.290*	0.324*	0.127^{+}	0.189*				
JKB	0.179*	0.205*	0.005	0.206*	0.259*			
ABC	0.156*	0.099†	0.031	0.075	0.155*	0.037		
UB	0.007	0.152*	0.139*	0.076	0.146*	0.162 *	0.113^{+}	
AJIB	0.112^{+}	0.153*	0.185*	0.169*	0.183*	0.092 †	0.125^{+}	0.119^{+}
B. Correlations between bank returns during the First sub-period (1998 - 2001)								
JNB	0.164^{+}							
CAB	-0.019	-0.032						
BJ	0.067	0.164*	-0.048					
HB	0.274*	0.324*	-0.054	0.122				
JKB	0.151^{+}	0.348*	-0.116	0.271*	0.256*			
ABC	0.027	-0.033	-0.137†	-0.155^{+}	-0.008	-0.262*		
UB	-0.053	0.032	0.092	0.017	-0.015	0.022	-0.022	
AJIB	-0.009	0.059	0.221*	0.075	0.118	0.044	-0.133^{+}	0.066^{+}
C. *Correlations between bank returns during the Second sub-period (2001 - 2005)*								
JNB	0.243 *							
CAB	0.080	0.047						
BJ	0.276*	0.253*	0.046					
HB	0.287 *	0.286*	0.221*	0.238*				
JKB	0.191*	0.111	0.065	0.152^{+}	0.251*			
ABC	0.248*	0.179^{+}	0.118	0.270*	0.294*	0.315*		
UB	0.037	0.233*	0.155^{+}	0.123*	0.295*	0.296*	0.239*	
AJIB	0.161^{+}	0.182^{+}	0.154^{+}	0.215*	0.212*	0.114	0.286*	0.145^{+}

*, +, † significant at the 1%, 5%, and 10% levels, respectively.

5.2 Stationarity Test Results

The issue of stationary is relevant for both investigating the cointegration and studying the relations between variables, it is essential to examine the stationary of bank (log) level prices and first differences series before conducting cointegration tests[18]. Table 2.3 presents the results of the common two approaches used in this study. ADF and PP tests results indicate the presence of non stationary in log prices in all banks series in all panels of data samples used, the null hypothesis of unit root cannot be rejected. However, the null hypothesis of a unit root in first differences is rejected at a 1%

[18] It is important to note here that going through testing for cointgration before conducting any stationarity tests can lead to serious problems of spurious regression.

significance level for all returns series indicating that all data, with no exception, are stationary.

Table 2.3

.Unit Root Test Statistics

Variables	Levels (log prices)				First differences (returns)			
	ADF	(k)	PP	(k)	ADF	(k)	PP	(k)
AB	0.793	(1)	0.852	(4)	-4.218 *	(8)	-19.583*	(6)
JNB	0.179	(1)	0.086	(3)	-21.756*	(0)	-21.543*	(7)
CAB	0.921	(2)	0.892	(7)	-9.753*	(0)	-17.003*	(2)
BJ	-2.032	(1)	-1.947	(2)	-16.536*	(0)	-16.536*	(0)
HB	0.399	(1)	0.522	(4)	-5.076*	(6)	-21.151*	(2)
JKB	-2.407	(3)	-2.198	(5)	-8.957 *	(2)	-20.668*	(8)
ABC	0.090	(1)	-0.067	(4)	-8.021*	(3)	-21.015*	(8)
UB	-0.123	(0)	-0.123	(5)	-17.571*	(0)	-17.634*	(5)
AJIB	-1.270	(0)	-1.194	(7)	-18.562 *	(2)	-18.564*	(5)

Notes:
All variables are expressed in logarithms. ADF is the augmented Dickey- Fuller test; PP is the Phillips- Perron test. (k) is the optimal lag length, for ADF test this lag length is decided by AIC. The critical value at the 1% significant level for log levels is -3.984, and for first differences is -2.566. The truncation lags PP are decided by Newey-West default, the critical value for PP test at the 1% significance level for the log levels is -3.435, and for first difference is -2.566. The two tests for the log level variables all have intercepts and trend, and the two tests for all the first difference variables have neither intercepts nor trends.
*Indicates rejection of the null hypothesis of non-stationary at 1% significance levels.

5-3 Results of Cointegration and Causality

Since each of the nine banks log prices contains a unit root, the nine variables as a group would become cointegrated if they share a common root. A non stationary variable tends to wander extensively over time. However, a set of non stationary variables may have the interesting property that a particular linear combination of them can keep these variables linked together, and then can prevent them from drifting too far apart. Table 2.4, shows the results from the Johansen (*J*) cointegraion Trace and Maximal Eigenvalue test statistics with their critical values at the 5 percent significance level. As multivariate cointegration tests, they cover all nine banks simultaneously. Panel A reports the results for the full estimation period. It is obvious from row one in this panel that based on both of the two test statistics (Trace = 198.240 and Maximal eigenvalue = 61.778) we are able to reject the null hypothesis of no cointegration among the nine Jordanian banks (the null hypothesis of r=0 is rejected).

This empirical result indicates that there is a single cointegration relationship binding the AB with other banks in the sector, during the full period.

To examine whether the cointgration test results differ between the first and second sub-periods under study, we perform another round of the *J* test of cointegration for each period separately. Table 2.4, Panel B, reports the results of the *J* test for the first period (pre 11th of September), while Panel C in Table 2.4 does the same for the second period (post 11th of September). The results in Panel B (row one) indicate that based on the two test statistics (Trace = 177.544 and Maximal eigenvalue = 49.979) we are not able to reject the null hypothesis of $r = 0$, which suggests that the AB exhibited no cointegration relations with the other banks in the sample during the first period. The judgment, however, is quite different for the second period. The results presented in Panel C (row five) of Table 4 indicate that the Trace test statistic, which equals 70.30, clearly supports the presence of five cointegrating relations linking the AB with the other eight banks in the sample (the null hypothesis of $r \leq 4$ is rejected in favor of $r = 5$)[19].

These results indicate that bank stock returns under study share a long run equilibrium (during the full period) which suggests that future fluctuations of prices in one bank stock can be determined or predicted to some extent using a part of the information set provided by the other bank stock prices. Moreover, the obvious presence of cointegration vectors in the second period could be partly attributed to the growing inflow of foreign portfolio investments in the ASE and the common path of Jordanian banks with regards to applying similar capital requirements, investments, and risk management techniques[20].

[19]Johansen and Juselius (1990) emphasize when a conflict between Trace and Maximal eigenvalue test statistics occurs, it is preferable to use the Trace statistic.
[20] Also these results might be explained by the remarkable changes in the financial system. During the last few years become one of the biggest net capital importers in the region. In particular, after the 11th of September event a large amount of funds inflowed to the market. Many Jordanian (as well as other Arab) investors returned to the country. They believed that Jordanian banks are the safest place for their deposits and the capital market is a profitable place for their investments (Saadi-Sedik and Petri, 2006)

Table 2. 4
Johansen Cointegration Test Results

Null Hypotheses	Alternative Hypotheses	The Trace Test Statistics	Critical Value (5%)	Alternative Hypotheses	The Maximal Eigenvalue Test Statistics	Critical Value (5%)
Panel A: Full Period (1995- 2005)						
$r=o$	$r\geq 1$	(198.240)+	197.370	$r=1$	(61.778)+	58.434
$r\leq 1$	$r\geq 2$	(136.460)	159.530	$r=2$	(44.446)	52.363
$r\leq 2$	$r\geq 3$	(92.010)	125.615	$r=3$	(27.918)	46.231
$r\leq 3$	$r\geq 4$	(64.090)	95.754	$r=4$	(23.608)	40.078
$r\leq 4$	$r\geq 5$	(40.480)	69.819	$r=5$	(15.532)	33.877
$r\leq 5$	$r\geq 6$	(24.950)	47.856	$r=6$	(9.861)	27.584
$r\leq 6$	$r\geq 7$	(15.090)	29.797	$r=7$	(8.660)	21.132
$r\leq 7$	$r\geq 8$	(6.430)	15.495	$r=8$	(5.229)	14.264
$r\leq 8$	$r=9$	(1.200)	3.841	$r=9$	(1.203)	3.841
Panel B: First Period (1995- 2001)						
$r=o$	$r\geq 1$	(177.544)	197.370	$r=1$	(49.979)	58.434
$r\leq 1$	$r\geq 2$	(127.566)	159.530	$r=2$	(40.259)	52.363
$r\leq 2$	$r\geq 3$	(87.307)	125.615	$r=3$	(33.276)	46.231
$r\leq 3$	$r\geq 4$	(54.031)	95.754	$r=4$	(21.124)	40.078
$r\leq 4$	$r\geq 5$	(32.907)	69.819	$r=5$	(15.176)	33.877
$r\leq 5$	$r\geq 6$	(17.731)	47.856	$r=6$	(8.7406)	27.584
$r\leq 6$	$r\geq 7$	(8.991)	29.797	$r=7$	(5.152)	21.132
$r\leq 7$	$r\geq 8$	(3.839)	15.495	$r=8$	(3.351)	14.264
$r\leq 8$	$r=9$	(0.488)	3.841	$r=9$	(0.488)	3.841
Panel C: Second Period(2001- 2005)						
$r=o$	$r\geq 1$	(327.090)+	197.370	$r=1$	(103.040)+	58.434
$r\leq 1$	$r\geq 2$	(224.080)+	159.530	$r=2$	(67.400)+	52.363
$r\leq 2$	$r\geq 3$	(156.660)+	125.615	$r=3$	(50.760)+	46.231
$r\leq 3$	$r\geq 4$	(105.900)+	95.754	$r=4$	(35.590)	40.078
$r\leq 4$	$r\geq 5$	(70.300)+	69.819	$r=5$	(28.390)	33.877
$r\leq 5$	$r\geq 6$	(41.910)	47.856	$r=6$	(19.300)	27.584
$r\leq 6$	$r\geq 7$	(22.610)	29.797	$r=7$	(15.050)	21.132
$R\leq 7$	$r\geq 8$	(7.560)	15.495	$r=8$	(6.900)	14.264
$R\leq 8$	$r=9$	(3.840)	3.841	$r=9$	(0.650)	3.841

Notes:
Johansen Cointegration test allows one to examine the number cointegrating vectors that might exist. The hypothesised number of cointgrating equation denoted as "r =o" exhibits the result of testing the hypothesis of no cointegration condition. r denotes the number of cointegrating ranks.
According to the general guidelines of the LR procedure and the requirement of white noise residuals, the cointgration test uses two lags in panel A, two lag in panel B and seven lags in panel C.
the (non-standard) critical values are taken from Osterwald- Lenum (1992).
+ indicates a rejection of the null hypothesis of cointegration at the 5% level of significance.

The presence of cointegration does not give an indication about the short run (causal) relationship. If a set of nonstationary variables is cointgrated, then an unrestricted VAR model comprised of the first difference of these variables will be misspecified. The reason is that the information of the long run equilibrium relationships among variables will be lost (Hammoudel et al., 2003). Therefore, the VEC model is used to analyse short run 'causalities' running from any bank stock to the other bank stocks in the sector, the speed of adjustment to the equilibrium path, lag relationships and the impact of a propagation mechanism in the JBS.

In order to estimate VEC models, the number of lags in each equation of different log series should be determined. The two VAR lag length with one error correction terms for the full period, in addition to two and seven VAR lags length are chosen for the first and second periods, respectively. These models are tested on the basis of the likelihood ratio (LR) test supplemented by the AIC and SBIC information criteria.

The VEC test is performed on the basis of Equation 7. The block exogeneity Wald's Chi Square (χ^2) test statistics are calculated to test the null hypothesis that the first bank return series does not Granger-cause the second, against the alternative hypothesis that the first bank return series Granger-causes the second. The results of VEC Granger causality are presented in Table 2.5. Each entry in the table denotes the χ^2 value of the bank on the left hand side caused by the bank at the top. The χ^2 values in the last column (all other eight banks column) indicate if we can reject the null hypothesis that each bank is not Granger caused by the remaining banks jointly.

In Table 2.5, the causality results of AB to the rest of the banks in the sample are presented in the first column. Moreover, the causality results running from other banks in the sample to the AB are presented in the first row. In Panel A, the Granger causality results for the full period are reported. The returns of AB can cause the returns of two banks only, BJ and HB. The χ^2 takes the values of 4.868 and 7.196, respectively, and are both statistically significant. On the other hand, there are no significant short-run channels of causality running from the relatively smaller bank stocks to the AB stock during the full period.

Additionally, it is interesting to note that the degree of interdependence among banks in the system is evident. Specifically, the role played by some banks was similar to that played by the AB in the VEC system by showing a significant causality effect on the banking system. Looking at the Chi square significance values from the second to the ninth column in Table 2.5, we can infer that BJ leads HB (χ^2 = 6.704, significant at the 5%), JKB (χ^2 = 6.669, significant at the 5%), and UB (χ^2 = 16.002, significant at the 1%) and follows KJB (χ^2 = 10.606, significant at the 1%). In addition, JNB leads HB (χ^2 = 27.396, significant at the 1%), AJIB (χ^2 = 14.995, significant at the 1%), and none of the banks influenced its returns. The main indication of these results is that some banks have a similar influential power as the Arab Bank (JNB, CAB, UB, and AJIB) and others (BJ) are even more influential.

Table 2.5
VEC Causality Test Results among the Nine Jordanian Banks

Bank	AB	JNB	CAB	BJ	HB	JKB	ABC	UB	AJIB	All other eight banks
A- Full period (1998-2005)										
AB		1.468	2.425	0.610	1.448	2.650	1.842	1.661	1.461	15.301
JNB	3.004		0.455	3.466	4.405	0.812	0.145	0.141	0.056	12.533
CAB	1.643	3.292		0.130	3.719	1.691	0.412	7.952+	3.772	18.518
BJ	4.868†	3.423	1.372		2.630	10.606*	2.838	2.449	2.509	26.171†
HB	7.196 +	27.396*	27.029*	6.704+		8.286+	1.748	8.625+	54.793*	84.948*
JKB	1.9625	1.233	0.256	6.669+	2.220		2.422	2.496	3.572	19.849
ABC	1.240	3.988	2.781	1.533	3.152	1.962		2.802	4.040	20.036
UB	1.054	0.676	9.061+	16.002*	1.252	1.598	2.870		5.324†	37.494*
AJIB	1.736	14.995*	4.526	0.399	33.925*	2.791	9.057+	2.676		47.803*
B- First sub- period(1998-2001)										
AB		1.454	0.756	0.249	0.128	0.856	2.784	3.075	0.192	10.922
JNB	1.848		1.996	3.121	2.648	0.027	0.185	0.480	1.978	12.007
CAB	0.345	0.389		1.599	1.862	0.106	0.521	2.178	3.523	10.235
BJ	2.032	0.130	2.173		0.313	6.467+	4.595	0.774	7.137+	20.821
HB	1.927	0.016	0.792	0.160		0.291	0.203	1.154	1.615	5.948
JKB	0.124	0.095	1.758	0.859	0.100		0.193	1.205	3.059	7.869
ABC	6.976+	0.849	3.932	2.144	1.720	0.616		0.009	0.041	19.083
UB	0.851	0.315	1.477	3.218	1.694	0.804	0.934		0.763	11.955
JIBA	1.918	0.329	5.087†	3.249	0.285	0.711	4.215	1.192		24.246†
C- Second sub-period (2001-2005)										
AB		22.887*	10.260	24.385*	12.688†	8.869	8.920	7.188	9.840	113.246*
JNB	5.991		10.038	8.351	14.321+	5.101	4.596	4.831	6.980	55.767
CAB	3.836	4.936		12.213†	3.385	7.122	4.222	12.603†	3.345	57.119
BJ	8.230	11.275	9.311		9.084	8.365	5.764	4.234	4.335	62.023
HB	8.102	10.574	9.048	8.374		9.313	5.785	4.735	4.075	61.552
JKB	12.229†	1.567	5.032	5.987	14.873		14.486+	26.495+	14.033*	108.712+
ABC	29.742*	4.648	8.947	5.169	13.182†	32.598*		4.642	17.696+	151.104*
UB	15.879+	6.678	11.762	14.517+	17.967+	3.562	5.839		8.468	82.626
AJIB	13.184†	2.430	13.741†	0.783	7.066	8.264	12.610†	12.870†		69.737

Notes

- The VEC causality test results for the full sample period are presented in this Table. Each entry in the Table denotes the Chi square value and the significant level of the bank on the left hand side caused by the bank at the top. The values at the last column (all other eight banks column) indicate the whether each bank is Granger caused by the remaining banks.
*, +, †indicate significance at the 1%, 5%, and 10% levels, respectively.

From the first to the tenth column in Table 2.5 it appears that the dominance role of the AB in causing stock returns of other banks is not evident since the pattern of relations between this bank and the rest of the banks during the full sample does not support the significant role played by its past returns in predicting the returns of the majority of the banks in the JBS.

Additionally, the empirical causality results during the first and second period are reported in Table 2.5 Panels B and C. These results do not support the dominance role of the large bank (AB). In particular, there are limited short run channels of causality running from changes in the Arab Bank stock to other smaller bank stocks. In the first period, the AB runs only one significant causal relation to the ABC bank. However, in the second period AB significantly influences four banks in the banking system (JKB, ABC, UB, and AJIB). On the other hand, there are a number of significant short-run channels of causality running from smaller bank stock returns (JNB, BJ, and HB) to AB stock returns. Despite the lack of dominance effect of the large bank (AB) on smaller banks in the sample, where the returns of the large bank have no relatively strong explanatory power over the rest of the banks, short-run Granger causality relations and predictability between small banks exist in all sample study periods. However, these causalities appear to be stronger in the second period. Specifically, in the first (second) period, among the nine banks in the sample 4 (21) significant causal links are found or 5.5% (29.2%) of 72 possible causal linkages are significant.

The causal findings in Table 2.5 give only qualitative relations. However, the Variance Decomposition (VDC) gives a quantitative measure to these causal relations indicating how much the movement in one bank stock can be explained by other bank stocks in terms of the percentage of the forecast error variance of that bank stock. Tables 2.6 summarises the VDC findings of 1-week, 5-week, and 10-week ahead of forecast in each bank stock for the entire period[21]. Each entry in the table denotes the percentage of forecast error variance of a bank on the left-hand side explained by a bank at the top[22].

The results in the table reveal that the AB own innovations fully account for its variance at the first horizon (1-week ahead) but the opportunity for the other banks innovations to explain the standard error for this bank increased from 0% in horizon 1 to 3.2 % (10-weeks ahead). In contrast, shocks from the AB stock are effectively transmitted to the other banks in the sector; they can collectively explain 31.3% of their variance over a 10-week horizon. However, other relatively smaller banks add new information beyond the information originated from the AB to the rest of banks in the sample over the same horizon (e.g. JNB explains 34.6%, and CAB explains 25.8%). In other words, the information observed from these two banks is also useful for explaining the price variation in the remaining bank stocks (e.g. BJ, JKB, UB, AJIB). Finally, the response of the rest of banks in the sample to the shocks from any other individual bank is minor. The forecast error variance caused by each of these individual banks ranges from 0.01% to 6.9%.

[21] It is often the case that a variable will explain almost all of its own forecast error variance at a very short horizon and a smaller proportion at a longer horizon (Ewing, 2002). Therefore, our discussion focuses on 10-week ahead forecast results, in order to give other banks innovations the opportunity to contribute in explaining the percentage of forecast error variance for each bank in the system.
[22] See Appendix 2.3 Table 1 and 2 for the variance decomposition results for the two sub-periods.

Table 2.6

Decomposition of the Forecast Error Variance for the Full Period -(1998- 2005)

Bank	H.Z	S.E	AB	JNB	CAB	BJ	HB	JKB	ABC	UB	AJIB	Others
AB	1	0.034	100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5	0.060	97.208	0.049	0.171	0.050	0.322	0.648	0.409	0.348	0.795	2.792
	10	0.047	96.804	0.074	0.187	0.057	0.370	0.818	0.516	0.486	0.688	3.196
JNB	1	0.053	4.009	95.99	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.196
	5	0.088	3.220	94.519	0.149	1.003	0.187	0.210	0.020	0.007	0.690	5.481
	10	0.070	3.686	93.999	0.140	1.062	0.251	0.234	0.014	0.004	0.611	6.001
CAB	1	0.059	0.152	0.004	99.844	0.000	0.000	0.000	0.000	0.000	0.000	0.156
	5	0.0818	0.472	0.194	95.818	0.354	1.577	0.134	0.224	0.730	0.497	4.182
	10	0.105	0.363	0.137	95.441	0.455	1.979	0.084	0.222	0.756	0.563	4.559
BJ	1	0.054	2.164	3.258	0.028	94.550	0.000	0.000	0.000	0.000	0.000	5.45
	5	0.100	2.307	3.018	0.102	91.103	1.406	0.931	0.492	0.115	0.527	8.897
	10	0.078	2.631	3.011	0.097	90.706	1.154	1.328	0.454	0.165	0.452	9.294
HB	1	0.039	10.639	7.538	1.6271	0.290	79.905	0.000	0.000	0.000	0.000	20.095
	5	0.049	13.534	12.259	5.883	1.182	57.267	0.310	0.349	0.713	8.502	42.733
	10	0.060	15.654	15.350	8.057	1.017	46.921	0.251	0.353	0.669	11.728	53.079
JKB	1	0.0487	2.243	3.550	0.276	1.940	1.768	90.221	0.000	0.000	0.000	9.779
	5	0.065	2.892	3.395	1.109	2.794	2.093	86.124	0.396	0.662	0.535	13.876
	10	0.082	3.182	3.334	1.357	2.445	2.154	86.223	0.310	0.601	0.395	13.777
ABC	1	0.058	0.364	2.166	0.044	0.022	0.648	0.062	96.694	0.000	0.000	3.306
	5	0.077	0.687	3.656	0.261	0.574	0.842	0.661	92.147	0.549	0.622	7.853
	10	0.098	0.732	4.021	0.185	0.420	0.540	0.683	92.594	0.416	0.410	7.406
UB	1	0.059	0.064	2.490	1.172	0.921	1.600	1.482	0.478	91.79	0.000	8.1670
	5	0.086	0.247	2.176	2.844	6.160	3.428	0.919	0.662	83.295	0.269	16.705
	10	0.111	0.177	2.106	2.811	6.850	3.840	0.615	0.408	83.029	0.163	16.971
AJIB	1	0.049	2.273	2.425	3.545	0.811	0.096	0.571	0.635	0.423	89.223	10.777
	5	0.065	4.550	5.239	10.680	0.630	5.018	0.818	1.080	2.975	69.011	30.989
	10	0.082	4.887	6.534	12.990	0.489	6.794	0.924	0.709	3.652	63.020	36.98

Notes:

Each number in this Table denotes the percentage of error variance, measured by the standard error, of banks in the left hand side explained by the banks at the top.
Others is the effect on a particular bank of all other banks in the system (the percentage of the forecast error variance of a particular bank [standard error] explained by all banks other than its own past.

The previous results do not strongly support the leading role of the AB. Although this bank is relatively exogenous during the entire period (the majority of its own variance is explained by its own shocks) and has a significant explanatory power for the price movements of the other banks in the sector, some relatively smaller banks have also a substantial information role in explaining the remaining banks variations. This lack of large bank dominance is consistent with Elyasiani's et al., (2007) argument who stated that the ability of large banks, compared to smaller banks, to avoid restrictive regulation and earn differential returns due to their product innovation and managerial skills make large banks have less information transmission to their relatively smaller rivals.

Additionally, testing for VDC during the two sub-periods (See appendix 2.3 Table 1 and 2) gives the same conclusion regarding the lack of a dominance role of the AB. In the first period, while AB innovations were the most important explanatory variable for the variation of some banks (for example, they explained 4.6% of JNB, and 4.7% of ABC), they failed to exert a dominant influence for the rest of the banks. The same conclusion exists for the second period. However, in the second period the Jordanian banks witnessed a higher degree of interdependence, this can be evident by examining the change of exogeneity of each individual bank between the first and the second sub-periods. Table 2.7 shows the proportion of bank stock movements that can be explained by its own shocks (or the degree of exogeneity) for the two sub-periods. We can infer that the exogeneity for all banks has been significantly reduced implying the high degree of interdependence between the Jordanian banks in the short run. It also clear that the AB becomes more influenced by other relatively smaller banks in the sector (its degree of exogeneity was reduced substantially from 93% to 56%). This result suggests that the AB stocks actively responded to other bank innovations during the second period compared with the first period. The higher level of interdependencies between the Jordanian banks after 11th of September may due to similar exposures to economic and regional conditions that may lead to greater correlations between banks returns and therefore more interdependency.

Table 2.7
The Comparison of Degree of Exogeneity during the Two Sub-Periods

Bank	Degree of Exogeneity		Difference (1)-(2)
	The First Sub-Period (1)	The Second Sub-Period (2)	
AB	92.734	56.379	36.355
JNB	88.829	70.130	18.699
CAB	92.851	67.271	25.580
BJ	86.074	59.769	26.305
HB	79.130	42.218	36.912
JKB	77.873	65.043	12.830
ABC	76.739	35.068	41.671
UB	90.118	51.435	38.683
AJIB	80.835	50.620.	30.215

Note:
The degree of exogeneity is calculated as 100 percent minus the bank's own explanation of its standard error.

5.4. Results of Volatility Spillover

5.4.1. Preliminary Analysis

The presence of a serial correlation and non-linearity in the return series are essential in order to implement the GARCH specification (Hsieh, 1989). Therefore, we perform a number of tests to examine the characteristics of the return series. We first perform the Ljung-Box test statistics $Q\ (p)$ and $Q^2\ (p)$ for $p = 6$ and 12 lags, to test for the presence of serial correlation and interdependency of each bank returns and squared returns series. The null hypothesis of no serial correlation is soundly rejected at the 1% and 5% significance levels for all bank returns and squared returns series. These results indicate the existence of significant linear and non–linear serial correlations (see Table 2.8). Non-linear serial correlations exhibit a characteristic known as volatility clustering, in which large changes tend to follow large changes, and small changes tend to follow small changes.

Table 2.8
Return Series Diagnostic Test Results

Variable	AB	JNB	CAB	BJ	HB	JKB	ABC	UB	AJIB
ARCH (LM)	263.867*	228.792*	20.824*	26.931+	122.737*	28.770+	26.217+	24.829+	22.582+
Q(6)	96.497*	167.71*	76.920*	69.934*	12.994+	51.139*	42.862*	98.861*	16.455+
Q(12)	123.16*	208.33*	82.397*	71.819*	22.226+	72.625*	56.970*	145.11*	27.586+
$Q^2(6)$	120.14*	317.54*	78.750*	136.41*	42.863*	78.367*	64.479*	136.92*	16.840+
Q^2 (12)	170.83*	425.50*	96.790*	137.71*	66.668*	96.942*	114.38*	172.05*	30.260+
BDS	0.202*	0.1996*	0.203*	0.2046*	0.2010*	0.2033*	0.2032*	0.2037*	0.2014*

Notes:
ARCH (LM) is a Lagrange Multiplier test to see if ARCH effects are present in the set of residuals obtained from linear regression. Each return series were regressed on constant values, and then the squared residuals are regressed on their own history (12 lags). The test statistics is $t = T^*R^2$, where T is the number of observations. It follows the Chi- square distribution with 12 degree of freedom. Rejection of the null hypothesis indicates the presence of ARCH effect.
BDS test is developed for detecting the nonlinear structure. It allows for testing the null hypothesis that a time series consists of Independent and Identically Distributed (IID) observations, against the alternative hypothesis that the time series is non-linear dependent (see Brock, et al., 1987).
Q(p) and Q2 (p) are the Ljung-Box test statistics for independence of the original and squared returns series, respectively. It follows the Chi square distribution with p degree of freedom. The number of observations equals 1688.
*, +, †indicate significance at the 1%, 5%, and 10% levels, respectively.

The volatility clustering characteristic can satisfactorily be captured by conditional heteroskedasticity models. This result is supported by the significant BDS test statistic results which examine the presence of non-linearity in the stock return series. Additionally, the Lagrange Multiplier (LM) test was used to ascertain whether ARCH effects were present and that the use of GARCH model is warranted. Looking at Table

2.8 the LM test results for all of the bank returns series indicate that the ARCH effects are significant (at the 1% and 5% significance levels), suggesting that the use of the GARCH methodology is warranted.

5.4.2. Volatility Spillover Effects

Because of the presence of autocorrelation in the returns series, it is important to account for serial correlation structures in these series. This is usually achieved through the determination of an appropriate lag structure in the formulation of the mean equation. For this purpose, we use the SBIC, See Appendix 2.4 Table 1 for the reported summary statistics for the univariate autoregressive (conditional) models, AR (*p*) using SBIC. The selected criterion is based on minimization of the value of the test ratio. From the reported results it can be obvious that the AR(1) model was the selected model in most cases except for the AB and JNB return series, where the AR (2) is selected.[23]

The estimation results during the full sample period are presented in Table 2.9. This table comprises the GARCH (1, 1) model results which are specified in equations (12) and (13). The second through the tenth column represent each bank mean and conditional volatility equations results. The fifth and sixth rows represent the ARCH and GARCH parameters in the conditional variance equations $\beta_{i,1}$ and $\beta_{i,2}$, respectively.

The degree of volatility persistence (sum of the ARCH and GARCH parameters) has lower values than one for all nine banks series, which implies that the GARCH model is stationary (Apergis and Rezitis, 2003). The results show that the own volatility for most of the banks are large and significant indicating the presence of ARCH effects. Looking at the fifth row in Table 2.9, the own volatility effects range from 0.003 (UB) to 0.560 (AJIB). In the GARCH set of parameters, all the estimated coefficients are significant. The lagged conditional volatility ranges from 0.198 to 0.991[24].

[23] We usually need higher number of lags in the AR model in order to capture the higher level of autocorrelation in the return series.

[24] The Q and Q^2 statistics for the GARCH residuals and their squares are not significant at conventional levels in most cases indicating that there is no serious problem in the models specification. Testing for the autocorrelation and ARCH effect of the results show that there is no significant autocorrelation among the residuals, and this suggests that the model is well specified. Results of LB (*Q) and LB (*Q^2) test are reported in Table 9 and Appendix 2.4 Table 2 and 3.

Table 2.9

Volatility Spillover Results during the Full Period (1998-2005)

Maximum Likelihood Estimates	AB	JNB	CAB	BJ	HB	JKB	ABC	UB	AJIB
Return Equation									
$\alpha_{i,0}$	0.000	0.001+	-0.001*	0.000	0.001+	0.000	-0.001†	0.001+	-0.001
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
$\alpha_{i,1}$	0.155*	0.166*	0.123	0.185*	0.110*	0.137*	0.137*	0.085†	0.031
	0.032	0.029	0.079	0.023	0.030	0.034	0.034	0.049	0.046
$\alpha_{i,2}$	-0.042	-0.037	-	-	-	-	-	-	-
	0.031	0.027							
Volatility Equation									
$\beta_{i,0}$	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ARCH ($\beta_{i,1}$)	0.297*	0.181*	0.259*	0.173+	0.156*	0.083*	0.051*	0.003+	0.560†
	0.042	0.022	0.064	0.520	0.028	0.026	0.013	0.001	0.325
GARCH ($\beta_{i,2}$)	0.632*	0.732*	0.606*	0.677*	0.595*	0.725*	0.883*	0.991*	0.198
	0.044	0.020	0.026	0.025	0.039	0.031	0.010	0.004	0.144
Volatility Spillover $\beta_{j,3}$									
AB		-0.009	0.015	-0.046	-0.015	0.084	0.001	0.066*	0.401†
		0.010	0.036	0.037	0.014	0.066	0.024	0.013	0.234
JNB	0.005		0.007	-0.082*	0.006	-0.075*	-0.036*	-0.027*	-0.033*
	0.007		0.016	0.025	0.015	0.019	0.008	0.006	0.002
CAB	0.002	0.003		1.268+	-0.002	-0.007*	0.028	-0.002	-0.013+
	0.004	0.005		0.525	0.009	0.002	0.023	0.001	0.006
BJ	0.005	-0.003*	0.006		-0.002	-0.007*	-0.007*	0.003	-0.004*
	0.005	0.001	0.007		0.005	0.003	0.001	0.002	0.001
HB	-0.001+	0.000	0.000*	-0.001		-0.001*	0.000	0.000*	-0.001†
	0.000	0.001	0.000	0.001		0.000	0.000	0.000	0.000
JKB	0.001*	-0.003*	-0.002	0.008	-0.002		-0.008*	-0.008*	-0.002
	0.001	0.000	0.003	0.010	0.002		0.002	0.003	0.004
ABC	0.002	-0.003+	0.005	-0.013*	-0.002†	-0.009*		-0.007*	0.005
	0.003	0.001	0.009	0.003	0.001	0.003		0.001	0.009
UB	0.002	-0.003	0.002	-0.002†	0.010	-0.001	0.007		-0.001*
	0.002	0.001	0.003	0.001	0.007	0.001	0.018		0.000
AJIB	-0.001*	-0.001	-0.003	-0.001	-0.001	-0.004+	-0.009*	-0.004+	
	0.000	0.001	0.004	0.004	0.000	0.002	0.001	0.002	
Log-L	5242.443	4519.161	4436.947	4075.171	4604.534	4226.931	4208.962	4177.349	4573.963
Q(6)	8.349	5.444	18.968	7.908	14.579	5.109	8.254	11.428	6.977
P-value	0.214	0.488	0.004	0.245	0.024	0.530	0.220	0.076	0.323
Q(12	11.305	9.532	25.826	15.400	28.938	14.465	11.016	21.833	16.575
P-value	0.503	0.657	0.011	0.220	0.004	0.272	0.528	0.390	0.166
$Q^2(6)$	6.000	7.937	11.753	0.896	3.813	0.461	3.722	7.123	0.511
P-value	0.423	0.243	0.109	0.989	0.702	0.998	0.714	0.310	0.998
$Q^2(12)$	9.250	14.080	14.006	1.146	9.351	0.943	5.452	7.999	2.508
P-value	0.681	0.296	0.300	1.000	0.673	1.000	0.941	0.785	0.998

Notes:

This Table reports the estimation results and the diagnostic test results of the GARCH (1,1) model as reported illustrated in equations (12) and (13), predicting the volatility for the daily returns of the eight relatively small banks in the sample (see Table 1 for banks notations). The parameters $\alpha_{i,0}$ $\alpha_{i,1}$ $\alpha_{i,2}$ are the estimated Autoregressive equation parameters, and $\beta_{i,0}$ $\beta_{i,1}$, $\beta_{i,2}$, and $\beta_{i,3}$, are the conditional variance equation represent the constant, ARCH effect, GARCH effect, and Volatility spillover, respectively. In the diagnostic part, Log-L is the maximum log likelihood ratio. Q (p) and Q^2 (p) are the Ljung-Box statistics for sixth and twelfth order serial correlation in standardized and squared standardized residuals. Numbers below the coefficient values in the Table are robust standard error statistics to allow for possible violations of the assumption of normality for the condition errors (Bollerslev and Wooldridge, 1992). †, +, * indicates significances at the 10%, 5% and 1%, respectively.

The numbers shown in rows seven to fifteen are parameter of volatility spillover $\beta_{i,3}$. The results indicate that the AB has a role in transmitting volatility to two banks only, UB and AJIB, at the 1% and 10% significance levels, respectively. It should be noted that the AB is subject to a significant volatility spillover effects from other three banks, HB, JKB, and AJIB at the 5%, 1 %, and 1% significance levels, respectively. On the other hand, some of the other banks appear to play a more important role than AB in transmitting volatilities to the sector. For example, JNB, HB, and ABC individually have significant effects on the volatility of other five banks (see row eight, eleven and thirteen in Table 2.9). In short, these results support the VEC model test results, discussed before. Hence, there is no clear evidence that the AB has a leading role in the transmission of returns and volatility in the JBS.

Tables 1 and 2 in Appendix 2.5 show the estimation results for the first and second sub-periods under study. Based on these results, the leading (dominance) role of the AB was not strongly supported by the two sub-period results. The AB affects significantly the volatility of three and two banks in the first and second sub-periods, respectively. However, it receives a significant volatility transmission from two and three banks in the same periods, respectively.

Finally, the significance patterns of volatility spillover in the two sub-periods within the banking sector have been increased. This increase of information spillover might be attributable to the fact that most of the flow of foreign capital for portfolio management increased after the 11th of September 2001.

In summary, our results show that the volatility spillover effects, namely the transmission of information flows, from large to small banks is not stronger than that between relatively small banks or from small to larger bank. This finding contrasts previous studies which document that return and volatility spillovers between small and large stocks are asymmetric due to signalling quality (e.g. Lo and MacKinlay, 1990)[25]. Our results are consistent with Conrad et al., (1991) who pointed out that conditional volatility of both large and small stocks are driven by the same factors in an economy,

[25] The returns and volatility of small stock tend to be correlated with the lagged returns of large stocks.

without any differences in the timing of the effects of these factors. It may simply be the case that these factors are not more closely associated with large bank stocks.

From applying the VEC and the GARCH models, we can conclude that there is no clear evidence that the large bank dominance effect exists in the Jordanian banking system. For the large bank to be dominant, two main conditions need to be satisfied. Firstly, the large bank should be independent which means that the returns and volatility of this bank should not be influenced by the majority of other relatively smaller banks in the system. Secondly, the returns and volatility of this bank should significantly affect the majority of the returns and volatilities of other relatively smaller banks in the system. However, the two conditions for the dominance effect to exist have been violated. During the full and the two sub-sample periods the large bank was not able to interpret the returns and volatility changes of the other smaller banks clearly, and it was affected by many other smaller banks.

6. Conclusions

The dominant position of large banks may enable them to play an important role in explaining the dynamics of returns and volatility of relatively small banks in the stock market. A bank may be considered dominant if it has an influence on the returns and volatility of other banks with its own stock price moving independently. Information transmission within the banking sector is important, relative to the other industries, because bank contagion occurs faster, spreads more broadly within the industry, and permeates far beyond the banking sector to cause substantial damage to the financial system and the economy (Kaufman, 1994; Elyasiani and Mansur 2003). This situation added importance and encourage regulators to place greater emphasis over the supervision of the largest banks.

This paper examines empirically the dynamic relations between bank share prices in an emerging market by investigating the return intedependence and volatility spillovers among bank stock prices and returns using cointegration, error correction representation and GARCH methodologies. In addition, we attempt to discover whether the advantages of being large in the banking industry are reflected in the capital market. In other words is large bank stock able to dominate relatively small bank stocks? We investigate whether large bank stock's movements influence the stock returns and volatility of other relatively small banks. We also investigate return causality or volatility effects from relatively small bank stock to large bank stock returns.

The evidence of cointegration between Jordanian bank stocks suggests that future fluctuations (returns) of prices of one bank stock can be predicted to some extent using a part of the information set provided by another bank stock price. Additionally, implementing the VEC model and VDC helped us to conclude that return interdependence exists between Jordanian banks. However, the large bank (AB) proved not to be the most influential bank for other smaller bank return, in other words, the large bank failed to be the dominant bank in explaining stock returns within the banking sector.

The GARCH model estimates reveal that volatility spillover exists between Jordanian banks, although a large bank dominance effect on volatility was not evident from the results. Furthermore; from the volatility results, it might be said that the large bank is almost independent, has not been affected by information of most of the banks in the sample. This result is not surprising because the market value of this stock is relatively high compared to other listed banks in the ASE. In addition, the AB stocks attracts institutional more than retail investors. This may be a reason why this stock moves in a manner isolated from the other banks in the Jordanian banking sector.

Overall, the evidence indicates that although returns and volatility transmission may exist between Jordanian banks, the information flow does not have an influence on the pattern of the transmission mechanisms between large and small stocks. Therefore, the dominance effect does not appear to exist in the Jordanian banking sector. This result may be consistent with Gebka's (2006) suggestion that factors other than size might be important proxies for informed trading which may further explain patterns in stock returns.

This conclusion might have important implications. First, our results suggest that any actions by regulators should be directed to industry-wide difficulties or interdependence among individual banks rather than large bank-specific idiosyncratic problems. In particular, regulators should look for stabilizing potentially adverse effects of a negative event at all banks in the system without providing special attention to the largest bank. Second, this study adds to our understanding that investors and portfolio managers should consider that return causality and volatility spillover between banks may be due to factors other than size when they construct their portfolios. Third, interdependence between bank stock prices may provide investors and portfolio managers important information for their investment strategies. Interdependence between bank share prices may indicate that prices in the market are not equal in their capacity to discover new information and one stock price may serve as a primary asset for price discovery.

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Appendix 2.1

Table 1

Middle East and North Africa: Financial Development Ranking

Level of financial Development*		
High	**Medium**	**Low**
Bahrain	Algeria	Iran
Jordan	Djibouti	Libya
Kuwait	Egypt	Sudan
Lebanon	Mauritania	Syria
Oman	Morocco	Yemen
Qatar	Pakistan	
Saudi Arabia		
United Arab of Emirates (U.A.E.)		

Source: Financial Development in the Middle East and North Africa Susan Creane, Rishi Goyal,A. Mushfiq Mobarak, and Randa Sab, 2003 International Monetary Fund.

Notes: Based on an index of qualitative and quantitative data; 2000–01 data; scoring 0–10, with 10 being the highest level of development. Within each category, the countries are arranged in alphabetical order

Table 2

General Statistics for the Jordanian Banking Sector (JD million)

Year	1998	1999	2000	2001	2002	2003	2004	2005
Number of banks	21	21	21	21	21	21	24	24
Number of branches	457	463	469	471	471	449	447	459
Population per bank branch	10	10.1	10.7	11.04	11.3	12.2	12	12.2
Total Assets*	10,460	11,551	12,914	15,119	15,702	16,236	17,821	21,087
Growth in total Assets	-	10.43%	11.80%	17.07%	3.86%	3.40%	9.76%	18.33%
Total deposits*	6811	7502	8225	8721	9368	9969	11564	12060
Growth in Total Deposits	-	10.15%	9.64%	6.03%	7.42%	6.42%	16.00%	4.29%
Direct credit facilities*	4285	4466	4547	4949	5130	5262	6189	7880
Growth in Direct credit facilities*	-	4.22%	1.81%	8.84%	3.66%	2.57%	17.62%	27.32%
Direct credit facilities to total Deposits*	-	59.53%	55.28%	56.75%	54.76%	52.78%	53.52%	65.34%
Total deposits*	6811	7502	8225	8721	9368	9969	11564	12060
Direct credit facilities*	4285	4466	4547	4949	5130	5262	6189	7880

Notes:
The number of banks licensed to operate in Jordan stood at 24 banks at the end of 2005, including 8 licensed foreign banks (five of which are Arabic banks). The licensed banks operate 459 branches in Jordan and 135 branches outside the country. Jordan also has two Islamic banks. With more than 20 banks operating in a small market, Jordan is widely thought to be over-banked. The number of population per bank branch in 2005 was 12.2 thousand for every branch, compared with 10 thousand for every branch in 1998. Financial savings in Jordan are primarily intermediated through the banking sector. In recent years deposits were attracted from other Arab nations, and the savings and remittances of the many Jordanians who traditionally had never used banks were captured (Central Bank of Jordan 2004). The banking system in Jordan is privately owned, and well-developed. Banks can extend loans and credit facilities in foreign currencies for trade-related purposes. Increasingly, banks have started introducing new products and corporate bond issues. Moreover, the inter bank money market has become prominent over the last few years.
* All numbers include the Jordanian branches only.
Source: Yearly Statistical Bulletin, Special Issue, Central Bank of Jordan, 2005.

Table 3

Concentration Ratio 3 and 1

	Concentration Ratio for Three Largest bank %			Concentration Ratio for the largest bank%		
	Total Assets	Total Deposits	Total Equity	Total Assets	Total Deposits	Total Equity
2002	75	75	76	52	55	61
2003	76	76	76	51	54	62
2004	75	75	73	50	52	58
2005	71	72	68	55	57	52

Source: Banks Scope Data Base and banks Annual Reports.
*The numbers are calculated as the percent of individual bank statistics relative to the total e number of all listed banks

Table 4
Number of Branches, Total Assets, Total Credit Facilities, Total Deposits, and Total Equities for a Sample of nine Jordanian banks

Bank name	N. B 2005	Total Assets*				Total loans			
		2002	2003	2004	2005	2002	2003	2004	2005
Arab Bank	84	68.48%	68.21%	66.30%	60.88%	65.44%	66.06%	61.40%	58.25%
Housing Bank	96	8.24%	8.90%	9.85%	11.57%	7.57%	7.53%	9.15%	11.03%
Jordan National Bank	41	6.45%	5.74%	6.19%	6.05%	10.20%	9.00%	10.60%	8.52%
Cairo Amman Bank	33	4.17%	3.86%	3.86%	4.44%	3.57%	3.38%	3.53%	3.85%
Bank of Jordan	44	3.75%	3.97%	3.78%	4.28%	4.26%	4.27%	4.05%	4.64%
Jordan Kuwait Bank	31	4.10%	4.46%	4.93%	7.20%	4.70%	5.38%	6.54%	8.50%
Union Bank	11	1.73%	1.73%	2.01%	2.36%	1.84%	2.11%	2.15%	2.81%
Arab Jordan Invest. Bank	8	1.69%	1.66%	1.59%	1.73%	0.88%	0.88%	1.25%	1.10%
Arab Banking Corp.	12	1.39%	1.47%	1.47%	1.49%	1.53%	1.39%	1.33%	1.29%

	Total Deposits and Money market Funding				Total Equities			
	2002	2003	2004	2005	2002	2003	2004	2005
Arab Bank	68.40%	67.57%	65.37%	62.42%	68.95%	69.08%	65.51%	59.19%
Housing Bank	7.96%	8.78%	10.05%	11.57%	13.25%	12.77%	13.05%	12.80%
Jordan National Bank	5.89%	5.72%	6.35%	5.61%	3.47%	3.55%	4.17%	6.14%
Cairo Amman Bank	4.45%	4.12%	4.15%	4.18%	2.18%	2.35%	3.33%	5.60%
Bank of Jordan	4.05%	4.33%	4.16%	4.50%	3.08%	3.11%	3.25%	3.79%
Jordan Kuwait Bank	4.25%	4.61%	5.06%	6.50%	4.25%	4.47%	5.05%	5.25%
Union Bank	1.88%	1.91%	2.16%	2.22%	1.69%	1.48%	2.06%	3.63%
Arab Jordan Invest. Bank	1.81%	1.78%	1.61%	1.80%	1.73%	1.72%	1.82%	1.77%
Arab Banking Corp.	1.32%	1.18%	1.09%	1.19%	1.39%	1.47%	1.76%	1.82%

Source: Banks Annual Reports 2006.
Notes:
N.B is Number of Branches
All numbers are calculated as bank total assets over the sum of the total assets for the nine banks in the sample.
The same procedure is applied for bank total loans, total deposits and money market funding, and total equities.

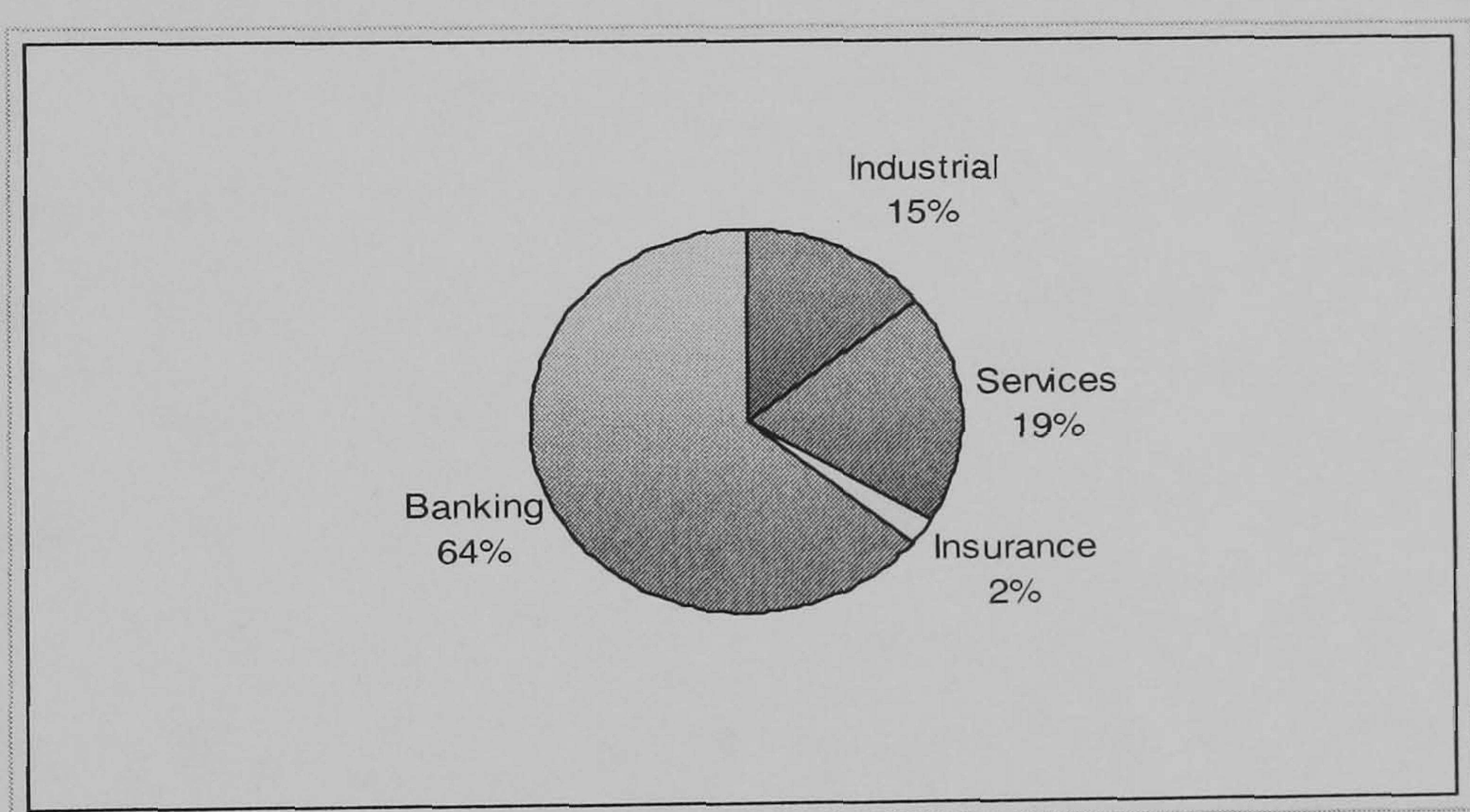
Table 5

Trading Volume and Market Capitalization for the four Main Sectors in Jordan

	Trading Volume (Thousand JD)			
Sector	2002	2003	2004	2005
Banking	349776	524838	71692995	6043405
Insurance	11418	22538	43427	179878
Services	114075	449866	1006396	8003977
Industry	471434	845796	1050432	16871052

Source: Amman Stock Exchange yearly bulletin 2006.

Figure 1
Market Capitalization of ASE Distributed by Sectors (2005)



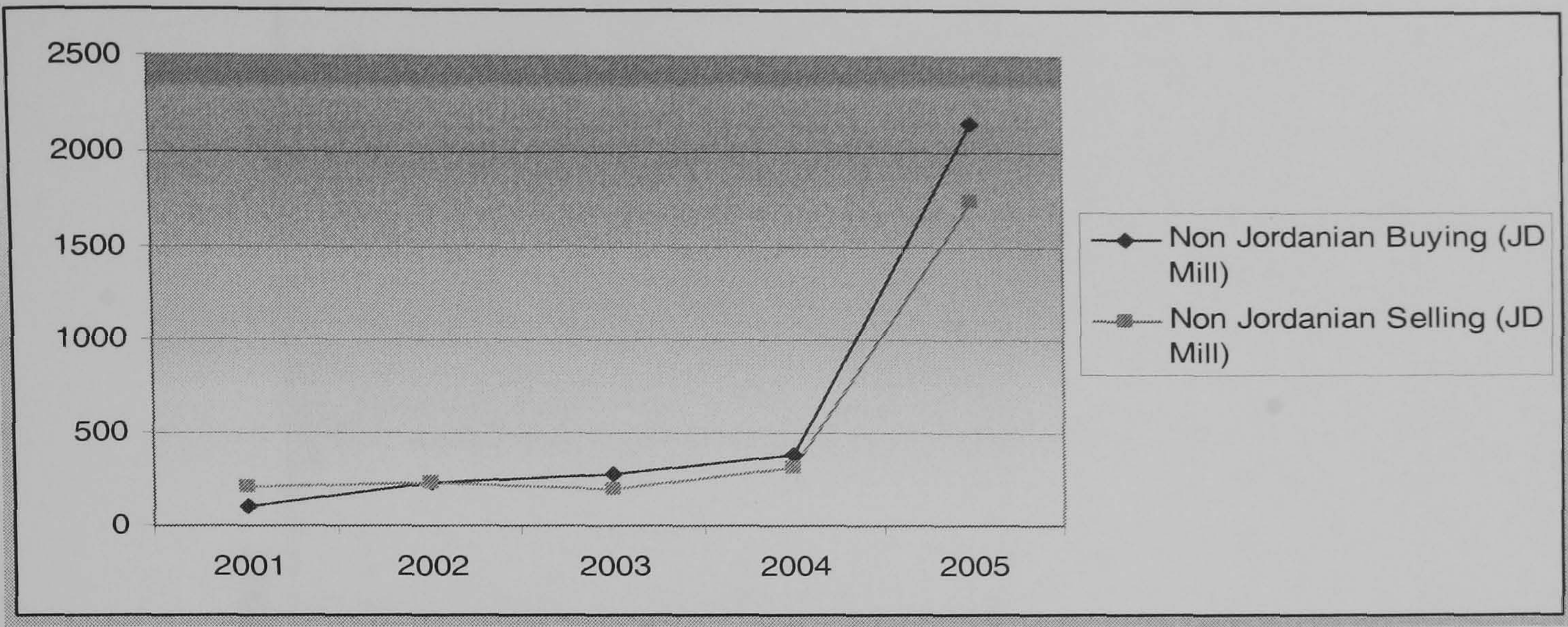
Source: Amman Stock Exchange Data Base 2006

Table 6
Trading for a Sample of Nine Jordanian Banks

Bank	Value Traded (million JD)				Number of Shares Traded (Thousand)			
	2002	**2003**	**2004**	**2005**	**2002**	**2003**	**2004**	**2005**
Arab Bank	222.108	177.502	822.921	3,350.289	1,135	749	3,404	54,207
Housing Bank	9.783	20.777	43.921	339.629	3,986	5,628	8,236	21,437
Jordan National Bank	13.001	17.206	146.889	120.167	11,104	13,675	59,561	19,648
Cairo Amman Bank	1.426	6.157	15.019	272.260	762	2,178	2,543	24,997
Bank of Jordan	37.415	64,392	99.603	235.536	14,504	22,801	21,997	235,536
Jordan Kuwait Bank	4.391	26.302	46.228	87.273	1,231	3,565	4,314	87,273
Union Bank	4.298	7.218	28.324	211.705	3,240	3,567	7,173	211,705
Arab Jordan Invest. Bank	7.672	13.490	17.272	27.813	402	3,203	5,598	27,813
Arab Banking Corp.	3..390	4.407	10.045	19.739	277	1,961	2,747	19,739
	Number of Contracts(Thousand)				**Market Capitalization (million JD)**			
Arab Bank	9.080	11.730	33.856	149.025	1,619.200	2,684	4,185.280	11,141,000
Housing Bank	3.761	5.996	8.389	19.219	242.000	433.00	800.000	2522.100
Jordan National Bank	8.698	11.561	39.492	14.206	41.588	69.176	217.200	311.100
Cairo Amman Bank	0.198	2.274	3.391	26.278	32.000	76.000	210,000	266.625
Bank of Jordan	15.899	22.581	23.807	32.343	7.765	154.030	250.000	198.000
Jordan Kuwait Bank	2.524	3.713	10.110	7.531	96.750	213.750	368.750	495.000
Union Bank	1.745	2.278	8.062	20.269	26.40	43.200	143.750	214.500
Arab Jordan Invest. Bank	0.960	1.768	5.255	6.412	30.400	67.000	93.800	139.920
Arab Banking Corp.	0.985	3.085	4.352	3.696	20.200	80.040	115.368	109.882

Source: Amman Stock Exchange data Base, 2005.

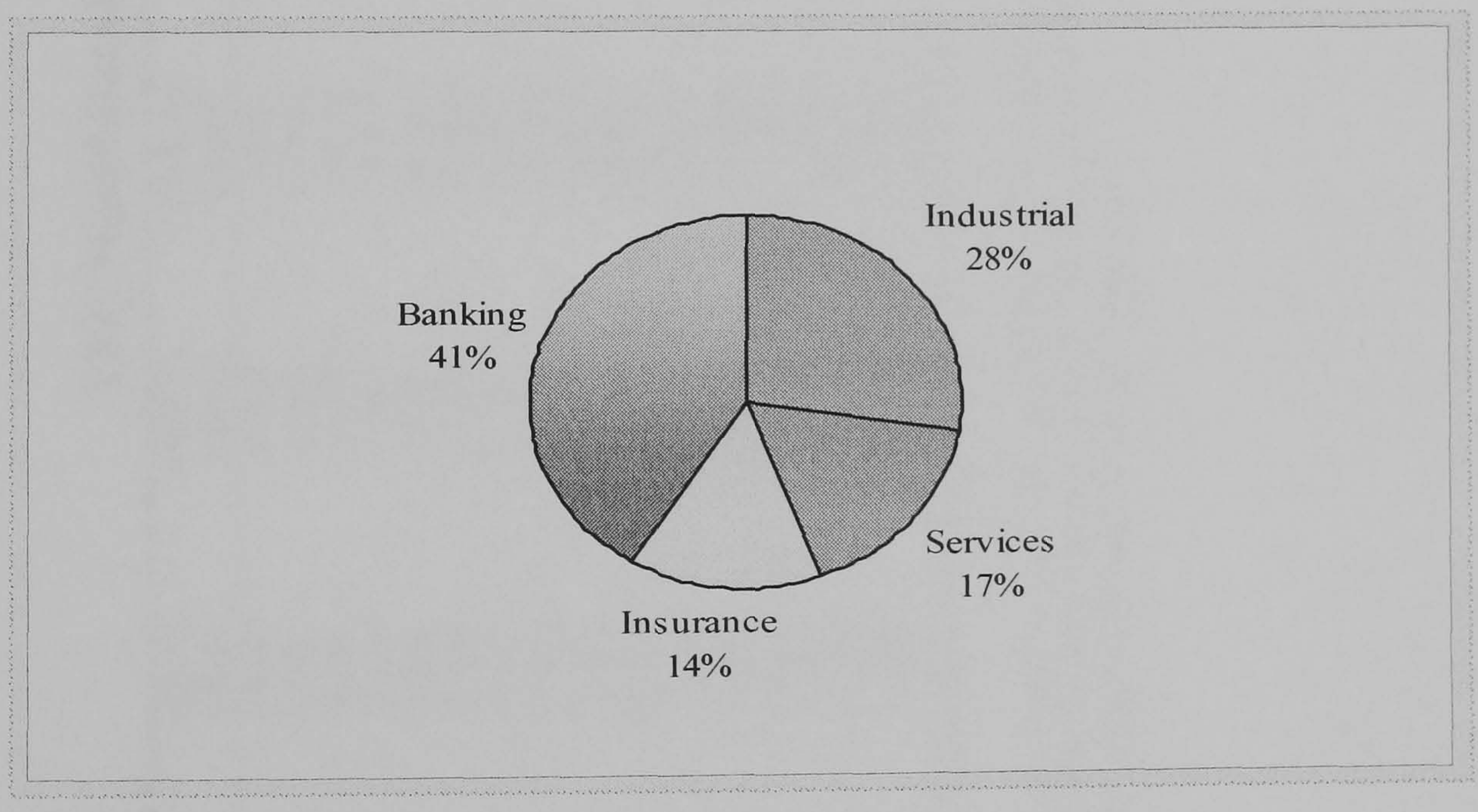
Figure 2: Foreign Investments Movements in ASE



Source: Amman Stock Exchange data Base, 2005.

Figure 3

ASE Foreign Investment Distributed Between Sectors in 2005:



Source: Amman Stock Exchange data Base, 2005.

Appendix 2.2

Table 1
VEC Model Results for the Full Sample (1998 – 2001)

Dependent Variables	ECT_{-1}	AB(-1); AB(-2)	JNB(-1); JNB(-2)	CAB(-1); CAB(-2)	BJ(-1); BJ(-2)	HB(-1); HB(-2)	JKB(-1), JKB(-2)	ABC(-1); ABC(-2)	UB(-1); UB(-2)	AJIB (-1), AJIB(-2)
AB	-0.050†	-0.659*	0.039	0.038	- 0.005	-0.028	-0.058†	-0.034	-0.038	-0.015
		-0.335*	0.043	0.048†	-0.022	-0.055	-0.016	0.001	-0.008	0.028
JNB	-0.079†	0.038	-0.758*	0.030	0.081†	-0.181+	-0.046	0.017	0.018	-0.014
		-0.102	-0.365*	-0.002	0.086†	-0.164+	-0.003	0.003	0.012	-0.001
CAB	-0.160*	0.006	0.124+	-0.488*	0.006	-0.222+	0.083†	-0.034	0.081	-0.144+
		-0.098	0.095†	-0.364*	0.021	-0.087	0.029	-0.022	0.148*	-0.116*
BJ	0.118+	0.011	-0.120+	-0.065	-0.517*	0.173†	-0.189*	0.023	-0.076†	0.116†
		-0.155+	-0.054	-0.032	-0.327*	0.072	-0.065	0.076†	-0.029	0.067
HB	0.353*	-0.177*	-0.241*	-0.207*	0.064+	-0.294*	-0.122*	-0.039	-0.089*	0.368*
		-0.059	-0.106*	-0.095*	0.097*	-0.173*	-0.055†	-0.041	0.001	0.112*
JKB	-0.037	0.114†	0.061	0.002	-0.073†	-0.128†	-0.794*	0.031	-0.059†	-0.031
		0.086	0.050	-0.018	0.067†	-0.103†	-0.369*	0.066†	0.004	-0.097+
ABC	0.035	0.090	-0.093†	-0.088†	0.071	0.129	0.066	-0.817*	-0.013	0.155+
		-0.006	0.019	-0.009	0.019	-0.016	0.085†	-0.397*	-0.080†	0.099†
UB	-0.090†	0.052	0.183*	0.046	0.183*	-0.043	-0.076	-0.089+	-0.633*	-0.183*
		0.098	0.075†	0.001	0.213*	0.043	-0.015	-0.055	-0.284*	-0.075
AJIB	0.310*	-0.086	-0.206*	-0.101+	0.006	0.559*	-0.090+	-0.106*	-0.090+	-0.409*
		0.011	-0.047	-0.075+	-0.026	0.233*	-0.054	0.066†	-0.054	-0.219*

Notes:

All variables except the error correction terms (ECT) are the first differences of their logarithms. The VEC of 2 lag length is selected on the basis of the LR test supplemented by AIC and SIC information criteria. Figures in parentheses are coefficient values.

*, +, †indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 2
VEC Results for the First Sub-Period (1998 - 2001)

Dependent Variables	AB(-1); AB(-2)	JNB(-1), JNB(-2)	CAB(-1); CAB(-2)	BJ(-1); BJ(-2)	HB(-1); HB(-2)	JKB(-1), JKB(-2)	ABC(-1); ABC(-2)	UB(-1); UB(-2)	AJIB (-1), AJIB(-2)
AB	0.222*;	-0.002;	0.059;	0.010;	0.169 †;	-0.048;	0.222 †;	0.074;	0.083;
	-0.008	0.152*	0.038	-0.190 †	0.021	-0.027	-0.320+	0.161	-0.097
JNB	0.037;	-0.280*;	-0.057;	-0.038;	-0.011;	-0.023;	-0.075;	0.038;	0.044;
	0.073	0.032	0.010	-0.019	-0.007	0.016	0.064	-0.052	0.023
CAB	0.028;	0.003;	0.028;	-0.020;	-0.045;	-0.099;	-0.199+;	0.116;	0.1290+;
	-0.036	-0.109*	-0.119 †	-0.137	0.047	-0.066	0.047	-0.072	0.079
BJ	0.019;	-0.070;	0.018;	0.012;	0.005;	-0.079;	0.142*;	0.171*;	-0.098*;
	-0.017	0.109†	0.105	-0.052	0.029	0.009	-0.049	0.102	0.0630
HB	0.006;	-0.095;	0.136	-0.017;	-0.346†;	-0.027;	0.130;	0.176*;	0.042;
	-0.019	-0.132 †	0.056	-0.060	-0.1041	-0.027	0.139	0.049	0.012
JKB	-0.001;	0.005;	-0.010;	-0.141†;	-0.025;	-0.146 †;	0.086;	-0.092;	-0.043;
	0.049	0.012	-0.027	0.170+	0.031	0.044	0.013	-0.060	0.034
ABC	-0.066†;	0.025;	-0.048;	0.080;	-0.021;	0.024;	-0.144 †;	-0.072;	-0.090*;
	0.011	0.001	0.001	0.139+	-0.020	-0.016	-0.041	-0.061	-0.074*
UB	-0.058†;	0.017;	0.073;	-0.055;	-0.012;	-0.068;	0.006;	0.031;	0.051;
	0.029	-0.032	0.046	-0.003	0.056	-0.006	0.002	-0.132*	-0.002
AJIB	0.001;	0.129 †;	-0.013;	0.241+;	0.028;	0.141 †;	-0.024;	0.047;	-0.080;
	-0.027	0.015	-0.190+	0.184+	-0.108	-0.115	-0.014	0.114	-0.177+

Notes:
All variables except the error correction terms (ECT) are the first differences of their logarithms. The VEC of 2 lag length is selected on the basis of the LR test supplemented by AIC and SIC information criteria. Figures in parentheses are coefficient values.
*, +, †indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3
VEC Results for the Second Sub-Period (2001- 2005)

Dependent Variables	ECT1 - ECT5	AB(-1) - AB(-7)	JNB(-1) - JNB(-7)	CAB(-1) – CAB(-7)	BJ(-1) - BJ(-7)	HB(-1) - HB(-7)	JKB(-1) - JKB(-7)	ABC(-1) - ABC(-7)	UB(-1) - UB(-7)	AJIB (-1) - AJIB(-7)
AB	-0.798*	-0.159	-0.358*	-0.007	0.202 †	0.038	-0.082	-0.356†	-0.029	-0.350+
	0.316+	-0.231	-0.386*	0.059	0.374*	0.077	0.044	-0.457	-0.038	-0.334+
	-0.008	-0.366+	-0.346*	0.068	0.424*	0.066	0.101	-0.397+	-0.036	-0.305+
	-0.310+	-0.211	-0.281*	0.079	0.262+	-0.015	0.077	-0.265†	-0.096	-0.339*
	0.178	-0.303+	-0.219*	0.163+	0.181+	0.164	0.081	-0.227†	-0.025	-0.249*
		-0.227†	-0.134	0.104†	0.088	0.319+	-0.034	-0.195+	-0.066	-0.151+
		-0.10	-0.145*	0.0452	-0.037	0.155+	-0.049	-0.069	0.062	-0.106+
JNB	0.843+	-0.865+	-0.547+	-0.530+	0.301	0.270	0.224	-0.080	-0.413+	0.583+
	-0.589+	-0.717+	-0.566+	-0.578+	0.238	0.157	0.191	-0.169	-0.279	0.551+
	0.542+	-0.655+	-0.434+	-0.492+	0.211	0.096	0.322	-0.223	-0.203	0.489 †
	-0.145	-0.379	-0.322†	-0.525+	0.045	0.101	0.208	-0.249	-0.036	0.460+
	-0.196	-0.381	-0.328+	-0.250†	-0.127	0.481+	0.337	-0.350	0.020	0.378+
		-0.219	-0.185	-0.200†	-0.055	0.562*	0.200	-0.151	-0.076	0.266†
		-0.087	-0.104	-0.077	-0.176 †	0.218	0.194	0.004	-0.152	0.224†
CAB	0.063	-0.255	0.053	-0.085	-0.795*	0.108	0.003	0.422	-0.185	-0.026
	-0.012	-0.275	-0.066	-0.231	-0.811*	0.270	0.019	0.409	0.045	0.100
	-0.775*	0.027	-0.094	0.028	-0.704*	0.297	0.088	0.419	-0.380*	0.096
	0.950*	0.185	-0.180	0.035	-0.507+	0.051	0.038	0.324	-0.317*	0.078
	-0.288	0.264	-0.183	0.035	-0.289†	-0.060	0.006	0.293	-0.218	-0.000
		0.232	-0.077	-0.056	-0.390	-0.029	-0.286	0.191	-0.100	0.065
		0.153	0.053	0.032	-0.200	0.136	-0.172	-0.064	-0.095	-0.055

BJ	0.442	-0.338	-0.262	-0.318 †	0.075	0.641+	0.461+	-0.563	-0.047	0.183
	0.189	-0.490†	-0.198	-0.232	0.069	0.418	0.494+	-0.504	0.053	0.128
	0.420+	-0.266	-0.116	-0.100	0.025	0.251	0.554	-0.485†	-0.083	0.047
	-0.839*	0.018	-0.046	0.022	0.097	0.056	0.361	-0.400†	-0.033	0.076
	-0.476	0.006	0.080	0.053	0.035	0.292	0.355	-0.428	-0.164	-0.067
		0.122	-0.090	0.121	-0.034	0.245	0.247	-0.212	-0.075	-0.053
		0.152	-0.117†	-0.003	0.030	0.059	0.228	-0.029	-0.022	0.027
HB	0.210	-0.239	-0.227†	-0.175	0.136	0.251	0.089	-0.341	-0.548*	0.437+
	0.215†	-0.075	-0.176	-0.155	0.194	0.394 †	0.0639	-0.378†	-0.386*	0.217
	0.239†	-0.062	-0.101	-0.150	0.020	0.419	0.203†	-0.337†	-0.327*	0.209†
	-0.053	-0.217	-0.108	-0.146	0.060	0.129	0.164	-0.030	-0.272+	0.168
	-1.290*	-0.297 †	-0.089	-0.066	-0.006	0.218	0.026	-0.021	-0.280*	0.171†
		-0.038	-0.039	-0.001	-0.047	0.331+	-0.159†	-0.105	-0.331*	0.155†
		0.088	-0.014	0.060	-0.003	0.112	-0.063	-0.083	-0.194*	0.133
JKB	0.082	-0.092	-0.061	0.184	0.151	0.301	-0.187	-0.740	-0.214	0.331
	0.049	-0.226	-0.083	0.1297	0.298†	0.338	-0.025	-0.676+	0.096	0.186
	-0.227	-0.410†	-0.149	0.019	0.026	0.345	0.102	-0.479*	0.180	0.287†
	-0.317†	-0.177	-0.062	0.014	0.271	0.089	-0.054	-0.313	-0.029	0.216
	-0.196	-0.299	-0.001	0.166	0.306+	0.114	0.102	-0.284	-0.082	0.071 †
		0.067	0.007	0.223+	0.209 †	0.141	0.134	-0.249*	-0.123	0.099
		0.073	0.001	0.170+	0.121†	-0.115	0.172	-0.154*	-0.1028	0.0808
ABC	0.777*	-0.793*	0.137	-0.309	0.152	-0.080	-0.500*	-0.097	0.129	-0.564
	-0.318†	-0.809*	0.098	-0.241 †	0.146	0.004	-0.347+	-0.189	0.108	-0.575*
	0.348+	-1.032*	-0.002	-0.145	0.027	0.236	-0.152	-0.101	0.138	-0.542*
	-0.073	-0.868*	-0.030	-0.038	0.153	0.239	-0.266	-0.009	0.138	-0.325+
	0.368	-0.722*	-0.032	0.019	0.135	0.155	-0.300+	-0.169	0.043	-0.295+
		-0.164	-0.073	0.087	0.013	0.356	-0.427	-0.070	-0.078	-0.094
		0.092	-0.071	0.0122	0.035	0.060	-0.052	-0.034	0.034	0.015
UB	0.652+	-0.624+	-0.207	-0.003	0.384+	0.466	-0.070	0.4272	-0.312 †	0.150
	0.134	-0.630+	-0.224	-0.165	0.201	0.118†	-0.010	0.285	-0.011	0.228
	0.171	-0.654+	-0.304	-0.181	-0.082	0.426†	0.001	0.218	0.126	0.227
	-0.174	-0.808*	-0.257†	-0.268†	-0.045	0.532+	0.051	0.249	0.135	0.282†
	0.084	-0.526 †	-0.191†	-0.122	-0.010	0.567*	0.021	0.140	0.152	0.196
		-0.131	-0.132	0.008	0.031	0.333+	-0.110	0.076	0.043	0.288+
		0.1070	0.020	0.021	-0.018	-0.046	-0.034	-0.116	-0.050	0.127 †
AJIB	0.442	-0.451	0.1452	-0.262	-0.075	0.613†	0.440†	-0.957+	-0.004	0.151
	0.180	-0.293	0.215	-0.267	-0.101	0.536†	0.402 †	-1.025*	-0.009	0.124
	0.369†	-0.684+	0.142	-0.097	-0.029	0.429	0.305 †	-0.688+	0.028	0.101
	0.204	-0.344	0.080	-0.278 †	-0.081	0.4153†	0.0610	-0.458†	0.003	0.072
	-0.439	-0.186	0.025	-0.145	-0.069	0.2559	0.054	0.121+	0.127	-0.065
		0.028	0.010	-0.259	-0.074	0.409+	-0.110	-0.426 †	0.287	0.053
		0.191	-0.002	-0.159	-0.066	0.200	0.031	-0.214+	-0.086	0.052

Notes:

*, +, †indicate significance at the 1%, 5%, and 10% levels, respectively.

Appendix 2.3

Table 1
Decomposition of the Forecast Error Variance for the First Sub-Period (1998 – 2001)

Variable	H.Z	S.E	AB	JNB	CAB	BJ	HB	JKB	AB	UB	AJIB	INT
AB	1	0.028	100.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
	5	0.027	92.778	0.958	0.790	0.783	0.171	0.341	1.964	2.160	0.055	7.222
	10	0.027	92.734	0.966	0.794	0.802	0.172	0.343	1.969	2.161	0.059	7.266
JNB	1	0.037	3.970	96.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.970
	5	0.040	4.620	88.908	1.325	2.377	0.877	0.221	0.165	0.230	1.276	11.092
	10	0.040	4.626	88.829	1.338	2.381	0.887	0.225	0.171	0.241	1.302	11.171
CAB	1	0.042	0.072	0.325	99.603	0.000	0.000	0.000	0.000	0.000	0.000	0.969
	5	0.044	0.325	0.477	92.940	1.124	1.164	0.164	0.422	1.172	2.211	7.06
	10	0.0439	0.331	0.490	92.851	1.1416	1.170	0.181	0.435	1.173	2.227	7.149
BJ	1	0.044	0.530	1.379	0.060	98.031	0.000	0.000	0.000	0.000	0.000	1.969
	5	0.047	0.987	1.954	1.558	86.101	0.055	3.830	1.616	0.417	3.481	13.899
	10	0.047	0.991	1.959	1.560	86.074	0.061	3.833	1.621	0.420	3.482	13.926
HB	1	0.037	7.903	10.005	0.024	0.679	81.389	0.000	0.000	0.000	0.000	18.611
	5	0.040	7.123	10.118	0.645	0.714	79.193	0.321	0.165	0.471	1.251	20.807
	10	0.040	7.136	10.117	0.665	0.718	79.130	0.325	0.172	0.471	1.266	20.87
JKB	1	0.044	1.297	9.933	1.212	4.211	0.709	82.639	0.000	0.000	0.000	17.361
	5	0.046	1.527	9.815	2.093	4.818	0.771	77.895	0.073	0.642	2.367	22.105
	10	0.0460	1.528	9.814	2.098	4.817	0.773	77.873	0.079	0.642	2.376	22.127
ABC	1	0.053	0.346	0.036	2.867	2.581	0.044	6.884	87.243	0.000	0.000	12.757
	5	0.056	4.749	0.543	4.624	4.956	0.910	6.988	76.760	0.346	0.124	23.24
	10	0.057	4.749	0.551	4.625	4.957	0.914	6.988	76.739	0.350	0.127	23.261
UB	1	0.057	0.186	0.662	0.708	0.098	0.141	0.209	0.002	97.990	0.000	2.01
	5	0.060	1.115	1.172	1.712	2.585	1.134	0.686	0.767	90.136	0.695	9.864
	10	0.060	1.114	1.172	1.714	2.587	1.138	0.687	0.772	90.118	0.698	9.882
AJIB	1	0.033	0.002	0.275	4.029	2.071	0.945	0.020	1.006	0.178	91.475	8.525
	5	0.035	1.010	0.530	7.767	3.969	0.919	0.930	3.242	0.747	80.885	19.115
	10	0.036	1.015	0.544	7.770	3.983	0.922	0.939	3.242	0.750	80.835	19.165

Notes;

Number in this Table denotes the percentage of error variance, measured my the standard error, of banks in the left hand side explained by the banks at the top

Table 2

Decomposition of the Forecast Error Variance for the Second Sub-Period from (2001- 2005)

Variable	H.Z	S.E	AB	JNB	CAB	BJ	HB	JKB	ABC	UB	AJIB	Others
AB	1	0.029	100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5	0.034	73.448	2.218	1.688	8.947	2.703	3.385	4.573	1.940	1.099	26.552
	10	0.041	56.379	4.0480	4.465	8.475	4.616	5.759	4.366	6.130	5.762	43.621
JNB	1	0.057	3.495	96.505	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.495
	5	0.062	3.923	86.202	1.111	2.922	0.392	1.267	0.359	1.851	1.973	13.798
	10	0.070	4.568	70.130	7.067	3.077	3.548	1.816	1.241	4.344	4.210	29.87
CAB	1	0.062	4.435	0.105	95.461	0.000	0.000	0.000	0.000	0.000	0.000	4.539
	5	0.071	6.740	1.324	78.493	1.879	2.089	2.694	1.456	4.970	0.356	21.507
	10	0.078	6.008	2.833	67.271	7.143	3.946	3.474	2.092	5.435	1.798	32.729
BJ	1	0.049	8.576	1.005	0.841	89.578	0.000	0.000	0.000	0.000	0.000	10.422
	5	0.057	12.938	1.916	7.110	69.245	3.784	1.474	0.421	1.176	1.937	30.755
	10	0.063	13.324	4.838	9.154	59.769	4.349	2.174	1.652	1.962	2.778	40.231
HB	1	0.034	11.915	4.865	3.622	4.753	74.846	0.000	0.000	0.000	0.000	25.154
	5	0.041	9.990	5.391	3.623	6.787	53.576	3.712	5.261	5.793	5.868	46.424
	10	0.047	9.049	6.198	6.685	8.155	42.218	5.798	5.948	10.573	5.377	46.424
JKB	1	0.046	3.332	0.785	0.036	0.277	1.712	93.858	0.000	0.000	0.000	6.142
	5	0.055	3.281	1.751	1.602	5.686	3.936	73.010	3.249	5.986	1.499	26.99
	10	0.062	4.176	1.704	3.744	8.451	4.647	65.043	3.903	5.225	3.108	34.957
ABC	1	0.040	10.065	0.244	0.049	1.174	1.010	12.871	74.587	0.000	0.000	25.413
	5	0.052	10.277	1.939	4.928	4.620	6.604	14.804	50.232	1.770	4.826	49.768
	10	0.063	14.785	2.221	3.968	7.163	6.237	19.926	35.068	3.802	6.831	64.932
UB	1	0.045	0.534	4.825	0.752	3.697	4.995	2.366	0.336	82.495	0.000	17.505
	5	0.056	1.792	6.966	5.922	8.167	8.259	4.113	3.906	59.732	1.142	40.268
	10	0.062	3.612	7.722	6.168	8.767	8.152	5.923	5.494	51.435	2.728	48.565
AJIB	1	0.053	10.409	0.673	0.837	5.254	0.420	0.414	1.343	0.644	80.006	19.994
	5	0.059	12.470	2.051	5.948	6.280	1.610	0.819	5.647	1.044	64.132	35.868
	10	0.068	12.815	2.960	9.782	7.514	3.501	2.105	5.670	5.033	50.620	49.38

Notes:

Number in this Table denotes the percentage of error variance, measured by the standard error of banks in the left hand side explained by the banks at the top

Others is the effect on a particular bank of all other banks in the system (the percentage of the forecast error variance of a particular bank (standard error) explained by all banks other than its own past).

Appendix 2.4
Table 1
Autoregressive Model Specification.

AR(p)	**Schwarz Bayesian Information Criterion (SBIC)**								
	AB	JNB	CAB	BJ	HB	JKB	ABC	UB	AJIB
AR(1)	-5.9476	-5.1944	-5.1048*	-5.0625*	-4.6834*	-5.2701*	-4.9903*	-4.8256*	-5.1977*
AR(2)	-5.951*	-5.196*	-5.1031	-5.0578	-4.6784	-5.2657	-4.9876	-4.8222	-5.1927
AR(3)	-5.9480	-5.1947	-5.0986	-5.0531	-4.6753	-5.2611	-4.9839	-4.8174	-5.1945
AR(4)	-5.9444	-5.1788	-5.0948	-5.0485	-4.6735	-5.2581	-4.9793	-4.8131	-5.1903
AR(5)	-5.9417	-5.1943	-5.0900	-5.0436	-4.6687	-5.2544	-4.9747	-4.8083	-5.1861

Notes

The univariate autoregressive model is given by AR (p) using Schwarz Bayesian Information Criterion, SBIC $= - 2L(\phi) + (\log T)k$. The criterion selection is based on minimization of the value of test ratio.

* is the minimum value.

Table 2
Volatility spillover during the First Sub- Period (1998- 2001)

Maximum Likelihood Estimates	AB	JNB	CAB	BJ	HB	JKB	ABC	UB	AJIB
Return equation									
$\alpha_{i,0}$	0.000	*-0.001†*	-0.003*	0.000	0.000	0.000	-0.001	-0.001	-0.002*
	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.000	0.000
$\alpha_{i,1}$	0.175*	*0.085†*	*0.097†*	0.075+	0.109	0.047	0.137	0.110	-0.051
	0.043	0.044	0.053	0.035	0.041	0.053	0.051	0.088	0.073
$\alpha_{i,2}$	-0.059	-0.086+	-	-	-	-	-	-	-
	0.052	0.039							
Volatility Equation									
$\beta_{i,0}\,(\times 10^5)$	0.000*	0.000*	0.000*	0.000*	0.000+	0.000*	0.000	0.000*	0.000*
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ARCH $\beta_{i,1}$	0.217*	0.266*	0.186*	0.110*	0.145*	0.019	0.058	0.084	*0.183*
	0.049	0.063	0.035	0.037	0.044	0.018	0.028	0.056	0.094
GARCH $\beta_{i,2}$	0.504*	0.565*	0.614*	0.445*	0.568*	0.914*	0.731	0.430+	0.595*
	0.083	0.080	0.028	0.043	0.111	0.042	0.060	0.020	0.091
Volatility spillover									
β_j									
AB		-0.003	-0.154*	-0.147*	0.016	-0.1458	0.335	3.806	-0.1148
		0.038	0.015	0.026	0.091	0.031	0.362	2.523	0.020
JNB	0.005		0.014	-0.011	0.021	-0.004	-0.041	*0.196*	0.001
	0.009		0.015	0.028	0.025	0.019	0.019	0.104	0.023
CAB	-0.007	0.020		0.262+	0.002	-0.016	0.090	0.131+	0.005
	0.005	0.015		0.105	0.016	0.011	0.098	0.054	0.019
BJ	0.021	-0.003+	0.025		0.031	*0.011†*	-0.009	-0.041+	-0.0088
	0.013	0.001	0.022		0.025	0.007	0.010	0.017	0.001
HB	*0.000†*	0.001	0.000*	0.000*		0.000	-0.001	-0.002+	0.0008
	0.000	0.001	0.000	0.000		0.000	0.001	0.001	0.000
JKB	0.004	-0.002	-0.006*	0.000	0.004		-0.002	-0.008	-0.0078
	0.005	0.016	0.001	0.006	0.008		0.005	0.053	0.001
ABC	-0.002*	*-0.002†*	0.015	-0.002	-0.002	0.003		-0.003*	-0.005*
	0.000	0.001	0.011	0.006	0.001	0.004		0.001	0.002
UB	0.001	0.000	0.003	-0.001*	*0.045*	0.002+	-0.002		-0.001*
	0.001	0.001	0.003	0.000	0.026	0.001	0.000		0.000
AJIB	-0.003*	0.007	-0.007*	-0.002	0.001	-0.005*	-0.007	-0.003	
	0.001	0.009	0.001	0.016	0.005	0.002	0.020	0.009	
Log-L	2636.42	2325.10	2248.85	2215.73	2195.36	2233.21	2142.38	2094.96	2329.15
Q(6)	2.272	13.618	4.698	4.214	17.929	8.826	5.211	6.171	15.502
P-value	0.893	0.034	0.583	0.648	0.006	0.184	0.517	0.404	0.017
Q(12	8.704	20.958	12.847	12.334	33.415	11.762	14.930	9.563	25.534
	0.728	0.051	0.380	0.419	0.001	0.465	0.245	0.654	0.012
$Q^2(6)$	9.254	3.437	22.215	3.085	2.469	1.539	0.707	0.464	18.413
	0.160	0.752	0.001	0.798	0.872	0.957	0.994	0.998	0.005
Q^2(12	12.357	8.150	26.715	4.181	5.204	2.591	1.593	0.714	22.450
	0.417	0.773	0.008	0.980	0.951	0.998	1.000	1.000	0.033

Notes:

This Table reports the estimation results and the diagnostic test results of the GARCH (1,1) model as reported illustrated in equations (12) and (13), predicting the volatility for the daily returns of the eight relatively small banks in the sample. The parameters $\alpha_{i,0}$ $\alpha_{i,1}$ $\alpha_{i,2}$ are the estimated Autoregressive equation parameters, and $\beta_{i,0}$ $\beta_{i,1}$, $\beta_{i,2}$, and $\beta_{i,3}$, are the conditional variance equation parameters represent the constant, ARCH effect, GARCH effect, and Volatility spillover, respectively. In the diagnostic part, Log-L is the maximum log likelihood ratio. Q(p) and Q^2 (p) are the Ljung Box statistics for sixth and twelfth order serial correlation in standardized and square standardized residuals. Numbers below the coefficient values in the Table are robust standard error statistics to allow for possible violations of the assumption of normality for the condition errors (Bollerslev and Wooldridge, 1992). †, +, * indicate significance at the 10%, 5% and 1%, respectively.

Table 3
Volatility Spillover during the Second Sub-Period (2001-2005).

Maximum Likelihood Estimates	AB	JNB	CAB	BJ	HB	JKB	ABC	UB	AJIB
Return equation									
$\alpha_{i,0}$	0.000	0.002+	0.000	0.001	0.002*	0.002+	0.001	0.001+	0.001†
	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001
$\alpha_{i,1}$	0.198*	0.211*	0.067	0.113*	0.085	0.134+	0.117*	0.106*	0.118*
	0.044	0.032	0.116	0.042	0.059	0.061	0.036	0.038	0.044
$\alpha_{i,2}$	-0.058	-0.009	-	-	-	-	-	-	-
	0.038	0.045							
Volatility Equation									
$\beta_{i,0}$	0.000*	0.0008*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ARCH $\beta_{i,1}$	0.301*	0.132*	0.3718*	0.228	0.254*	0.088*	0.069*	0.129*	0.160*
	0.057	0.024	0.110	0.341	0.051	0.024	0.014	0.033	0.039
GARCH $\beta_{i,2}$	0.568*	0.799*	0.5108*	0.839*	0.465*	0.791*	0.909*	0.725*	0.623*
	0.064	0.025	0.056	0.026	0.094	0.030	0.015	0.050	0.059
Volatility spillover									
β_j									
AB		-0.012	0.075	0.011	-0.052*	0.106+	-0.024	0.036	0.046*
		0.009	0.058	0.033	0.009	0.043	0.015	0.026	0.015
JNB	0.015		-0.017	-0.094*	0.010	-0.063*	-0.023+	-0.017	-0.014*
	0.015		0.022	0.026	0.017	0.016	0.010	0.015	0.002
CAB	0.006	-0.002		-0.006*	-0.001	-0.003	-0.006*	0.002	0.000
	0.009	0.004		0.002	0.001	0.002	0.001	0.006	0.009
BJ	-0.001*	-0.005*	0.005		0.004	-0.006	-0.006*	0.004	-0.004
	0.000	0.000	0.007		0.004	0.005	0.001	0.005	0.003
HB	0.026	-0.003	0.012	-0.226		0.091+	-0.025*	0.014	0.014
	0.017	0.014	0.035	0.344		0.039	0.010	0.018	0.018
JKB	-0.001	-0.004*	-0.003	0.016	-0.005*		-0.009	0.012	0.030+
	0.002	0.001	0.004	0.023	0.001		0.013	0.012	0.015
ABC	0.008	-0.008	0.007	-0.005	-0.001	0.004		0.004	0.012
	0.007	0.006	0.024	0.009	0.005	0.007		0.008	0.012
UB	-0.012*	0.009	0.008	-0.054+	0.003	-0.081*	0.041*		0.058*
	0.005	0.006	0.028	0.024	0.016	0.017	0.015		0.020
AJIB	0.000	-0.001*	-0.0028*	-0.005	-0.001*	-0.003	-0.013*	0.001	
	0.003	0.000	0.000	0.003	0.000	0.003	0.002	0.002	
Log-L	2569.393	2219.424	2288.774	2030.059	2407.390	2180.94	2174.880	2266.166	2291.259
Q(6)	5.429	3.730	21.130	2.203	4.495	2.493	5.601	4.979	4.989
P-value	0.490	0.713	0.002	0.900	0.610	0.869	0.469	0.546	0.545
Q(12	9.010	11.717	24.546	4.705	11.240	10.372	7.726	18.461	7.708
	0.702	0.469	0.017	0.967	0.508	0.583	0.806	0.102	0.808
$Q^2(6)$	4.004	3.635	10.210	0.897	9.807	0.551	2.721	6.428	0.721
	0.676	0.726	0.116	0.989	0.133	0.997	0.843	0.377	0.994
$Q^2(12$	9.751	7.526	11.444	0.990	14.613	1.375	9.741	11.805	2.467
	0.638	0.821	0.491	1.000	0.263	1.000	0.639	0.461	0.998

Notes:

This Table reports the estimation results and the diagnostic test results of the GARCH (1,1) model as reported illustrated in equations (12) and (13), predicting the volatility for the daily returns of the eight relatively small banks in the sample. The parameters $\alpha_{i,0}$ $\alpha_{i,1}$ $\alpha_{i,2}$ are the estimated Autoregressive equation parameters, and $\beta_{i,0}$ $\beta_{i,1}$, $\beta_{i,2}$, and $\beta_{i,3}$, are the conditional variance equation parameters represent the constant, ARCH effect, GARCH effect, and Volatility spillover, respectively. In the diagnostic part, Log-L is the maximum log likelihood ratio. Q(p) and Q^2 (p) are the Ljung Box statistics for sixth and twelfth order serial correlation in standardized and square standardized residuals. Numbers below the coefficient values in the Table are robust standard error statistics to allow for possible violations of the assumption of normality for the condition errors (Bollerslev and Wooldridge, 1992). †, +, * indicate significance at the 10%, 5% and 1%, respectively.

Paper 3

Market Value, Book Value and Earnings: Is Bank Efficiency a Missing Link?

Abstract

Banking institutions play a vital role in the economy. They provide a major source of financial intermediation and participate in the economic development of a country. Trends towards internationalization, globalization, liberalization, and deregulation in emerging markets, reinforce competition among different financial institutions and induce improvements in banking productivity and efficiency. In addition, creating value has also become an important issue in the development of the financial services industry. The main purpose of this study is to explore the market value of banks. It aims to determine the main reasons for the difference between the book and market values in the banking industry. More specifically, this study seeks to examine whether earnings and its components are relevant and sufficient to bridge the gap between banks' market and book values, and whether bank efficiency can be value relevant for banks valuation. This study applies a non-parametric frontier analysis (DEA) to estimate the relative cost efficiency of Jordanian commercial banks from 1993 to 2004, and employs the Truman's et al (2000) valuation methodology. We find that the components items of net income are more important in explaining bank value compared with only looking at the aggregate value at the bottom line of the income statement (net income). Furthermore, banks operational efficiency adds incremental information in explaining the market and book values gap. The results are robust to the inclusion of other explanatory variables such as credit risk and solvency risk. This study provides further insight for bank investors, shareholders, policy makers and regulators who need to accurately assess bank market value and performance.

1. Introduction

Banking institutions play a vital role in the economy. They provide a major source of financial intermediation and participate in economic development and growth. Evaluating banks' value and monitoring their financial condition is important to depositors, owners, managers, potential investors, supervisors, and society in general. All these parties are interested in the safety and profitability of the banking sector as this is inextricably linked to safe growth of the economy[1]. Valuation approaches differ according to the field of application, goals and methodologies used. For example, accountants take value to mean book value, where economists are concerned about fair value (intrinsic value). On the other hand, stakeholders evaluate the services which they receive based on the utility provided by these services and concentrate on the market value that proceeds from actual financial transformation or sale of instruments.

Due to the rapid development and appetite for innovations in the banking industry, it is important to accurately evaluate bank performance, and consequently a number of theoretical methods of valuation exist. Based on the purposes of bank valuation, two main types of valuation approaches exist related to internal and external valuation. The latter refers to valuations performed by independent evaluators such as central banks and credit rating agencies; whereas the former usually focuses on valuation methods used by shareholders with the purpose of analysing (and growing) increasing cash flows and profitability[2].

A bank's internal value can be estimated using stock market prices which can be defined as the present value of expected net cash flows discounted at the appropriate risk-adjusted rates of return (Rose and Hudgins, 2004). A bank stock price reflects the market's evaluation of the bank's performance. According to rational expectations theory traders learn about bank quality from the stock price and informed traders produce information about future profitability which consequently influences bank's future stock prices. Therefore, banks' managers pay closer attention to the value of their stocks and direct strategies arrived at boosting shareholder and stakeholder value. In

[1] Many researches suggest that well- functioning banks promote growth. For example, Levine and Zervos (1998), Beck, et al. (2000), Lozaro-Vivas and Pastor (2006), among others provide evidence that bank operations affect economic growth. See Levine (2006) for a review of this literature.
[2] In this study our focus is on bank internal valuation rather than external valuation.

general, a bank creates value for shareholders over a given time period if the level of generated returns on invested capital exceeds the opportunity cost (cost of capital) [3].

Recently, banks have faced greater levels of competition and this has created excess capacity in traditional lines of business and forced them to become more market-oriented. The degree of bank complexity has increased further as they have moved away from being traditional intermediaries to more market-oriented and sophisticated institutions, providing a wider range of non-banking products and services. [4] As a result of such changes, banks nowadays rely more heavily on intangible or hidden assets in their operations. Therefore, as argued by Ang and Clark (1997), the conventional wisdom that banks book values should closely approximate their market values is becoming increasingly invalid. Accordingly, book and market values will differ and the former cannot adequately reflect the enterprise's internal value. The difference between market value, current stock price, and intrinsic value is an indication of the expected rewards for investing in a security (Kothari, 2001). If the stock fails to rise in value commensurate with stockholders' expectations, current investors may seek to unload their shares and the bank will have difficulty in raising new capital to support its future growth.

Since earnings are considered the primary profitability indicator, capital market-based researchers in accounting have developed and tested a variety models in order to explain the observed relation between earnings and other accounting information, firm fundamentals, and market value. They test the accounting information value relevance and the ability of financial information to explain the divergence that can occur between market and book values. Most of the empirical studies explain market value by using key accounting number approaches predominantly built on a growing theoretical framework, starting from the permanent earnings approach adopted by Miller and Modigliani (1966), and followed by methodologies based on abnormal earnings adopted by Ohlson (1995), Feltham and Ohlson (1995), and Penman (1998). These approaches use a linear function of equity book value and the present value of expected future residual income to determine the market value.

[3] Opportunity cost is the rate that investors could earn from investing in a second investment choice with the same risk.
[4] Banks focused recently on non interest earning activities such as insurance and assets management.

In some cases, stock market valuation studies have discovered that variation in stock prices does not reflect the variation in earnings (Kothari, 2001)[5], or the explanatory power of earnings levels and changes for market returns has significantly decreased over time (Francis and Schipper, 1999). An increasing gap between market and book values of equity in most countries is a significant signal of the loss of relevance of accounting information and may signify that other kinds of information are needed in order to explain actual value. As a result, the accounting literature has started to consider other types of information that might not be captured in current accounting measures. For example, Amir and Lev (1996), Ittner and Larcker (1998), Trueman, et al., (2000), Liedtka (2002), and Liang and Yao (2005) indicate that the value relevance of financial accounting information to investors is largely insufficient for security valuation and a combination of financial and non-financial information better explains stock prices.

However, the accounting literature does not provide a comprehensive analysis of the valuation of banking firms. Furthermore, a large number of banking studies examine bank valuation issues indirectly[6] and only a small number of studies directly address the sources of inter-bank variation in market valuation. Under this view, Kane and Unal (1990) demonstrate that whenever the economic market values of bank assets and liabilities differ from their accounting and book value, the firm has substantial hidden assets. They argue that banking valuations must combine backward looking accounting information and forward looking market success indicators that better measure relative performance and market value (and also capture hidden asset values). Subsequently, studies have started to examine the relevance of (new) economic variables extracted from financial and non-financial sources that recognize a possible mismatch between book and market values (e.g., Ang and Clark, 1997).

In order to succeed and survive, banking institutions have to efficiently produce their outputs from inputs. Producing more outputs than competitors from the same amount of inputs, or consuming fewer inputs from the same amount of outputs is a sign of relative efficiency (Adenso-Diaz and Gascon, 1997). Therefore, bank efficiency can be used to

[5] Kothari (2001) relates the low magnitude of earnings response coefficients to five main reasons: prices leads earnings, inefficient capital markets, noise in earnings, and deficient GAAP and transitory earnings.
[6] For example, studies which use the event study methodology report significant capital market reactions to the cited events including Unal (1989), Musumeci and Sinkey (1990), Megginson et al. (1995), and Black et al. (1990). In addition, in a recent study, Caprio et al., (2006), studies the relationship between bank value (estimated by market to book value, and Tobin's Q) and shareholders protection. They find that stronger shareholder protection laws increase valuations.

proxy for firms' competitive advantage which affects the firm's current profitability and its future potential. These factors can be treated as important ingredients in bank valuation. Banks relative success in utilizing inputs efficiently (we argue) has important information value since relative performance also provides information on the banks competitive advantage. Firms which can operate efficiently can exploit their competitive advantage and produce sustainable profits for a longer period of time leading to greater market share at the expense of other firms (McWilliams and Smart, 1993). While a substantial body of literature has emerged on bank efficiency[7], this strand of literature has not often been analysed from shareholders point of view, and only a few studies (e.g. Eisenbeis et al., 1999; Chu and Lim, 1998; and Beccalli et al., 2006) have attempted to bring together the issue of bank efficiency and (stock) market performance.

This study seeks to advance the literature that examines the issue of bank valuation in two ways: First, it examines the information content of earnings and its components as applied to commercial banks in an emerging market. Secondly, instead of only focusing on earnings or its components as a proxy for bank market value, this study also aims to explore whether efficiency is a primary determinant of bank market value. As a consequence, we examine the question as to whether the choices made by management in the cost minimization process explain bank market valuation.

In order to address the above issue, this study uses share prices from banks listed on the Amman Stock Exchange (ASE) as well as accounting variables obtained from their annual reports over the period from 1993 to 2004. Bank cost efficiency estimates are derived using the Data Envelopment (DEA) approach (additionally, bank efficiency is also measured using the cost-to-income ratio and the results are compared with the DEA estimates to check for consistency). Overall, our results support the view that bank efficiency is an important variable that helps to explain the gap between market and book values. Additionally, earnings components are also statistically significant in providing information to investors in term of explaining bank market valuation.

This study is important not only because it is one of the handful of studies that explicitly evaluate the relationship between bank efficiency and stock prices, but also (as far as we are aware) it is the first to examine such relationships for emerging market banks. This

[7] See Berger (2007) for recent review of efficiency studies around the world.

paper provides insights for policy-makers as to the importance of operational efficiency in influencing shareholder wealth maximization in banking. This is significant because regulators need to be able to accurately value banks in order to efficiently monitor the banking system and ensure its safety. Valuations derived from market prices can also be more accurate and timely than those derived from standard accounting sources and as such further investigation into the determinants of banks' market prices can be helpful in assessing the risk of bank failure (Laeven, 2002).

This paper is organized as follows: Section 2 will discuss the theoretical justification as to why non-financial (economic) information variables can be useful in explaining bank valuation, followed by a summary of the relevant literature in Section 3. Section 4 illustrates the empirical methodology used in this study. Section 5 analyses the results of the study. Finally, Section 6 concludes.

2. Background on Valuation and Efficiency

In order to bring together bank valuation and bank efficiency, it is possible to identify within the economics literature two schools of thought that provide different sets of economic objectives for firms to pursue: the new classical theories of the firm (Marginalists) and the behaviouralists (Fiordelisi, 2005). Economist under the framework of the new classical theories of the firm (Marginalists), argue that a firm exists to allocate resources and organize production in such a way as to satisfy consumer wants, driven by the desire to maximize profits (see March and Simon, 1958; Cyert and March, 1963; and Jensen and Meckling, 1976). Hence, if the firm wants to survive it has to concentrate on profit maximization (Alchian, 1965) through efficient use of resources[8].

However, developments of theories of the firm focus on contractual relationships between the parties who comprise the organization (originally introduced by Alchian

[8] The new classical view has four main assumptions. First, firms have a limited size, Secondly, firms operate in a perfectly competitive market, thirdly, firms have perfect knowledge of market supply and demand, and finally, firms work in a regime characterized by perfect mobility and divisibility of productive inputs, where frictions are absent and conditions are static. Based on these assumptions, for a firm to maximize its instantaneous profits, they argue, it has to take two decisions, first it has to select an optimal production function, and secondly, it has to define the optimal quantity of output. In this case the optimal production function is the function which allows the firm to produce with the lowest average cost per unit (given output quantity) and the optimal output quantity is that corresponding to the minimum point of average cost per unit curve (for more discussion on the new classical theory of the firm see for example March Simon, 1958; and Jensen and Meckling, 1976).

and Demsetz, 1972). Jensen and Meckling (1976) argue that the firm is the entire set of contractual relationships which bind together the firm's stakeholders (owners, employees, material suppliers, creditors, customers and other parties with contractual involvement in the firm activities). Jensen and Meckling declare that most firms are simply legal fictions, which possess an artificial identity created by law, and serve as link or nexus for the contractual relationships between the individual parties. Accordingly, banks' management are hired by stakeholders principally to efficiently manage the bank resources and maximize banks' profits to create more wealth for the banks' owners.

On the other hand, behaviouralist economists (Monsen and Downs, 1965; Williamson, 1963; and Baumol, 1959 among others) assume that a firm is managed by two groups: managers and owners, while the latter intend to maximise firm's profits, managers aim to maximise their own utility functions. In addition, they believe that owners do not have the possibility to directly manage their firm (especially large firms) and they have to delegate to managers the decision-making on the daily activities[9].

Consequently, bank stakeholders need to monitor bank behaviour, by doing so they can improve the functioning of the bank, and are also able to alter the valuation and cost of capital of the bank (Claessens, 2006). One way of monitoring and evaluating bank performance is through assessing the bank's ability to create value for the existing shareholders. A firm (bank) is said to create value for shareholders over a given time period when the return on invested capital is greater than its opportunity cost, or than the rate that investors could earn by investing in other securities with the same risk (Fiordelisi, 2007)[10].

Originally, the shareholder value theory (also referred to as the Theory of Business Value) can be traced back to the seminal work of Markowitz (1952), Miller and Modigliani (1961), Sharpe (1964) and Fama (1976). Shareholder value theory begins from the works undertaken by economists who developed the Capital Assets Pricing Model (CAPM), which relates the expected return of an investment to the risk incurred by owning the particular investment. Consequently, accounting profits, disclosed in the

[9] Also called the Managerial Capital View. These economists showed substantial differences between the new classic view and reality. They argued that since large firms are managed by subjects distinct from owners, the ability of management to pursue owners' objectives is a questionable issue, and the deviation from pursuing a profit maximization strategy by management may exist.
[10] The concept of shareholder value is an old term in business. See for example, Marshall (1890).

bank income statement, is not the same as shareholder value. The measure of bank profitability ignores such items as cash flows, timing and risk, whereas in estimating value creation these factors have to be considered.[11]

In the market place, prices (value) are formed by the forces of demand and supply. the more the expected reward the higher the demand and the superior the market price. A commonly accepted view is that accounting income is the reward that is due to stakeholders from their investment (Morley, 1979). A significant factor that underlies the acceptance of this view is the dominance of "contractual theories of the company" within the accounting discipline (Williams, 2001). In contrast, Oberholzer and Westhuizen (2004) assert that any conclusion drawn from conventional accounting information analysis is not final; they argue that this type of analysis is not adequate in the basis for judgment about the future. Accounting information represents short-term measures of operating performance rather than more relevant long-term performance. The former information may be not sufficient because it tends to aggregate many aspects of performance such as financing, marketing and operations. "A bank may appear to be performing well even if it is poorly managed in some of these dimensions, as long as it compensates by performing particularly well in other dimensions" (Sherman and Gold 1985, p 298).

As dissatisfaction with the traditional model of company evaluation (Accounting model) has grown, alternative theories of the company have emerged. This has also led to changing views on income – a key variable that accountants attempt to measure. The enterprise theory of the company is one alternative perspective that provides a different notion of income (or earnings) (Van Staden, 1998). This alternative interpretation of income is termed "value added" and is specifically defined as the wealth created or distributed by the company through the utilization of the essential productive resources (Firer and Stainbank, 2003). In this setting, Kothari (2001) demonstrates that accounting performance measures serve either as managerial performance measures or valuation information indicators. A managerial performance measure has a contracting motivation that indicates the value added by the managers' efforts or actions over a period, whereas an information valuation measure is designed to provide information useful for company valuation, including such things as the firm's economic income or the changes in shareholders' wealth.

[11] For the difference between profit maximization and value creation see Gitman, (2006)

Economists (such as Penrose, 1959) recognized that firms are not homogeneous and have highly distinct individual characteristics and resources. From this early work what emerged was the so-called "Resource Based Theory" of the firm (RBT)[12]. The main premise of this theory is that firm performance is a function of the effective and efficient use of its resources. The value creation capability of the organization comes not from the dynamics of the industry, but from organizational processes, leading to idiosyncratic endowments of proprietary resources (Barney, 1991; Collis and Montgomery, 1995). A key idea behind the RBT is how organizations develop strategic resources. That is, RBT examines the nature and quality of resources deployed in the value creation process, and does not provide a framework for understanding the deployment process and how the resulting value is created; the relationship between resource (input) and corporate value (output) is assumed, but not explained (Peppard and Rylander, 2001).

The ability to create more value for stakeholders is nowadays considered by many to be the appropriate means for conceptualising a company's performance in addition to being a good indicator highlighting financial returns to company owners (Firer and Stainbank, 2003). Accordingly, economists (e.g., Edvinsson and Malone 1997; Stewart 1997; and Pulic 1999) believe that traditional measures of a company's performance, which are based on conventional accounting principles of determining income, are unsuitable in the new economic world. Firer and Stainbank (2003) argue that the use of traditional measures may lead investors and other relevant stakeholders to make inappropriate decisions when allocating scarce resources. In addition, economists are also interested in how such changes in the economy may affect the efficiency with which banks transform resources into various financial services. Given that financial measures are important inputs into top management decision-making, and traditional accounting measures have limitations, it is important that we understand the determinants of bank value. In addition, it seems reasonable to assume that efficiency influences firm valuation but this has rarely been examined in the academic literature. It is important, we believe, to determine the extent to which bank market value can capture management efficiency.

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[12] In fact, researchers distinguish between tangible and intangible resources, physical, human and organizational capital.

The performance and valuation of banks may be described in terms of their efficiency. The efficient bank effectively transforms resources into various financial services, whereas an inefficient bank wastes resources, namely, bank produces less than the feasible level of output from the resources employed (or uses relatively costly combinations of resources to produce a particular mix of products or services). Thus, as Wheelock and Wilson (1995) pointed out, the main goal of stakeholders, as well as managers, is to devise policies that improve the efficiency of banks. If efficiency is maximized, one would expect this to be reflected in improved bank valuation.

The goal of shareholder wealth maximization (SWM) is typically interpreted to mean maximizing the market value of a firm's common stock. In semi-strong efficient markets where most information is incorporated into prices, as is widely accepted (Brealey and Myers, 2002) stock value performance is the best measure of estimating whether firms are creating value for shareholders or not. While management needs to increase profitability to create more value for shareholders, the management of risks and profitability is closely related, because risk-taking is a necessary condition of future profitability (Bessis, 2002). To obtain more value, a bank must either take on increased risk or lower its operating costs. Greater risk translates as greater volatility of both net income and the market value of a bank's shareholders' equity.

In this sense, Bronn and Bronn (2005) argue that for any managerial measure to be useful it should be operation oriented and not simply an indicator of past performance. The aforementioned authors noted that using internal operational aspects in monitoring can assist practicing managers to better utilize this strategic resource. Competitive advantage accrues to the bank through efficiency, although efficiency levels are not directly reported in the balance sheet or income statement. Improved efficiency would be expected to create value for shareholders; therefore, as such it should be managed and quantified.

Consistent with wealth maximization (creation), managers' performance and their efficiency needs to be assessed by shareholders from a valuation perspective (market performance). However, the market value of equity is a function of variety of 'information variables', including a firm's earnings, the book value appearing in the balance sheet and, perhaps, other contextual and economic variables as well (Tippett, 2000). Burgstahler and Dichev (1997) note that this relationship arises out of the fact that a firm can be viewed as a set or collection of resources to which it applies a particular 'business technology' to produce a stream of expected future earnings. There are, as a consequence, two complementary aspects to the valuation of a firm's equity. The first of these is determined by discounting the stream of expected future earnings under the assumption that the firm applies its existing business technology indefinitely into the future. This is defined as the 'recursion value' of equity. The second element of this value arises out of the fact that the firm invariably has options to convert or use its resources in alternative and potentially more profitable ways. That is, the firm has the option to change its existing business technology. The potential to make change like this gives rise to what is known as the 'adaptation value' of equity (Burgstahler and Dichev, 1997, p.188).

Consequently, based on the above, the market value of the firm is the sum of its recursion and adaptation value. In this study we examine whether recursion value indicators, represented by earnings and book value are sufficient to bridge the gap between market and book values or should these be complemented by other adaptation values, (represented by bank efficiency measures).

3. Empirical Studies on Valuation and Efficiency: A Literature Review

Valuation is currently one of the most studied areas in finance (for example, see Biddle et al., 1997 and 1999; Charreaux and Desbrières, 2001; Fernández, 2002 and Weaver and Weston, 2003). Over the last decade or so, it has been recognised that shareholder-value maximization is an important priority for firms, and creating value for shareholders has become a major strategic objective of banks.

The notion of value maximization is inextricably linked to stock prices performance. In theory, the behavior of stock prices is the preferred indicator of firm performance as it reflects the expectations of all market participants to that particular stock. It summarizes the aggregate information that market participants have about the firm, and the aggregate expectation for the firm's future profitability growth, and risk. The literature dealing with stock valuation is substantial, for example; Stewart (1991), Schuster (2000), Copeland at al., (2000), Black et al., (1998), Rappaport (1998), Weissenrieder (1997), Schroeck (2002) and Belmont (2004). This literature can be divided into two groups. Studies in the first group focus on assessing the value- relevance of different company items, such as accounting performance measures (e.g. Barth and Beaver 2001, and

Holthausen and Watts 2001). On the other hand, studies in the second group model the link between market value and either traditional accounting performance measures (e.g. Ohlson, 1995; Felthman and Ohlson, 1995; Dechow et al., 1999; Ahmed et al., 1999; and Ota, 2002), or more innovative performance measures (e.g. O'Byrne, 1996; and Garvey and Milbourn, 2000). Nevertheless, few of the above two groups recognise the importance of including other types of information in stock valuation (Truemanet et al., 2000; Liang and Yao, 2005), or consider bank valuation through linking measures of bank productive efficiency to stock performance (Beccalli et al 2006, Eisenbeis et al 1999, and Chu and Lim 1998).

This paper seeks to investigate the 'black-box' between non-financial performance measures (efficiency) and bank valuation. In particular, we examine whether banks' efficiency explain the difference between market and book values of equity by providing signaling information to market participants that bank efficiency can improve future bank profits. Two strands of literature relates to this area of study. First, the market-based accounting literature (value relevance literature), and secondly, banking efficiency studies. A summary of this literature will be provided in the following sections.

3.1. The Value Relevance Literature

Since stakeholders have an obvious interest in the value of the firm, academics and consultants have examined features of firm value extensively. In this section we will focus on the main studies that examine the relationships between firm valuation and earnings, book values and earnings components. Then, we will summarize the major studies that include other types of information and more innovative performance measures in firm valuation.

Generally it has been assumed that firm value can be defined as the present value of expected net cash flows discounted at the appropriate risk-adjusted rate of return. Accounting financial statements produce the necessary information for market participants to form their valuations. The information presented in the balance sheet and the income statements are considered to be the most useful information. For example, book value of equity represents past performance and current earnings are indicative of future performance (Barker, 1999; Foerster and Sapp, 2005).

Academic researchers in the area of market-based accounting develop and test models to explain the observed relation between accounting figures and a wide variety of capital market variables such as stock prices and stock returns (Stickney et al. 2004). The impact of financial statement information on capital markets indicators referred to as value relevance studies, is a well documented area of research (Kothari 2001), and the number of these studies is large (see appendix 3.1 Table 1 for Holthausen and Watts 2001's summary of the main value relevance studies).

The main focus of the value relevance studies is to identify accounting items, and other variables that influence market returns. Information is considered "value relevant" if stock price movements are associated with the release of such information. The value relevance is usually interpreted by the size of the coefficient of determination (adjusted R^2) from regressions of stock price or returns on accounting and other information (e.g., Collins et al., 1997; and Dontoh, et al., 2004).

In general, empirical studies explaining stock market values using key accounting numbers are predominantly built on various theoretical frameworks, including: the permanent earnings approach adopted by Miller and Modigliani (1966); the dividend discounting model and its transformation; approaches using abnormal earnings adopted by Ohlson (1995), Feltham and Ohlson (1995); and approaches that use a linear function of equity book value and the present value of expected future residual income as outlined by Penman (1998). [In addition, more recent approaches to abnormal earnings growth models have also emerged, for instance see Ohlson and Juettner-Nauroth, 2005; and Penman, 2006)].

Many of the previous studies have argued that earnings, as a key accounting number, provide information content in stock returns. Earning is important in valuations because it summarizes firm performance. The information content of earnings has been a major focus of accounting research since the1960s (see Ball and Brown, 1968; and Beaver, 1968). These studies set the foundation for future research by being the first to show that changes in earnings, as a summary performance measure, correlate with unexpected changes in stock prices[13]. Some of the researches following Ball and Brown and Beaver

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[13] In addition, a literature has emerged that investigates value relevance in emerging markets. Such studies examine the value relevance of earnings and book value (El Shamy and Keyed, 2005), the effect of different accounting systems on firm valuation (Gomik-Tomaszewski and Jermakowicz, 2001), or compare the value relevance of accounting numbers across countries (Harris, 1994; Joos and Lang 1994;

have reproduced their results in different settings: in different countries, using interim earnings compared to annual earnings, or using shorter earnings announcement periods (e.g., Beaver and Dukes 1972; Patell and Kaplan, 1977; Bowen et al., 1987; Kormendi and Lipe, 1987; and Pfeiffer, 1998 among others). [14]

Typically, value relevance studies examine the link between a range of earnings measures and market indicators. For instance, items such as historical earnings, current earnings, residual earnings and operating cash flows among others have been used in order to examine how they predict future market returns (see for example Stewart, 1991). Additionally, previous studies have also investigated the value relevance of earnings and cash flows. However, the results are not conclusive. Some studies found that each measure provides incremental information in explaining market returns (Rayburn, 1986; Wilson, 1986; Pfeiffer, 1998; and Ali and Pope, 1995), whereas others conclude that earnings variations is superior to cash flows in explaining value creation (Dechow, 1994).

Kormendi and Lipe (1987), Collins and Kothari (1989); and Sloan (1996); and Baber et al., (1999), distinguish between two types of earnings, transitory versus persistent, and investigate the value relevance of these types of earnings[15]. These studies found that both earnings and earnings changes are value relevant with greater weight to persistent earnings than those that are perceived as transitory. Permanent or persistent earnings influences the value relevance of earnings with the market assigning greater weight to persistent earnings than to those that are perceived as transitory (Collins and Kothari 1989).

Cheng et al., (1996) examine the effect of earnings permanence on the information content of cash flows and conclude that falls in the persistence of earnings results in a decline in value relevance of earnings and an increase in the value relevance of cash flows. These findings indicate that the market looks to cash flows as an alternative source of information if earnings values look inadequate. In this context, Collins et al., (1997) show that when book values are added as an additional independent variable along with earnings, the value relevance holds steady or improves over time, and that

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and King and Langli 1998). Many studies empirically support the value relevance of accounting information.

[14] See Kothari (2001) and Lee (2001) for further details of the value relevance studies.

[15] Persistence of earnings is indicated by levels and earnings changes.

the incremental value relevance of earnings (book value) declines (increases). Similarly, Collins et al., (1999) examine whether book value is a correlated omitted variable to demonstrate that the basic earnings valuation model is mis-specified (if book value is excluded). In general, the literature suggests that some factors have been found that increase the value relevance of book value but these reduce the value relevance of earnings (Berger et al., 1996). For instance, factors such as the increasing magnitude frequency of abnormal and extraordinary items (Elliott and Hanna, 1996); and increases in intangibles (Amir and Lev, 1996) have been examined before. Bernard (1993) empirically tested various valuation functions which used earnings and book value as determinants and found that book value explained 55% of the cross sectional variance in stock prices.

The link between book and market values and company valuation has received increase academic attention since the work of Ohlson (1995) who considered both earnings and book value as major determinants in equity valuation. The model provides a theoretical framework for identifying those tasks which are necessary to value firms via fundamental approach. The essence of the model is that book value and earnings are relevant valuation attributes, not merely signals about other attributes. Book value represents a stock measure of value, while earnings (a flow variable) measures increments to book value. Dividends inter the model due to their impact on the time series of subsequent realizations of accounting data. The model also allows for any value relevant information other than book value, earnings, and dividends[16].

When book value is a poor indicator of market value (for example, due to the presence of unrecognized assets) and when earnings are transitory, other variables may provide some explanation for security prices. Given that security price changes primarily reflect revisions in expectations of current and future profitability, studies attempt to explain the differences in the relation between market value and earnings by providing evidence of a list of firm-specific (profitability ratios, liquidity ratios, and sales), or/and industry-specific (market structure) determinants relations. Mostly, the selection of the variables

[16] It should be imphasis that the Ohlson model does not provide a fully developed framework for fundamental analysis. Most notably, Ohlson does not identify specific financial statement variables (beyond book value and earnings) or non financial information useful in assessing firm value. However, this should not be considering a weakness of the model. By appealing to economic intuition and institutional knowledge, accounting researchers have begun to identify such variables. The Ohlson model provides the genesis of arguments benefiting the financial analysis (Bauman, 1996)

has been governed by either statistical procedures (Ou and Penman, 1989) or through surveys of financial statement users (Lev and Thiagarajan, 1993).

The amount of earnings can play a critical role in the valuation process as it provides an important source of information to investors. If markets perceive a decline in the reliability of earnings figures they may look to other descriptive information as a base for valuation. Investors and researchers consider earnings components more informative than aggregate earnings for explaining market values as they are more relevant for evaluating the firm's ability to generate future earnings and for assessing earnings persistence (Giner and Reverte 1999, Chen and Wang 2004).

In the accounting literature there is a consensus that using components of earnings instead of just earnings provides incremental value relevance. Lipe (1986) analyses whether six commonly reported earnings components (gross profits, general and administrative expenses, depreciation expense, interest expense, income taxes and other items) provides additional information not included in earnings to explain market returns. He provides evidence consistent with the fact that the decomposition of earnings providing a statistically significant amount of information that would be lost if only earnings were reported and the stock market recognizes differences in the time-series properties of the components of annual earnings. Ohlson and Penman (1992) discover that stock returns react differently over short time horizons to earnings components (gross margin, operating expense, depreciation and amortization, taxes, extraordinary items and all other items) however reactions are similar over longer horizons.

Barth et al., (1992) examine whether market participants implicitly assign different coefficients to pension cost components when determining security prices. The results support the view that pension cost components' coefficients generally differ from one another. Additionally, consistent with the market viewing pension related income streams as less risky, pension-related components generally have larger coefficients than non-pension components of income. Chen and Wang (2004) investigate the value relevance of operating income versus below-the-line items in to the Chinese stock market and find that earnings components are impounded in to stock prices as they are persistent whereas non persistent below-the-line items are value irrelevant.

Overall, Kothari (2001) notes that the interest in research on the value relevance of the earnings components has three main motives, First, it is used to evaluate standards that require earnings components to be disclosed and fundamentals analysed, by examining whether earnings components are incrementally informative in their association with security prices, see, for example, Ohlson and Penman (1992), Dechow (1994), and Basu (1997). Secondly, earnings management or window dressing that might distort earnings as a measure of firm performance can be examined by looking at various accruals or cash flows that have an impact on market value (see e.g. Matsumoto, 2002). Finally, the link between earnings components and market value can be used by management for forecasting. Interest in the time-series properties of earnings components also arises because summing the forecasts of the components might yield a more accurate forecast of earnings, see e.g., Lennox and Park (2006), Frankel et al., (1995); Kasznik and Lev (1995); and Coller and Yohn (1997).

In fact, despite the aforementioned evidence which support the view that accounting information, such as book value earnings and earnings components are value relevant, a body of literature has emerged that created the widespread impression that accounting information has lost its value-relevance. Francis and Schipper (1999) and Brown et al., (1999) document a decline in the value-relevance of earnings over time. In particular, these studies claim that financial statements are less relevant in assessing the fundamental value of high technology service-oriented firms (Dontoh et al., 2007).

It has also been stated that the value relevance of accounting information is becoming increasingly questionable in the new economic era (knowledge economy) with higher levels of innovation and rapid technological developments in which investments in human resources, information technology, and research and development have become essential in order to strengthen firm's competitive success (Quinn et al., 1996).

Goldfinger (1997) notes that, the source of economic value and wealth is no longer the production of material goods but the creation and manipulation of intangible assets[17]. Intangibles are often difficult to identify because, in accounting, for an item to be included in the balance sheet: it must be quantifiable an either on asset or liability; it

[17] Intangible assets are often identified as the excess of the cost of an acquired company over the value of its tangible net assets, in most cases intangibles are simply defined as (capital) assets that lack physical substance but which are likely to yield future benefits. Then, whenever those probable future economic benefits lack physical form, they should be considered as intangible assets (See Riahi-Belkaoui, 2005).

must have a reliable measurable relevant attribute; the information provided by the item must make a differences in users decisions; and the information must be representational faithful, verifiable and neutral. Accordingly, Hendriksen and Van Breda (1992) argue that standard valuation procedures developed for tangible assets may not be applicable for intangible assets. For instance, Trueman, et al., (2000) find that the addition of non-financial indicators on the basis of net income provides significant incremental explanatory power in terms of the valuation of Internet firms. Truemant et al provide evidence supporting the view that financial information has very limited use for valuation of internet companies. Using Ohlson's (1995) model they add internet usage as a non-financial performance measure for such firms. They conclude that non-financial information is important in valuing the internet companies.

Kane and Unal (1990) develop a model to investigate the structural and temporal variation in the market valuation of banking firms. In their model they try to capture the hidden reserves of US banking firms. According to Kane and Unal hidden capital (un-booked capital) exists whenever the accounting measure of a firm's net worth diverges from its economic value. Such un-booked capital has on-balance-sheet and off-balance-sheet sources. They argued that the accounting or book value of a bank's capital represents a biased estimate of the market value of stockholders equity.

As innovation is a fundamental source of wealth, and the degree of freedom given by GAAP may be exploited by management accounting information becomes insufficient and less informative of the firms' current financial position and future prospects and less useful in firm valuation (Lev and Zarowi, 1999). Increasingly the gap between market and book value of equity in most countries is a significant signal of the loss of relevance of accounting information. For example data from Morgan Stanley's World Index revealed that the listed value of these companies, in the USA ranged between double and nine times their book value (Edvinsson and Malone, 1997).

Furthermore, the previous literature has found that the market perceives intangibles as an asset (Duangploy et al., 2005), and that it has to be accurately valued. Thus, firm value (market value) is considered a combination of tangible value (book value) and intangible value (intellectual capital, goodwill, patents, brand, research and development, customer or relational capital and advertising etc). In this context, there is a stream of value relevance studies of intangible assets or non financial measures, which are not directly and accurately disclosed in financial statements (Kallapur and Kwan, 2004). Chauvin and Hirschey (1993), and Ballester et al., (2003), for instance, document a positive valuation effect of advertising and research and development expenditure for a broad sample of firms. Tseng and Goo (2005) argue that despite that intellectual capital is intangible and cannot be accurately measured; firms need to develop methods of increasing firm's value by proactively focusing on intellectual capital management. Kim and Chung (1997) argue that brand popularity is significantly related to market share.

An increasing body of literature (see for example Bao and Bao, 1998; Liedatka, 2002; Chen and Dodd, 1997; Clinton and Chen, 1998; and Hassel et al., 2005) also focuses on examining the value relevance of non-accounting (emerging) performance measures, such as economic value added or balanced scorecards, and whether these measures can substitute for traditional financial measures, such as net income and cash flows, in explaining equity market prices. These studies conclude that emerging financial measures can add incremental information not included in the comprehensive (traditional) financial measures.

In summary, the gap that occurs between market and book values due to internal or external factors suggests that accounting information is not the only information needed in the valuation process. Thus, the market will search for other information that might reflect market value. Subsequently, recent studies have started to employ a number of additional economic variables extracted from financial and non financial information variables such as the firm's economic shareholders value added (e.g., Bao and Bao, 1998; Riahi-Belkaoui,1993; Liang and li Yao, 2005; and Wang et al, 2005).

Pfeiffer et al., (1998) found that off-balance sheet mortgage servicing rights was value relevant in explaining the market value of equity. Amir and Lev (1996) indicate that there are complementarities between financial and non-financial information. They argue that if we were to only use financial indicators in the traditional way, this might result in biased inferences. For a company that focuses its core value on intangible assets, non-financial indicators that are related to the company's value are even more important than traditional financial indicators (Liang and Li Yao, 2005).

The relationship between the market and book values of equity in banks has attracted various researchers. Beaver et al., (1989) focus on the banking industry. They examine whether cross sectional differences in market to book ratios for bank equities are captured by supplemental disclosures with respect to default risk (non performing loans) and interest rate risk (loan maturity) using a sample of 149 US banks in 1983. They found that non-performing loans and loan maturity variables contribute in a statistically significant manner to an explanation of cross sectional variation in market to book values. Nelson (1996) examined the relationship between bank market and book values and the reported fair value of assets and liabilities. He proposed that after controlling for future profitability, the fair value of securities is the only value that has explanatory power incremental to book value. Additionally, a small number of studies have attempted to provide an explanation for the gap between book and market values in banking. Ittner and Larcker (1998) and Lambert (1998) note that customer satisfaction and stock prices are significantly positively correlated. However, customer satisfaction cannot completely reflect the accounting book value of the bank. Dermine and Hillion (1992), examine the relationship between the market value of equity and book value of assets and liabilities for French banks over the years 1971 to 1981. They found that assets and liabilities subject to taxation are priced at a lower value and that demand deposits appear to provide rent. Baele et al., (2007), find some evidence of the relationship between diversification and market returns. They show that higher levels of diversification seem to be associated with slightly higher market returns. However, diversification also seems to increase systemic risk.

In attempt to analyze bank's market value, the literature has also examined the relationship between regulation and the value of equity of the banking firm. Keeley (1990), for instance, has studied the association between bank charter values and regulation. He provides empirical support that increased competition causes the market value of banks to decline relative to their book value.

In this context, Ang and Clark (1997) argued that the level of bank efficiency (scale and scope efficiency) and the new trend in banking activities (the growth of non-interest income) must be reflected in the market value of bank shares. Many of these activities do not appear on the balance sheet but affect cash flows. Ang and Clark examine the value additivity[18] of cash flow producing activities of US banking organizations for the period from 1974 through 1991. They provide evidence that the response of banks to changing technological (including increased efficiency), competitive and regulatory environment increases their market value.

Although firm valuation is one of the core features of corporate finance and has attracted extensive coverage in the literature, we argue that a bank's business exhibits peculiarities that deserve special treatment. From our perspective we suggest that efficiency is important and can be treated as an unrecognized asset (hidden asset) as defined in the accounting literatures. Hidden assets (what Kane and Unal (1990) call as a hidden capital) appear whenever the economic or market values of bank assets and liabilities differ from their accounting or book value. While efficiency is equivalent to an intangible asset in banking, it is a firm-specific performance measure that can be simply calculated using publicly available information or alternatively, can be estimated using more sophisticated non-parametric or parametric techniques. The following section will provide an overview of the bank efficiency literature and explain how this is to be linked to valuation.

3.2. Bank Efficiency and Valuation

Basically, efficiency is viewed from both the industrial organization and strategic management literatures as the product of firm-specific factors such as management skill, innovation, cost control, and market share as the determinants of current firm performance and its stability (McWilliam and Smart, 1993). Although, the concept of efficiency has typically been ignored in accounting valuation studies, it has been explored extensively in the banking literature[19]. This section focuses on the following issues. First, we will start by defining efficiency in banking. Secondly, we will give some explanation regarding the relationship between bank's value and efficiency. Finally, the main

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[18] The value additivity principle has been applied both to the valuation of cash flows produced by portfolios of securities and the cash flows produced by firms. As applied to portfolios of securities, value additivity is said to hold if the sum of market prices of a bundle of securities bought separately is equal to the market price of the same combination of securities purchased as a single unit. In this form, value additivity is simply the no arbitrage condition in the capital market (see Huang and Litzenberger 1988; and Jarrow 1988). However, Ang and Clark (1997) concentrate on the valuation of the cash flows of a firm which is said to be hold if the sum of the market values of *n* separated cash flows produced within a bank is equal to the sum of the market values of these same cash flows produced in n individual banks.

[19] There are a few studies in the accounting literature that use techniques to investigate inefficiency in a non-for-profit setting (Hayes and Millar, 1990), measure the inefficiency for possible budgeting and control purposes (Mensah and Li, 1993), or measure performance (Dopuch and Gupta, 1997).

evidence found in the empirical literature regarding the estimation of efficiency and the connection between efficiency and valuation will be summarized.

Regarding the definition of efficiency, Afriat (1988) defines efficiency as the relation between ends and means; he suggests that efficiency can be measured as the 'extent to which they are matched' (Cebenoyan, 2003). Banks have focussed on improving their productivity and efficiency in order to create value for their shareholders[20]. Usually, banks focus on identifying the potential for achieving cost savings even by selecting the optimal firm size (scale economies) and product mix (scope economies), or by maximizing operational or productive efficiency (Goddard et al., 2007). In operational or productive efficiency two components can be identified: pure technical (or physical) efficiency and allocative (or price) efficiency. Koopmans (1951, p.60) defines technical efficiency as follows: "a firm is technically efficient if an increase in any output requires a reduction in at least one other output or an increase in at least one other input and if a reduction in any input requires an increase in at least one input or a reduction in at least one output". Therefore, Technical Efficiency (TE) demonstrates the ability of a bank to obtain maximal outputs from a given set of inputs or of minimising inputs for a given target of outputs, this component focuses only on physical quantities and technical relationships. If information on prices is available and a behavioural assumption (such as profit maximisation or cost minimisation) can be appropriately made, Allocative Efficiencies (AE) can be introduced. AE in input selection refers to the selection of that mix of inputs which produces a given quantity of outputs at the minimum cost. In formal terms, Price Efficiency[21] refers to the ability of using the input in optimal proportions, given their respective prices and production technology.

Farrell (1957) introduced a measure which combines technical and allocative efficiency, known as Overall Efficiency (OE) which expresses the ability of a firm to choose its input and/or output levels and mix them to optimise its economic goal. The overall efficiency is also called "X-efficiency" (or *Economic Efficiency*). Berger et al., (1993, p.228) define the term X-efficiency as "all technical and allocative efficiency of

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[20] Although productivity and efficiency are used in the literature interchangeably, a difference between the two concepts exists. As defined by Lovell (1993), the productivity of a production unit is expressed as the ratio of its outputs to its inputs and it is determined by the production technology. On the other hand, the efficiency of production is only a determinant of productivity, which can be defined as the comparison between observed and optimal values of a firm's inputs and outputs.

[21] Allocative Efficiency is the terminology currently adopted by the most recent literature, whilst Farrell (1957) originally labelled this measure as "Price Efficiency".

individual firms, as distinguished from scale and scope efficiencies". A more precise definition is proposed in Bauer et al., (1997, p.1), "X-efficiency measures the deviations in performance from that of *best-practice* firms on the efficient frontier, holding constant a number of exogenous market factors such as the forces faced in the local market. That is, the frontier efficiency of an institution measures how well it performs relative to the predicted performance of the *best* firm in the industry if these *best firms* were facing the same market conditions" [22]. Berger et al., (1993) argued that X-efficiencies across banks are relatively large and dominate scale and scope efficiencies.

Put simply, deviation from the best practise frontier is termed X-inefficiency. If cost minimization is the banks' objective, then cost inefficiency shows how far the estimated cost function of a bank is to the estimated best practice cost function. On the other hand if the main objective of the bank is profit maximization profit X-inefficiency estimates how far a bank's profit function is to the best performing bank's profit function in the industry.

Regarding the issue of how bank efficiency can be the related to bank valuation, we can illustrate this relation based on both components of X efficiency, TE and AE. By improving TE, a bank is able to obtain a higher level of outputs from a given set of inputs or of reducing inputs for a given target of outputs. Additionally, by improving allocative efficiency, a bank is able to use inputs in optimal proportions, given their respective prices and production technology. In both cases, a bank, operating efficiently, all other things being equal, will obtain a higher net income which is expected to increase investors' expectation of future benefits and therefore produce higher market valuation for the bank.

There is a large body of literature dedicated to describing approaches to measuring the efficiency of financial institutions. Publications targeted for practitioners audience frequently focus a well-known accounting ratio such as the cost income ratio (CIR) (Davidson, 1997). This measure has intuitive appeal and is thus simply called "efficiency ratio". According to the Cocheo (2000), this ratio is generally considered an important benchmark particularly among US Publicly traded banks. This conclusion comes as no surprise as CIR is the focus of many bank equity analysts when gauging

[22] See for example US studies: Kaparakis et al., (1994), Mester (1993), Berger and Humphrey (1992). and Elyasiani and Mehdian (1994), European studies Altunbas et al (2001), and Maudos et al., (2001), and emerging market studies Kwan (2006).

relative efficiency in the sector (Asher, 1994). The limitations of CIR have been discussed in numerous Articles such as that by Osborne (1995), who found no clear correlation between the CIRs and return on equity for a sample of US banks. In summary, recent academic studies clearly have major reservations when this simple accounting ratio is used as an efficiency measure.

Efficiency research tends to be family routed in economic theory. There has been a growing interest in estimating operating efficiency in various banking markets. Previous bank efficiency studies have focused on how well banks utilize cost advantages resulting from scale and scope production (e.g. Humphrey, 1987; Molyneux et al., 1996; Lang and Welzel, 1996; Berger et al., 1993 and Altunbas et al., 2001)[23].However, the attention has more recently switched to X- efficiency using different methodologies. Two main methodologies are usually applied to estimate bank efficiency: parametric and non-parametric approaches. The former identifies a specific form for the production function, whereas the latter does not specify any such form. Berger and Humphrey (1997) summarise over 120 studies (See Appendix 3.1 Table 2, for the list of reviewed papers) dealing with cost and profit efficiency in banking. These studies are divided between those using parametric and non-parametric techniques: 69 studies applied non-parametric techniques and 60 adopted parametric approaches. Berger and Humphrey (1997, p. 15) affirm that "overall, it seems clear that the estimates of mean or median efficiency for an industry may be a more consistently reliable guide for policy and research purposes than are rankings of firms by their efficiency values, especially between non-parametric and parametric approaches".

Berger and Mester (1997) contribute to the efficiency literature by employing three concepts of economic efficiency in order to examine the variation in the estimated efficiency of banking firms. Cost efficiency, standard profit, and alternative profit efficiency measures are the three concepts of efficiency which are employed in their study. They analyzed 6000 US banks over the period 1990 to 1995 using the distribution free approach (DFA). The efficiency scores are found to be 86% for cost efficiency, 54% for standard profits, and 46% for alternative profit efficiency. Although the three efficiency measures were positively correlated to some traditional accounting performance measures, they found that profit efficiencies were not positively correlated with cost efficiency.

[23] Where scale efficiency measures whether a bank is providing the most cost efficient level of output, scope efficiency measures whether a bank is producing the most cost efficient combination of outputs (Isik and Hassan, 2003a).

Similarly, Maudos and Pastor (2003) analysed cost and profit efficiency of the Spanish banking sector over the period 1985-1996 using a non-parametric estimation approach, Data Envelopment Approach (DEA). They found that average cost efficiency, standard profit, and alternative profit efficiency in commercial banks (91%, 67%, and 53% respectively) are higher than for saving banks (80%, 47% and 35% respectively) and profit efficiency for both types of banks was well below those for cost efficiency. According to Maudos and Pastor, these results imply the existence of market power in the setting of prices and the existence of differences in the quality of bank output.

Furthermore, the banking literature has also developed by relating efficiency estimates to various aspects of bank business. Some studies tackle the aspect of variation in efficiency across banks in term of their ownership and organizational structure yielding often mixed or inconclusive results. Whereas some authors provide evidence that higher foreign ownership of banks is associated with greater efficiency, others show that privatization by itself is not sufficient to increase bank efficiency (see Berger and Humphrey, 1997; and Isik and Hassan, 2003b; Chakravarty and Williams, 2006; and Berger et al., 2006). Moreover, previous literature relates aspects of bank management and efficiency. Spong et al., (1995) find that cost efficient banks are characterised by having incentives and monitoring procedures that align management behaviour with shareholders' interests'. Berger and Hannan (1998) provide evidence on US banks, that the structure of banking markets and the level of concentration and its implications for firm behaviour (quit life hypothesis) is positively related to bank cost efficiency. Mester (1996) found that managerial prudence in terms of higher levels of bank capitalization has been found to be positively related to efficiency (moral hazard hypothesis). Berger and De Young (1997), Williams (2004), and Rossi et al., (2005) among others, examine the intemporal relationship (sign and direction) between cost efficiency, asset quality, capitalization, and risk, in attempt to analyze specific types of managerial behaviour namely bad management, bad luck, and skimping behaviour. Usually a Granger causality method is used to study the aforementioned behavioural types, (and these are not mutually exclusive). "Bad luck" behaviour exists if an increased level of problem loans leads to a reduction in cost efficiency. In contrast, a fall in bank cost efficiency followed by increases in problem loans at the industry level reflects bad management. Efficient banks may engage in "skimping" behaviour, when reductions in capital at thinly capitalized banks causes an increase in problem loans (Williams, 2004).

Recently the banking literature has related efficiency measures to bank profitability. De Young and Hasan (1998) and Berger et al (2000) use the X-efficiency measures to explain profitability following bank mergers and acquisitions. Elyasiani et al (1994) investigates the relationship between a bank's financial performance measured by accounting ratios and production performance proxied by efficiency indices using data on 203 large US banks from 1983 to 1987. They find a significant association between the financial and production performance measures for large banks, however, this association is time sensitive. They suggest that efficiency indexes should be considered as a supplement to financial ratios in examining the performance of banking firms. In addition, other studies have examined the efficient structure paradigm by linking bank profitability and efficiency (Demsetz, 1973). The efficient structure hypothesis suggests that relatively efficient firms compete more aggressively for and gain dominant market shares and also have higher profits because of their ability to reduce the cost of production (Berger and Humphrey, 1997). Most research seems to supported evidence of the efficient structure hypothesis which indicates that bank efficiency has a significant effect on bank profitability (Park and Weber, 2006)[24].

In addition, the relationship between efficiency, solvency, and bank failure have also been discussed in the literature. Akhigbe and Madura (2001) for instance argue that bank failure is related to the profit efficiency. Miller (1996) also noted that management driven weaknesses, for example, inefficiency in profitability, play a significant part in determining 90% of US bank failures (Lou, 2003). Siems (1992) investigated a sample of 930 small US commercial banks and found that profit efficiency or management quality is indeed a determinant of bank failure. Additionally, Reboredo (2004) finds that greater efficiency with respect to a risk return frontier improved solvency (although solvency is not related to efficiency).

While a number of bank efficiency studies have examined profit efficiency measures very few have examined the link to market value. Lou (2003) examined marketability efficiency (activities generating more market value) in addition to profit efficiency for a sample of 245 large banks using the non parametric DEA approach. He found that 14%

[24] This area of studies compares between two types of profitability drivers, bank market power versus efficiency effect. The evidence of these studies support that more cost efficiency is more important than market power in explaining profitability.

of banks in the sample obtained higher level of profit performance but lower levels of marketability performance. In a recent study, Fiordelisi (2007), creates a new measure of efficiency namely "Shareholder Value efficiency". He used the parametric Stochastic Frontier Analysis (SFA) to estimate his new efficiency measure. According to Fiordelisi, more efficient banks are these which produce the maximum possible economic value added (EVA). Based on his sample of selected European banks (from France, Germany, Italy, and the UK), he found that this measure of efficiency can explain value creation in banking better than cost and profit efficiency.

Additionally, Chu and Lim (1998) evaluate the cost and profit efficiencies of banks listed in Singapore over the period 1992 to 1996. They studied the effect of this efficiency on the percentage change in bank share prices. Using the DEA method to estimate efficiency they conclude that the average profit efficiency is significantly lower than cost efficiency (83% and 95%, respectively). Furthermore, they find a significant relation between profit efficiency rather than cost efficiency and the percentage change in bank share prices (correlation coefficients of 0.82 and 0.32, respectively). According to them, since shareholders desire dividends which are paid out of profits and not income, profit efficiency can explain fluctuations in share prices. Alternatively, Kirkwood and Nahm (2006) adopted Chu and Lim's (1998) approach to examine the relationship between profit and cost efficiency to changes in Australian banks' stock prices over the period 1995 and 2002. They note that Chu and Lim's model ignores factors that may affect stock returns. Thus they specify a Sharp and Lintner's model of excess stock returns which includes profit efficiency as an explanatory variable (in addition to market excess return). Kirkwood and Nahm conclude that the efficiency of bank operations significantly explain bank's stock prices.

Adenso- Diaz and Gascon (1997) linked various measures of bank efficiency with the stock performance for all Spanish banks quoted on the Madrid stock exchange in 1994. Four partial measures of bank efficiency were estimated each of which included various inputs and outputs. The four efficiency measures included: production costs, systemic risk, specific risk and the size of branch network distributions. They found that the most influential variable in determining stock performance was the specific risk of banks. However, the other efficiency measures seem to have only a limited effect on bank stock performance.

Eisenbeis et al., (1999) studied the information content of cost X-efficiency estimates using both stochastic and linear programming frontier techniques for a sample of US bank holding companies (BHC) from 1986 to 1991. First, they found that the non-parametric inefficiency scores were two to three times larger than those estimated using the parametric stochastic frontier approach. However, the patterns of the efficiency measures across banks and time were similar and highly rank correlated. Overall they found that the stochastic frontier measures of bank inefficiency were more closely related to bank stock returns. Beccalli et al., (2006), in contrast, arrived at different conclusions concerning the most appropriate efficiency estimation technique when examining the relationship between bank efficiency and stock performance. Beccalli et al., (2006) found that cost efficient banks do better than less cost efficient banks in term of market returns when using both parametric and non-parametric techniques to examine the relationship between efficiency scores and stock returns for a cross-country sample of European banks. They also suggest that the DEA efficiency measures better explain bank stock market performance compared to the parametric (Stochastic Frontier) estimates.

While the previous literature addresses the important relationship between market performance and bank efficiency, none of these studies directly analyze the issue of banks' market valuation by examining the gap between market and book values, or explore this relation in emerging markets. Subsequently, this study contributes to the above mentioned literature by attempting to connect two branches of the literature (namely *accounting* and *banking studies)*. While efficiency -as a performance measure-has typically been ignored in the market-based accounting literature, it has been widely studied in the banking literature, but (generally) not in the context of the market valuation process. This study, therefore also aims to contribute to the established value relevance literature by using the relative performance measure, bank efficiency, and to examine how this measure may relate to the gap that occurs between market and book values across banks.

4. Empirical Methodology

This section presents the methodology used to examine the relevance of net income (and its components) and also efficiency in order to explain bank stock performance. This section is organised in three sub-sections. Firstly, we illustrate the link between bank market value with various financial and economic performance indicators and, secondly, various hypotheses and testable models are presented. Finally, we discuss the data used in the study.

4.1. Linking Bank Value to Financial and Economic Performance Measures

Previous studies assume that share prices in efficient markets incorporate most of the available information. Additionally, the behaviors of stock prices are believed to be the best indicator of a firm's performance (Brealey and Myers, 2002). From an economic point of view, the fair (intrinsic) value of any resource equals the present value of the expected future returns (cash flows) from the resource discounted at the rate that reflects the risk inherent in those expected returns. Yet, prices do not necessarily equal value for every security at all times, even in relatively efficient securities markets. Price is observable, value is not. Thus, this study tries to examine this issue in emerging markets. More specifically, it aims to explain the difference between market and book values in emerging market banking sector, the focus will be on Jordanian banks listed on the Amman Stock exchange (ASE).

As discussed in section 3, valuation is a question of debate. Although firm valuation is one of the core problems of corporate finance and has attracted extensive coverage in the literature, we argue that a bank's business exhibits peculiarities that do deserve special treatment. However, the special nature of banking does not require a separate and novel pricing theory; instead, certain deviations from standard methods appear to be appropriate. As stated by Damodaran (2005), p. 603): "The basic principles of valuation apply just as much for financial service firms as they do for other firms. There are, however, a few aspects relating to financial service firms that can affect how they are valued". Based on Damodaran's argument, we modify the standard valuation models which include the traditional accounting information and include an important economic performance measure, namely bank efficiency. In other words, this study examines whether bank efficiency provides incremental information in explaining bank market valuation. The main structure of the methodology of this study is summarized in Figure 1.

Figure (1) shows that internal value drivers may enhance bank market value. Internal value drivers are indicated by using two types of information. First, financial information can be used by analysts by extracting performance measurement variables presented in financial statements, particularly net income, and its components. Secondly, because of the existence of differences in the value creation activities that are directly connected with management efficiency, we also plan to include cost efficiency as a bank-specific performance measure estimated using the non-parametric DEA methodology. Thus, we aim to examine whether the efficiency of banks helps in explaining the difference between market and book values. Finally, we also include risk measures which are also expected to affect bank value.

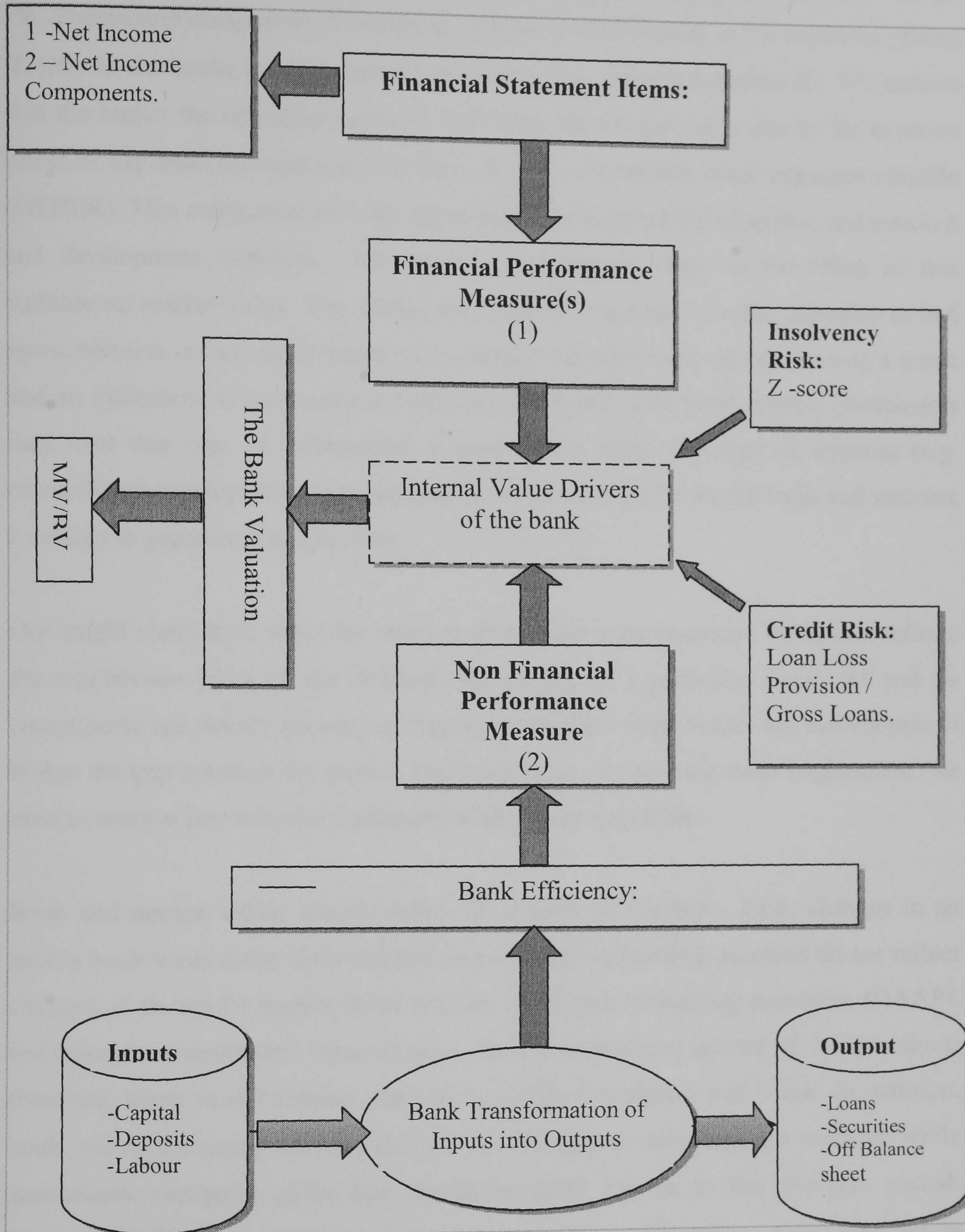
Regarding the first group of variables, accounting information (net income and its components) is expected to influence bank market value, and move book values closer to market values. Profit measures are used in the market valuation models in most of the value relevance literature (Ohlson, 1995; Collins et al., 1999; Ballester and Livnat, 1997; Graham et al., 2000, among others). In this study we use the aggregate net income value that appears in the bottom line of the income statement. Net income is calculated as the difference between all bank's income and costs (including tax and financial expenses) obtained over a year. It can be summarized as follows:

NI= (IR+FR)-(IC+FC) = IM + (FR-FC)

Where, NI is the bank net income, IR is the interest cost, FR is the fee revenue, IC is the interest cost, FC is the fee Costs, and IM is the interest margin[25]. We expect that the greater the net income the higher the market value, since market value reflects the investors' expectations of the future benefits associated with their investments. The higher the net income, the greater the ability of the bank to pay dividends to existing shareholders, and therefore the higher the demand for bank stocks, which increases share prices.

[25] Net income values were divided by the number of shares in order to keep the values included in the model consistent.

Figure (3.1): Financial and Economic Information in Bank Valuation.



Source: Author's own

As noted in the previous literature (e.g Ohlson and Peman, 1992; Dechow, 1994; Basu 1997, and Chen and Wang 2004) the more the available information the better the valuation of stocks. Therefore, we disaggregate net income into components. Three main components have been included in a separate model. The first component of net income is operating income (OI) which can be calculated as the summation of IR and FR. The second component is operating expense (OEXP) which is the expenses related directly to the banks product delivery including total interest expenses IC. We assume that the higher the operating expenses the lower the market value due to the negative effect of expenses on expected cash flow. Finally, we include other expenses variable (OTHER). This component includes depreciation, administrative expenses, and research and development expenses. Two possible explanations relate to the effect of this variable on market value. The market may treat the increase of other expenses as bad news, because market participants may consider the high value of expenses as a waste and an indication of management inefficiency. On the other hand, market participants may treat this type of information as good news, since this type of expense (e.g. research and development) may generate more future benefits for the bank and increase its ability to generate future income.

One might claim that, while the share market value is an economic value that reflects the equilibrium price of the demand and supply of a particular stock, NI and its components are mainly accounting figures. Therefore, these values are not enough to bridge the gap between the market and book value. To provide more explanation, we need to analyse first why the market and book values may differ.

Book and market values mainly differ for at least two reasons. First, changes in an asset's book value differ from changes in its market value since accounts do not reflect changes of an asset's market value because of various accounting principles (GAAP). For example, accountants' value an asset using historical cost instead of market values; therefore, items in the balance sheet do not reflect economic real value. In addition, book values are conservative; gains are not recognized until they are realized, while accountants recognise gains that should properly belong to the previous period. Secondly, balance sheets may miss some important information. they may fail to recognize some assets (e.g. items that refer to the capacity of the company to generate abnormal returns in the future, such as managerial skills).

As a consequence, we include bank cost efficiency as an indicator that reflects the ability and skills of bank management to choose inputs and/or output levels and to mix these inputs to minimize cost. Regarding the relationship between bank efficiency and market value, we assume that the higher the efficiency levels the more the current and expected cash flows. This is because more efficient banks are able to reduce costs and produce greater profits[26]. Bank cost efficiency has been included in this study rather than profit efficiency because we believe that banks have more control over their costs than profits. In addition, the ability of banks to generate profits is clearly indicated to a major degree in earnings and its components that are already included in our models.

We also note that banks may increase their profits by undertaking more risky activities. As such, the opportunity cost of capital increases since shareholders require higher returns from more risky acting. Instead, by improving cost efficiency, a bank may increase its profits without increasing risks and, consequently, creating value for shareholders. As such, it is possible that cost efficiency has a closer statistical relationship with shareholder value than profit efficiency.

Bank market and book values, as well as financial and economic performance, may also be influenced by two specific risk indicators, credit and insolvency risks. These types of risks may influence market value. Credit risk is the probability that bank borrowers will fail to meet their obligations in accordance with the agreed terms. This type of risk is considered the major risk faced by commercial banks, because revenues associated with lending activities is the main source of bank income, hence, previous studies have typically focus on credit risk measurement in banking (e.g. Duffie, 2005; Lucas and Klaassen, 2006; and Galluccio and Roncoroni, 2006), and the relationship between this risk and other risks (e.g. Zheng, 2006; and Jobst et al., 2006). The effect of credit risk on bank market value is obvious, a downside credit risk positively affect bank's market value. The main reason for this expected relationship is that the higher the credit risks the more the required rate of return by investors (discount rate used to calculate the present value of expected future cash flows). Since banks are assumed to accurately forecast their credit losses, and reflect their forecasting by seeking protection against loan-losses through their choice of appropriate provision for such losses. Therefore, in this study we proxy bank credit risk using annual loan-loss provisions ratio (LLP) (measured as loan loss provision to total loans); this ratio is assumed to provide an

[26] A negative relation may be possible as well; more cost efficiency may have negative effects on cash flows. For example, cost minimization may adversely affect customer satisfactions that may lead to lower level of future cash flows.

indication of credit risk. This ratio has two possible effects on market value. The market may interpret loan-loss provisions as signals of bank managers' private information about expected future earnings, and by increasing loan-loss provisions will be able to withstand a 'hit to earnings' through absorbing future potential losses (Beaver et al. 1989). Therefore, investors interpret components of unexpected provisions as 'good news' (Elliot et al., 1991; and Beaver and Engel 1996). On the other hand, an increase in the banks' loan-loss provision can also be viewed as bad news, especially if it is not accompanied by other, more timely indicators of loan default, because LLP will then serve as the primary source of information on loan default (Ahmed et al. 1999; and Hatfield and Lancaster, 2000).

Finally, we also consider insolvency risk measured by the Z score, a metric for bank insolvency risk developed by Boyd et al., (1993). The Z score is a statistic indicating the solvency for each bank j in every year t that can be calculated as follows:

$$Z = \frac{\sum_{j=1}^{12} \pi_j / A_j + \sum_{j=1}^{12} \frac{E_j}{A_j}}{S_r}$$

Where π j is the estimated market value that can be calculated as follows:

$$\pi_j = c_j p_j - c_{j-1} p_{j-1},$$

Where c_j is the number of outstanding shares adjusted for stock splits, and p_j is the share price of the last business day of month j. Ej is the market value of total equity (e.g. share prices multiplied by number of shares outstanding); A_j is the market value of total assets:

$$A_j = E_j + L,$$

L is the book value of total debt at the end of each fiscal year. And S_r is the estimated standard deviation of π_j / A_j. The Z score is negatively associated with insolvency risk, where Z is the number of standard deviations below the mean by which profits must fall in order to eliminate equity. Boyd et al., (1993) defines the downside risk as being negative values of the Z score (see Yasuda et al., 2004). Therefore, we assume that Z has a positive effect on market value. In other words, the higher the value of the Z-score the lower the insolvency risk and the higher the expected market value.

4.2. Empirical Models, Testable Hypotheses and Data

The empirical foundation of this study is based on relating bank's stock prices to the underlying financial information disclosed in the financial statements and to other non financial (economic) information. Particularly, we adopt Ohlson's (1995) model which links firm market value with both of financial and non-financial information. This model has been used in various value relevance studies (e.g. Callen and Morel, 2001; Biddle et al., 2001; Myers, 1999; Trueman et al., 2000, and Dechow et al., 1999). In particular, we use Trueman's et al., (2000) methodology which tests for the difference between book and market values using both net income, net income componets as well as other information (bank efficiency measures and risk indicators).

Traditional financial theory notes that the value of a firm is estimated as the present value of the future dividend stream to equity holders over an infinite horizon. Consequently, to estimate fair value, analysts are required to forecast a complete future stream of firms' net dividends. Obvious difficulties in a practical application of the dividends discount model have been overcome by Ohlson (1995) who redefines the valuation model using accounting variables as follows:

$$MV_t = BV_t + \sum_{i=1}^{\infty} \frac{E(RE_{t+i})}{(1+r)^i} \tag{1}$$

Where MV_t refers to the market value at the end of the current period t, BV_t is the book value of common equity at time t, RE_{t+i} represents residual earnings[27] for period t=i, r is the company's required rate of return on its equity capital and E(.) is the expected value.

When a bank's expected earnings are decomposed into its components for period t+i equation (2) can be written as:

$$E_{t+i} = OI_{t+i} - OEXP_{t+1} - NONEXP_{t+i} \tag{2}$$

Where E_{t+i} refers to the earnings for period t+i, OI_{t+i} is the bank operating income for period t+i, $OEXP_{t+i}$ represents the banks operating expenses for period t+i and

[27] With a linear information dynamic assumption (as in Feltham and Ohlson 1995, Ohlson, 1995), the residual income model is equivalent to a weighted average of book value and earnings. Although, in Ohlson's model, prices are related to book values of equity plus the present value of excess earnings "abnormal earnings". Nevertheless, it has become common in previous studies (Collins et al., 1997; Gornik-Tomaszewski and Jermakowicz, 2001; and Graham et al., 2000) to examine the value-relevance of accounting data by regressing stock prices on book values and earnings.

$NONEXP_{t+i}$ refers to other non operating expenses for period t+i.(other expensed not accounted in the OEXP)

Following Trueman et al., (2000), our paper ties investors' expectation for each of the components of earnings to the current available accounting information and other information by using two main hypotheses. First, we hypothesize that there is a positive linear correlation between the operating income in the future and the current operating income, operating expenses, and the other financial and non-financial information. Subsequently, the future expected operating expenses will be positively linearly correlated with the current operating expenses. Second, future non-operating expenses are expected to be zero. Thus, alternative rearrangement of equation 1 using the information in equation 2 gives the market value as a linear combination of book value, operating income, operating expenses and other financial and non-financial information.

$$MV_t = \alpha_0 + \alpha_1 BV_t + \alpha_2 OI_t + \alpha_3 OEXP_t + \alpha_4 OFI_t \tag{3}$$

Where OFI_t is the bank's other financial and non-financial information for period t.

According to the above mentioned theoretical model, and to analyze the explanatory power of bottom line net income into the value of the bank, this study establishes the first empirical regression model that is shown in the following equation:

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \varepsilon_{jt} \tag{4}$$

Where, MV_{jt} is market value (proxied by stock prices) calculated for each bank j three months after fiscal year end period t to account for any delay in the release of accounting information. BV_{jt} is bank j's book value of common equity at the end of the year t, and NI_{jt} is the net income available to bank j's common stockholders at the end of year t[28].

Two additional arguments can be used to support our specification. First, although Ohlson's (1995) valuation model relies on forecasts of future earnings, not the current reported earnings, the current earnings can be thought of as the realization of previously forecasted earnings (Gornik-Tomaszewki and Jermakowiz, 2001).

[28] Some researchers argue that earnings forecasts contain value relevant information and add this information to Ohlson's valuation model (e.g., Dechow, et al., (1999) and recently Loh and Main (2006) among others) but unfortunately this type of information is not available in the Jordanian market, and if they are available they are biased measures as argued by Das, et al., (1998). For the above reasons, these forecasts are not included in the model.

Second, the use of current end-of-period book value instead of the lagged book value allows us to analyze the gap between market and book value.

Consequently, the above model (Equation 4) will be used to test the first hypothesis that can be stated in its alternative form as follows:

H1 = net income has value relevance in explaining the difference between bank market and book values.

In order to directly address the of noted assertion that net income plays only a small role, at best, in the valuation of bank stocks (Bao and Bao 1998, Riahi-Belkaoui 1993, Liang and li Yao 2005, and Wang et al 2005), we test whether net income components are able to provide different explanations in the market to book value relationship:

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHER_{jt} + \varepsilon_{jt} \qquad (5)$$

Where OI_{jt} is the operating Income (interest and non-interest income) of bank j in quarter t, $OEXP_{jt}$ is the expenses related directly to the banks product delivery including total interest expenses and non interest expenses including commissions and fees of bank j in year t, and $OTHER_{jt}$ are expenses other than interest expenses of bank j in year t (including depreciation and amortization, administrative expenses, and research and development expenses).

The second tested hypothesis in its alternative form is as follows:

H2 = net income components add information beyond aggregate net income, in which they can improve the explanation of the difference between banks market and book value.

Furthermore, to assess the relevance of bank efficiency as non financial information, the following equation is expressed as:

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_5 Eff_{jt} + \varepsilon_{jt} \qquad (6)$$

Where, Eff_{jt} is the cost efficiency for bank j at year t estimated using the DEA methodology (see section 4.3 for detailed discussion of this methodology), or the accounting cost income ratio.

Thus, the third alternative hypothesis can be expressed as follows:

H3= Banks' cost efficiency has value relevance; it can provide a significant incremental information content to the net income model.

Additionally, this study will include other information indicators, important in bank valuation, as additional independent variables along with the financial data obtained from financial statements. Two risk measures will also be added to the aggregate model to control for the effects of efficiency on the relationship between market and book value as follows:

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 LLPR_{jt} + \varepsilon_{jt} \tag{7}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 Z_{jt} + \varepsilon_{jt} \tag{8}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 Eff_{jt} + \varepsilon_{jt} \tag{9}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_{31} LLPR_{jt} + \alpha_{42} Eff_{jt} + \varepsilon_{jt} \tag{10}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 Z_{jt} + \alpha_4 Eff_{jt} + \varepsilon_{jt} \tag{11}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \beta_1 LLPR_{jt} + \beta_2 Z_{jt} + \beta_4 Eff_{jt} + \varepsilon_{jt} \tag{12}$$

From equations 7 to 12 we can test the following hypothesis in its alternative form as:

H4= banks' efficiency has value relevance after considering for credit and insolvency risk in the net income model.

Furthermore, the efficiency measure, as well as the other control variables, will be added to the net income components model as follows:

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \beta_1 LLPR_{jt} + \varepsilon_{jt} \tag{13}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \beta_1 Z_{jt} + \varepsilon_{jt} \tag{14}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \alpha_5 Eff_{jt} + \varepsilon_{jt} \tag{15}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \beta_1 LLPR_{jt} + \beta_2 Eff_{jt} + \varepsilon_{jt} \tag{16}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \alpha_{51} Eff_{jt} + \alpha_6 Z_{jt} + \varepsilon_{jt} \tag{17}$$

$$MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \alpha_{51} LLPR_{jt} + \alpha_6 Z_{jt} + \alpha_6 Eff_{jt} + \varepsilon_{jt} \tag{18}$$

Where $LLPR_{jt}$ is our measure of bank credit risk namely, the ratio of loan-loss provisions to gross loans for bank j in year t; Z is a score that refers to a metric for insolvency risk developed by Boyd et al., (1993), (see section 4.2 for the calculations and expected effect of the variables).

From equations 13 to 18 the following alternative hypothesis can be derived as follows:
H5= banks' efficiency has a value relevance after considering for credit and insolvency risk in the income components model.

To control for heteroscedasticity in the above mentioned models, all variables are deflated by the end of year book values[29]. Furthermore, to examine the incremental or marginal contribution of the efficiency variable to explaining bank value, we employ the following F test (Gujarati, 2005)[30]:

$$\frac{R^2{}_{New} - R^2{}_{Old} /(Df_1)}{(1 - R^2{}_{New})/(Df_2)} \qquad (19)$$

Where,

$R^2{}_{Newl}$ Is the R^2 for the bank valuation model with the efficiency measure.

$R^2{}_{Old}$ Is the R^2 for the bank valuation model without the efficiency measure.

Df_1 Is the number of new regressors.

Df_2 Is the number of observations – number of parameters in the new model.

The F test will be used to examine the following alternative hypothesis:

H6: the complete model (with efficiency) provides improved explanatory power compared to the model with earnings or earnings components alone.

Considering that pooled time series cross-sectional data requires various stochastic specifications, we control in all regressions for fixed firm and time effects[31]. The following section will briefly discuss the chosen panel technique used (fixed and

[29] A number of deflators have been used before, as proxies for scale, in valuation models such as: sales, number of shares, opening market value, for further discussion on deflation and scaling see Akbar and Stark (2003).

[30] F test for nested models are chosen here rather than the non-nested models tests such as Voung (1989) and the J test by Davidson and MacKinnon (1981) because in this study, the competing models are nested where in each time the first model becomes part of the second model.

[31] Most of the prior studies made the simplest assumption of common effects.

random effects) and then we will discuss the approach used to calculate our bank efficiency measures.

4.2.1. Panel Data Techniques

The term panel data refers to the pooling of observations on a cross section of firms (banks) over several time periods (Baltagi, 2005). Pooled data for banks over several years are used to deal with the limitation of the small number of banks in the study. Various other benefits of using panel data have been discussed in the literature (see for example Hsiao, 2003). Using pooled data may help to control for individual heterogeneity which is an essential part of the analysis. However, in the basic regression model, a simple assumption is that the parameters do not vary across sample observations.

Three main pooling techniques are typically used with panel data, the common, fixed (dummy variable) and random effects (error components) techniques. While the common effects model assumes that the financial relations are homogeneous across firms, the other techniques account for heterogeneity.

The fixed effects model allows for differences in intercepts to be modeled using dummy variables, that is, fixed coefficients. Assuming we have i= 1,2……,N cross sectional observations, and t=1, 2, 3……, T time series observations, the (i, t) the observation on the dummy variable model with which we are concerned can be written as:

$$y_{it} = \alpha_1 + \sum_{i=2}^{n} \beta_i D_{it} + \sum_{K=1}^{k} \beta_K x_{kit} + e_{it} \qquad (20)$$

Where,

β_i, is the intercepts coefficient for the ith cross- sectional banks

D_{it}, are dummy variables that take a value of unity for observations on bank i but will be 0 for observations on other banks.

β_k, are the slope coefficients that are common to all banks,

y_{it}, is the dependent variable

x_{kit}, are the explanatory variables, e_{it}, are independent and identically distributed random variables with E [e_{it}] =0 and

E [e_{it}^2] = $\sigma_e^{2.}$

As argued by Judge et al., (1988), fixed effects are usually employed when specifying a different intercept coefficient for each cross- sectional unit and can adequately capture differences in cross-sectional units. That is, cross-sectional identifiers explain changes from bank to bank.

An alternative to the fixed-effects model is a random-effects model that assumes that the coefficients are random variables drawn from some larger population (Worthington and West, 2004). The random effects model can be written as follows:

$$y_{it} = \beta_1 + \sum_{K=1}^{k} \beta_K x_{kit} + u_i + e_{it} \tag{21}$$

Where E[u_i] = 0, E[u^2] = σu^2, E[$u_i u_j$] = 0 for $i \neq$ j, E[$u_i e_{it}$] = 0 and all other variables are as previously defined. The structure of the model is such that, for a given bank, the correlation between any two disturbances in different time periods is the same, and unlike a first-order autoregressive model, does not decline as the disturbances vary over time. Further, not only is the correlation constant over time, it is identical for all banks (Judge et al., 1988). The inference is that the results from this model may be generalised to the whole population from which the sample is taken.

4.2.2. Common, Fixed and Random Effect Choice

This study will depend heavily on the following tests to choose between common, fixed, and random effects estimates. These are listed as below:

4.*2.2.1* Lagrange Multiplier Test *(LM)*

This test was originally developed by Breusch and Pagan (1980) and is based on OLS residuals. The test is used in our study to compare between the pooled regression and the random effects model based on Maximum Likelihood estimation under the null hypothesis that the OLS is the preferred model, as follows:

H_0: $\delta_u^2 = 0$ (or Corr [n_{it}, n_{is}] =0),

H_1: $\delta_u^2 \neq 0$

LM test value will be calculated using the following equation:

$$\text{LM}=\frac{nT}{2(T-1)}\left[\frac{\sum_{i=1}^{n}\left[\sum_{i=1}^{T} e_{it}\right]^2}{\sum_{i=1}^{n}\sum_{t=1}^{T} e_{it}^2}-1\right]^2=\frac{nT}{2(T-1)}\left[\frac{\sum_{i=1}^{n}(T\bar{e}_i)^2}{\sum_{i=1}^{n}\sum_{t=1}^{T} e_{it}^2}-1\right]^2 \tag{22}$$

t~ $\chi^2(1)$ if H0 is true.

4.2.2.2. Hausman Test:

This test is used to choose between a fixed or random-effects specification. Under this hypothesis, there are two sets of estimates; one of which is consistent under both the null and alternative hypothesis, and another that is consistent only under the null. The null hypothesis is that both the fixed and random specifications are consistent, whereas under the alternative the fixed effect model is, but the random-effects model is not. The test is based on a Wald criterion which is asymptotically distributed as chi-squared with K degrees of freedom (Greene 1993, p.479-480).

$$t = \chi^2\left[\frac{(\hat{\beta}^{fe} - \hat{\beta}^{re})^2}{Var[\hat{\beta}^{fe}] - Var[\hat{\beta}^{re}]}\right] \tag{23}$$

t~ $\chi^2(1)$ if H0 is true.

4.2.3. Data

The sample used in this study comprises 15 listed commercial banks that operate in Jordan. The banks in the sample consist of all publicly traded banks which had market data during the time period under study. All of the fifteen banks have December 31 as their financial year end. The data sample selected in the research was collected for each year during the 1993-2004 periods. The data used in the empirical models have been acquired from the annual financial statement of the banks in the sample and the Amman Stock Exchange Data Base[32]. This study uses annual data because accounting information that is required is only available on a yearly base (not quarterly as in the USA and some other developed markets). The data set consists of 173 bank year combinations. Moreover, the non-parametric DEA model will be applied to calculate the efficiency scores of sampling banks. Because homogeneity of operations is essential in efficiency analysis, our study excludes foreign owned banks, which constitutes a small portion of the sector. In addition, foreign banks stocks are not listed on the Amman Stock Exchange.

[32] The reason for the lack of empirical analysis on banks in emerging markets and Arab countries in particular relates to the availability of data. Most of the time, such data are considered confidential and typically proprietary. However, as the Jordanian economy opens up, the Amman stock exchange became a rich database and covers all of the national listed banks.

4.2.3.1. Efficiency Estimation

As mentioned before (in section 3-2), operational efficiency is a broad concept. It refers to the banks success in transforming resources (inputs) to outputs with minimum cost (or maximum profit). The banking efficiency literature has focused on different aspects of efficiency: technical efficiency, allocative efficiency, and overall efficiency. Overall Efficiency (OE), also called "X-efficiency" (or Economic Efficiency), expresses the ability of a firm to choose its input and/or output levels and mix them to optimise its economic goal. X-efficiency is estimated in banking studies as the sum of both allocative and technical efficiency. On the other hand, Technical Efficiency (TE) expresses the ability of a firm to obtain maximal outputs from a given set of inputs or of minimising inputs for a given target of outputs: this component focuses only on physical quantities and technical relationships. Allocative Efficiencies (AE) refer to the ability of using inputs in optimal proportions, given their respective prices and production technology[33].

In this paper, X-efficiency (introduced by Leibenstein, 1966), will be used to proxy for bank economic performance. The empirical banking literature focuses on frontier efficiency, or how close financial institutions are to a best practice frontier, as an important performance matrix (see Berger and Humphrey, 1997). We choose to use X-efficiency, rather than scale or scope efficiency, because as noted by Berger and Humphrey (1992), X-efficiency differences across banks are relatively large and dominate scale and scope economies. More formally, X-inefficiency can be defined (in banking) as the deviation of the bank cost (profit) function, observed input(s) - output(s) combinations, for a specific bank from the best practice cost (profit) function (frontier), the closer the bank to the best practice frontier, the more the X-efficient the bank (Molyneux and Iqbal, 2005).

There are five main approaches to estimating the efficient frontier, three of which are parametric: Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA), and Thick Frontier Approach (TFA); and two of which are non-parametric (linear programming) approaches including: Data Envelopment Analysis (DEA) and the Free Disposal Hull (FDH)[34]. Both of these approaches attempt to benchmark the relative

[33] On the other hand, allocative inefficiency is the failure of the Decision Making Unit (DMU) to choose an optimal input mix to reach relative input prices mix, and technical inefficiency occurs when the DMU is employing an excessive level of inputs for output production (Molyneux and Iqbal, 2005).

[34] There is consensus in the previous literature that the advantages of efficiency estimation derived from parametric and non-parametric approaches exceed the efficiency estimation using accounting ratios. For

performance of production units but differ from each other mainly due to their underlying assumptions. A major challenge for both sets of approaches is in distinguishing random error, arising from accounting practices or some other sources, from inefficiency. Each of the parametric approaches has different ways of dealing with random error, whereas the non-parametric approaches have generally ignored this feature, parametric approaches require particular feature of the error distribution in estimating the efficiency. In comparing the two methodologies Resti (1997, P.221) stated that: '(i) econometric and linear programming results do not differ dramatically, when based on the same data and conceptual framework; (ii) when differences arise, they can be explained by going back to the intrinsic features of the models'.

This paper attempts to estimate efficiency using DEA, a nonparametric technique that does not require a prior functional specification of the unknown technology (Fukuyama, 1993). This technique was developed in its initial form by Charnes, et al., (1978), and has been frequently used in efficiency studies and production analysis (e.g Elyasiani, et al., 1994; Barr, et al., 1994; and Wheelock and Wilson, 1995) DEA has advantages over other frontier estimator methods. First, it deals easily with multiple input-multiple output production, and variable return to scale (VRT)[35]. Second, this non-parametric frontier is estimated using a mathematical linear programming, and is less data demanding, hence it is preferred when working with small samples.[36] [Parametric frontiers are estimated using econometric techniques that require relatively larger sample sizes in order to estimate unbiased coefficients of underlying cost/ profit function models. These have a large number of inputs, outputs, inputs or output prices, environmental factors and so on (Isik and Hassan, 2003a)]. Finally the DEA approach uses the actual sample data to derive the efficiency frontier against which each firm in the sample can be evaluated , thus it does not require any specifications of functional

---

example, financial ratios do not consider input prices and output mixs (Berger and Humphrey, 1992) and the frontier approaches provides an overall, objectively determined numerical score and a ranking (Berger and Humphrey, 1997), where the selection of the weights of financial ratios is subjective. Additionally, such approach can accommodate multiple inputs and multiple outputs and the results are all inclusive (Thanassoulis et al., 1996). Furthermore Rees (1995) addresses the effect of the use of accounting data that may exaggerate the limitation of accounting statements, the effect of accounting policies and practices, and technical issue related to negative numbers and small divisors.

[35] For disadvantages of DEA see Yilderim (2002).

[36] Particularly, it is a useful method in our study because the population size of the Jordanian banking system is relatively small. Although, this study covers all types of banks operating in the Jordanian banking sector and no discrimination is made between different forms of banks in the sector. This procedure is consistent with Altunbas's et al.., (1994) analysis, who study all types of banks operating in the same market.

form, which is ideal (we would suggest) for most emerging markets banking institutions because although some banks operate a fairly typical intermediation service, others offer a wider range of services and these characteristics make the specification of a production function difficult and fraught with the probability of using an incorrect functional form (Kirkwood and Nahm, 2006).

It is important to mention here that the potential of data error, often noted as a shortcoming of DEA (Mester, 1996), is minimized here as this study employs only audited data extracted from the respective banks' annual reports. Moreover, given that the main purpose of this study is to estimate the overall effect of efficiency scores on bank valuation rather than detecting the sources of inefficiency, the overall cost efficiency estimates will be used in this study rather than its components (allocative and technical efficiency using the DEA technique[37]). In addition, cost efficiency has been chosen here because cost control is a prerequisite and necessary condition to maximize shareholders' value (see Sinkey 1998), and the bank managers have more control over costs rather than outputs (Goddard et al., 2001).

DEA measures efficiency by estimating a non-stochastic envelopment frontier over the data points that lie on or below the frontier. Thus, the frontier represents the set of best practice observations for which no other unit or linear combination of units employs as little or less of every input without changing the output quantities (input oriented efficiency frontier) or produces as much or more of every output without altering the input quantities used (output oriented efficiency frontier). The DEA input orientated models are chosen in the present study because cost minimization or reduction is assumed (Golany and Roll, 1989). Therefore, this study will use an input oriented DEA technique to measure the efficiency scores of the Jordanian banks in the sample. In addition, the DEA approach has been used because, as argued by Seiford and Thrall (1990), the kind of mathematical programming procedure used by DEA for efficient frontier estimation is comparatively robust.

One has to make an assumption about the bank production process before efficiency can be estimated. Humphrey (1985) distinguishes two alternative approaches to the

[37] Berger et al., (1993) find that banks inefficiency is technical in nature rather than allocative. Hence authors, in the banking studies like: Altunbas et al., (2000) and Mester (1993), do not decompose the x efficiency measures.

definition of banks input and outputs: the production approach and the transaction (intermediation) approach. According to the production approach, banks are considered to produce deposits and loans using capital, labour and materials. The number of deposits and loans accounts is the appropriate measure of output, and only operating costs are taken into account. On the other hand, the transaction approach assumes that banks collect funds, deposits and purchased funds, and intermediate these funds into loans and other assets[38]. This study will adopt the intermediation approach, originally developed by Sealey and Lindley (1977). Consequently, this study views banks as intermediating between agents with surplus funds (depositors) and agents with deficit funds (borrowers) because, as noted by Ferrier and Lovell (1990), the intermediation approach is more closely connected with the overall costs of banking.[39]

For our estimation of cost efficiency we choose three outputs: total loans, securities and all other earning assets, and off balance sheet items proxied as non interest income (fee based income and cotangent liabilities). We include the latter measure of non-traditional banking output because, as noted by Clark and Siems (2002), omission of off-balance sheet activity from output is likely to result in understated measures of firm efficiency, as total bank output would tend to be underestimated (Jagtiani and Khanthavit, 1996).

In accordance with Aly et al., (1990) the inputs should we use in an estimation of bank efficiency include bank deposits, labour and capital. Hence, we choose three inputs: deposits (including: customer deposits, other banks deposits, notes and debenture, and other borrowed funds), capital (fixed assets) and labour (employee personal expenses). The prices for the inputs were calculated as follows: the price of interest bearing liabilities W_1, equals total interest expenses of time and saving deposits and all other loanable funds divided by loanable funds (borrowed funds), the price of capital, W_2, is equal to operating expenses (excluding employees expense) divided by total assets, and finally the labour price input, W_3, is equal to labor expenses divided by total assets (including capitalized leases).

[38] It should be noted that the definition and measurement of bank inputs and outputs has long been debated by researchers, for more discussion see Molyneux and Iqbal (2005).
[39] As discussed by Berger and Mester (1997), the transaction approach (intermediation) is most often used because it is easier in terms of data availability, and because it relates specifically measuring the cost of intermediating deposits to the receivers of loans. This mentioned reason encouraged the majority of banking studies to use the intermediation approach (Molyneux and Iqbal, 2005).

following Kirkwood and Nahm (2004) we estimate our DEA efficiency measure as follows, considering a group of i banks (i=1,....N) that produce M outputs using K inputs, the input-oriented DEA model to measure the cost efficiency for bank J can be estimated as follows:

Minimize $w_i'z_i$ (over z_i and λ)

Subject to

$$
\begin{aligned}
& y_i - Y\lambda \le 0_m, \\
& -z_i + X\lambda \le 0_k, \\
& N1'\lambda = 1, \\
& z_i \ge 0_k \ and \\
& \lambda \ge 0_N
\end{aligned}
$$

Where, Y is an (M* N) matrix of actual quantities of M outputs by N banks, y_i is an (M*1) vector of the output quantities actually produced by bank i, which is the ith column of Y,X is a (K* N) and is a matrix of used quantities of K inputs by used quantities of K inputs by N bank, x_i is a (K*1) vector of the input quantities actually used by bank i, which is the i th column of X, z_i is a (K*1) vector of optimal quantities of input prices, and λ is an (N*1) vector of constants whose optimal values are to be found together with z_i, N1 is an (N*1) vector of ones and 0_M, 0_K, 0_N are null vectors of order M,K, and N, respectively. The objective function $w_i'z_i$ represents the minimum cost that bank i could achieve in producing the output quantities y_i if it were as efficient as its peers (best practice in the sample). The actual cost incurred in producing y_i is $w_i'x_i$.

So cost efficiency can be measured as follows:

$$CE=\frac{w_i'z_i}{w_i'x_i}$$

The cost efficiency score will be a value ranging between 0 and one and will never be a negative value. To compare the cost efficiency estimates derived from DEA estimates with standard accounting measures we will also use the cost-to-income ratio to test for robustness so as to see which measure has greater value relevance. The cost income ratio is simply, the ratio of all operating income (including interest income, non-interest income, and other income) to all operating costs (including interest expenses, non-interest expenses and other expenses).

Instead of estimating a common frontier across time, we construct twelve separate annual efficiency frontiers, one for each year under study, to account for the changes in the macroeconomy and marketplace over time. Constructing an annual frontier specific to each year t is more flexible and thus more appropriate than estimating a single multi-year frontier for the banks in sample (DeYoung and Hasan, 1998)

5. Results

5.1 Cost efficiency

The first set of the results pertains to the estimation of the bank cost efficiency scores. Table 3.1 shows the average cost efficiency scores calculated based on the DEA approach. The table also presents the accounting efficiency measure (cost-income ratio calculated as total cost to total income). Over the sample period 1993 to 2004 the average banks' cost efficiency scores range between 61.9% and 83.3% with an average value of 73.5%. Our results appear to be consistent with previous studies. For example, Berger and Humphrey (1997) summarise over 120 studies in banking and found an average cost efficiency of 79%. Distinguishing between parametric and non-parametric studies, the authors found on average that cost efficiency amounted to 72%[40], based on non-parametric efficiency analysis.

Moreover, Berger and Humphrey (1997) defined a sort of confidence interval formed by the mean plus and minus one standard deviation (between 66% and 92%) that captured 82% of the observations summarised in their study. Looking at our findings, most of our annual mean levels estimated using DEA (Table 3.1) are inside the interval estimated by Berger and Humphrey (1997). However, comparing our results to more recent studies, our cost efficiency estimates are lower than those estimated by Luo (2003) for US banks (88%), Maudos and Pastor (2003) average cost efficiency of Spanish banks (90%), and Kirkwood and Nahm (2006) for Australian banks (between 86 % and 98%).

On average, Jordanian banks can save nearly 26.5% (1-73.5%) of their total costs compared to the best practice frontier without decreasing their outputs. This result suggests that the same level of outputs could be produced with approximately 74% of current inputs if the banks under study were operating at their most efficient level.

[40] This mean value mostly account for technical efficiency levels.

Table 3.1

Average Cost Efficiency Scores for All Banks in the Sample

Year	Average cost efficiency Scores [1]	Cost Income Ratio [3]
1993	0.746	0.589
	(0.237)[4]	(0.219)
1994	0.733	0. 759
	(0.229)	(0.591)
1995	0.773	0.715
	(0.203)	(0.356)
1996	0.619	0.652
	(0.211)	(0.251)
1997	0.688	0.640
	(0.191)	(0.272)
1998	0.685	0.675
	(0.210)	(0.279)
1999	0.714	0.662
	(0.227)	(0.350)
2000	0.789	0.671
	(0.161)	(0.280)
2001	0.754	0.548
	(0.165)	(0.168)
2002	0.763	0.588
	(0.161)	(0.209)
2003	0.721	0.611
	(0.185)	(0.391)
2004	0.833	0.510
	(0.261)	(0.206)
Average 1993-2004[2]	0.735	0.636
	(0.204)	(0.313)

Notes:
1Cost efficiency scores are calculated by the DEA input oriented methodology, using the DEAP 2.1 computer programme from Coelli (1996).
2 16 banks were included to estimate the best practice frontier on a yearly bases.
3 Cost Income ratios are calculated as all operating costs including interest and non interest income as will as other expenses divided by all operating income including interest and non interest income and other income.
4 Standard deviations are in parentheses

In spite of the assumed negative effect of economic instability on bank efficiency (see for example Yildirim, 2002), Jordanian banks obtained relatively high efficiency between1993 to 2004 recording its highest level in 2004 at 83%[41]. This result is consistent with Al-Jarrah and Molyneux (2003) who found that the average cost efficiency in Jordanian banks between 1992 and 2000 averaged 89%, and Isik et al, (2005) found that it amounted to just fewer than 90% during 1991 and 2001. This level of cost efficiency in Jordanian banks during our period may due to the implementation

[41] During this time period the region faced the first and second Iraqi war. These two wars affected the economy mainly because Jordan is not an oil producer and depended heavily on the subsidized oil supply from Iraq (See Al Jarrah and Molyneux, 2003).

of economic and financial reforms which helped banks improve their efficiency and reduce their deviation from the best practice frontier.

The standard deviation of the DEA cost efficiency scores varies from year to year during the study period. The yearly standard deviation of efficiency scores within ranged between 62% and 83%; reaching its highest variation in 2004. This result suggests that Jordanian banks witnessed an efficiency gap within their operations. On the other hand, the average cost income ratio calculated during our sample period had a higher standard deviation, 31.3%. Average cost income ratios fell in the range between 51% and 76%. The lowest deviation was achieved in 2004 consistent with the DEA score. This level of cost income ratio seems not to be very far from the benchmark suggested by Salomon Brothers (1993) of 50-55%. The high variations between banks appear to relate to the different size of bank.

5.2. Descriptive Statistics

In this section, we present the descriptive statistics for the variables used in the empirical models developed in section 4. Table 3.2 presents the values for the variable included in the models. The market value per share variable tends to exceed the book value per share widely during the sample period. The average market value stands at 10.395 JD compares with 2.36 JD for the book value per share. By comparison, we can say that the standard deviation of the market value (29.56) is noticeably more than the standard deviation of the book value (3). This gap between the two values suggests that the classical accounting bank valuation model should include other relevant variables which may help explain the gap and provide a better explanation of bank market value. In this study the efficiency scores are included in the valuation model as "other" information. The average efficiency scores during the sample period are around 73.5% ranging between the minimum and maximum values of 8.54% and 100%, respectively, with a variation equal to 19.54%. Consistent with our results (Table 3.2), the accounting cost income ratio witnesses a higher standard deviation equal to 31%.

Comparing the two types of expenses, it is obvious that operating income exhibited variation over our sample period equal to 2.57, whereas the standard deviation of net income is only equal to 0.43. The different levels of standard deviation values between the NI and the OI may indicate the income smoothing of net income streams practice by

Jordanian banks, who may have been motivated to reduce the banks' risk and cost of capital (Liu et al., 1997).

Table 3.2

Descriptive Statistics for the Main Variables Used in the Study

Variable	Mean	St.Dev	Minimum	Maximum
MV	10.3950	29.5578	0.320	177.72
BV	2.3649	3.0029	-1.7990	16.3640
C/I %	62.96	31.00	17.81	257.14
Eff %	73.50	19.45	8.54	1.000
OI	2.0084	2.5661	0.1116	16.0881
OEX	1.2161	1.8382	0.0211	11.9423
OTHER	0.7923	0.7952	0.0905	4.3286
NI	0.2377	0.4256	-0.4534	2.4467
LLPR	0.0153	0.1740	0.0005	0.1463
Z	146.825	.7848	8.6670	354.02

Notes:
1- Variables are defined as follows:
MV is the market value per share.
BV is the book value per share.
C/I %is the cost income ratio.
Eff %is the relative cost efficiency score.
OI is the operating income per share generated by the bank during the year.
OEX is the operating expenses per share generated by the bank during the year.
OTHR is the other expenses per share generated by the bank during the year.
NI is the net income per share generated by the bank during the year.
LLPR is the loan loss provision ratio.

Z score index value calculated as $$Z = \frac{\sum_{j=1}^{12} \pi_j / A_j + \sum_{j=1}^{12} \frac{E_j}{A_j}}{S_r}$$

Where π j is the estimated market value of total profits that can be calculated as follows:, $\pi_j = c_j p_j - c_{j-1} p_{j=1}$

Where c_j is the number of outstanding shares adjusted for stock splits, and p_j is the share price of the last business day of month j. Ej is the market value of total equity (e.g. share prices multiplied by number of shares outstanding); A_j is the market value of total assets: $A_j = E_j + L$, and L is the book value of total debt at the end of each fiscal year. And Sr is the estimated standard deviation of π_j / A_j

2- The net income and net income components are calculated as a per share numbers to avoid small coefficient values. As argued by Ramanathan (2002) the regression coefficients and the corresponding standard errors will be affected but the significance of the variable as well as all other statistics will be unchanged because of variables scaling

The two measures of risks (credit risk and insolvency risk) have a noticeable difference in their variations. The credit risk measure (LLP ratio) which records an average value of 1% during the sample period and varies between (.05% and 14.65%) with standard deviation around 17.4 %[42], and the Z-score has an average value of 146.82 with standard deviation of 78.49%. This different level of standard deviation between the two risk measures may indicate that whereas the Jordanian banks might use quite similar methods in managing their credit risk and estimating their loan-loss provisions

[42] We may say that this level of loan loss provision ratio is not very high in comparison with other studies. For example Eng and Nabar (2007) find the loan loss provision to be 7.7% for Malaysia and Singapore for their overall study period from 1998 to 2000, and 6% in the non crisis period.

they vary a lot with regard to their insolvency. Comparing our sample mean value for the Z-score with other studies that have used the same method, we can say the Z-score for Jordanian banks value is quite high. For example, Yasuda at al., (2004) estimate an average Z-score value for Japanese banks during 1990s between 8.91 % and 17.63 %. In addition, Konishi and Yasuda (2004) found that the Z-score ranged between 14.64% and 18.79%, the same time period.

5.3. Correlation Analysis

To investigate the preliminary relationship between market value and the other variables, we present a correlation matrix in Table 3.3. This table shows the correlation patterns of the relationships among market value and the financial and non-financial measures. Clearly, the market value is significantly correlated with the efficiency scores and the cost-income ratio, net income, operating income, and other operating expenses.

The accounting and economic measures of efficiency are negatively and significantly correlated. This result is not surprising given that banks with higher costs attain lower cost X-efficiency. More importantly for our study, and consistent with our assumptions, from Table 3.3 we can infer that a significant correlation occurs between market value and banks' cost efficiency. Positive and significant relationship (5% significance level) exists for relative efficiency measure. However, cost income ratio seems to negatively affect banks market value. This result perhaps is not surprising given the focus of management on minimizing cost in order to improve bank market value. Additionally, the risk variables show a significant association with the efficiency estimates.

Loan-loss provision announcements are treated as good news in the market. Although banks share prices and loan-loss provision ratios are positively correlated, this correlation was not supported with statistical significance. On the other hand, the insolvency risk measure (Z-score), is negatively correlated banks stock prices which may indicate that investors in the market cannot sufficiently assess the insolvency of banks, and the most important consideration in their stock selection is short-term profitability because higher insolvency risk is not reflected in the market as a higher cost of capital, instead, investors continue to demand bank stock even if its insolvency risk increases.

Table 3.3

Correlation Matrix: Market and Book Values and the Financial and Non Financial Variables Included in the Models

	MV	BV	C/I	EFF	OE	NOEX	OI	NI	Z score
BV	-0.088								
	(0.250)								
C/I	-0.152	0.754							
	(0.047)	(0.000)							
EFF	0.175	0.054	-0.635						
	(0.02)	(0.477)	(0.000)						
OTHER	0.205	0.289	0.088	-0.074					
	(0.007)	(0.000)	(0.248)	(0.336)					
OE	0.116	0.390	0.358	-0.024	0.747				
	(0.129)	(0.000)	(0.070)	(0.754)	(0.000)				
OI	0.228	0.192	-0.158	0.025	0.862	0.896			
	(0.003)	(0.012)	(0.037)	(0.740)	(0.000)	(0.000)			
NI	0.186	-0.595	-0.590	0.045	-0.321	-0.122	0650		
	(0.014)	(0.000)	(0.000)	(0.561)	(0.000)	(0.000)	(0.002)		
Z -score	-0.1839	0.199	0.479	0.5347	-0.003	0.119	0.088	0.123	
	(0.023)	(0.009)	(0.009)	(0.0 07)	(0.968)	(0.120)	(0.252)	(0.106)	
LLP	0.0124	0.420	0.287	0.236	0.447	0.428	0.095	-0.608	-0.010
	(0.831)	(0.000)	(0.000)	(0.002)	(0.041)	(0.000)	(0.212)	(0.00)	(0.893)

Notes:
- See Table 3. 2 for variables definition.
The values between brackets are the p values.
- In each cell in the table the upper value is the Pearson product moment correlation coefficient which measures the degree of linear relationship between two variables. The correlation coefficient assumes a value between -1 and +1. If one variable tends to increase as the other decreases, the correlation coefficient is negative. Conversely, if the two variables tend to increase together the correlation coefficient is positive. For a two-tailed test of the correlation p value (the value between brackets to test the following hypotheses: H_0: $r = 0$ versus H_1: $r \neq 0$ where r is the correlation between a pair of variables.

Furthermore, banks' operating income and net income are positively and significantly related to banks' market value, indicating that more profitable banks have higher market values. Additionally, where operating expenses are not significantly correlated with market values, other operating expenses, including research and developments and depreciation expenses, are positively correlated with market value. Additionally, the banks operating income is positively and significantly correlated with each of the expense components indicating that higher realized operating expenses are associated with the ability of the banks to generating more operating income. One would expect that higher operating expenses (mainly interest expenses) are associated with improvement in deposits level and hence a greater ability of bank loans to grow investments and therefore operating income (interest income). On the other hand, the more the non-operating expenses, such as research and development and other administrative expenses, the higher the future income.

5.4. Empirical Results

In this section, we estimate the models outlined in section 4. For each model, the selection of the most appropriate pooling procedure is documented based on the techniques discussed in the methodology section[43]. Tables 3.4 to 3.6 present the estimated coefficients and standard errors of the valuation models. The dependent variable is specified as the market to book value in each of these models.

5.4.1. Net Income and Net Income Components Models

The regression results of models 1 and 2 are presented in Table 3.4. Where net income and book values are included in model 1 as independent variables, in model 2 net income is replaced by the three components of income (operating income, operating expenses, and other expenses). The results indicate that the net income coefficient (1.49) is statistically significant at the 5% level; suggesting that market value is significantly associated with net income. This means that net income in its aggregate level contributes to explaining the difference between market and book values. The explanatory power of this model equals 13% as indicated by the adjusted R^2 value[44,45].

However, when net income is decomposed into its components (model 2), the overall explanatory power of the model increases substantially. The explanatory power of this model is higher compared with the aggregate net income model, as indicated by the adjusted R^2 values of 21.14% versus 13.82%. This explanatory power enhancement exists because net income comprises various accounting items and mixes too much information together (Liang and Li Yao, 2005).

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[43] In general, there is a consistency in the signs and significances of the estimated coefficients for all the pooling techniques (common, fixed, or random effect).

[44] R-squared coefficient allows one to evaluate the proportion of the variability of the dependent variable that is explained by the selected explanatory variables. This coefficient ranges between 0 and 1 and the closer the model is to 1, the greater the explanatory power. The adjusted coefficient of determination (or adjusted R^2) is expressed as:

$$\text{adj.}R^2 = \frac{(n-1)R^2 - p}{n-p-1}$$

Where n is the number of observations and p the number of explanatory variables.

[45] The explanatory power of other studies which examine the value relevance of earnings, vary greatly where some studies found that R^2 is low (e.g. Liang and Yao, (2005) found this ratio to be nearly 6% for electronic industry firms, and Trueman et al., (2000) recorded R^2 for earnings model equal 3% in internet firms), some banking studies found quit high explanatory power of earnings (e.g. Kohlbeck. 2004 found that value relevance of earnings is around 50%).

Table 3.4

Regression Results for the Difference between Market and Book Values Based on Net Income and Net Income Components

Model 1: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \varepsilon_{jt}$

Model 2: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OP_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHER_{jt} + \varepsilon_{jt}$

Model	(1)	(2)
BV	.7500+	.4793
	.3654	.4148
NI/BV	1.4915+	
	.6623	
OI		2.233 *
		.6992
OEXP		.0233
		.0780
OTHER		-3.9212*
		.8784
F	4.26	4.57
(P- value)	(0.00)	(0.00)
R^2	.218	.294
Adj. R^2	0.1382	0.2114
LM	7.33	10.50
(P- value)	(0.00)	(0.00)
HT	4.46	9.33
(P- value)	(.09)	(.05)
Estimation	FE	FE

Notes:
- In each model the dependent variable is the market book value.
-See Table 3.3 for variable definition.
- In each model the first value is the estimated coefficient, and the second is the standard errors.
-*, +, † indicate significance at the 1%, 5%, 10% levels, respectively.
-LM is the Lagranger Multiplier, this test originally created by Breusch and Pagan (1980) based on OLS residuals. This test is used in this study to compare between pooled regression and random effect model based on Maximum Likelihood estimation under the null hypothesis the efficient estimators is pooled least Square.
- FE is the Fixed Effects model; RE is the Random Effects model. The F statistic and Adjusted R2 for the valuation models assume the fixed effects in the pooled data. The F-statistic tests the hypothesis that all of the slope coefficients (excluding the intercept) in a regression are zero.
HT is Hausman Test to choose between a fixed or random effects specification. The null hypothesis is that both the fixed and random specifications are consistent and the alternative hypothesis is that fixed effect is better estimator than Random effect.
- Values between brackets are p- values.

Regarding the coefficients of the net income components, although operating income and operating expenses have positive coefficients (2.2 and 0.02, respectively), only operating income coefficient seems to be significant in the valuation of Jordanian banks at the 1% significance level. On the other hand, operating expenses do not provide any important signaling for market valuation. This might be because investors believe that this type of information is already incorporated in the net income value. The other operating expenses coefficient looks relatively high (3.9) and suggests that this variable is relatively important in providing information to the market about the future earnings of banks. Although, other operating expenses (including administrative expenses, research and development expenses, and marketing expenses) would be expected to influence market values of banks, it appears that investors in Jordanian banks assume that theses expenses reduce value. This could be because investors believe less attention is being paid by managers to core business areas[46, 47].

From the first and second models we can accept the first two alternative hypotheses and agree that net income can provide investors in the Amman Stock Exchange (ASE) approximate prediction ability of the trend of bank's stock prices as it does explain differences between bank market and book values. However, if investors only place emphasis on the bottom line net income they will then ignore the important implications hiding behind a large number of other accounting components which can improve the predictive ability about future earnings. This result is consistent with Easton (1989) and Giner and Reverte (1999) who note that accounting earnings are not the only potentially relevant data that accounting systems produce. In addition, this result is in line with many studies relating to the earnings disaggregation literature e.g., Lipe, (1986), and Ballas (1996). Hence, earnings components convey information and are complementary to that provided by aggregate earnings because such information enables investors in emerging markets to evaluate contributions made by individual earnings components to the firm's overall market value.

5.4.2 Net Income, Efficiency, and Other Variables

As argued by Kohlbeck (2004), the value relevance of net income does not mean that accounting information is the only information that can be used to value securities, investors and analysts may use other information sources. In the case of Jordan, the result of using the other information is tested through models 3 to 8 and presented in Table 3.5.

The first two columns of Table 3.5 show the results of model 3 and 4 when the two types of risk (credit and insolvency risk) have been added to the net income model (model 1). Credit risk is calculated by the loan-loss provisions ratio. The coefficient of

[46] Administrative and sales expenses are expenses which are associated with developments of financial products to meet customer demand. In order to implement the banks' future plans and vision, banks need to spend more on research and development and employ researchers with specialized financial knowledge in order to develop products that meet the particular demands of individuals..

[47] This variable is included as other operating expenses in aggregate terms instead of more detailed expenses because of the lack of comprehensive data for all banks in the sample, especially in the early years.

credit risk ratio (9.4) tends to have a positive and significant relationship with market value at the 5% level. This result is consistent with Beaver et al., (1989, p158) who suggest that an increase in LLP can indicate that "management perceives the earnings power of the bank to be sufficiently strong that it can withstand a 'hit to earnings' in the form of additional loan-loss provisions". Similarly, Liu and Ryan (1995) as well as Wahlen (1994) provide evidence that LLP contain only "good news" components.

On the other hand, the coefficient of insolvency risk that is estimated using the Z-score index is negative (-.006) and significantly affects market value at the 1% level. This result is quite surprising, because one would expect that the more the insolvency risk (indicated by lower values of our estimated Z-score) the less the market price. As argued by Clark (1996), a more risky collection of projects will require a higher expected return on the comparable financial securities and therefore a higher cost of capital. Recall the main definition of the fair value of a bank in the market, as the present value of expected future cash flows. Investors, or more generally the stakeholders, need to estimate the future benefits of acquiring a stock, also they have to use appropriate discount factors (the cost of capital rate or the opportunity cost rate) in order to reach the best estimation of fair value. Usually, the cost of capital (or the required rate of return) is the discount rate that is used to estimate the market value of the firm and investors suppose that the higher the risk the more the required the rate of return should be. In view of the fact that the Z-score measures the number of standard deviations below the mean by which market profits must fall in order to eliminate equity (Boyd et al, 1993), then the higher the Z- score value the lower is the bank insolvency risk and the lower the expected return in this case the more the expected market value of the bank.

However, it still remains a question to be answered: why insolvency risk is negatively and significantly associated with the market value. Two reasons may be given to explain this negative relationship between the Z-score and market prices. The first reason is that the ability of investors in emerging markets to assess the insolvency risk of banks is questionable. The second explanation is that although banks' shareholders have much to lose if a bank becomes insolvent, speculators still can earn short-term capital gains from investing in insolvent bank stocks which may raise the market value of such stocks irrespective of their performance. Based on this result reported in Table 3.5, we can conclude that under the net income model, the Z-score provides an additional 2.2% (based on adjusted R^2 values reported in Tables 3.4 and 3.5) of explanatory power while the percentage for the incremental explanatory power of loan-loss provisions provides additional explanation close to only 1%.

Table 3.5

Regression Results for the Difference between Market and Book Values Based on Net Income, Efficiency, and other Variables

Model 3: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 LLPR_{jt} + \varepsilon_{jt}$

Model 4: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 Z_{jt} + \varepsilon_{jt}$

Model 5: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_5 Eff_{jt} + \varepsilon_{jt}$

Model 6: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_{31} LLPR_{jt} + \alpha_{42} Eff_{jt} + \varepsilon_{jt}$

Model 7: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 Eff_{jt} + \alpha_4 Z_{jt} + \varepsilon_{jt}$

Model 8: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \beta_1 LLPR_{jt} + \beta_2 Z_{jt} + \beta_4 Eff_{jt} + \varepsilon_{jt}$

Model	(3)	(4)	(5)	(6)	(7)	(8)
BV	.4223+	.9109*	.1123*	-1.4328*	-.5113	-.6733
	.2110	.2784	.0288	.5493	.5724	.5560
NI	3.1787*	2.1317*	1.9814 *	2.495*	1.8698*	3.2950*
	.7150	.6229	.5576	.7392	.6291	.7323
LLPR	9.3678+			11.4126*		13.8737*
	3.928			4.0956		3.958
Z		-.00589*			-.00598	-.00686*
		.00168			.0016	. 0017
Eff			.89026*	1.8361*	1.4546*	1.6512*
			.2164	.5397	.5315	.5175
F	2.76	3.24	2.86	2.76	3.09	3.33
P-Value	(.0000)	(.0000)	(.0003)	(.0003)	(.0001)	(.0000)
R^2	.232	.2619	.2487	.2436	.2654	.292
Adj. R^2	.1479	.1800	.1600	.155	.179	.204
LM	1.57	3.86	.08	.43	.27	.09
(P-Value)	(.2104)	(.0495)	(.7728)	(.5116)	(.6005)	(.7689)
HT	6.14	5.97	6.89	5.28	10.32	7.65
(P-Value)	(.1051)	(.1129)	(.0755)	(.2602)	(.0353)	(17.69)
Estimation method	OLS	RE	OLS	OLS	OLS	OLS

Notes:

- In all models the dependent variable is the market book value.
- In each model the first value is the estimated coefficient, and the second is the standard errors
-*, +, † indicate significance at the 1%, 5%, 10% levels, respectively.
-LM is the Lagrange Multiplier, this test originally created by Breusch and Pagan (1980) based on OLS residuals. This test is used in this study to compare between pooled regression and random effect model based on Maximum Likelihood estimation under the null hypothesis the efficient estimators is pooled least Square.
- FE is the Fixed Effect model; RE is the random effect model and OLS is the Ordinary Least Square Model. For comparison reason, the F statistic and Adjusted R^2 for the valuation models assume the fixed effects in the pooled data.
- HT is Hausman Test to choose between a fixed or random effects specification. The null hypothesis is that both the fixed and random specifications are consistent and the alternative hypothesis is that fixed effect is better estimator than Random effect. Values between brackets are p- values.

Column 5 in Table 3.5 presents the results of the relationship between the cost efficiency measures and market value. The evidence here is consistent with our claim that bank cost efficiency significantly affects bank market value and helps partly explain the gap between market and book values. When the DEA efficiency scores are used as explanatory variables, the coefficient of the efficiency scores (0.89) is positively and significantly affect banks market value at the 5% significance level. In addition, it provides around 2.3% incremental information to the net income model (model 1). This result is inline with previous studies that indicate that stocks of efficient banks tend to perform better than their inefficient counterparties in the stock market (Beccali et al., 2006; Kirkwood and Nahm, 2006). The implications of these results are that more efficient banks with superior management shelter banks from unexpected profit shocks (see Baele et al, 2007). Accordingly, investors would demand less compensation for such behaviour. Improvements in bank cost efficiency appear to be reflected in banks market value. Senior managers and investors (as well as regulators) should note that improvements in bank efficiency feed through the improvements in the valuation process.

Based on the results of models 6 to 8 in Table 3.5, the importance of efficiency exists even when each type of risk (LLP ratio and Z-score) are included in our models. The explanatory power reaches its highest level when all variables are included together, as expected, and the adjusted R^2 equals to 20.4%. This is followed by the model which includes jointly the Z-scores and efficiency scores (both deflated by book value in model 7), that have an adjusted R^2 equals to 17.9 %. These results indicate that the two variables contribute to explaining the differences between book and market values.

Overall, efficient banks are more capable in attaining a minimum operating cost and these banks are likely to benefit from improvements in market value. From the former results we can accept the two alternative hypotheses three and four that efficiency measures are important in explaining the gap between market and book values and it stay significant even after controlling for risk. We can conclude that if only the aggregate financial performance measurement (net income) is considered, the explanatory power of the valuation model decreases.

5.4.3 Net Income Components, Efficiency, and Other Variables

The regression results of the net income components models are presented in Table 3.6 It can be observed from models 9 and 10 that the relationship between LLP ratio and market value is not statistically significant when net income has been disaggregated into its components. However, Z-score significantly affect market value at the 1% significance level

More importantly, the test results for the incremental information of the efficiency scores over the net income components are illustrated in Table 3.6 (model 11). The coefficient of efficiency scores (0.90) has a significant relationship with the market value at the 1% significance level. Net income components are significantly related to market value. Looking at model 11 in Table 3.6 we can observe that adding the bank cost efficiency measure to the valuation model improves the explanatory power of the models slightly by around 2%. Additionally, inferences regarding the efficiency scores seem to hold significant after considering the additional risk variables. In models 12, 13 and 14)

In essence, our efficiency measure is value relevant with respect to bank market value in both the aggregate net income and the income components models. This conclusion supports the fifth alternative hypothesis. While this paper does not specifically address whether efficiency scores should be recognized or disclosed in financial statements, the result supports the call for greater emphasis on bank efficiency measures as a driver of bank value.

Furthermore, we examine whether the unconstrained valuation models which include the efficiency scores are superior to each of the two constrained valuation models (net income or net income components). The incremental information of the cost efficiency measures in the net income model (model 5, Table 3.5) is tested using the F test in equation (19). The results of this test rejects the null hypothesis that the unconstrained efficiency model is not superior ($F= 6.64 \sim F^{0.05}_{1,170}$). Likewise, the F test rejects the same null hypothesis for model 11 in Table 3.6 where the efficiency has been included in the net income components model ($F= 5.21 \sim F^{0.05}_{1,170}$). Therefore, this conclusion supports the sixth alternative hypothesis.

Table 3.6

Regression Results for the Difference between Market and Book Values Based on Net Income, Efficiency, and other Variables:

Model 9: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \beta_1 LLPR_{jt} + \varepsilon_{jt}$

Model 10: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \beta_1 Z_{jt} + \varepsilon_{jt}$

Model 11: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \beta_1 Eff_{jt} + \varepsilon_{jt}$

Model 12: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \beta_1 LLPR_{jt} + \beta_2 Eff_{jt} + \varepsilon_{jt}$

Model 13: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \alpha_{51} Eff_{jt} + \alpha_6 Z_{jt} + \varepsilon_{jt}$

ModeL 14: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHEXP_{jt} + \alpha_{51} LLPR_{jt} + \alpha_6 Z_{jt} + \alpha_6 Eff_{jt} + \varepsilon_{jt}$

Model	(9)	(10)	(11)	(12)	(13)	(14)
BV	.4993 .4221	.8306+ .4181	.1298* .0284	-1.7478* .5537	.1055* .0287	-.9972† .5694
OI	2.3568* .8283	2.7458* .6985	2.5551* .5583	2.4193* .7247	2.6596* 5443	3.1510* .7245
OEXP	.4676 1.0248	-.1262 .7665	-.8751 .6126	-.9963 .8703	-1.0552† .5989	-1.9685+ 0.8771
OTHER	-4.0294* .9614	-4.3725* .8655	-3.5395* .6975	-3.286* .8029	-3.5624* .6788	-3.8470* .7874
LLP	1.2610 4.4811			7.7047* 4.2739		10.4010+ 4.1767
Z score		-.0052* .0017			-.0049* .0016	-.0062* .0016
EFF			.9006* .2083	2.0912* .5392	1.1992* .2231	1.8730* .5224
F **(P-Value)**	3.36 (.0000)	4.10 (.0000)	3.71 (.0000)	3.48 (.0000)	4.14 (.0000)	3.98 (.0000)
$\mathbf{R^2}$	.294	.337	.315	.313	.352	.356
Adj. $\mathbf{R^2}$	.206	.255	.230	.223	.268	.267
LM **(P-Value)**	7.78 (.0052)	6.88 (.0087)	0.13 (71844)	2.30 (0.1292)	.03 . (0.8659)	.59 (0.4420)
HT **(P-Value)**	11.10 (.0495)	13.38 (.0201)	12.17 (.0325)	8.83 (0.1823)	12.53 (.0511)	13.57 (.0594)
Estimation method	FE	FE	OLS	OLS	OLS	OLS

Notes:
- In each model the dependent variable is the market book value.
-See Table 3.3 for variables definition.
- In each model the first value is the estimated coefficient, and the second is the standard errors for each variable included.
-*, +, † indicate significance at the 1%, 5%, 10% levels, respectively.
-LM is the Lagrange Multiplier. This test originally created by Breusch and Pagan (1980) based on OLS residuals. This test is used in this study to compare between pooled regression and random effect model based on Maximum Likelihood estimation under the null hypothesis the efficient estimators is pooled least Squares.
-FE is the Fixed Effect model; RE is the random effect model and OLS is the Ordinary Least Square Model. For comparison reason, the F statistic and Adjusted R^2 for the valuation models assume the fixed effects in the pooled data.
- HT is Hausman Test to choose between a fixed or random effects specification. The null hypothesis is that both the fixed and random specifications are consistent and the alternative hypothesis is that fixed effect is better estimator than Random effect.
- Values between brackets are p- values.

5.4.4. Cost Income Ratio Analysis

In order to compare between DEA bank efficiency economic measures and accounting indicator of cost efficiency in the Jordanian banking sector, we re-estimate the previous valuation models by using the cost income ratio to examine if the economic measure of efficiency dominates the accounting measure in explaining the difference between market and book values.

The results including the cost income ratio, as an alternative cost efficiency measure in the bank valuation models, are illustrated in Table 3.7. This table is divided into two parts. Part A (from columns 1 to 4) shows the results from adding this ratio to the net income model, and Part B (from columns 5 to 8) discloses the results from adding the same ratio to the net income components model. One can see that the coefficient of accounting cost income ratio (-0.78) is significant at the 5% level in the net income model (column 1 in Table 3.7), although this significancey disappeared when the cost-income ratio is included in the income components model (Column 5 in Table 3.7). The explanatory power in both cases has not improved substantially, with only slight increases in the net income model (14.17% compared with 13.82% for the net income model without adding the cost income ratio). Additionally, this modest improvement has not been supported with a significant F-test ($F= 0.693< F^{0.05}_{1,170}$). These results are not surprising. The cost-income ratio has incremental explanatory power in the net income model because the aggregate value of income may mask information regarding bank valuation which gives an opportunity to the cost income ratio to provide additional signalling regarding the future prospects of the bank. However, this ratio lacks explanatory power when it is included in the income components model because these components may give the investors more information regarding the banks operating situation. Based on the above results, our empirical findings suggest results that show that the economic measure of bank cost efficiency (DEA scores) is more important than the accounting measures (cost-income ratio) in explaining the market value of Jordanian banks. These results reveal that while accounting numbers in banks' financial statements have information content regarding bank value, non-parametric estimates of bank efficiency provide greater information content than simple accounting ratios of bank cost performance.

Table 3.7

Valuation Models with Cost Income Ratio

	A - Net Income Valuation Model				B –Income Components Valuation Model			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BV	.9165*	.6551+	1.3643*	.5220	.08457*	.09774*	.0101	.0997
	.3159	.2772	.2992	.0366	.0400	.02943	.0964	.0963
NI	1.5444*	2.0743	2.0106	2.3780*				
	.6238	.7904	.61807	.80149				
OI					1.7417 *	2.7744 *	2.5863 *	2.8210*
					.6229	.7713	.7156	.8481
OEXP					.3930	-1.3764	.55147	.23513
					.6705	.9041	.7303	.9499
OTHER					-3.0512*	-3.628*	-4.235*	-4.4283
					.7710	.8572	.8859	.9679
LLP		9.5693+		10.7948+		7.3838*		2.6097
		4.2616		4.367		4.3362		4.4988
Z score			-.0060*	-.0035+			-.00437	-.00456*
			.0017	.00169			.00165	.00170
Cost income ratio	-.7850+	-.15604	-.76925*	.26328	-.0366	.5408	.2434	.1828
	.31443	.21926	.2816	.2709	.2529	.3668	.5320	.3477
F	2.67	2.31	3.10	2.48	3.37	3.18,	3.67	3.49
(P-Value)	(.0008)	(.0037)	(.0000)	(.0001)	(.0001)	(.0000)	(.0000)	(.0000)
R^2	.227	.202	.266	.236	.2949	.295	.326	.326
Adj. R^2	.14170	.115	.181	.140	.207	.202	.236	.2333
LM	2.88	2.26	.94	1.38	6.91	1.96	5.98	5.44
(P-Value)	(.0896)	(.1326)	(.3316)	(.2393)	(.0086)	(.1615)	(.0145)	(.0197)
HT	2.28	5.31	6.95	9.20	5.16	12.39	11.70	13.65
(P-Value)	(.5169)	(.1506)	(.1387)	(.1012)	(.3972)	(.0538)	(.0689)	(.0578)
Estimation Method	RE	OLS	OLS	OLS	RE	OLS	FE	FE

Notes: - In all models the dependent variable is the market book value.

- In each model the first value is the estimated coefficient and the second is the standard errors for each variable included.

-*, +, † indicate significance at the 1%, 5%, 10% levels, respectively.

-LM is the Lagrange Multiplier,. This test originally created by Breusch and Pagan (1980) based on the OLS residuals. This test is used in this study to compare between pooled regression and random effect models based on the Maximum Likelihood estimation under the null hypothesis the efficient estimators is pooled least Squares.

- FE is the Fixed Effect model; RE is the random effect model and OLS is the Ordinary Least Square Model. For comparison reason, the F statistic and Adjusted R^2 for the valuation models assume the fixed effects in the pooled data.

- HT is Hausman Test to choose between a fixed or random effects specification. The null hypothesis is that both the fixed and random specifications are consistent and the alternative hypothesis is that fixed effect is better estimator than Random effect.

- Values between brackets are p- values.

6. Conclusions

In this paper several hypotheses have been proposed and tested concerning the value relevance of earnings, earnings components, efficiency, and risk. This study contributes to the extant valuation literature in two respects: First; instead of focusing on earnings as an aggregate number in interpreting the gap between market and book values we examine the value relevance of earnings components in bank valuation. Secondly, we analyses the gap between banks' market and book values using variables developed in the economics literature based on production theory (banks' relative cost efficiency).

This study is important, because it is one of the few studies that explicitly evaluate banking efficiency from a shareholders' perspective. In addition, it contributes to the literature that analyses the relationship between bank cost efficiency and stock performance in the banking literature. This paper follows the approach adopted by Trueman et al., (2000) (based on Ohlson, 1995) to evaluate the relation between earnings, earnings components and market value.

The cost-to-income has been traditionally used in the literature to indicate bank cost efficiency[48]. However, researchers have demonstrated that cost efficiency measures derived from parametric and non-parametric approaches have advantages over traditional accounting indicators (see Berger and Humphrey, 1997). This study advances the literature by incorporating DEA bank efficiency measures in addition to accounting measures to test whether cost efficient banks are more able to create value for shareholders.

The main findings of this paper are as follows: First, it is found that earnings and its components are value relevant and explain the gap between market and book values. Secondly, cost efficiency, as an economic performance measure, provides incremental information, not contained directly in banks financial statements, to the market. These

[48] Cost-income ratio is computed as the ratio of operating costs over operating income. This measure expresses the part of income that is residual after the company covers all operating incomes. This ratio is calculated focusing on the long-term and, consequently, extra-ordinary costs and incomes are omitted. As such, the cost-income ratio is calculated as the ratio between operating costs (defined as all interest costs, commission and fee expenses, administrative costs, personnel expenses and other operating costs) and operating incomes (defined as all interest revenues, commission and fee income, dividend earned and other operating income). A company with a higher cost-income ratio than another company achieves a low level of residual income and, as such, this company is judged less efficient. This measure has the advantage to be easy to be calculated and is intuitively simple. However, it presents some shortcomings it does not control for business mix and therefore may not be an accurate measure for comparison purposes.

results support the argument of Dutta and Reichelstein (2005) that stock prices aggregates signals received by the market and firm's accounting systems and each of these signals reflect management's unobservable efforts). Our findings regarding the positive relationship between bank efficiency and market value seem to be in concordance with the main findings reported in the literature, (e.g. Beccalli et al 2006, and Eisenbeis et al., 1999).

However, while Beccalli et al (2006) found that accounting measure of efficiency (cost-income ratios) had no influence in market returns in European banking, our study finds that in Jordanian banking investors make use of accounting-based efficiency in the valuation procedure and the cost income ratio appears to be significant in some of our valuation models[49].

Economic estimation of bank's cost efficiency is able to provide more explanatory power in the difference between market and book values of Jordanian banks, a weaker explanation can be achieved using accounting measures of bank efficiency. It is important to note here that the relation between market value and our accounting cost efficiency measure (cost income ratio) indicates that individual accounting ratios numbers do have information content regarding the bank market value for investors in emerging markets (Jordan). However, our accounting ratio of bank efficiency has less sufficient information content compared with the economic estimation of efficiency.

Moreover, credit risk, the probability that a bank's borrower does not have the ability to meet its loans obligations, seems to be positive and significant in some of our valuation models. This positive sign means that banks with lower credit risks have higher market values. We choose loan-loss provisions to measure bank credit risk because we assume that banking firm's respond to exogenous sources of credit risk by increasing their loan-loss provisions. The positive influence of banks loan-loss provision suggests that the stock market considers the way in which banks manage their credit risks. In addition, increasing loan-loss provisions appear to be interpreted as "good news" this news may

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[49] Beccalli et al., (2006) studied the effect of some accounting performance measures ROE and income cost ratio on market value without including book value in the model. In addition, they assess the value-relevance of efficiency estimates running the following model

$$R_{jt} = \beta_0 + \beta_1 E_{jt} + \varepsilon_{jt}$$

Where, R_{jt} is the raw market return of bank j at the period ending at t and E_{jt} is the annual change of efficiency estimates for bank j at the period ending at t for two consecutive periods.

indicate strength of banks future earnings (see Beaver et al., 1989, and Johnson 1989. Elliot et al., 1991; Liu and Ryan, 1995; and Wahlen, 1994).

In addition, insolvency risk is also included in our models, and this measure is estimated following Boyd et al., (1993) Z-score. We find that our measure of insolvency risk negatively affect market values. The main interpretation for this negative relationship between market value and insolvency risk suggest an inability of market investors (in the Jordanian banking sector) to accurately quantify the accurate level of bank insolvency.

The value relevance of banks' efficiency has an important implication for regulators and policy makers because it is important for regulators, especially in emerging markets, to create an environment that enhances the efficiency and stability in the banking system. Using bank efficiency as a performance evaluation measure may improve banking systems overall efficiency and stability. In addition, valuations derived from market prices can also be more accurate and timely than those derived from standard accounting sources and as such further investigation into the determinants of banks' market prices can be helpful in assessing the risk of bank failure.

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Appendix 3.1

Table 1
Value Relevance Literature Classified by Methodology and Motivation

No.	Author(s)	Journal[a]	Year	Methodology					Standard-setting motivation	
				Relative association	Incremental association	Measurement	Marginal infor. content	Inter temporal	Explicit	Implicit
1	Aboody	JAE	1996		1				1	
2	Aboody and Lev	JAR	1998		1				1	
3	Ahmed and Takeda	JAE	1995		1				1	
4	Alford, Jones, Leftwich and Zmijewski	JAR	1993	1					1	
5	Amir	AR	1993		1				1	
6	Amir	AR	1996		1				1	
7	Amir, Harris and Venuti	JAR	1993		1		1		1	
8	Amir, Kirschenheiler and Willard	CAR	1997		1	1			1	
9	Amir and Lev	JAE	1996		1		1			1
10	Anthony and Petroni	JAAF	1997		1				1	
11	Ayers	AR	1998		1				1	
12	Ballas	WP	1997		1			1	1	
13	Balsam and Lipka	AH	1998	1	1			1	1	
14	Bandyopadhyay, Hanna and Richardson	JAR	1994		1		1		1	
15	Barth	AR	1991		1	1			1	
16	Barth	AR	1994		1	1			1	
17	Barth, Beaver and Landsman	JAE	1992		1				1	
18	Barth, Beaver and Landsman	AR	1996		1				1	
19	Barth, Beaver and Stinson	AR	1991		1				1	
20	Barth, Clement, Foster and Kasznik	RAS	1998		1	1				1
21	Barth and Clinch	CAR	1996		1				1	
22	Barth and Clinch	JAR	1998		1				1	

No.	Author(s)	Journal[a]	Year	Relative association	Incremental association	Methodology Measurement	Marginal infor. content	Inter temporal	Standard-setting motivation Explicit	Implicit
23	Barth and McNichols	JAR	1994		1				1	
24	Bartov	CAR	1997		1				1	
25	Beaver, Christie and Griffin	JAE	1980				1		1	
26	Beaver and Dukes	AR	1972	1					1	
27	Biddle, Bowen and Wallace	JAE	1997	1	1				1	
28	Black	JFSA	1998		1					1
29	Bodnar and Weintrop	JAE	1997	1	1					1
30	Chan and Seow	JAE	1996	1					1	
31	Chaney and Jeter	JAAF	1994		1				1	
32	Cheng, Liu and Schaefer	AH	1997		1				1	
33	Choi, Collins and Johnson	AR	1997		1	1			1	
34	D'Souza, Jacob and Soderstrom	JAE	2000		1	1				1
35	Davis-Friday and Rivera	AH	2000		1				1	
36	Dhaliwal, Subramanyam and Trezevant	JAE	1999	1					1	
37	Eccher, Ramesh and Thiagarajan	JAE	1996		1	1			1	
38	Ely and Waymire	WP	1999		1				1	
39	Fields, Rangan and Thiagarajan	RAS	1998	1	1				1	
40	Francis and Schipper	JAR	1999					1	1	
41	Gheyara and Boatsman	JAE	1980				1		1	
42	Givoly and Hayn	AR	1992				1		1	
43	Gopalakrishnan	RQFA	1994		1				1	
44	Gopalakrishnan and Sugrue	JBFA	1993		1	1			1	
45	Graham, Lefanowicz and Petroni	WP	1998		1				1	
46	Harris, Lang and Moller	JAR	1994	1	1				1	
47	Harris and Muller	JAE	1999	1	1			1	1	
48	Harris and Ohlson	AR	1987	1	1				1	

No.	Author(s)	Journal[a]	Year	Methodology: Relative association	Methodology: Incremental association	Methodology: Measurement	Methodology: Marginal infor. content	Methodology: Inter temporal	Standard-setting motivation: Explicit	Standard-setting motivation: Implicit
49	Henning and Stock	WP	1997		1				1	
50	Hirschey, Richardson and Scholz	WP	1998		1				1	
51	Joos and Lang	JAR	1994	1				1	1	
52	Lev and Sougiannis	JAE	1996		1				1	
53	Nelson	AR	1996		1	1		1	1	
54	Petroni and Wahlen	JRI	1995		1	1			1	
55	Pope and Rees	JIFMA	1993	1	1				1	
56	Rees and Elgers	JAR	1997		1				1	
57	Rees and Stott	WP	1999		1			1	1	
58	Shevlin	AR	1991		1	1			1	
59	Venkatachalam	JAE	1996		1	1				1
60	Vincent	JFSA	1997		1	1				1
61	Vincent	JAE	1999	1	1		1		1	
62	Whisenant	WP	1998	1	1					1
	Total			15	53	13	7	7	54	8

[a]Journal abbreviations:

ABR=Accounting and Business Research
AER=American Economic Review
AFE=Applied Financial Economics
AF=Accounting and Finance
AH=Accounting Horizons
AQAFA=Advances in Quantitative Analysis of Finance and Accounting
AR=Accounting Review
BAF=Bank Accounting and Finance
CAR=Contemporary Accounting Research
FAJ=Financial Analyst Journal
FASB=Financial Accounting Standards Board
IJA=International Journal of Accounting
JAAF=Journal of Accounting, Auditing and Finance
JAE=Journal of Accounting and Economics
JAL=Journal of Accounting Literature
JAR=Journal of Accounting Research
JBF=Journal of Banking and Finance
JBFA=Journal of Business Finance and Accounting
JEB=Journal of Economics and Business
JREPM=Journal of Real Estate Portfolio Management
JFSA=Journal of Financial Statement Analysis
JIFMA=Journal of International Financial Management and Accounting
JRI=Journal of Risk and Insurance
MA=Management Accounting
RAS=Review of Accounting Studies
RQFA=Review of Quantitative Finance and Accounting
WP=Working Paper (included only if publication not found)

Source: Holthausen and Watts (2001, p. 8-9)

Table 2

Studies of the Efficiency of Banks up to 1997

Application:	Country:	Method:	Authors:
Inform Government Policy:			
Deregulation, financial disruption	Norway	DEA	Berg, Forsund and Jansen (1992)
	U.S.	DEA	Elyasiani and Mehdian (1995)
	Japan	DEA	Fukuyama (1995)
	Spain	TFA	Lozano (1995a)
	Turkey	DEA	Zaire (1995)
	U.S.	TFA	Humphrey and Pulley (1997)
	Spain	DEA	Grifell-Tatje and Lovell (1997)
Institution failure, risk, problem loans and management quality	U.S.	TFA	Berger and Humphrey (1992a)
	U.S.	SFA	Cebenoyan, Cooperman and Register (1993)
	U.S.	DEA	Barr, Seiford and Siems (1994)
	U.S.	DEA	Elyasiani, Mehdian and Rezvanian (1994)
	U.S.	DEA	Hermalin and Wallace (1994)
	U.S.	SFA	Berger and De Young (1996)
	U.S.	SFA	Mester (1996)
	U.S.	SFA	Mester (1997)
	U.S.	TFA	De Young (1997c)
Market structure and concentration	Norway	TFA	Berg and Kim (1994)
	U.S.	DFA	Berger (1995)
	U.S.	DEA	Devaney and Weber (1995)
	Norway	TFA	Berg and Kim (1996)
	Spain	SFA	Maudos (1996b)
	U.S.	DFA	Berger and Hannan (1997)
Mergers	Norway	DEA	Berg (1992)
	U.S.	DFA	Berger and Humphrey (1992b)
	U.S.	IN	Fixier and Zieschang (1993)
	U.S.	DFA	Akhavein, Berger and Humphrey (1997)
	U.S.	TFA	De Young (1997b)
	U.S.	DFA	Peristiani (1997)
Address Research Issues:			
Confidence intervals	Italy	DEA	Ferrier and Hirschberg (1994)
	U.S.	DEA	Wheelock and Wilson (1994)
Comparing different efficiency techniques or assumptions	U.S.	DEA,SFA	Ferrier and Lovell (1990)
	Greece	DEA,SFA	Giokas (1991)
	U.S.	SFA,DFA,TFA	Bauer, Berger and Humphrey (1993)
	U.S.	DEA,SFA	Eiseinbeis, Ferrier and Kwan (1996)
	Spain	SFA	Maudos (1996a)
	Germany	SFA	Altunbas and Molineux (n.d.)
	U.S.	SFA	Zhu, Ellinger and Shumway (1995)
Comparing different output measures	Norway	DEA	Berg, Forsund and Jensen (1991)
	Finland	DEA	Kuussaari (1993)
	Italy	DEA	Favero and Papi (1995)
	U.S.	DFA	Hunter and Timme (1995)
	Finland	DEA	Kuussaari and Vesala (1995)
Organizational form, corporate control issues	U.S.	DEA	Rangan,Grabowski,Aly and Pasurka (1988)
	U.S.	DEA	Aly,Grabowski,Pasurka and Rangan (1990)
	U.S.	DEA	Elyasiani and Mehdian (1992)
	U.S.	SFA	Cebenoyan, Cooperman, Register and Hudigins (1993)
	U.S.	SFA	Chang, Hasan and Hunter (1993)
	U.S.	DEA	Grabowski, Rangan and Rezvanian (1993)
	U.S.	SFA	Mester (1993)
	U.S.	DFA	Newman and Shrieves (1993)
	U.S.	SFA	Pi and Timme (1993)
	U.S.	DFA	De Young and Nolle (1996)
	U.S.	TFA	Mahajan, Rangan and Zardkochi (1996)
	India	DEA	Battacharya, Lovell and Sahay (1997)
	U.S.	SFA,TFA	Hasan and Hunter (1996)
General level of efficiency	U.S.	DEA	Elyasiani and Mehdian (1990a)

	U.K.	DEA	Field (1990)
	U.K.	DEA	Drake and Weyman-Jones (1992)
	Tunisia	SFA	Chaffai (1993)
	Japan	DEA	Fukuyama (1993)
	Switzerland	DEA	Sheldon and Haegler (1993)
	Denmark	DEA	Bukh (1994)
	U.S.	SFA	Kaparakis,Miller and Noulas (1994)
	Spain	DEA	Perz and Quesada (1994)
	Germany	TFA	Lang and Weizel (1995)
	Italy	DEA,SFA	Resti (1995)
	Germany	DFA	Lang and Weizel (1996)
	U.S.	DEA	Miller and Noulas (1996)
Intercountry comparisons	Norway, Sweden, Finland	DEA	Berg, Forsund, Hjalmarsson and Suominen (1993)
	11 OECD countries	SFA	Fecher and Pestieau (1993)
	8 developed countries	DEA	Pastor, Perez and Quesada (1994)
	Norway, Sweden, Finland, Denmark	DEA	Bukh, Berg and Forsund (1995)
	15 developed countries	TFA	Ruthenberg and Elias (1996)
Methodology issues	U.S.	DEA	Charnes,Cooper,Huang and Sun (1990)
	U.S.	TFA	Berger and Humphrey (1991)
	U.S.	DFA	Berger (1993)
	Belgium	FDH	Tulkens (1993)
	U.S.	DEA	Ferrier,Kersterns and Vanden Eeckaut (1994)
	Spain	DEA	Grifell-Tajte and Lovell (1994)
	Norway, Sweden, Finland, Denmark	MOS	Bergendahl (1995)
	U.S.	DFA	Adams,Berger and Sickles (1996)
	U.S.	DFA	Akhavein,Swamy and Taubman (1997)

Source: Berger and Humphrey, (1997, Table 1)

Summary and Concluding Remarks

1. Summary

This PhD thesis has analysed three empirical issues related to the banking sector in an emerging market. The issues are market discipline, large bank dominance and bank valuation.

In paper 1, we examine the hypothesis of effective depositors' discipline. We attempt to answer two initial questions: first, do depositors react to bank risk-taking behaviour, and is this reaction affected by financial crises or the introduction of explicit deposit insurance? Second, is depositor discipline effective enough to force banks to respond to the signals sent by depositors to the market?

We present evidence that depositors can practice disciplinary effects with regard to banks operating in an emerging market. In order to assess if depositors react to bank risks in such a way that deposit withdrawals could be considered an action of market discipline in the country, we test if riskier banks attract fewer deposits. The null hypothesis is that deposit withdrawals and deposit interest rates do not respond to observable weaknesses in individual banks, traceable to ex-ante bank characteristics. If bank characteristics (measured using CAMEL variables) explain significantly the growth rate of real deposits and/ or interest paid to depositors, this will be evidence for the existence of depositors' discipline. In other words, we assume that market discipline exists if an increase in bank risk leads to a decrease in the supply of deposits and therefore, holding other factors constant, market discipline will lead to higher interest paid and a lower level of deposits.

Building on market discipline studies (e.g. Martinez Peria and Schmukler, 2001; Murata and Hori, 2006; Ghosh and Das, 2003; Goldberg and Hudgins, 1996; Barajas and Steiner, 2000; and Park and Peristiani, 1998; among others) we include two sets of control variables, first, non-fundamental variables (variables not directly related to bank risks such as size and number of branches), and secondly macroeconomic and systemic variables (GDP growth, inflation, concentration, cash outside the banking sector, and US risk free rate). Control variables have been considered in testing for market discipline, as suggested by Barajas and Steiner (2000), to overcome the main short-comings of the specifications used in previous market discipline studies as additional individual bank variables that should play a key role in depositor behaviour towards bank risks.

A comprehensive panel data was collected from the Jordanian banking sector for the period from 1982 to 2005. In order to see if depositors respond to bank risk we estimate reduced form equations, in which the dependent variable (deposits, as proxied by yearly percentage growth rates in total deposits, and price proxied by implicit interest rates which are interest expenses divided by total deposits) are modelled as a function of bank fundamentals, systemic and macroeconomic variables, as well as other control variables. Furthermore, in order to analyse depositors' sensitivity to financial crises, two non-overlapping periods (namely pre- and post-crises) have been examined, as well as the effect of the introduction of deposit insurance.

Overall, the estimation results enable us to conclude that depositors in Jordan punish banks for their risky behaviour through both withdrawals of deposits and higher deposit prices. Depositors seemed to witness a "wake-up call" effect after the financial crises (where market discipline effects strengthened). Regarding the results of the effect of introducing the explicit deposit insurance on depositors' discipline, no clear evidence was found to support that market discipline is harmed by new depositors' insurance coverage. This result may be interpreted as a perceived lack of deposits protection coverage by the new insurance scheme - that is, the system may be viewed as being non-credible. Depositors may have no or little confidence in the new deposit insurance arrangements. This view is supported by Marinez Peria and Schmukler's (2001) argument that deposit insurance has no effect on depositors' behaviour towards risk. Another interesting finding of our study, in contrast to Levy-Yeyati et al., (2004), is that we find that macroeconomic variables tend to have a limited effect on market responses. Furthermore, deposits sensitivity to the global market seems to be effective in the post-crises period and this may also be limited to the economic reforms during the same period and the globalization trend. This result may signify that external discipline could play a role in strengthening domestic market discipline in the post-crises period. The limited effect of macroeconomic factors on market discipline is supported by the study of Caprio and Klingbeil (1997) who conclude that microeconomic factors have played the major part in recent banking crises in emerging markets.

In order to answer our second question we employ Barajas and Steiner's (2000) methodology by examining the response of banks to the signals provided by depositors. We assume that banks respond to the decrease in deposit growth by taking corrective action regarding bank fundamentals. Furthermore, we allow for asymmetric responses by banks. In all cases, we find that banks respond only by improving their profitability, more than adjusting other fundamental variables. This result may indicate (implicitly) that bank managers "gamble for resurrection" generating more income for owners which makes them more able to pay higher interest to depositors. However, this conclusion may indicate that policy makers and regulators should improve bank incentives to improve their overall fundamentals in order to reduce risk.

Various policy implications appear from these results. Financial regulators could rely more on elements of private market discipline as a complement to deposit insurance schemes and allow market participants (e.g. depositors) to assess banks' ability to absorb aggregate shocks and remain solvent. Furthermore, the results open the door for more discussion at the policymaker level in emerging markets as to the relevance of greater financial information disclosure (by both market participants and regulators) in order to build-up more effective discipline as components of evolving regulatory frameworks. Timely and accurate dissemination of information combined with greater transparency of reporting and accountability within banks could go a long way to reduce weaknesses detracting from effective market discipline and help enable depositors (private participants) to assess banks' ability to absorb aggregate shocks and remain solvent. Additionally, it is important to note here that market monitoring in emerging markets cannot effectively replace official supervision, but that it has a potentially powerful role within the overall regulatory regime. In particular, it has the advantage of exploiting the synergies between supervision and market discipline and thereby increasing the efficacy of the overall supervisory process. Until recently, depositor discipline has not grown strong enough to affect banks risk-taking behaviour. The implementations of Basel 2's new three pillars may provide a broader role and help emerging markets protect the banking system from excessive risk-taking and therefore reduce bank failure[1]. Finally, debate regarding the ability of depositors to efficiently and effectively monitor bank risk in emerging markets due to their low level of sophistication is questioned in our findings. We argue that depositors are able to participate directly or indirectly to reduce weaknesses of the official regulation and supervision of banks operating in such markets.

Although previous literature support market discipline and argue that holders of bank claims are effective monitors of bank activities, so free, unregulated banking is practical (e.g. Kareken and Wallace, 1978; Dothan and Williams, 1980; and Calomiris and Kahn, 1991), others do not support this view. Diamond and Dybvig, (1986); Bryant, (1980); and Chan et al., (1992) contend that some government regulation of banks is necessary to protect depositors and counter perverse incentives at distressed banks. In their view, bank regulations and supervision are necessary forms of monitoring, since depositors are held predominantly by small, uniformed investors, implying a collective action problem and the potential for negative externalities (Merton, 1977, 1978; and Bhattacharya, 1982). Too-big-to-fail is one of the mechanisms that permit regulators to foster confidence in the banking system, and reduce external effects of a bank's difficulties. Regulators have used their discretion to assure the durability of large banks, a form of implicit insurance that is based on the assumption that a large bank failure generates widespread negative externalities.

Proponents of the too-big-to-fail doctrine argue that there is a need for regulators to stabilize potentially adverse effects of a negative event at a large bank, which are not present when a similar event occurs at a small bank. Therefore regulators attempt to enhance welfare by foreclosing the possibility of the failure of a large bank and therefore reduce systemic risk in banking. Alternatively, Sharpe (1990) and Rajan (1992), argue that there is no need to provide special protection to large banks, since effective competition among financing sources minimizes the effects of the failure of a single large bank. Given the aforementioned conflicting views concerning the

[1]Another suggested strategy which may be applicable here is that it is worth making banks seek a credit rating and make that credit rating public to ensure outside agencies that are not supervisors but have high skills in risk analysis to give an objective opinion regarding the risk of the bank. The credit ratings agencies should be authorised international agencies that would suffer too much loss of reputation and devalued rating if they rated inaccurately and such agencies could be used in order to control rating quality.

influence of large banks in the banking system, it is interesting to examine whether large banks are able to dominate the banking sector and therefore regulators need to consider large banks as being special.

While systemic risk has traditionally been associated with banking markets, the growth of securities markets has probably increased their role in the transmission of shocks (De Bandt and Hartmann, 2000). Hence, in Paper 2 we analyse the intra-industry information transmission associated with returns and volatility within the Jordanian banking sector (JBS). In particular, three main questions have been examined: (1) Are risk and returns of Jordanian banks tightly linked? (2) Does the large bank dominate the returns and volatility linkages in the banking sector? (3) Has the 11th of September US event influenced banks' returns and volatility patterns?

The methodology used in this study includes testing for the return causality and volatility spillover between Jordanian banks. Both Multivariate Vector Error Correction (VEC) model for testing causality, and Generalized Autoregressive Hetroscedastic (GARCH) model for explaining time-varying volatility are employed in this study. We use weekly and daily data from the Amman Stock Exchange (ASE) during the period from 6th of May 1998 to 31st of March 2005. All tests are conducted before and after 11th of September 2001 to incorporate the effect of this event on bank stock prices. Therefore, the sample is divided into two periods. The first period is from 6th of May 1998 to 6th of September 2001, and the second periods from 13th of September 2001 until 31st of March 2005.

Implementing the VEC model leads us to conclude that return interdependence exists within the Jordanian banking sector. However, the large bank proved not to be the most influential (causal) indicator for other smaller banks returns. At the same time its return is affected by the returns of some other banks in the sector. Regarding the ability of the large bank to explain the forecast error variance of the relatively smaller banks, its power of explanation does not outperform the power of other small banks. These results indicate that the large bank failed to be the dominant bank in explaining stock returns within the banking sector. On the other hand, based on the GARCH model results we can say that volatility spillover exists between Jordanian banks. However, a large bank dominance effect was also not evident from these results.

Finally, our results find that returns and volatility have been intensified after the 11th of September.

Based on these results, we can argue that investors appear to be indifferent to the signal quality of information between large and small banks. If the durability of large banks is implicitly guaranteed by the regulators, then the effect of large banks should be modest relative to small banks (Slovin et al., 1999). In addition, other factors such as deeper liquidity and greater levels of profitability may play an important role in investment decisions and affect return and volatility spillover between banks regardless of their size. While this result is not consistent with Lo and MacKinlay (1990) it may be in line with Gebka's (2006) suggestion that factors other than size might be important proxies for informed trading which may further explain the patterns in stock returns.

This conclusion may have important implications. First, our results suggest that any actions by regulators should be directed to industry-wide difficulties or interdependence among individual banks rather than large bank-specific idiosyncratic problems. In particular, regulators should look for stabilizing potentially adverse effects of a negative event at all banks in the system without providing special attention to the largest bank. Second, this study adds to our understanding that investors and portfolio managers should consider that return causality and volatility spillover between banks may be due to factors other than size when they construct their portfolios. Third, interdependence between bank stock prices may provide investors and portfolio managers important information for their investment strategies. Interdependence between bank share prices may indicate that prices in the market are not equal in their capacity to discover new information and one stock price may serve as a primary asset for price discovery.

Studies on the stock market have found that market values do incorporate all relevant publicly known information (Ball and Kothari, 1994). It may be expected that efficient firms perform better than inefficient firms and this fact will be reflected in market prices (directly through lower costs or higher output or indirectly. through higher customer satisfaction and higher prices which in turn may improve stock performance). In paper 3 we attempt to combine the accounting and banking literature in order to explore the role of bank efficiency in explaining the difference between the bank book and market values. In particular, we empirically examine the following two questions: Is accounting information value relevant in evaluating banks in emerging markets? Can efficiency (as an economic performance measure) add more information in interpreting the gap between the bank book and market values in these markets?

In order to answer the aforementioned two questions, we adopt a methodology similar to the value relevant studies in the capital market-based accounting research. Based on Ohlson (1995), we used the approach of Trueman et al., (2000) to study the impact of accounting (earnings and its components) and economic information (cost efficiency) on bank valuation. This paper utilizes the non-parametric Data Envelopment Analysis (DEA) technique to measure bank cost efficiency.

The main findings of this paper are as follows: First, it is noticed that earnings and its components are value relevant and explain the gap between market and book values. Secondly, cost efficiency as an economic performance measure of firm success, provides extra information, not contained directly in the banks financial statements, to the market. Theses results support the argument of Dutta and Reichelstein (2005) which indicates that market prices aggregate signals received by the firm's accounting system, each of these signals reflects management unobservable efforts. In addition, these results seem to be in concordance with the main findings reported in the literature, (e.g. Beccalli et al., 2006, and Eisenbeis et al., 1999). Finally we also find that investors in emerging markets still make use of accounting-based efficiency indicators in the valuation procedure and the cost income ratio appears to be significant in some of our valuation models.

The conclusion of this study may provide insights for policy makers and regulators concerning the development of an operating environment that enhances the efficiency and value of commercial banks which in-turn could lead to a larger volume of intermediation, improved financial services and products, and ultimately a safer banking system.

2. General Discussion

Policy makers in emerging markets are faced with increasing globalisation pressures and this can have implications for the regulation of the banking system. Increased volume and volatility of capital flows, for instance, may endanger the financial stability needed for economic growth. The question which arises, therefore. (here) is how to adapt the regulatory framework to the increasingly competitive globalised environment. Regulators in most emerging markets have been required to implement appropriate regulation and supervisory practices in the financial sectors. Therefore, policy makers have introduced various prudential and systemic regulations aimed at increasing safety and stability.

Generally, the two main components of the financial system are financial institutions (mainly banks) and financial markets. Because emerging markets financial systems are typically bank-based (as posed to market-based) regulators appear to concentrate their attentions on banking institutions. However, over recent years the liberalization trend, financial innovation and integration with the global financial system have created new environments for financial markets where banks are more closely linked for markets. As a result regulators and policy makers increasingly recognise the connection between banks and financial markets and the links to financial stability and economic growth.

However, the evidence of a growing number of financial crises around the world has illustrated that the safe and efficient operation of the financial system cannot be guaranteed by government regulation alone. Therefore, regulators have realised that the trend towards market oriented banking operations, and integrated financial markets require more creative regulation regardless of how conscientious the regulators, or well intended the regulations. Thus, it has been suggested that government regulations need to be supplemented by market discipline (Kaufman, 2003).

The core theme of this thesis has been to explore the participation of depositors and investors in maintaining overall financial stability and to reveal how the connection between banks and financial markets can contribute in this track.

First, we argue that depositors are the first party who can pursue market discipline (monitoring) which can complement rule-based regulators in emerging markets. Depositor discipline may be treated as a pressure exercised on bank managers in order to push those managers to work in a sound and safe manner. Furthermore, there is a general belief that depositors are more able to share the burden of bank regulation than shareholders, because shareholders' incentives to increase bank profitability may outweigh their desire to decrease bank risk (Tsuru, 2003; and Park and Perstiani, 2007).

Secondly, the natures of investors (shareholders) contracts (extra benefits are expected from banks' high risk-taking which create strong incentives for managers to attain high risk in order to increase returns) has led some researchers to believe that investors may be considered as enemies of regulators (Park and Peristiani, 2007). We argue that investors can support regulators efforts indirectly towards achieving financial stability by inducing bank managers to improve the level of bank efficiency. The ability of the stock market to reflect the information content of bank efficiency in bank market values will encourage managers to improve the efficiency level of their operations because investors may prefer more efficient banks. Hence, this can be a potential way to stabilise excessive volatility in emerging stock markets.

Finally, we believe that the link between banking and financial markets can improve our understanding of the behaviour of the banking sector. Some might argue that the dominance of large banks over relatively smaller banks (dominance hypothesis) is self evident, but what is evident in our results is that large bank dominance does not exist and other small banks can play an important role in information transmission and volatility spillover. Since the stability of financial markets is important for the soundness of the financial system, it is worth noting that regulators need to consider the relations between banks in the financial markets and not disregard individual small bank share behaviour. The results support the view that financial difficulties in one bank trouble in one bank whether large or small, can easily spread to another. The transmission of shocks from one bank to another might create financial market instability during a crisis, which could further spread to the production side of the economy.

3. Limitations and Suggestions for Further Research

The main limitation of the study predominantly relate to the small number of banks in Jordan and data availability. Although research conducted in this thesis contributes to the literature in some ways, the analysis could have been improved were specific data were more easily available. The unavailability of bank account details and the lack of comprehensive information regarding the classification of insured and uninsured deposits restricted our ability to distinguish between the behaviour of insured and uninsured depositors towards bank-risk taking. Furthermore, the lack of sufficient information regarding detailed bank accounts types prohibited us from examining whether depositors react through changes in account types rather than changing their banks as a consequence of altered bank conditions.

In addition, the small number of listed banks made it difficult to undertake different estimations of bank efficiency in our third paper as we only use DEA as an efficiency estimation technique. Unfortunately, assessing bank efficiency is extremely challenging when the aim is to utilise a small data sample as undertaken in this thesis. However, one should add that data issues are a common limitation of emerging market studies.

As an avenue for further research on depositor discipline one fruitful area for further research could be to analyse the difference between depositors behaviour across different types of banks. Islamic bank depositors, for example, may have different attitudes towards bank risk compared with commercial banks. Hence, it is worth widening the analysis of depositor discipline to examine depositors' behaviour and subsequent Islamic banks response particularly as this type of banking business is increasing rapidly in Jordan and elsewhere. Finally, the results of the second and third papers could be further enriched by extracting the analysis to other developed and emerging markets. This would provide us with the opportunity to compare between the behaviour of bank stocks in different capital markets.

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