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Long-term effects of bank privatisation on performance and bank business models

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LONG-TERM EFFECTS OF BANK PRIVATISATION ON PERFORMANCE AND BANK BUSINESS MODELS

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Yr wyf drwy hyn yn datgan mai canlyniad fy ymchwil fy hun yw'r thesis hwn, ac eithrio lle nodir yn wahanol. Caiff ffynonellau eraill eu cydnabod gan droednodiadau yn rhoi cyfeiriadau eglur. Nid yw sylwedd y gwaith hwn wedi cael ei dderbyn o'r blaen ar gyfer unrhyw radd, ac nid yw'n cael ei gyflwyno ar yr un pryd mewn ymgeisiaeth am unrhyw radd oni bai ei fod, fel y cytunwyd gan y Brifysgol, am gymwysterau deuol cymeradwy.

I hereby declare that this thesis is the results of my own investigations, except where otherwise stated. All other sources are acknowledged by bibliographic references. This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree unless, as agreed by the University, for approved dual awards.

This thesis is dedicated to

my country (Iraq)

And

My lovely family.

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Abstract

This study addressed the impact of bank business models on banking stability and performance. We use a sample of 2,513 commercial banks from 26 countries between 1985 and 2015. Business models are identified using k-medoids cluster analysis. The results show two main banking business models, namely focused retail model and trader business model.

In addition, the newly privatised banks have undergone some changes in bank business models in the post-privatisation period, where they have tended to become more focused-retail and rely more on traditional intermediary activities.

The study employs Stochastic Frontier Analysis (SFA) to estimate the profit and cost efficiencies. The findings suggest immediate improvements in privatised bank efficiency after privatisation followed by subsequent continuous improvements and sustainable change in profit and cost efficiency in the privatised bank in the long-term.

The empirical evidence suggests that privatisation produced mixed effects depending on which variable is examined. The findings show that focused retail banks performed better in terms of efficiency, performance, and stability, since they exhibited higher profitability in terms of profit efficiency, ROA, ROE and NIM, and more stable, while focused retail banks were less cost efficient. Furthermore, commercial banks with trader model performed better in term of cost efficiency, ROA, ROE and NIM, but they are significantly less stable.

The relationship between bank business models and bank performance in the privatised bank is examined. The findings revealed that commercial banks with a focused-retail model performed better since they exhibited higher profitability in terms of profit efficiency, return on assets (ROA), return on equity (ROE), net interest margin (NIM), and more stability. However, they were less cost efficient. in contrast, privatised banks with a focused retail model exhibited lower profitability in terms of ROA and ROE. On the other hand, Commercial banks with trader business models performed significantly worse in terms of profit efficiency, ROA, ROE, NIM and less stable, but they were significantly more cost efficient. In contrast, privatised banks with trader model performed better in terms of ROA and ROE.

We extended the literature by examining the long-term effects of privatisation on bank performance. As a result of the competitive environment in which privatised banks operate and the changes in the banks' objectives towards maximising profit and minimising costs, we expected that privatisation could affect bank performance positively in the long-term. We employed a difference-in-differences (DID) approach to identify the effects of privatisation on bank efficiency and performance. The results revealed that privatised banks made significant profit efficiency improvements, cost efficiency, ROA, and NIM in the long-term. Nevertheless, the privatised banks showed an increase in risk-taking post-privatisation compared with other commercial banks.

Furthermore, the findings provide evidence that commercial banks with high non-deposit funding share (NOD) are more profit efficient than other banks. At the same time, banks with higher non-interest income share (NII) were less profit efficient and less stable but more cost efficient over the long-term.

On the other hand, the privatised banks with higher non-deposit funding share were less profit efficient, ROE and NIM, while the non-privatised banks were more profit efficient but less stable. Besides, privatised banks with high non-interest income share performed better in terms of ROA and ROE.

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List of Abbreviations

Cost	Cost-to-income ratio
Dep	Deposits and short-term funding
Equity	Total equity-to-total assets ratio
Foreign	Foreign ownership
FBM	Focused retail business model
GDP	Gross Domestic Product
GDPG	Real GDP Growth
GFC	Global financial crisis
GLS	Generalised Least Squares
IMF	International Monetary Fund
LLR	Loan Loss Reserves-to-gross loans ratio
Loans	Loans-to-total assets ratio
M&A	Mergers and acquisitions
MENA	Middle East and North Africa
NII	Non-interest income share
NIM	Net Interest Margin
Non-Dep	Non-deposit funding ratio
NPI	Negative Profit Indicator
NPL	Non-Performing Loans
PBT	Profit before-tax
Priv	Privatised banks
ROA	Return on Assets
ROE	Return on Equity

Size	Bank size
TBM	Trader business model
TOC	Total operating costs
TRA	The ratio of trading assets to total assets
UK	United Kingdom

Chapter 1: Introduction

This chapter describes the background of the study consisting of motivation, objectives, contributions, and the methodologies chosen. The last section provides a summary of the thesis highlighting the contents of each chapter.

1.1 Research Motivation

Many countries have privatised state-owned banks as an essential policy to reform banking sector in developed and transition economies, as well as in developing countries to reduce the role of government in the banking industry. This procedure agreed with previous studies (e.g., Berger et al., 2005; Boubakri et al., 2005; Nakane and Weintraub, 2005; Omran, 2007; Di Patti and Hardy, 2005; Fries et al., 2006; Lin and Zhang, 2009 and Mohsni and Otchere, 2014) which showed the bad performance and the contribution of state banks towards supporting financial development. The poor performance of state-owned banks has been attributed to several causes, including agency problems, political intervention, and competition problems.

Theoretical and empirical literature (e.g., Berger et al., 2005; Boubakri et al., 2005; Omran, 2007; Di Patti and Hardy, 2005; Fries et al., 2006; Lin and Zhang. 2009 and Iannotta et al., 2013) have shown that government-owned banks are less efficient than private banks. This could be because state banks achieve social and political objectives rather than profit maximisation. Therefore, many countries adopted strategies, such as bank privatisation, to reduce the role of government in the banking industry.

Over the last four decades, the topic of privatisation and financial deregulation have received considerable attention from academic researchers around the world. A significant amount of literature (e.g. Boubakri et al., 2005; Williams and Nguyen, 2005; Di Patti and Hardy, 2005; Hao et al., 2001; Omran, 2007; Clarke et al., 2005a; Clarke et al., 2005b; Beck et al., 2005; Berger et al., 2005; Clarke et al., 2009; Jiang et al., 2013; Boubakri et al., 2013; Mohsni and Otchere, 2014; Wang and Chiou, 2015; Boubakri et al., 2015) have attempted to understand and assess the effects of privatisation on bank performance in different countries. However, problems or gaps have been observed during the related literature review, and these motivated the researcher to conduct the present study.

Arguably, a change in bank ownership structure can lead to changes in banks strategies and objectives. These include an increase in shareholder value and the managing of newly privatised banks according to the principles of profit-maximisation and cost-minimisation. The results of bank privatisation differ between countries depending on the timing of the privatisation, the design of the privatisation contracts, and the approach to privatisation.

Furthermore, financial deregulation, increased competition, innovation, and the deepening of financial markets prompted most banks to rely more on non-traditional activities and non-interest income to enhance bank profitability and stability.

The global financial crisis raised questions concerning the importance of bank privatisation and triggered deep debates after several countries nationalised failing private-owned banks, such as ABN Amro in the Netherlands (Bertay et al., 2015), Royal Bank of Scotland and Lloyds TSB in the UK, Allied Irish Bank in Ireland, and Dexia in Belgium. The collapse of many banks after the financial crisis showed that the market can weed out banks which have chosen an unviable business model. In addition, the nationalisation of private-owned banks after the global financial crisis and the increasing ratio of state bank ownership in the banking industry led to further debate about the economic benefits and costs of government banks.

The literature on bank business models has developed quickly since the global financial crisis started (GFC) in 2007. Many empirical studies (Altunbas et al., 2011; Martel et al., 2012; Ayadi et al., 2012; Kohler, 2014; Kohler, 2015; Mergaerts and Vander Vennet, 2016; Hryckiewicz and Kozłowski, 2017) have examined the impact of bank business models on bank performance and stability and tried to understand why some banks were more damaged than others during the GFC. Many recent papers have included data about the financial crisis period and provided a mixture of evidence.

To our knowledge, no empirical studies have considered the influence of bank business strategies on performance and bank stability in privatised banks. Based on the preceding, our study is part of a growing body of literature which concentrates on the combination of bank ownership and strategic bank choices (e.g., Martín-Oliver et al., 2017 and Andrieş and Mutu, 2017) to explain the performance and bank stability of privatised banks.

Therefore, the main objectives of this thesis are to identify the bank business models of privatised banks using cluster analysis and to explore the effect of bank business models on bank performance and stability in privatised banks and other commercial banks.

On the other hand, much attention has been paid to investigate the impact of privatisation on the performance outcomes of privatised banks, in terms of efficiency, profitability, and risk-taking ignoring the critical role of government-owned banks in reducing the effect of counter-cyclical during financial crises. Some of these studies (e.g., Beck et al., 2005; Otchere, 2005; Omran, 2007; Lin and Zhang, 2009) have revealed that the improvements in bank performance included some but not all the performance indicators of the privatised banks post-privatisation. Other studies, for example, Hao et al. (2001) found that the improvement in privatised banks productivity was not sustainable over the long-term. Besides, Nakane and Weintraub (2005) noted that the potential positive benefits of bank privatisation might have taken longer to be realised. The results of these studies thus raised the question of whether countries should privatise their government-owned banks or not. Our study has tries to provide an answer to the critical question which is how does privatisation affect the performance of privatised banks in the long-term.

We might expect a better performance by privatised banks, or at least for then to operate like private-owned banks. Otherwise, one could say that bank privatisation itself is not sufficient to enhance the efficiency of privatised banks. Thus, after more than four decades of implementing bank privatisation and financial deregulation in different countries, we need to know to what extent those strategies have contributed to enhancing bank performance and competitiveness.

Our empirical analysis is based on an international sample of 2,517 commercial banks from 26 countries for the period 1985–2015. As far as we know, no previous study has examined the efficiency changes in developed and developing economies over more than 31 years following privatisation. The dependent variable takes alternatively the form of profit efficiency, cost efficiency and z-score. We employ a set of control variables which included in the empirical specifications to control for differences at the bank level and macroeconomic environment.

1.2 **Research Objectives**

Mainly, this thesis addressed the following research objectives:

1. To identify bank business models in privatised and non- privatised banks using cluster analysis.
2. To estimate cost and profit efficiency using translog cost and profit functions.

3. To examine the effect of bank business models on performance and bank stability in privatised and non- privatised banks (include all commercial banks except privatised banks).
4. To investigate the long term effects of bank privatisation in developed and developing countries over the period 1985-2015.
5. To investigate whether privatised banks are more resilient to face the global financial crisis than other banks.

1.3 Research Questions

The research questions were developed in line with the research objectives. The first group of questions were formed to address the first, second and third objectives. While the second group of questions were designed to examine the fourth and fifth objectives.

The first group of questions ask if the changes in bank governance following privatisation raised critical research questions such as the effect of bank business model on performance and bank stability following privatisation:

Q1: Do privatised banks change their business models following privatisation and become similar to other private-owned banks?

Q2: To what extent, and how, do changes in bank business models affect bank performance and stability following privatisation?

Q3: Which is the most appropriate business model to boost bank performance and stability in privatised banks?

The second group of questions: What are the long-term effects of bank privatisation?

Q1: To what extent, and how, do changes in ownership structure affect bank efficiency?

Q2: Does bank privatisation lead to improved performance of newly privatised banks?

Q3: Does bank privatisation lead to an increase or decrease in the risk-taking of newly privatised banks?

Q4: Are the outcomes of bank privatisation sustainable over the long-term?

Q5: Are the privatised banks more resilient to face the global financial crisis than other banks?

1.4 Research Hypotheses

The research hypotheses are classified into three main groups based on research questions and objectives. The first group is related to estimated profit and cost efficiency. Whereas the second group of hypotheses is relevant to the identified bank business models in privatised and non-privatised banks and the association between the bank business models and the performance of the post-privatisation. The final one is related to the impact of privatisation on bank performance in the long-term. All the hypotheses were developed based on the gaps consider in the prior literature and have supported with relevant theory. Details of these groups are given below:

First-group: we hypothesised that there are four main possible patterns of the changes in privatised bank efficiency in the post-privatisation period based on Boardman et al. (2016):

H1: There were immediate improvements in privatised bank efficiency followed by subsequent continuous improvements.

H2: There were immediate improvements in privatised bank efficiency followed by diminishing marginal gains or no further improvement.

H3: There was no performance change or a small negative change during the first few years, but a positive impact over time which more than compensated for any short-run adverse effects.

H4: There was a decline in some performance indicators following privatisation, either short-term or long-term based on Lin and Zhang (2009).

Second-group: the behaviour of bank business models and their effect on performance post-privatisation:

H5: Bank business models in privatised banks became similar to those of rival banks.

H6: Bank business models had an impact on the performance of newly privatised banks.

H6a: Focused business model affected bank performance in newly privatised banks.

H6b: Trader business model affected bank performance in newly privatised banks.

H7: Privatised banks have become more prudent and more stable after privatisation, based on work of the Mohsni and Otchere (2014).

Third-group : The long-term effects of privatisation on bank performance:

H8: Privatised banks became more efficient over the long-term.

H8a: Privatised banks became more profit-efficient over the long-term.

H8b: Privatised banks became more cost-efficient over the long-term.

H8c: Privatised banks became more stable over the long-term.

H9: Privatised banks owned by foreign ownership are more efficient than (perform better than) their counterparts (domestic banks) over the long-term.

H10: Privatised banks were more resilient to face the global financial crisis than other banks.

H10a: Privatised banks performed better following the global financial crisis.
H10b: Privatised banks became more stable following the global financial crisis.

1.5 Research contributions

This study aimed to identify the business model characteristics of privatised banks and determine the effects of bank business models on bank performance and stability in the post-privatisation period. Most of the previous studies have investigated the impact of business models pre- and post-financial crisis; however, our work significantly differs from existing studies in the following ways. Firstly, most studies have analysed bank business models and their effects on the performance and bank stability while ignoring the impacts on ownership and bank governance in identifying bank business strategies. However, one contribution of this study is to provide evidence of an important part of the privatisation literature by investigating the effects of business models on performance and stability in the newly privatised banks. To get a more representative picture of how bank privatisation has affected bank business models, hence, their effects on performance and stability in newly privatised banks. We have included a large number of rival and newly privatised commercial banks in 26 developed and developing countries in our sample. While Altunbas et al. 2011; Mergaerts and Vander Vennet 2016 focused on European banks, Kohler 2015, used the German banking sector and Martín-Oliver et al. 2017 used Spanish banks for a case study.

Furthermore, this study is related to a growing literature which concentrates on the combination of bank ownership and strategic bank choices, such as Martín-Oliver et al., (2017) and Andrieş and Mutu, (2017), to explain the performance and bank stability in privatised banks.

To our knowledge, no empirical studies have considered the influence of bank business strategies on performance and bank stability in privatised banks. However, a small number of studies (e.g., Martín-Oliver et al., 2017 and Andrieş and Mutu, 2017) have examined the implication of bank business choices on performance and banks stability across bank ownership.

Furthermore, our study aimed to quantify whether changes in bank governance led to sustainable improvements in bank performance over the long term. We compared bank performance before governance changes with subsequent performance and the performance of other banks.

This study contributes to the existing literature by providing a piece of evidence on the effect of corporate governance on bank performance over the long-term. To the best of our knowledge this is the first international empirical study which investigates the long-term effect of bank privatisation. The use of international data from developed and developing economies allowed us to provide new evidence and obtain novel insights about the implications of privatisation policy. Our study examined the impact of privatisation on commercial banks efficiency in 26 developed and developing countries over the long-term. As far as we know, no previous study has examined the efficiency changes following privatisations in developed and developing economies over more than 31 years.

1.6 Research Methodology

In order to achieve the objectives and provide answers to the research questions and to test the research hypotheses, this section states the study's research methodology. We conducted our tests using a unique panel database covering 2,513commercial banks in 26 countries over the period from 1985 to 2015, representing a total of 31 years. We focused on transitional economies and developed economies countries to display different levels of economic development as well as institutional and legal environments.

We identified bank business models using k-medoid clustering approach following (Ayadi et al., 2012; van Ewijk and Arnold 2014; Ayadi et al., 2016; Mergaerts and Vander Vennet 2016; Martín-Oliver et al., 2017 and Hryckiewicz and Koztowski, 2017). A set of variables were used to determine a bank's strategic choices based on assets and funding namely, the ratio of net loans-to-total assets, the ratio of other earning assets-to-total assets, the ratio of deposits and

short-term funding-to-total assets, and the ratio of non-deposit funding-to-total assets. This methodology allowed us to cluster the banks with similar assets and liabilities exposure into one group. Simultaneously, we created different groups for banks which did not exhibit the same characteristics.

This thesis adopts a stochastic frontier approach and the translog functional form with a half-normal distribution of the inefficiency term and time-varying efficiency following Williams (2012) to estimate the cost and profit efficiency. This approach measures performance of a bank by comparing it as a distance from the best practice frontier profit and cost efficiency estimates values fell into the range between 0 and 1.

To study the effect of bank business models on the bank efficiency of privatised banks and investigate the long-term effect of privatisation, our study used Tobit regression and random-effects Tobit regressions given that the efficiency scores (dependent variables) have the features of censored value between 0 and 1. This method was also adopted by some studies (e.g., Clarke and Cull, 2005; Lin et al., 2016; Claessens and Horen, 2010; Akhigbe and McNulty, 2011).

In addition, the dependent variable took alternatively the form of profit efficiency, cost efficiency, return on equity (ROE), return on assets (ROA), and net interest margin (NIM) to measure the bank performance. We also used the z-score to capture the financial stability of banks. To control for differences at the bank level and the macroeconomic environment, a set of control variables was included in the empirical specifications. This thesis used generalised least squares (GLS) regressions with clustering of the errors at the bank level. Robust standard errors were also used to correct for potential heteroskedasticity and potential time-series autocorrelation within each bank, following Hryckiewicz and Kozłowski (2017) and Demirgüc¸-Kunt and Huizinga (2010).

In a second set of regressions, we used a difference-in-differences (DID) approach, as in previous studies (e.g., Williams, 2012; Mohsni and Otchere, 2014; and Boardman et al., 2016), to provide an answer to the question of how bank governance changes impact on bank efficiency following privatisation. Williams (2012) used this approach to investigate how privatisation and foreign bank entry affect bank performance in a sample of 419 Latin American commercial banks between 1985 and 2010. The present study aimed to fill a gap in the literature since few studies investigated the effect on bank efficiency of privatisation over

the long-term. In addition, we used difference-in-differences approach (DID) to investigate the effect of GFC on privatised banks efficiency.

1.7 The structure of the study

The remainder of this thesis has been structured in a manner which helps to achieve the objective of this research as follows,

The thesis is composed of eight chapters, including the current introduction chapter. Chapter two reviewed the theoretical background of bank privatisation. We reviewed previous studies relating to the relationship between privatisation and bank performance. Furthermore, this chapter provides an overview of how privatised banks altered their business models following privatisation. Then, we discuss the previous empirical research on the relationship between bank ownership, performance, and risk-taking behaviour. This chapter also reviews previous studies relating to bank business models, performance, and stability. We also review previous studies relating to bank governance and performance over the long-term. Finally, we reviewed the empirical studies which examine foreign ownership, performance, and financial stability.

Chapter three presents the methodologies employed to obtain the empirical results. The first section describes data and sample selection. While the second section presents the cluster analysis method to identify bank business models. This chapter also provides the methods that employed to proxy bank performance including the parametric SFA method to estimate profit and cost efficiency and other performance indicators. This chapter also describes the multiple regression techniques including Tobit regression and Generalised Least Squares (GLS) regression for the panel data to examine the relationship between bank business models and bank efficiency in privatised banks. In addition, we use difference-in-differences model to examine the long-term effect of privatisation on bank efficiency and stability.

Chapter four provides analyses of the empirical findings covering the SFA profit and cost efficiency of commercial banks over the study period. The chapter also presents the descriptive statistics of profit and cost efficiency by country and year, and descriptive statistics of profit and cost efficiency by bank business models. Finally, this chapter provides the inter-temporal analysis of bank efficiency pre-and post-privatisation period.

Chapter five provides an empirical analysis of differences between banking business models. In addition, it presents an analysis of identification of bank business models in privatised and

non-privatised banks. Whereas Chapter six provides an empirical analysis of the effects of bank business models on bank efficiency and performance in privatised banks and perform various robustness checks. Chapter seven presents an empirical analysis of the long-term privatisation effects on bank efficiency and stability using the difference-in-differences model. In addition, we discussed the empirical evidence of the impact of governance changes on bank performance and risk-taking pre- and post-global financial crisis using difference-in-differences model. We also perform various robustness checks. Finally, Chapter eight summarises the main empirical findings and the limitations of the current study besides the suggestions for future research.

Chapter 2 : Literature Review and Hypotheses Development

2.1 Introduction

This chapter reviews the literature relevant to the current study and discusses the development of hypothesis. We structured this chapter as follows. Section 2.2 briefly explains the theoretical background of bank privatisation. We review previous studies relating to the relationship between privatisation and bank performance in section 2.3. After that, section 2.4 provides an overview of how privatised banks altered their business models following privatisation. Then, in section 2.3 we discuss the previous empirical research on bank business models, performance, and stability. The relationship between bank ownership, performance, and risk-taking behaviour are discussed in section 2.5. Then, in section 2.7 a review of previous studies relating to bank governance and performance over the long-term is presented. Finally, section 2.8 reviews the theoretical and empirical studies which examine foreign ownership, performance, and financial stability.

2.2 Theoretical background

The state-owned banks have an essential role in supporting the financial development and economic growth in many countries. Governments can use their state banks to balance social and economic objectives. For example, providing the main financial services in remote areas, and serving some market sectors which are neglected by the private sector, such as providing credit to the agricultural sector (Clarke et al., 2005a). Also, state banks have the ability to mitigate market failures resulting from asymmetric information (Farazi et al., 2011). Beside their crucial role of counter-cyclical, it could help in preventing an excessive reduction of credit during a financial crisis.

Governments can instruct their banks to lend because the lending by government banks is less responsive to macroeconomic shocks than lending by private-owned banks (Micco and Panizza, 2006 and Bertay et al., 2015). The lending behavior of government banks is less reliant on short-term obligations and takes advantage of government funds to provide loans.

Number of studies illustrate the relationship between bank governance and performance. Many previous investigations (e.g., Berger et al., 2005; Boubakri et al., 2005; Nakane and Weintraub, 2005; Omran, 2007; Fries et al., 2006; Lin and Zhang, 2009 and Casu et.al. 2015) found that state-owned banks have lower bank efficiency and productivity than domestic and foreign

banks as a consequence of political influence, weak management, and lending to underperforming state-owned enterprises. Due to several bankruptcies of state-owned banks in the banking crises of the 1980s and 1990s, many emerging economies' governments have introduced reforms that have led to the privatisation of the banking sector to encourage competition and enhance the efficiency of the sector (Casu et.al. 2015). However, evidence from the studies of Nakane and Weintraub (2005) and Mohsni and Otchere (2014) documents the significant role of government banks in the supporting of economic and social objectives to maximise social stability by the provision of employment and providing loans to rural areas and the low-income housing sector at subsidised rates.

Accordingly, many countries have reduced the role of the state for the following principal reasons: firstly, agency problems because the state-owned banks are not managed according to profit-maximisation and cost minimisation principles (Mohsni and Otchere, 2014). Williams and Nguyen (2005) discuss the importance of bank ownership in explaining the differences in bank performance based on the agency problem theory which arises due to the separation of ownership and control. Secondly, the political intervention that makes politicians and bureaucrats exploit state-owned banks to achieve their political or personal goals (Clarke et al., 2005b) — as well as looting and rewarding political supporters (Megginson, 2005). The final reason is the competition between state banks and private banks where state-owned banks can face less competition if they are protected by politicians and bureaucrats (Clarke et al., 2005b).

Bank privatisation includes a change in the bank's objectives due to a change in owners and managers, leading privatised banks to be more focused and efficient (Otchere, 2005). Many studies addressed the effects of bank privatisation and deregulation (e.g., La Porta et al., 2002; Boubakri et al., 2005; Sathye 2005; Di Patti and Hardy, 2005; Omran, 2007; Hauner and Peiris, 2007) and suggested that the level of improvement in bank performance depends on the ownership structure.

Privatisation also affects the profitability, efficiency, risk exposure and capitalisation of privatised banks post-privatisation. For example, Clarke et al. (2005b) analysed how privatisation affected bank performance for a set of developing countries: (Argentina, Brazil, Mexico, Nigeria, and Pakistan); Eastern Europe region (Bulgaria, Croatia, the Czech Republic, Hungary, Poland, and Romania), and East Asia region (Indonesia, Korea, Malaysia, Philippines, and Thailand). This study summarised some valuable lessons from developing countries' experiences that bank privatisation leads to improved bank performance and

increased competition in the banking sector. Besides, the researchers reviewed the set of obstacles that affect the success of privatisation programs. The first one is the continuation of the government to hold partial shares of banks, which leads to poor performance. Whereas the second obstacle relates to the privatisation approaches which are important to success. Their results showed that under a weak institutional environment, the direct sales to strategic investors approach are better than share offerings, which lead to poorer performance in privatised banks. Also, allowing foreign banks to participate in the privatisation of banks increases the benefits of the privatisation process, although credit growth can be slower after privatisation. The last obstacle is increasing competition in the banking sector may improve the performance of privatised banks while oligopolistic competition could lead to bad results for the banking sector. Table 2-1 presents the effects of privatisation on performance and stability in different countries. The literature showed that the findings of privatisation are not uniformed. In some countries, privatised banks' performance is improved after privatisation but in others are not; besides, some improvements are more significant in some countries than others. It can be noticed that some studies suggest improvements in performance after privatisation such as the studies in Brazil, Argentina, Nigeria, China, and Sub-Saharan Africa etc.

Furthermore, the privatisation process's outcomes may take a long time to be realised where it can take several years to complete the changes. Hence, the improvements will not show immediately after privatisation. Moreover, privatisation can be costly and might lead to a temporary increase in costs or reduction in profit (Clarke et al., 2005b). In contrast, some studies revealed immediate improvements in privatised bank performance could be shown (Hao et al., 2001; Di Patti and Hardy, 2005; Berger et al., 2005 and Jiang et al., 2013).

Table 2-1 Effect of privatisation on the performance and stability of privatised banks.

Country case studies	Authors	Study period	Improved	Deteriorated
Brazil	Nakane and Weintraub (2005)	1994 -2002	Return on equity, return on assets, costs/assets, costs/assets, total factor productivity	
Egypt	Omran (2007)	1996 - 1999		Some profitability and liquidity ratios
China	Lin and Zhang (2009)	1997 -2004	A little performance change after the privatisation	
China	Jiang et al. (2013)	1995–2010	Cost efficiency, profit efficiency, and interest income efficiency	
Argentina	Berger et al. (2005)	1993- 1999	Non-performing loans, profit efficiency, cost efficiency.	
Korea	Hao et al. (2001)	1985-1995	A little bank efficiency	
Nigeria	Beck et al. (2005)	1990 -2001	Profitability, quality of the loan portfolios	
Pakistan	Di Patti and Hardy (2005)	1981- 2002	Profit efficiency	
Pakistan	Burki and Ahmad (2010)	1991–2005	Cost-efficiency	
Sub-Saharan Africa	Clarke et al. (2009)	1996-2004	Quality of the loan portfolio bank profitability credit growth, deposits, the number of depositors	operational costs increased
Cross- country				
Middle-and low-income countries	Otchere (2005)	1989-1997	Operating performance, capital adequacy	
Emerging markets and industrialised countries	Boubakri et al. (2013)	1981- 2007		exposure to credit risk and interest rate risk
Developing countries	Boubakri et al. (2005)	1986-1998	Economic efficiency and credit risk exposure	Interest rate
East Asia banks (Indonesia, Korea, Malaysia, Philippines, and Thailand)	Williams and Nguyen (2005)	1990- 2003	Profit efficiency, productivity performance	
Developed and developing countries	Mohsni and Otchere (2014)	1988- 2007	Reduction in risk-taking	

2.3 Bank privatisation and performance

Empirical studies on the improvement of bank efficiency after privatising by foreign or local banks have no definite conclusions as in the studies of Hao et al. (2001), Di Patti and Hardy (2005), Williams and Nguyen (2005), Burki and Ahmad (2010) and Jiang et al. (2013). Consequently, we hypothesise that there are four main possible patterns of changes in privatised bank efficiency in post-privatisation:

H1: There are immediate improvements in privatised bank efficiency followed by subsequent continuous improvements.

H2: There are immediate improvements in privatised bank efficiency followed by diminishing marginal improvements or no further improvement.

H3: There is no performance change or a small negative change during the first few years, but a positive impact over time that more than compensates for any short-run negative effects.

H4: There is a decline in some of performance indicators following privatisation either short-term or long-term.

Some studies found that there are immediate improvements in privatised bank efficiency after privatisation, followed by subsequent continuous improvements. For example, Jiang et al. (2013) investigated the effect of privatisation on bank performance in a sample of 49 Chinese banks during the period 1995–2010. The results suggested that privatisation has a positive and significant impact on Chinese bank efficiency, including enhancement in cost, profit, and interest income efficiency in both the short and long term. Berger et al. (2005) investigated the impact of corporate governance on bank performance in a sample of Argentinian banks during the 1990s and support this view. Their results referred to the fact that the best results appear in state banks that underwent privatisation or restructuring. They also found a dramatic improvement in the performance of privatised banks post-privatisation through a remarkable reduction in non-performing loans, which increased profit efficiency substantially and improved cost efficiency. Williams and Nguyen (2005) used a sample of South-East Asia banks (Indonesia, Korea, Malaysia, the Philippines, and Thailand) from 1990 to 2003 and examined the effects of bank governance on commercial bank performance. This period witnessed many radical changes: financial deregulation, the 1997 crisis, and bank restructuring, which changed the ownership of many banks. Also, this study considers the implications of bank privatisation

policy, the entry of foreign banks, and the restructuring of local banking systems on bank efficiency. The results concluded that there were noticeable improvements in profit efficiency and productivity performance in privatised banks. In addition, foreign bank ownership takes more time to obtain the benefits of privatisation. While the domestic private-owned banks should target improvements in profit efficiency.

Other studies showed immediate improvements in privatised bank efficiency, followed by diminishing marginal improvements or no further improvement. For example, Hao et al. (2001) examined the effect of deregulation on 19 private Korean banks' productive efficiency between 1985 and 1995. They used the stochastic frontier cost function approach to measure productive efficiency. They aimed to investigate the relationship between the macroeconomic performance and efficiency of the banking sector to know the critical determinants of bank efficiency in the Korean banking sector. In general, the findings found that financial liberalisation had an adverse effect on privatised banks' efficiency by domestic banks. In contrast, privatised banks bought by foreign investors had a positive impact on cost efficiency.

They also added that the positive relationship between deregulation and productivity was not sustainable over the long-term for the following reasons: firstly, the number of employees has a negative impact on bank efficiency, which could be attributed to the robust control of the labour unions on the banking system. The second reason is related to the impact of the deposits mix on efficiency. This tendency adds support to the findings of Di Patti and Hardy (2005), who investigated the impact of financial liberalisation and banks privatisation on productivity and efficiency in the Pakistani banking sector between 1981 and 2002. They studied the effects of banking sector reforms on the productivity of banks using various techniques. Their study was divided into three sub-periods: the first period was before the financial reform over the period 1981-1992; the second period was included the set of financial reforms between 1993 and 1997, and the last period was from 1998 to 2002 and included the implementation of new reforms. Di Patti and Hardy provided a comprehensive analysis of bank ownership and performance and concluded that the new private banks are more efficient than state banks. Besides, they found that privatised banks improved their profit efficiency. Nevertheless, in the last period of their study, only one bank continued to enhance its profit efficiency significantly.

In addition, some studies reported a small negative change or no performance change during the first few years, but a positive impact over time that more than compensates for any short-run negative effects. For example, Clarke et al. (2009) investigated the relationship between

privatisation and bank performance in Sub-Saharan Africa from 1996 to 2004. They found an improvement in bank performance after privatisation, which arose from improvements in the loan portfolio quality and bank profitability. They also revealed that privatised banks increased credit growth, deposits, and the number of depositors. On the other hand, operational costs, i.e., the cost of mergers, re-branding and installing a proprietary intra-bank payment system, increased remarkably during the privatisation process, which then started to fall significantly due to the adoption of new banking strategies. Similarly, Burki and Ahmad (2010) examined the short-term and long-term effect of bank governance reforms on Pakistani and foreign banks' efficiency over the 1991–2005 period. They used the stochastic frontier model to estimate cost efficiency. The findings revealed that gains from bank privatisation are not immediate; this reflects a decrease in the level of cost-efficiency of privatised banks over the short-term while they experienced a dramatic improvement in cost-efficiency over the long-term.

Also, some studies revealed the improvements in bank performance included only some but not all the performance indicators. For example, Beck et al. (2005) investigated the effect of privatisation in Nigerian banks from 1990 to 2001. The study used a set of indicators to assess and compare the performance of privatised banks with other banks in the financial sector, including return on assets (ROA), the return on equity (ROE), and non-performing loans-to-total loans (NPL). The results found that privatisation has some positive effects on bank performance. It helped privatised banks improved their performance in terms of profitability and the quality of loan portfolios. On the other hand, the privatisation of the Nigerian banks did not improve costs. Beck et al. offer evidence of the limited performance improvements in a relatively weak institutional environment due to the poor data quality and limited information on the privatisation transactions and the individual banks. Therefore, the researchers were unable to disentangle the sources of changes in bank performance from governance changes. Evidence from Egypt, Omran (2007) investigated the effect of the privatisation process on bank financial and operating performance. He used cross-sectional regressions to measure the impact of privatisation on a sample of 12 Egyptian banks from 1996 to 1999. Omran found a noticeable reduction in profitability, liquidity, and a slight improvement in other performance indicators in privatised banks. Similarly, Otchere (2005) analysed privatised banks' operating performance and their rivals in the middle- and low-income countries. the findings demonstrated a slight improvement in the operating performance of privatised banks. Although these banks incurred high problem loans and high costs relative to the performance of existing

rival banks in post-privatisation, they were better capitalised than rival banks. It could be attributed that the privatised banks experienced inadequate capital market monitoring in the middle- and low-income countries. Besides, most of the state-owned banks, which were subsequently privatised, were privatised partially; this means government ownership continued to reduce managers' role and their ability to restructure the newly privatised banks.

2.4 **Bank privatisation and bank business models**

Bank business models changed radically due to deregulation and financial innovation. The deregulation and privatisation allow bank management to alter the banks' input and output mix and add to technological developments, which promote an increase in bank outputs (Altunbas et al., 2011). These changes may occur due to meaningful changes in organisational goals for privatised banks and their ability to reduce and control agency costs Berger et al. (2005). Furthermore, many essential banking aspects, such as bank size, recourse to non-interest income revenues, corporate governance, and funding practices, have influenced by changing the business model as well as the macroeconomic and competitive environment.

Many empirical studies, e.g., Hao et al. (2001), Berger et al. (2005), Beck et al. (2005), Clarke et al.(2005a) and Clarke et al. (2009), provided evidence on how privatised banks changed their performance following privatisation. Empirical studies addressed the effect of privatisation and suggested that some changes in business practices and portfolio orientation occur following privatisation. In line with the above-mentioned previous studies, we expect that the banks which privatised could perform differently after privatisation. We hypothesise that the privatised banks tend to move closer to behaving like other private-owned banks. Accordingly, our research is interested in examining the following hypothesis:

H5: Bank business models of privatised banks become similar to rival banks post-privatisation.

Several attempts have been made to study how bank privatisation does influence the assets' structure. For example, Berger et al. (2005) examined the relationship between bank governance and portfolio allocations of funds between loans and other assets for 16 Argentine banks following privatisation over 1993 to 1999. The results reported that the privatised banks behave more prudently in their loan portfolios after governance changes. They also found a decline in loan portfolios' share allocated to mortgages, Peso loans, and agricultural loans. The authors also found that the privatised banks have portfolios substantially different from those

of the domestic-owned banks and state-owned banks. Furthermore, their study reported that the privatised banks behave rationally through diversifying their loan portfolio by a higher ratio of public-sector loans, agricultural loans, and peso loans. In a related study, Clarke et al. (2005a) studied the direct effects of foreign entry and bank privatisation on lending behaviour in Argentina from 1995 to 1999. They suggested that the bank privatisation and foreign entry reduced lending to some sectors, such as agriculture and mining sectors, due to the poor performance of these kinds of loans before privatisation. Also, in Sub-Saharan Africa, Clarke et al. (2009) examined the impact of bank privatisation on performance between 1996 and 2004. They found a shift in the strategy of privatised bank's portfolio allocation by focusing on increasing agricultural lending and reducing holdings of government securities and manufacturing loans. These changes represent a strategic shift for privatised banks in post-privatisation. Moreover, Beck et al. (2005) investigated the relationship between privatisation and bank performance in their study of Nigerian banks between 1990 and 2001. Their results mentioned that privatised banks made some changes in their business practices by decreasing the investment in government bonds and increasing the level of loans that reflected positively on cost efficiency after privatisation. Beck and his co-authors also found that retail-oriented banks with large branch networks achieve the lowest ROA. They also showed that the banks depending on fee-based business are positively affect both ROE and ROA, but have the highest non-performing loans ratio. They also showed that banks with a high share of government bonds in their portfolio performed better than others in terms of ROA and ROE significantly.

On the other hand, previous empirical studies (e.g., Hao et al., 2001; Berger et al., 2005; Clarke et al., 2009) provided evidence on how privatised banks change their performance following privatisation and try to disentangle the sources of changes in bank performance from governance changes. Some of these empirical studies addressed the effect of privatisation and indicated that some changes in business practices and portfolio orientation occurred following privatisation. For instance, Hao et al. (2001) employed the ratio of demand deposits-to-total deposits and non-interest income-to-total operating income to capture the impact of bank business practices on bank efficiency post-privatisation. The results indicated that the deposit mix has a significant impact on bank efficiency, where it can influence positively or negatively the bank efficiency according to the bank business model. Thus, a high proportion of demand deposits might increase bank efficiency because banks can use this kind of deposit without paying high interest. Furthermore, the impact of non-interest income share depends on the

bank's expertise and strategic objective. Depending on a bank's business model, the effect of non-interest income on bank efficiency can be positive or negative. It positively impacts bank efficiency when bank management tends to provide financial and banking services based on fee and non-interest income. While the non-interest income share has a negative impact when bank management tends to employ its resources in traditional commercial and industrial lending activities. While Lin and Zhang (2009) in their study about the relationship between changes in banks ownership and bank performance in Chinese banks during the period 1997-2004 reached an important conclusion, which is the non-interest income is inversely proportional to the efficiency and assets quality in Chinese banks.

In another study, Micco et al. (2007) examined the nexus between ownership structure and bank performance for 179 countries worldwide from 1995 to 2002. The ratio of non-interest income and the ratio of demand deposits were used to explain bank business practices. They found no correlation between non-interest income and profitability for banks located in developing countries, while it has a positive impact on profitability for banks located in industrial countries. Furthermore, the findings suggested that the retail banks with a higher proportion of demand deposits and non-interest income share tend to be more profitable in developing countries. In contrast, the wholesale and investment banks, which have a higher non-interest income ratio, are more profitable in industrial countries. The opposite is true of the demand deposits-to-total deposits ratio.

2.5 Bank business models, performance, and stability

Two main structural developments have changed the bank business models. The first one is the deregulation and liberalisation of the banking sector after the globalisation of financial markets, aiming to achieve economic gains and increased competition. This development encouraged the establishment of large financial institutions which perform a wide range of banking activities. At the same time, the second change is the financial innovation that led to disintermediation and greater use of direct funding in financial markets, including securitisation activity. Due to this change, the banks became more integrated with financial markets that increased their share of non-interest income as a proportion of total revenues derived from trading actives, brokerage, and investment banking activities (Altunbas et al., 2011).

Altunbas et al. (2011) documented many factors that have contributed to increasing bank risks, such as the expansion in credit, reducing the reliance on customer deposits, bank size, capital weakness, and concentration in income resources. Furthermore, Vazquez and Federico (2015) found that both macroeconomic factors and monetary conditions are associated with the likelihood of bank failure, while Hryckiewicz and Kozłowski (2017) showed that funding structure was the main driver of systemic risk during the 2008 financial crisis.

Our study is related to a growing literature that examined the impact of bank business models on bank performance and risk-taking decisions. The research on bank business models has developed quickly since the GFC, where several empirical studies tried to understand why some banks were more damaged than other banks during the GFC. However, the evidence is mixed. We hypothesise that privatised banks become more profitable and more stable following privatisation. Thus, our study is directed toward the following hypotheses:

H6: Bank business models have an impact on performance of newly privatised banks.

H6a: Focused business model affects bank performance in newly privatised banks.

H6b: Trader business model affects bank performance in newly privatised banks.

H7: Privatised banks have become more prudent and less risky after privatisation based on the Mohsni and Otchere (2014)

Following Alunbas et al. (2011), Kohler (2015), Mergaerts and Vander Vennet (2016), and Hryckiewicz and Kozłowski (2017), we employed a set of financial variables which reflect the long-term strategies choices of bank management. Bank business models are identified using cluster analysis in privatised and non-privatised banks by employing four indicators of bank assets and liabilities: net loans-to-total assets, other earning assets-to-total assets, deposits and short-term funding-to-total assets and other interest-bearing liabilities-to-total assets. To understand the changes, which have taken place in the performance of privatised banks and non-privatised banks, we capture the profit and cost efficiency, return on assets (ROA), return on equity (ROE), net interest margin (NIM) to measure bank performance. Furthermore, we used the z-score to measure the stability of the bank.

Several empirical investigations like the studies of Ayadi et al. (2012), Ayadi et al. (2016), Martín-Oliver et al. (2017), Hryckiewicz and Koztowski (2017), Mergaerts and Vander Vennet (2016) and van Ewijk and Arnold (2014) employed statistical techniques to determine business

models, such as cluster analysis and factor analysis, according to the structure of bank capital, assets, funding source, and income. Martel et al. (2012) studied business models' developments in large international banks from 2006 to 2010. They used a global sample of (28) banks representing the most significant international banks in the world and applied the k-medoid clustering analysis. Their results suggested that during the GFC, the oriented business models in commercial banks are more flexible than the oriented models in investment banks. They suggested that commercial banks depend on stable funding sources (customer deposits) and operated with a high level of diversification in business lines, adding to the limited exposure to trading and derivatives activities. In his study, Ayadi et al. (2012) analysed business models' performance and flexibility in the EU banking industry. Based on balance sheet structures and using cluster analysis, they categorised four business models in the EU banking industry, namely the investment-oriented model, retail-oriented-focused, retail-oriented-diversified and wholesale. Their findings provided evidence that focused and diversified retail-oriented models were safer than other models. Furthermore, wholesale and focused retail banks tended to be more risky during economic downturns. While Mergaerts and Vander Vennet (2016) investigated the influence of bank business models on European bank performance and risk over the long term using Factor analysis to classify business models according to individual bank characteristics. Their sample covered 505 banks from 30 European countries from 1998 to 2013. The results showed that banks with the retail-oriented business model performed better in the long term since they exhibited high profitability and lower risks. It can be attributed to the dependence on customer deposits and high capital ratios, while the banks with a diversified business model appear to be profitable but less stable. Interestingly, other studies support the opposite conclusion. For example, Hryckiewicz and Kozłowski (2017) investigated the impact of bank business models on bank risk and profitability in 65 countries between 2000–2012. They concluded that the investment model has the lowest individual risk while it has a higher systemic risk than a trader business model before and during the financial crisis. They argued that the bank with the investment business model relies on deposits to fund their assets and could face a deficit in financing and liquidity due to the freeze in interbank markets, leading to insolvency problems in these banks. Therefore, it could be supposed that the countries which relied on the investment business model could overcome the financial crisis efficiently. Moreover, Curi et al. (2015) investigated the relationship between bank business models and technical efficiency in Luxembourg banks over 1995-2009. The study employed diversification

and concentration measures based on assets, funding and income using a modified Herfindahl–Hirschman Index (HHI) to measure the business model. The researchers found that the strategy of concentration strategy in asset, funding and income was the most efficient business model. Besides, they show that the diversification strategy negatively affected foreign bank efficiency during the GFC. This result implied a rational limit for diversification strategy in traditional, activities and non-traditional activities. They also demonstrated that the concentration strategy in asset, funding and income was the most efficient business model in the Luxembourg banks. Curi et al. selected the optimal business model that can be adopted by foreign banks in Luxembourg and showed that it could not determine the optimal business model. In line with the debate mentioned above, it can be argued that no unique bank model is more or less exposed to the global liquidity crisis and credit crunch. Consequently, it could be argued that the bank business models' characteristic features rely mainly on the interbank market for funding and the quality of the asset base. Prabha and Wihlborg (2014) examined the relationship between the factors related to implicit guarantees, bank business models and bank risk in 45 countries from Europe and the US over the period 2004 - 2010. The study attempted to explain how risk-taking behaviour changed across the study period. Their results suggested that there was a U-shaped relationship between implicit deposit insurance and bank risk, and the bank business models also have a substantial effect on risk-taking behaviour during and post the GFC. Furthermore, the results revealed that the wholesale funding model adopted by US banks led to a significant increase in risk-taking during and after the GFC. Nevertheless, the dependence on wholesale funding as a business model was linked with low risk-taking in European banks. The authors also mentioned that the derivatives had not shown any increase in risk-taking before the financial crisis.

The existing literature on bank business models employed a set of bank characteristics, which summarise strategic bank choices directly according to four dimensions – capital, assets, funding, and income structure or some of them. Our study used two dimensions (i.e., the structure of funding and income) and employed the non-interest income share and non-deposit short-term funding share to capture bank business models in chapter seven that addresses the long-term effect of privatisation. Furthermore, we tried to determine if privatised banks were more resilient during the global financial crisis than other banks. Consequently, we formulated the following hypothesis:

H10: Privatised banks are more resilient to face the GFC than other banks.

Some related studies dealt with a set of variables to explain bank business models directly. For example, DeYoung and Torna (2013) illustrated the relationship between non-traditional banking activities and commercial banks' failures in the U.S during the GFC. The non-interest income is divided into three categories: non-interest income from non-traditional investment activities, non-interest income from non-traditional fee-for-services activities and non-interest income from traditional banking activities, such as fees and commissions. The results suggested that the probability of commercial bank failure increased because of the reliance on non-interest income from investment activities during the GFC. While income from non-traditional and fee-for-service activities reduces the probability of bank failure. These results are related to differences in production and risk-return characteristics, which are related to categories of non-interest activities. This implies that non-interest income from different sources affects the probability of bank failure. Also, the results showed that the liberalisation of financial markets is not related to the banks' failure. Similar conclusions were reached by Brunnermeier et al. (2012), who found that banks with a higher non-interest income share have a more significant contribution to systematic risk than traditional banks with a higher percentage of interest income. Their results also revealed that non-interest activities have a significant effect only on systematic risk; this allows banks to diversify individual risk. Williams (2016) investigated the relationship between income diversification and bank risk in Australia. He concluded that banks with a large share of non-interest income are riskier or less stable; due to increasing bank revenue volatility and stock market risk. He found that the income diversification did not add any benefit to the bank portfolio diversification. Busch and Kick (2015) examined the relationship between non-interest income share and bank performance in the German banking industry between 1995 and 2011. Their findings presented that non-interest income positively impacts the return on assets (ROA) and returns on equity (ROE), suggesting that banks with a higher share of non-interest income have a higher risk-adjusted return on equity (RAROE) and risk-adjusted return on total assets (RAROA). The results also found that commercial banks that expand their non-interest activities exhibit a higher risk than cooperative and savings banks, which means an increase in the fee-based activities in commercial banks enhances ROA and ROE's volatility. Thus, an increase of non-interest income could influence the stability of the banking system negatively. Moreover, Senyo et al. (2015) investigated the impact of income diversification on financial performance and profit stability in the Ghanaian-banking sector from 2002 to 2011. The results suggested

that the interest income still comprises the more significant part of bank profits, and non-interest income has a positive and significant effect on bank profitability. The study also found that the revenue from non-traditional activities contributes to ensuring the stability of profitability in Ghanaian banks. In contrast, Erji et al. (2012) tested the effect of non-interest income on bank risk and returns in Taiwan's banking industry during the period 1992 - 2009. The findings showed that reliance on non-interest income could boost bank risk and reduce bank profits. The findings also showed that the benefits of diversification could be reduced due to increasing dependence on non-traditional activities significantly.

Evidence from Germany Kohler (2014) investigated the effect of non-interest income on bank risk in retail- and investment-oriented banks. He found that the non-interest income has an impact differently on bank stability according to bank type. Savings and cooperative banks tend to be more stable and profitable when focusing on lending and deposit activities. Conversely, the investment banks are exposed to more risk remarkably when they diversify their income. Additionally, the findings revealed that the diversification of funding also has different effects based on bank type. The savings and cooperative banks were noticeably less stable than the investment banks when they increased the non-deposit funding ratio.

In the same way, in a sample of the EU countries, Kohler (2015) addressed business models' effect on bank stability from 2002 to 2011. The author identified the bank business models by income and funding structures, and his empirical results revealed that the effect of business models vary across types of banks. It could be argued that it is essential to identify the business model when analysing the impact of non-interest income and non-deposit funding. These differences have a significant effect on bank stability and returns. The study also showed that savings banks and cooperative banks which depend on a retail-oriented strategy by expanding their share of non-interest income, leading to more stability and profitability. In contrast, the commercial and investment banks with investment-oriented strategy that increased their non-interest income share were more risky and less profitable. Besides, the study determined that the reliance on non-deposit funding has a different effect on bank stability. It also uncovered that the retail-oriented banks, which increased their share of non-deposit funds were less stable. On the other hand, the investment banks could be more stable when they increase their non-deposit funds share. On the other hand, Vazquez and Federico (2015) investigated the effect of bank funding structure on financial stability in 11,000 banks in the U.S. and Europe from 2001 to 2009. They found an increased likelihood of bank failure in banks with lower liquidity and

a higher leverage level in the pre-crisis period. The analysis also found that bank size has an essential effect on the likelihood of bank failure. They indicated that small banks were more exposed to liquidity risk while large global banks were more exposed to solvency risk during the GFC.

Furthermore, Spice et al. (2016) investigated the relationship between bank business models and risk in a sample of 241 listed banks from 39 countries between 2007 and 2009. The bank rating is used as a measure of risk. The share of traditional income is employed to explain the bank business model. Their findings suggested that banks with a diversified business model were more stable during the GFC.

In contrast, Sudrajad and Hübner (2019) examine the relationship between bank business models and banking stability and performance in six ASEAN countries from 2002 to 2015. They employed a non-interest income share and non-deposit short-term funding share to present bank business models. The results found banks with a higher ratio of non-interest income were related to higher bank stability and better bank performance. Meanwhile, they studied the impact of market power on bank business models and found that banks with higher market power increased the share of non-deposit short-term funding in their financing mix.

Other researchers focus on assets and funding sources and their impact on bank risk and performance. For example, King et al. (2013) investigated the effect of bank trading activity on bank risk, profitability, and stock return in BHCs (Bank Holding Companies) in the U.S from 2000 to 2012. The study focused on balance sheet items as a measure of trading activity. The results revealed that the market share of trading assets could explain the extent of the BHC's contribution to systemic risk rather than the trading income share. It suggested that the diversification into non-traditional activities could achieve advantages to BHC's. Besides, during and after the GFC, findings showed that trading activities positively related to bank risk. While it has a negative association with both profitability and stock returns, it is also suggested that reducing proprietary trading might lead to improving the BHC performance and mitigate systemic risk. Finally, this study provided empirical evidence about the importance of regulatory changes in the economic soundness of the new regulations like the Volcker rule, Vickers.

Liikanen reports. Demirgüc-Kunt and Huizinga (2010) investigated the effect of bank activity and short-term funding strategies on risk and returns using an international sample of 101

countries. The findings showed that banks that relied on non-interest income activities have a high return on assets and lower levels of risk due to risk diversification benefits. On the other hand, banks, which relied on non-deposit, wholesale funding have the lowest return on assets while it could be less risky at the low levels of non-deposit funding. The fast-growing institutions relied significantly more on fee income-generating activities and non-deposit funding. Furthermore, banks in developed countries mostly tend to rely on non-deposit funding. Dependence on fee-generating activities was more common in developing countries. Evidence from Central and Eastern European countries, Andrieş and Mutu (2017) found that banks with higher capitalisation ratios performed better in terms of profitability and stability. Banks would be significantly more stable and profitable if they increased their traditional lending activities and degree of income diversification during 2007-2008. The results showed an enhancement of the positive relationship between the capitalisation ratios and return on average equity during the GFC. Altunbas et al. (2011) studied the relationship between bank business models and bank risk using a sample of listed banks from the European Union and the United States during the GFC (2007-2009). This study addressed business models' characteristics, namely, capital, asset, funding, and income diversification. The researchers found that larger banks faced more risks due to reduced capital, increased credit growth, and reliance on the short-term market. However, banks with diversified income and a strong base of deposits were less exposed to risk.

A few studies of the bank business model, for example, Martín-Oliver et al. (2017) and Andrieş and Mutu (2017), addressed the combination of bank ownership and bank business choices to explain bank performance and stability. After the global financial crisis, many studies investigated the impact of bank business choice on performance (risk and return) based on assets, funding, capital, and income structure, as mentioned before, while ignoring the bank ownership's role and their effects on bank business models. Hence, these changes in bank strategies will reflect on performance and banks stability. Martín-Oliver et al. (2017) investigated how the ownership form and governance mechanisms affect Spanish banks' performance and stability. They assumed that banks' ownership and governance are responsible for the financial crisis's causes and results. The results showed that reduction in both interest rates and liquidity after creating the Euro led the Spanish banks to change their business strategies and move from business models based on deposit financing to models based on market-debt financing. Martín-Oliver et al. emphasised the relevance of ownership and

governance of banks in achieving financial stability in the Spanish banking sector. They found shareholder banks are more resilient in bad times. Andrieş and Mutu (2017) investigated the relationship between bank business strategies and performance across ownership and bank size in Central and Eastern European countries. They used characteristics of capitalisation, assets, funding, and income diversification to explain bank business strategies. The results found that the asset structure has a positive effect on foreign banks' performance, while foreign banks which rely on non-deposit funding have a negative impact on return on average equity. Regarding bank size, there was a positive and significant impact of lending activities on small bank profitability.

Cheng et al. (2016) employed propensity score matching and difference-in-differences approaches to capture foreign strategic investors' effect on business models in China's banking sector from 1995 to 2014. They showed that foreign strategic investors shares have a significant impact on income structure; this means banks with a high share of foreign ownership increased the non-interest income. Besides, this study provides evidence about foreign strategic investors' importance in supporting bank privatisation in China and modernise its financial sector.

Curi et al. (2015) pointed to the importance of the bank organisational forms before and during the financial crisis. They noticed that the branches could capitalise from the high efficiency of bank subsidiaries.

2.6 Bank ownership, performance, and risk-taking behaviour

This section reviews literature that studies the effect of ownership and governance on bank performance and risk-taking decisions. According to the theoretical and empirical research, bank performance and risk-taking behaviour are affected by bank ownership. The existing literature provides ample evidence of bank risk-taking behaviour in newly privatised banks (e.g., Mohsni and Otchere, 2014; Lassoued et al., 2015 and Dong et al., 2014).

Boubakri et al. (2005) examined the effect of privatisation on performance and risk-taking exposure in a sample of 22 developing countries from 1986 to1998. They analysed the relationship among the ownership structure (foreign investor, industrial group, or state), the performance and risk-taking of banks after privatisation. The findings suggested that although the state-owned banks which underwent privatisation faced problems in their economic efficiency and solvency, they improved performance after privatisation. Besides, it has been

found that the ownership type affected the profitability, efficiency, risk exposure and capitalisation of privatised banks post-privatisation. The results revealed an increase in credit risk and interest rate risk in newly privatised banks dominated by locally owned banks. However, the newly privatised banks controlled by domestic and foreign became more efficient.

In contrast, the effect of bank privatisation on risk-taking behaviour has been investigated by Mohsni and Otchere (2014) using a sample of 242 privatised banks in developed and developing countries from 1988 to 2007. The empirical results showed that the risk-taking in privatised banks decreased considerably; this could be attributed to two main factors: firstly, the cancellation of government support to privatised banks, which led to an increase in the stability of the banking system and bank franchise values. Secondly, the changes in bank ownership structure. Overall, the results demonstrated that the bank ownership structures, the level of a country's development, and the political risk significantly impact risk-taking behaviour in newly privatised banks. On the other hand, the researchers found the newly privatised banks show a higher risk than rival banks in the post-privatisation. The results also suggested a nonlinear relationship between bank ownership and risk-taking where they found a significant reduction in risk-taking in privatised banks due to changes in the bank ownership structure. This result suggested that privatised banks became more prudent after the removal of government guarantees.

In addition, Boubakri et al. (2013) examined the relationship between shareholders' identity and corporate risk-taking in 381 newly privatised firms from 57 countries, including emerging markets and industrialised countries, between 1981 and 2007. The researchers concluded that ownership identity has a significant impact on risk-taking post-privatisation. The study highlighted that state ownership negatively affects risk-taking, while foreign ownership has a positive effect on risk-taking. Furthermore, it found that corporate risk-taking in newly privatised firms depends on the ownership structure, the level of country development, and governance institutions' level. Boubakri et al. showed an increase in exposure to credit risk and interest rate risk in privatised banks that underwent local industrial groups after privatisation.

Conversely, evidence from MENA countries, Lassoued et al. (2015) assessed the influence of ownership structure on bank risk-taking in 171 commercial banks from 2006 to 2012. The results showed a positive relationship between state-owned banks and risk-taking. Therefore, the state banks resort to increasing their capital to face high-risk levels. The researchers found that foreign-owned banks negatively affect bank risk, meaning that foreign banks exhibited a

lower risk than their rivals. The results revealed that the differences in ownership structure reflect differences in bank objectives and the interests of shareholders.

On the other hand, Ho et al. (2015) studied the role of country governance in 113 privatised banks across 39 countries. They demonstrated that the privatisation effects in developing countries are more significant than those in developed countries. They found that country governance related positively with a privatisation effect in developing countries. This trend could be attributed to political interference or high corruption levels that affect privatised banks' performance in these countries.

Other groups of researchers investigated how the level of ownership concentration affects bank performance and risk-taking. For example, a European study by Barry et al. (2011) examined the impact of changes in ownership structure on risk and profitability in state banks and private banks from 1999 to 2005. The study identified five owners: directors, investors of institutions, non-financial institutions, individuals, and banks. The results focused on the importance of changes in bank ownership structure in determining the risk levels. They found state-owned banks did not influence credit risk; however, in private banks, the relationship between changes in bank ownership structure and risk-taking depends on categories of shareholders. Furthermore, the banks and individuals seek to reduce risk while the institution's investors and non-financial companies adopt a risky strategy.

Similarly, Dong et al. (2014) tested the nexus between ownership structure and risk-taking behaviour in the Chinese banking sector between 2003 and 2011. The results showed that bank risk is affected by the degree of concentration in bank ownership. They also found that state-owned banks tended to take a higher risk than other banks due to political intervention and weak incentives to follow prudent bank management practices. Furthermore, the adoption of profit-maximising strategies and prudential lending practices could decrease the risk-taking in banks controlled by state-owned enterprises SOECBs and private banks. Similar conclusions were reached by Iannotta et al. (2013), who reported that state-owned banks have lower default risk but higher operating risk than private banks due to the presence of governmental protection, which explains the high risk-taking. They also found increased operational risk and governmental protection in state-owned banks during election periods; state-owned banks seek political goals in European countries.

2.7 Bank governance and performance over the long-term

A large and growing body of literature investigates the impact of privatisation on bank performance to identify how long it takes privatised banks to alter the bank's course and improve its performance and which ownership form is the best to change bank behaviour and enhance performance? Domestic private ownership or foreign ownership.

One could argue that some of these studies use only a limited number of observations for the post-privatisation period. Nevertheless, the long-term bank privatisation effects have been examined in several economies like Korea (Hao et al., 2001), Pakistan (Di Patti and Hardy, 2005 and Burki and Ahmad, 2010), South East Asia countries (Williams and Nguyen, 2005) and China (Lin and Zhang, 2009 and Jiang et al., 2013). All the above studies have focused on emerging economies; however, bank privatisation in developed countries has not been extensively studied. In the current study, we examine the effects of bank privatisation on bank efficiency over the long-term in developed countries as well as developing and transitional countries. More recent attention focuses on the sustainability of expected efficiency gains after privatisation. For instance, Hao et al. (2001) and Di Patti and Hardy (2005) are among early studies which emphasise the importance of distinguishing between short-term and long-term effects of deregulation and privatisation and bank performance. Therefore, we hypothesise the following:

H8: Privatised banks become more efficient and stable over the long-term.

H8a: Privatised banks become more profit-efficient over the long-term.

H8b: Privatised banks become more cost-efficient over the long-term.

H8c: privatised banks become more stable over the long-term.

The evidence on improving the efficiency of privatised banks, which are controlled either by foreign or local banks, over the long-term are limited or have no definite conclusion. We are aware of only a few studies that investigate post-privatisation performance effects over the long-term such as Hao et al. (2001), Di Patti and Hardy (2005), Williams and Nguyen (2005), Burki and Ahmad (2010) and Jiang et al. (2013). As aforementioned before, Hao et al. (2001) found a positive relationship between deregulation and productivity in their study of private Korean banks, but the improvements in bank productivity are not sustainable over the long-term. This view is supported by Di Patti and Hardy (2005), who revealed a decline in

profitability and an increase in costs in the last period of their study on Pakistani banks. They attributed their results to regulatory changes and business conditions, including loan quality assessment and early recognition of doubtful loans, leading to increasing extraordinary costs in the income statement.

On the other hand, Boubakri et al. (2005) provided evidence of post-privatisation bank performance and risk-taking behaviour in 22 developing countries. Although the privatised banks showed an increase in profitability, a significant decrease in efficiency and more exposure to credit risk have been identified following privatisation. Therefore, the critical result of this study is the considerable improvement in efficiency and credit risk exposure over the long-term.

Evidence from China, Lin and Zhang (2009) examined the relationship between changes in bank ownership and performance from 1997 to 2004. The study employed the analysis of static, selection, and dynamic effects of (domestic) private, foreign, and state ownership to assess the impact of bank ownership on performance. The findings showed that the privatised banks with a foreign acquisition or public listing record performed better than other banks. In their study, Lin and Zhang also provided empirical evidence of little performance change after the privatisation of Chinese banks in either the short or the long term.

On the other hand, Nakane and Weintraub (2005) investigated the effects of privatisation on bank productivity between 1994 and 2002 in a sample of 242 Brazilian commercial banks. The Cobb–Douglas production function was used to estimate productivity. The researchers found that although privatisation has a positive effect on bank productivity, these potential positive benefits may take longer to be realised fully. Furthermore, the study revealed no robust performance difference related to the method of privatisation (i.e., straight privatisation or federalisation followed by privatisation. Burki and Ahmad (2010) examined the short-term and long-term effect of bank governance reforms on the efficiency of Pakistani and foreign banks over the period 1991–2005. The results showed that gains from bank privatisation are not immediate; this reflected from the decrease in the level of cost-efficiency of privatised banks over the short-term and the dramatic improvement in cost-efficiency over the long-term. Moreover, Jiang et al. (2013) studied the effect of privatisation on bank performance in a sample of 49 Chinese banks during the period 1995–2010. The results suggested that privatisation has a positive and significant impact on Chinese bank efficiency, including enhancement in cost, profit, and interest income efficiency in both the short and long-term. In

addition, they found that the positive impact is more significant for banks with minority foreign ownership over the short- term, but it has declined in the long-term.

Empirical researches documented the positive impacts of foreign ownership in privatised banks, and some studies (e.g., Bonin and Wachte, 2005; Williams and Nguyen, 2005; Jiang et al., 2013) found that privatised banks with foreign ownership are significantly more efficient than other banks with regard to cost and profit efficiency. It could be said that increasing foreign ownership participation in banking systems is expected to improve bank efficiency and performance in transitional economies. This improvement can be attributed to the advanced technology and modern banking techniques of foreign banks, such as superior risk management skills and excellent managerial skills in addition to their experience in financial intermediation. Based on the above, the following hypothesis is formulated:

H9: Privatised banks by foreign ownership are more efficient than (perform better than) their privatised counterparts by domestic banks over the long-term.

The literature (for example, Bonin et al., 2005; Williams and Nguyen, 2005) also agreed that banks privatised by foreign ownership might take longer to get potential benefits regarding cost and profit efficiency. For South East Asia, Williams and Nguyen (2005) provided evidence that privatised banks sold to strategic foreign owners may take longer to be realised. Meanwhile, for transition countries, Bonin et al. (2005) suggested the positive impacts of privatisation on bank efficiency may not be realised immediately in banks privatised by foreign ownership. Later, Fries et al. (2006) examined the effects of market entry and privatisation on bank performance in transition countries from 1995 to 2004. They employed the equilibrium model of monopolistic competition in banking to examine the relationship between market entry, privatisation, and bank performance. They divided their study period into three sub-periods. The results suggested that in the first sub-period, a noticeable increase in the revenue of private banks compared with the revenue of foreign or state banks and the marginal costs of foreign banks were much lower than other banks. In the second sub-period, their results showed that local private banks have a better margin than the margins of foreign or state banks, which reflected the privatised banks' capacity to increase the demand for loans and deposits. In the third sub-period, the costs of foreign banks and privatised banks, which underwent to foreign investors, decreased dramatically compared to those of local and state-ownership banks because foreign banks used new technology and their skills to get these results. Finally, the study provided evidence of foreign bank entry and bank privatisation to increase the demand

for loans and deposits and control costs. Similarly, Bonin et al. (2005) investigated the relationship between foreign ownership and bank efficiency in 11 transition countries over five years from 1996 to 2000. Using stochastic frontier analysis (SFA) to estimate cost and profit efficiency, these authors found that the privatisation policy itself is not sufficient to improve privatised bank efficiency in transition countries. Therefore, private and state banks could not increase efficiency in the banking sector. They also found that state and private banks have a negative and insignificant effect on cost and profit efficiency. However, it is noted that foreign banks could attract further depositors, borrowers and provide the best service. Therefore, foreign banks' participation has a positive influence on profit efficiency, where foreign banks have worked on the restructuring of state banks. Furthermore, Bonin et al. (2005) also conclude that privatised banks with foreign ownership are more cost-efficient than other rival banks. Using more empirical evidence from a sample of 63 developed and developing countries, Taboada (2011) analysed the effect of bank ownership structures on capital allocation. This study included the top 10 banks in each country as of 1995, 2000, and 2005. The results showed that capital allocation efficiency is significantly affected by bank ownership structure, depending on whether the investors were local or foreign. Their findings also showed that foreign banks could improve capital allocation through better loans quality. They concluded that this ability might reduce lending problems related to government politicians. Furthermore, the study found the local banks have poor-quality loan portfolios, especially in countries with high levels of corruption and firms with strong political relationships.

Concerning the importance of private domestic ownership, evidence from Pakistan, Di Patty and Hardy (2005) found that banks privatised by private domestic ownership were more efficient than foreign banks. Similarly, Berger et al. (2005) tested the effect of bank governance on portfolio allocation in Argentine banks and found that domestic-owned banks performed better than foreign-owned banks. Evidence from Korea, Hao et al. (2001) found that the banks privatised by domestic ownership had a negative effect on cost efficiency while those privatised by foreign ownership had a positive impact on cost efficiency. Whereas Williams and Nguyen (2005) found that the main challenge of the privatised banks by domestic ownership in SE Asia was increasing the profit efficiency. Besides, Lin and Zhang (2009) revealed that the privatised banks, which underwent partial sales to foreign firms and public stockholders after changing the bank ownership, improved considerably. Their results also documented that the Chinese

government sold the best banks to attract foreign and local investments, which helped the government support financial reform.

2.8 Foreign Banks Ownership, Performance and Stability

In this section, we review the theoretical and empirical studies that address the effect of foreign bank penetration and bank privatisation. Besides, we review the previous studies about foreign bank entry and their relationship with financial stability. Finally, we present previous studies related to the effect of foreign bank entry on bank performance.

Over the past few decades, many countries have liberalised their financial policies and opened their doors to foreign banks to enter the domestic banking system. There are two common strategies to privatise state banks: attracting foreign investors and going public. Empirical studies (e.g., Williams and Nguyen, 2005 and Jiang et al., 2013) revealed that banks with foreign ownership are more efficient due to "advanced technology and modern banking techniques such as superior risk management skills, superior managerial skills and experience in financial intermediation".

Given the importance of foreign banks in many countries, we should understand the motivation of foreign banks to enter a particular host country and their impact on financial sector development and lending stability. The empirical literature has sought to identify the motivation of foreign bank entry; for example, Molyneux et al. (2013) studied the motivation of foreign bank entry in South East Asia during the period 1998-2004. They concluded that there were two main types of motivation for the entry of foreign banks into South-East Asian countries, namely profit opportunities and the desire to provide banking services to their customers wherever they are. However, the strongest motivation was finding profit opportunities.

In addition, Claessens and van Horen (2012) showed that foreign banks have several advantages, including servicing and following their home customers abroad to ensure a continuing relationship with them, diversifying bank risk, and high efficiency and scale gains. Their study also found a set of essential determinants which affected the profitability of the foreign banks, including the level of development in the home country and, the quality of regulation in the host country, size and monopoly power of the bank and a cultural and regulatory distance between home and host country. Claessens and van Horen indicated some

factors that might help foreign banks acquire market share and perform better than domestic banks in host countries, such as old and inefficient banking practices, the development of the financial sector, and, finally, the financial sector bad rules and regulations.

2.8.1 Foreign Bank Entry and Performance

The academic literature has devoted attention to the outcomes of privatisation and financial liberalisation in the banking sector, where the deregulation of foreign banks was investigated in several papers in both developed and developing countries. Some recent literature emphasises the importance of foreign ownership and its effect on bank efficiency and performance. For example, evidence from transition and developing countries, Clarke, Cull, et al. (2005a) investigated the direct and indirect effects of bank privatisation and foreign entry on bank credit in the Argentine banking system between 1993 and 1999. The authors explained the lending behaviour of foreign banks and privatised banks under foreign ownership. Their results suggested that an improvement in bank efficiency follows the removal of restrictions on foreign bank entry and bank privatisation. The study also showed a decline in agricultural loans and mining sector loans in the privatised banks and foreign banks. Furthermore, the non-performing agricultural loans accounted for about 50% of loans from State banks before privatisation. Based on an international sample of banks from 63 countries, Taboada (2011) suggested that capital allocation efficiency is affected significantly by a bank ownership structure (local or foreign investors). The findings revealed that foreign banks enhanced capital allocation efficiency by increasing lending to productive industries, improving the quality of loan portfolios, mitigating the lending problems associated with high levels of corruption, and firms with strong political relationships. Furthermore, Wu et al. (2010) investigated the effects of foreign bank penetration on capital allocation and economic growth in emerging economies from 1996 to 2003. The sample included 35 countries from Asia, Latin America, and Eastern and Central Europe. Wu et al. found foreign bank penetration positively affects allocating capital and economic growth in the host emerging economies. They also revealed that foreign banks played a crucial role in enhancing economic integration between emerging economies (host countries) and advanced economies (home countries of foreign banks).

Other evidence from emerging markets using a unique dataset from Poland, Degryse et al. (2012) examined the relationship between foreign bank entry, credit allocation and lending rates in emerging markets between 1996 and 2006. The results focused on the importance of

foreign entry mode, Greenfield, and requisition, to determine the composition of foreign bank portfolios based on the kind of borrower, loan maturity, and currency. They also found the entry of foreign banks by Greenfield investment has important effects on the reallocation of lending by domestic banks. It could be argued that these effects might contribute to increasing opaque borrowers and portfolio risk. Furthermore, limited evidence suggested that foreign bank entry by acquisition tended to increase short-term lending.

Evidence from transition countries, Bonin and Wachtel (2005) found foreign banks could attract further depositors and borrowers with the best services. According to their results, the participation of foreign banks in the privatisation process has a positive influence on profit efficiency and performance of privatised banks by foreign ownership. In the same vein, using evidence from Asian developing countries, Li Lin et al. (2015) examined the relationship between bank ownership changes and cost efficiency under conditions of financial liberalisation using data covering 219 banks from 12 Asian developing countries over the period 2003 to 2012. Their findings suggested there was a positive relationship between foreign shareholders and cost efficiency. In contrast, they observed a negative correlation between domestic ownership and cost efficiency in countries with high financial freedom.

In contrast, using data from 105 countries from 1998 to 2003, Lensink et al. (2008) investigated the effect of foreign ownership on bank efficiency and how this relationship varies according to the institutional quality of the host country. The results showed that foreign ownership negatively affected bank efficiency, and these adverse effects were less apparent in countries with good governance. They concluded that the high quality of the institutions in the home country and the similarity between the home and host country institutional quality worked to reduce foreign bank inefficiency. Using unique data from 137 countries covering emerging markets and developing countries, Claessens and Van Horen (2011) investigated the effect of foreign bank activities on financial development and stability between 1995 and 2009. This study tested the relationship between foreign banks, financial development, and bank stability regarding loans, deposits and profits, and market shares of foreign banks during the GFC. The results showed that balance sheet variables reflect differences between foreign banks and domestic banks; whereas the ratio of both capital and liquidity of foreign banks were higher than the local banks, foreign banks' profitability was lower. Furthermore, the entry of foreign banks into developing countries had a negative effect on domestic credit creation.

Chen and Liao (2011) investigated the common effects of banking market structures, macroeconomic conditions, banks governance, and changes in bank supervision in the home and host countries on bank profitability. Their study covered foreign banks in 70 countries (transition, developed and developing) from 1992 to 2006. They analysed the main factors that affected foreign bank profitability. They investigated the impact of banking market structures, macroeconomic environments, institutional governance, banking competition, and country risk between the host country and home country on foreign banks' profitability. They also investigated bank supervision's effect on foreign banks' profitability in the joint home- and host-country. Their results showed that foreign banks' profitability, which operated in a host country, is more significant than that of domestic banks. Moreover, it is concluded that if the parent bank in the home country faced high economic risks, restrictive capital requirements, and less competitive banking market structures, foreign banks in a host country could witness a significant decrease in the net interest margin compared with domestic banks. On the other hand, the results indicated that the profitability of foreign banks in a host country was affected positively by the decline of competition in the market, the decrease of the growth rates of GDP in a host country, the increase in the interest and inflation rates, and the regulatory constraints related to Basel risk weights. Regarding the changes in bank supervision in the home country, the study found these changes resulted in a noticeable increase in foreign banks' profitability.

Claessens and Van Horen (2012) examined the effect of market structure on foreign banks' performance, they used the ratio of profit before taxes-to-total assets (ROA) to measure profitability. Two indicators measure the market structure, including the share of the largest three banks and the Herfindahl index based on assets or deposits.

The findings showed that the market structure of the home and host country did not affect foreign bank performance. The results also indicated that there was a set of essential determinants which affect foreign banks performance; namely, the level of development in the home country, the quality of regulation in the host country, bank size, banking monopoly power, and the cultural and regulatory distance between home and host country.

2.8.2 Foreign ownership and financial stability

There is an increased interest in investigating the relationship between foreign ownership's effects on financial stability, and the studies confirmed that they have a negative impact on financial stability. Using evidence from Asian countries, Chiang Lee and Fen Hsieh (2014)

investigated the relationship between foreign ownership and financial stability. Their bank-level data cover 1387 banks from 27 Asian countries over the period 1995 to 2009. The percentage of foreign investor shares was used as a measure of foreign ownership, while the following indicators measured the financial stability of a bank: Z-score, capitalisation ratio, the ratio of loan loss reserves-to-non-performing loans, and the ratio of non-performing loans to equity. The authors applied the Generalised Method of Moments (GMM) to find the impact of foreign ownership on financial stability under different conditions of bank reforms, including banks' privatisation. The results found a negative relationship between foreign bank ownership and bank stability in Asian countries. Moreover, there was an inverse U-shaped curve relationship between foreign ownership and stability. Besides, the authors also found a significant negative relation between explicit deposit and financial stability. However, their results demonstrated the liberalisation of credit control plays a crucial role in mitigating the negative effect of foreign ownership on stability and the liberalisation of banking supervision and bank privatisation did not produce a harmful effect on financial stability during the Asian financial crisis.

Kasman and Kasman (2015) investigated the influence of bank competition and concentration on financial stability in the Turkish banking industry. The study of competition covered the period from 2002 to 2012. The researchers used the Boone indicator and the efficiency-adjusted Lerner index to measure competition, whereas employed the non-performing loan (NPL) ratio and the Z -score to measure bank stability. The empirical results showed that the increase in competition between banks has a negative effect on bank stability due to a rise in credit risk. On the other hand, the results demonstrated that increases in bank concentration have a positive impact on the NPL ratio and a negative effect on the z-score. Chen et al. (2017) investigated the relationship between foreign ownership and bank risk-taking behaviour in 32 emerging economies from 2000 to 2013. They found that banks with foreign ownership take more risk than their domestic counterparts. The study provided empirical evidence that there were several factors (e.g., foreign banks' informational disadvantages, agency problems, the contagious effect of parent banks' financial conditions and the disparity between home and host markets) that significantly affect the level of risk-taking in foreign banks.

Shabana and James (2018) examined the relationship between ownership changes and performance and risk exposure in 60 Indonesian commercial banks between 2005 and 2012. They analysed the static, selection, and dynamic effects of domestic, foreign, and state

ownership on bank performance and risk exposure. They found state-owned banks were less profitable and more exposed to risk than private-owned banks or foreign-owned banks. Besides, private-owned banks performed better in terms of cost and profit efficiency. Furthermore, the domestic acquisition was generally related to a decline in efficiency, while foreign acquisition is associated with a decrease in risk exposure. Using evidence from European countries, Barry et al. (2011) focused on the importance of the ownership structure in determining risk levels. The results showed that state-owned banks did not affect credit risk, and the relationship between privatised banks and risk-taking depended on shareholders' categories and the banks. The study also showed that the banks and individuals tended to reduce risk, while institutional investors and non-financial companies adopted risky strategies. In their study, Lassoued et al. (2015) revealed a positive relationship between state ownership and risk-taking for the MENA countries, but they found that foreign banks negatively affect bank risk. These results reflect the differences in shareholders' objectives and interests.

2.9 **Conclusion:**

This chapter considers the literature review and hypotheses development, beginning with a brief overview of the theoretical background followed by the literature show of corporate governance and bank performance, and then we review the previous studies of bank privatisation and bank business models. After that, we discuss the previous empirical studies on bank business models, performance, and stability. Then, we present the previous empirical research on bank ownership, performance, and risk-taking behaviour, followed by reviewing governance and performance literature over the long-term. Finally, we review the theoretical and empirical studies which examine foreign banks ownership, performance, and stability. The next chapter is the data collection and research methodology.

Chapter 3 : Data Collection and Research Methodology

3.1 Introduction

This chapter aims to outline the research methodology and to describe the dependent and independent variables used to find out the effect of bank business models on bank performance and stability, then examine the long-term effects of privatisation on bank performance. Therefore, this chapter is organised as follows: we first show our data and sample selection in section 3.2. The next section, 3.3, describes the empirical model and the variables used to identify bank business models using cluster analysis. In section 3.4, we present the methods that employed to act as proxies for bank performance which include profit efficiency, cost efficiency and other performance indicators. Then, section 3.5 presents a definition of independent variables. After that, section 3.5 provides summary statistics of the variables used in our analysis and finally, section 3.7explains the research methodology of the current study.

3.2 Data and sample selection

A unique feature of this study is the construction of a panel data set covering 31 years for 2,513 commercial banks from regional economies in Latin America (Argentina, Brazil, Chile, Mexico, Venezuela), South East Asia (Indonesia, Malaysia, Philippines, Thailand, China, Korea, Vietnam); Eastern and Western European countries (Belgium, Czech Republic, Hungary, UK, Austria, France, Greece, Italy, Portugal, Spain and Poland) in addition to Australia. Lastly, Turkey and Egypt from developing countries. Our sample ended in 2015, and our data set includes the financial crisis of 2007, which helps us examine the ability of privatised banks to withstand the global financial crisis. We obtained bank privatisation data from the literature, including Megginson (2005) and Mohsni and Otchere (2014). Besides, we used the World Bank Privatisation Database (2008), which provides information on privatisation transactions in developed and developing countries. We collected data from 186 privatised banks across 26 countries. The accounting data of bank balance sheets and income statements were obtained from BankScope over the period 1985–2015. We collected control groups of state-owned banks, foreign banks, and private owned banks from the same sources. We sourced obtained macroeconomic time-series data (e.g., the inflation rate and GDP growth) from the IMF International Financial Statistics database, World Bank development indicators,

and the world economic outlook database. We also used the S&P DOW JONES country classifications to construct our lists of developed and developing countries. Data have been deflated by national GDP deflators and converted into US$ millions at 2010 prices.

The main causes of concern that could negatively affect confidence in terms of the regression results are the outliers. The term 'outlier' or extreme values can be defined as an observation of variables (dependent or independent variables), which is markedly different in value from the rest of the observations in the data set. Brown and Tucker (2011) stated that the outliers might lead to bias in findings and potentially violate the Ordinary Least Squares OLS assumptions. Furthermore, reliance on these outliers could lead to unreliable results.

Two strategies are used to deal with outliers: deleting the outliers and winsorising them. Deleting the outliers means that all the observations that represent extreme values that may affect the reliability of the results are removed from the analysis. The second strategy is winsorising, defined as a value modification method for outliers that does not exclude any observations (Searls, 1966). It involves replacing extreme values with values closest to them in the tail of the distribution in which they occur. Tabachnick and Fidell (2007) mentioned that many scholars prefer to winsorise the data to mitigate outliers' effect. Consequently, the data is winsorised by setting all outliers at 99% of the data.

Our study does not adopt the option that leads to the elimination of some outliers. Therefore, following the studies of Chen et al. (2014) and Mergaerts and Vander Vennet (2016), we winsorise our variables to mitigate the impact of outliers in the data by assigning the outlier a lower weight and changing the value so that it is close to other values in the set. As a result, all financial variables are winsorised at the 1% level on both sides of the sample distribution to deal with severe outliers and reduce outliers' influence in our results. Our final sample has 30,891 bank-year observations and covers 2,513 commercial privatised and non-privatised banks.

Table 3-1 presents the sample of commercial banks. Panel A highlights the distribution of the sample by country. We showed that the country with the highest number of privatised banks is Argentina, followed by Mexico and France. Panel B shows the number of bank privatisations in developed and emerging countries. We also observe that the ratio of privatisations in developing and developed countries is about 70% and 30% respectively.

Table 3-1 Descriptive statistics

Panel A: Distribution of privatised banks and non-privatised banks observations by country

Country	Obs.	No. of banks	No. of Privatised banks	No. of non-privatised banks	Date of privatisation
Eastern and Western European countries					
Poland	753	96	7	89	1992
Czech Republic	247	18	3	15	1992
Austria	1518	122	3	119	1997
Belgium	1027	84	1	83	1996
France	4646	318	16	302	1987
Greece	371	28	7	21	1991
Hungary	352	26	5	21	1995
Italy	2625	250	7	243	1985
Portugal	576	49	6	43	1990
Spain	1560	128	1	127	2004
UK	1989	156	1	155	1990
South-East Asia					
Indonesia	1740	161	8	153	1996
Korea	630	34	9	25	1972
Malaysia	795	50	3	47	1985
Philippines	816	60	6	54	1989
Thailand	616	35	15	20	1989
China	1981	209	7	202	2001
Vietnam	652	55	3	52	2005
Latin America					
Argentina	1568	117	24	93	1991
Brazil	2734	218	7	211	1997
Chile	713	44	4	40	1985
Mexico	923	76	18	58	1991
Venezuela	923	76	8	68	1991
MEAN countries					
Turkey	404	49	7	42	1992
Egypt	425	20	7	13	1996
Australia	307	34	3	31	1995
Total	30,891	2,513	186	2,327	

Panel B: Distribution of privatised banks by developed and developing countries

No. of privatised banks	Developed countries	Developing countries
186	54	132

Source: BankScope, 1985–2015.

3.3 Identification of bank business models

Our purpose in this thesis is to identify the business models of privatised and non-privatised banks. This section aims to provide answers concerning whether the bank business models have changed after privatisation or not. We also investigate whether privatised banks become more like rival banks or not. Then we identify the impacts of bank business models on performance and stability in privatised banks. This section begins with a review of methods that are used to determine bank business models in the literature. Section 4.2.2 displays the variables which are used to characterise the bank business models which are examined in this thesis. Section 4.2.3 reports descriptive statistics of the variables, while section 4.2.4 identifies the bank business models using cluster analysis.

3.3.1 Methods used to identify bank business models

Our study is related to a large number of studies that analyse the impact of bank business models on bank performance. Most of these studies focused on the global financial crisis. The literature suggests several approaches to identify bank business models, and these approaches fall into two categories. The first one is using a statistical technique to identify groups of observations and features to determine business models. The first approach uses cluster analysis to identify bank business models according to bank assets and funding sources in order to measure and compare performance during and after the GFC, such as Ayadi et al. (2012), Ayadi et al. (2016), Martín-Oliver et al. (2017), Hryckiewicz and Koztowski(2017) and Lueg et al.(2019).

Ayadi et al. (2012) applied cluster analysis using a set of variables to capture a bank's strategic choices related to funding sources and investment activities in the European banking industry from 2006 to 2010. Their study identified four business models: investment, retail-focused, retail diversified, and wholesale business models. Hryckiewicz and Kozłowski (2017) identified bank business models in 65 countries between 2000 and 2012, based on earning assets and liability sources using cluster analysis. They classified bank business models into four models, namely specialised, investment, diversified and trade models. Martín-Oliver et al. (2017) used a set of financial variables: equity-to-total assets, loans-to-total assets, loans-to-deposit, and net interbank-to-total assets, to identify business models in Spanish banks from 1992 to 2007. They grouped business models, using cluster analysis, into four clusters: retail-deposits, retail-balanced, retail-diversified, and retail-market and use four shorter sub-periods

to compared pre-Euro and post-Euro periods. Lueg et al. (2019) also used cluster analysis to classify the business models of a sample of 63 European and US banks from 2007 to 2012. They employed six main variables as proxies: net interest income-to-operating income, customer deposits-to-total assets, trading assets-to-total assets, interbank liabilities-to-total assets, fee and commission income-to-operating income, and tangible common equity-to-tangible assets. The results showed three business models: investment bank model, retail bank model, and universal business model in European and US banks.

Other studies, for example, Mergaerts and Vander Vennet (2016), Van Ewijk, and Arnold (2014) employed factor analysis to group features. Its primary goals are to reduce the number of variables and to detect the structure in the relationships between variables, which are loans to earning assets, deposits to liabilities, income diversification is measured by the share of non-interest income, bank size is measured by the log of total assets, loan loss provisions, net stable funding ratio, and equity to total assets, to classify variables. Therefore, factor analysis is applied as a data reduction or structure detection method.

Van Ewijk and Arnold (2014) employed a set of financial variables to find bank business models using factor analysis in a sample of US commercial banks from 1992 to 2010. These variables are the log of the number of domestic offices to total loan volume; bank size; commercial and industrial loans plus farm loans divided by total assets; the interest income to total income ratio; the proportion of retail deposits to total liabilities; the ratio of small business loans to total assets; and finally, the core deposits to total liabilities ratio. Mergaerts and Vander Venn (2016) constructed a sample of banks from 30 European countries. They employed a factor analysis technique to identify bank business models by using variables to capture strategic bank choices related to the asset, liability, capital, and income structures. These variables are loans-to-earning assets, deposits-to-liabilities, income diversification, the log of total assets, loan loss provisions, and net stable funding ratio. They determined two primary business models, namely, retail and diversification business models.

The second approach employs a set of bank characteristics directly to summarise strategic bank choices according to four denominations: capital, assets, funding, and income structures, or some of them (Altunbas et al., 2011; Kohler, 2015; Cheng et al., 2016 and Andrieş and Mutu, 2017).

Kohler (2015) investigated the impact of business models on bank stability in 15 EU countries between 2002 and 2011. Bank business models are represented using the ratio of net non-interest income to total operating income and the ratio of non-deposit funding to total assets. Similarly, Cheng et al (2016) focused on income structure and funding structure to represent bank business models in China's commercial banks. They used non-interest income-to- total operating income ratio and the non-deposit funding-to- total funding ratio. While Spice et al. (2016) studied the impact of bank business models on bank rating and defined bank business models as the traditional interest income share in total operating income.

3.3.2 **Definition of variables**

We employed a set of strategic variables which reflect the long-term strategic choices of bank management related to assets and funding structures to understand the changes that have taken place in bank performance after the privatisation of the state-owned banks. This thesis used the characteristics of assets and liabilities of 2,513 commercial banks from 26 developed and developing countries from 1985 to 2015. The k-medoid clustering approach is used to identify bank business models. This methodology allows us to cluster the banks with similar assets and liabilities exposure into one group. Simultaneously, we create different groups for banks that do not exhibit the same characteristics.

In this section, we consider that business models that reflect bank strategic choices related to assets and funding structures. For clarity, we summarise the definitions of variables to be used in cluster analysis to identify bank business models:

- The ratio of net loans-to-total assets: this ratio indicates the extent of the involvement of the bank in traditional lending activities and reflects the banks' ability to transform the liquid deposits into illiquid loans (Altunbas et al., 2011 and Mergaerts and Vander Vennet, 2016).
- The ratio of other earning assets-to-total assets: this ratio is defined as the total other earning assets include loans and advances to banks; securities; derivatives; and other securities.
- The ratio of deposits and short-term funding-to-total assets: this ratio represents to what extent bank assets are funded from stable sources.
- The ratio of non-deposit funding: this ratio is defined as debt liabilities which include the other interest-bearing liabilities, for example, derivatives; trading liabilities; and long-

term funding divided by total assets. This kind of financing is a more risky and less stable source of funding than deposits (Altunbas et al., 2011 and Kohler, 2015).

3.3.3 **Descriptive statistics**

Table 3-2 presents the descriptive statistics for the clustering variables. This table shows the indicators employed to identify bank business models using cluster analysis. All bank variables are winsorised at the 1- and 99-percentile level. We used the assets and funding structures to represent the bank business models in our study, assets' structure expressed by the loans-to-total assets ratio, and other earning assets-to-total assets ratio. Deposits and short-term funding ratio, and non-deposit funding-to-total assets represent the funding structure.

The differences in the dominance of individual asset and liability variables of the sample banks identify the differences in banking models. Importantly, this allows banks to change their strategy during the study period (i.e., the pre-and post-privatisation periods).

The assets' structure shows that the ratio of loans to total assets has a higher mean of 48.1 percent, and the mean of other earning assets is about 41 percent. The funding structure variables, the proportion of deposits and short-term funding - total assets show a higher mean of 71.3 percent while the mean of debt liabilities is about 7.1 percent.

Table 3-2 Descriptive statistics of variables to be used in the cluster analysis; % of assets

Bank variables	Obs.	Mean	Std. Dev.	Min	Max
Asset's structure					
Loans	30891	0.481	0.248	0	0.986
Other earning assets	30878	0.410	0.246	0.002	0.981
Funding structure					
Deposits and Short-term funding	30859	0.713	0.222	0	0.978
Debt liabilities	30846	0.071	0.133	0	0.754

Notes: The data are denominated in millions of US dollars at 2010 prices. All variables have been calculated using data from BankScope. All bank variables are winsorised at the 1- and 99-percentile levels.

3.3.4 The identification of bank business models using cluster analysis

Many approaches are used in the literature to identify bank business models. This thesis relies on the k-medoid clustering analysis to characterise the bank's strategies in 26 developed and developing countries.

Cluster analysis involves many ways for classifying which are based on optimising some criteria, for example, minimising the within-cluster variance, or maximising the distance between the objects or clusters.

Our study uses medoid-partitioning algorithms to construct the cluster analysis. This approach minimises the sum of dissimilarities between points labelled to be in a cluster, and a point designated as the medoid of that cluster, to identify the bank business models.

We analyse the international sample and examine what role each asset and funding structures play in identifying the different groups. Since we did not have any initial hypothesis on how many clusters there might be, we created as many as were necessary from the banks sampled. We employed the K-medoid method using STATA- 15 software. The basic strategy of the K-medoid algorithm is to find cluster centres in a set of data points arbitrarily. Then, any remaining objects are clustered with the medoid to which they are most similar.

The K-medoid method uses representative objects as reference points instead of taking the mean value of the objects in each cluster as is done in K-means. As an input parameter, the algorithm considers the number of clusters among a set of data points (Dasgupta and Ghosh, 2012). This approach avoids heterogeneity in each set of data. It aims to group observations, based on a set of measured variables, into a number of different groups (clusters) such that similar variables are placed in the same group. Therefore, cluster analysis can be described as a form of categorisation (Batra, 2011).

K-medoid clustering is an iterative procedure that partitions the data into k clusters. The procedure begins by selecting k data points as the medoids from n data points. Then, observations are assigned to the group with the closest medoid. After that, the median of the observations assigned to each group is computed, and the process is repeated. These steps continue until all observations remain in the same group from the previous iteration (StataCorp, 2013).

We employed the following variables to capture bank business models: the ratio of net loans-to-total assets, the ratio of other earning assets-to-total assets, the ratio of deposits and short-term funding-to-total assets and the ratio of other interest-bearing liabilities-to-total assets. We homogenise these key variables by dividing all balance sheet positions by the total assets.

The most difficult task in cluster analysis is deciding on the appropriate number of clusters. To determine the optimal number of clusters k for each year, we use the Calinski–Harabasz (1974) pseudo-F index as stopping rules. The larger values of the Calinski–Harabasz pseudo-F index indicate distinct clustering. The sum of squared Euclidean distances to the medoid in each cluster is minimised to obtain an optimal cluster, and this is also termed as the error sum of squares. The pseudo-F statistic is defined as the ratio between- cluster variance to within-cluster variance. The between-cluster sum of squares is calculated as:

$$B_c = \sum_{t=1}^{c} \sum_{i=1}^{n_t} n_t \, (v^t - \bar{v})^2 \qquad \text{Eq. 3-1}$$

$$\bar{v} = \frac{1}{n_t}(x_1 + x_2 + \cdots + x_n) \qquad \text{Eq. 3-2}$$

$$v^t = \frac{1}{n}\left(x_1^t + x_2^t + \cdots + x_{n_t}^t\right) \qquad \text{Eq. 3-3}$$

Where k, t and n are respectively the number of clusters, the number of observations and the number of samples in the cluster.

To measure how tight the clusters fit together, the variance within-cluster is usually used as an indicator. The high value of the variance means that the cluster has high dispersal and vice versa. The within-cluster sum of squares can be expressed as:

$$P_k = \sum_{t=1}^{k} \sum_{i=1}^{n_t} (x_i - \bar{v_l})^2 \qquad \text{Eq. 3-4}$$

The pseudo-F statistic is calculated as:

$$Pseudo - F = \frac{B_k}{P_k} . \frac{n-k}{k-1} \qquad \text{Eq. 3-5}$$

Where n is the number of observations, k is the number of clusters, B_k is the between-cluster sum of squares and P_k is the within-cluster sum of squares. The maximum value of pseudo-F indicates optimal number of clusters, Yang et al (2015).

Based on the pseudo-F indices values, the results show that the number of clusters (bank business models) is different across the study period. (See Appendix A and B)

As a result of the k-medoids cluster analysis, three separate clusters appear. We run a cluster analysis for each year to explore the evolution of bank business models over time. More specifically, according to the results of k-medoids clustering using both the earning asset and funding structures, two bank business models are identified, namely:

- ***Focused retail model:*** this cluster represents a more traditional bank model. The main features are a high proportion of loans and other earning assets, such as securities and derivatives funded by deposits and short-term funding as the primary source of funding.
- ***The trader model:*** the dominant feature of this model is it has the highest share of trading assets. However, the funding structure is traditional because it depends predominantly on deposits and short-term liabilities — average values of ratios to total assets.

Appendix A characterises the bank business models regarding all four choice variables (columns). The last row shows the average ratios for all banks which were classified for each year.

Table 3-3 presents the frequency distribution of bank business models for all samples. A frequency distribution summarises the results of the cluster analysis. The most common business models are the focused retail model and trader model 56.30%, 43.70%, respectively.

Table 3-3 The frequency distribution of bank business model for all sample

Bank Business Models	Freq.	%
Focused retail	17360	56.30
Trader model	13477	43.70
Total	30837	100

Source: outputs of cluster analysis using Stata.

3.4 Methods employed to construct proxies for bank performance

This section defines and explains the dependent variables of our modelling framework, namely: profit efficiency, cost efficiency and other performance indicators.

3.4.1 The estimation of profit and cost efficiency using stochastic frontier models

The estimation of cost and profit efficiencies reflects the bank managerial abilities to achieve maximum profit and minimum costs respectively, where the minimum and maximum are determined by the best practice frontier (Berger et al., 2010). Bank efficiency can be defined as the ratio of the maximum output for a given input which can be achieved by applying the best management practice and making use of new technology. It is composed of two components, namely, technical efficiency and allocative efficiency. The former refers to banks' ability to maximize outputs for given inputs or minimize inputs for given outputs while the latter refers to the ability of banks to combine inputs and outputs in optimal proportions for the given prices (Coelli et al., 2005). The summation of technical and allocative efficiencies is called X-efficiency, which represents a deviation of banks from a best practice frontier (Berger et al., 1993). It also reflects managerial ability to control costs and/or maximize revenues, i.e. the difference between actual and minimum cost or actual and maximum profit.

Recent studies have used two different approaches to estimate bank efficiency, the first is the parametric stochastic frontier approach (SFA) while the second one is the non-parametric data envelopment analysis (DEA). These two approaches differ in the date assumptions such as the shape of the efficiency frontier, the existence of random error, and the distributional assumptions imposed on random error and inefficiency (Berger and Humphrey, 1997)

The main advantages and disadvantages of the SFA and DEA approaches concern the data assumptions and the ease of interpretation. The SFA, for instance, is a regression based econometric technique and is constructed under the assumption that the data sample has a

normal distribution whilst the DEA assumes there is no random error (Kumbhakar and Lovell, 2003). Besides, the SFA has advantages over the DEA in estimating banking efficiency by allowing for estimating the measurement error and generation of bank specific efficiency. These estimations are vital tools for bank managements to help in improving their operational efficiency (Lin et al., 2015).

Follow the previous works of Bonin et al. (2005), Berger et al. (2009), Berger et al. (2010), Olson and Zoubi (2011), Williams (2012), Fungáčová et al. (2013) and Lin et al. (2016), we employed the SFA approach to estimate the bank efficiency. This method is more suitable than DEA technique in terms of the ratio of statistical noise to inefficiency.

Bank performance is measured using alternative profit efficiency and cost efficiency by the SFA approach. This approach employs a parametric technique to estimate the characteristics of the best bank management practices which are employed to produce financial services at minimum cost using the optimal mix of bank inputs (Hao et al., 2001).

Estimating efficiency in the banking sector is not an easy task and there is an argument about how to identify bank outputs when banks provide a variety of intermediation and transaction services. In estimating profit and cost efficiency of a bank using SFA, the literature suggests two main approaches: the production approach and the intermediation approach. The first approach treats the banking industry as similar to any kind of industries which produce goods and services (Nakane and Weintraub, 2005). Therefore, material, capital and human resources are considered as production factors to produce outputs. Whereas the inputs for the intermediation approach are usually the general and administrative expenses, the labour cost, and the price of capital while the outputs are deposits and loans.

For SFA used in our study, to disentangle individual time-invariant unobserved heterogeneity from inefficiency, we estimated cost and profit for a sample of 2,513 banks from 26 developed and developing countries. We employed Greene's true random-effects approach to estimate a half-normal stochastic frontier model using maximum likelihood (Greene, 2005a b). We also focused on the examination of changes in profit and cost efficiency over time. Such analysis can help in examining the impact of privatization policy on bank efficiency. Consequently, we can determine whether the privatization of state banks has resulted in cost and profit efficiency improvements in 26 developed and developing countries.

Our study is based on the intermediation approach of Sealey and Lindley (1977). It is common in the bank efficiency literature to distinguish the inputs and outputs of the banking industry. The intermediation approach supposes banks are intermediate financial institutions purchasing liabilities (deposits as inputs essential to get profits) to generate earning assets. From this perspective, our study focusses on two outputs and two input prices which have been adopted by Williams (2012). The two outputs are total loans (y1), and customer deposits (y2) whereas the two input are the price of the labour (x1) and the price of the physical capital (x2). The first input is measured by the ratio of personal expenses-to-total assets and the second one is measured as the ratio of non-interest expenses-to-fixed assets. The total cost variable (TC) of banks is the summation of interest expense and non-interest expenses, and it can be expressed as (Bonin et al., 2005):

$$C_{it} = f(y_{it}, X_{it}) + \varepsilon_{it} \qquad \text{Eq. 3-6}$$

$$\varepsilon_{it} = v_{it} - u_i \qquad \text{Eq. 3-7}$$

Where:

C_{it} : the natural logarithm of costs (profit) for i bank in year t,

y_{it} : the services produced by the banks, including total loans and customer deposits,

X_{it} : the inputs prices, including price of the capital and price of the labour,

ε_{it} : independently distributed and homogenous variable,

v_{it} : measurement error and other uncontrollable factors, and

u_i : relates to aspects that management can affect technical and allocative inefficiency.

To control the heteroscedasticity, total assets are used to normalize each of the total costs (profit before-tax) and the outputs of the variables in the model.

The translog profit function

Alternative profit efficiency could be defined as a tool to assess the quality of the performance of a bank with respect to a ‘‘best-practice” bank producing the same outputs and working under the same environmental conditions (Williams and Intarachote, 2002) (Berger et al., 2010).

In our study, we introduce the stochastic frontier model for panel data which takes into account the time-invariant and individual-specific effects. This is an important feature of the panel data model when modelling the temporal behaviour of inefficiency Kumbhakar et al. (2015). We employ the translog profit function to estimate profit efficiency.

The profit before-tax and outputs variables are normalised by total assets, which is considered to be a fixed netput z, to control for heteroskedasticity and to reduce scale biases in the estimation Williams (2012) and (Bos and Koetter, 2011). We include independent variable Negative Profit Indicator (NPI) which has been defined to be equal to one for observations where positive profits are equal to the absolute value for a loss incurring bank. We follow Williams (2012) in estimating an alternative profit function based on Humphrey and Pulley (1997) under the assumption that banks may be willing to assume additional costs to realise improvements in profit. The frontier model includes two inputs and two outputs, and it is specified based on standard assumptions regarding the similarity of bank inputs prices and symmetry of the second order parameters (Williams, 2012).

We follow Williams (2012) and specify the translog profit function as follow:

$$\ln\left(\frac{PBT}{z}\right)_{it} = \alpha_0 + \sum \ln(x_{hit}) + y_l \ln\left(\frac{Loans}{z}\right)_{it} + y_D \ln\left(\frac{Dep}{z}\right)_{it} + \frac{1}{2}\sum \gamma_{hm} \ln(x_{hit}) \ln(x_{mit}) + \gamma_{LD} \ln\left(\frac{Loans}{z}\right)_{it} \ln\left(\frac{Dep}{z}\right)_{it} + \frac{1}{2}\gamma_{LL} \ln\left(\frac{Loans}{z}\right)_{it}^2 + \frac{1}{2}\gamma_{DD} \ln\left(\frac{Dep}{z}\right)_{it}^2 + \sum \gamma_{hL} \ln(x_{hit}) \ln\left(\frac{Loans}{z}\right)_{it} + \sum \gamma_{hL} \ln(x_{hit}) \ln\left(\frac{Dep}{z}\right)_{it} + \mu_1 T + \frac{1}{2}\mu_2 T^2 + \mu_L T \ln\left(\frac{Loans}{z}\right)_{it} + \mu_D T \ln\left(\frac{Dep}{z}\right)_{it} + \mu_h T \ln(x_{hit}) + LnNPI + \ln(\varepsilon_c) - \ln(\mu_c) \quad \text{Eq. 3-8}$$

lnPBT is the natural log of the variable profits before tax of bank i at time t; ; ln Loans is the log of total loans; ln Dep is the log of customer deposits; ln xi is the log of input prices (physical capital (non-interest expense/fixed assets) and labour (personnel expenses/total assets)); z is fixed netputs represent total assets; T represents trend variable, t : 1; 2; 3; 4; ….; 31 for years 1985, 1986, 1987, 1988, ……, 2015. We consolidate year dummies variables to capture the macroeconomic and business cycle factors, including changes in the market and regulatory conditions over time (Berger et al., 2005; and Beck et al., 2005).

NPI represents a Negative Profit Indicator equal to the absolute value of the loss; ln ε_{it} which are identical and independently distributed and homogenous variables. ln μ_{it} which is positive random variables which are assumed to account for inefficiency.

The translog cost function

The cost efficiency score is determined by comparing bank actual costs to best-practice minimum costs to produce the same output under the same conditions (Berger et al., 2010). The multi-output translog functional form for the cost frontier is as follows:

$$\ln\left(\frac{OC}{z}\right)_{it} = \alpha_0 + \sum \ln(x_{hit}) + y_l \ln\left(\frac{Loans}{z}\right)_{it} + y_D \ln\left(\frac{Dep}{z}\right)_{it}$$
$$+ \frac{1}{2}\sum \gamma_{hm} \ln(x_{hit}) \ln(x_{mit}) + \gamma_{LD} \ln\left(\frac{Loans}{z}\right)_{it} \ln\left(\frac{Dep}{z}\right)_{it}$$
$$+ \frac{1}{2}\gamma_{LL} \ln\left(\frac{Loans}{z}\right)_{it}^2 + \frac{1}{2}\gamma_{DD} \ln\left(\frac{Dep}{z}\right)_{it}^2$$
$$+ \sum \gamma_{hL} \ln(x_{hit}) \ln\left(\frac{Loans}{z}\right)_{it} + \sum \gamma_{hL} \ln(x_{hit}) \ln\left(\frac{Dep}{z}\right)_{it}$$
$$+ \mu_1 T + \frac{1}{2}\mu_2 T^2 + \mu_L T \ln\left(\frac{Loans}{z}\right)_{it} + \mu_D T \ln\left(\frac{Dep}{z}\right)_{it}$$
$$+ \mu_h T \ln(x_{hit}) + \ln(\varepsilon_c) + \ln(\mu_c) \qquad \text{Eq. 3-9}$$

Where i and t denote the banks and years, respectively. ln OC is the log of operating cost (the sum of personnel expense and non-interest expense). ; ln y1 is the log of total loans; ln y2 is the log of customer deposits; ln xi is the log of input prices (physical capital (non-interest expense/fixed assets) and labour (personnel expenses/total assets)); z is fixed netputs represent

total assets; T represents trend variable, t : 1; 2; 3; 4; ….; 31 for years 1985, 1986, 1987, 1988, ……, 2015. ln ε_{it} are identical and independently distributed and homogenous variables; ln μ_{it} which is non negative random variables which are assumed to account for inefficiency.

3.4.2 Descriptive statistics of basic variables used in the profit and cost efficiency estimations

Table 3-4 shows the descriptive statistics of inputs and outputs which are employed to estimate the translog-function of profit (cost) efficiency of 2,513 commercial banks over the period 1985-2015. We use the intermediation approach following the previous studies of Williams and Intarachote (1997), Hao etal. (2001), Olson and Zoubi (2011). We employ the translog-based estimations of profit (cost) efficiency; output variables considered are total loans and customer deposits. The input variables are x1 price of physical capital proxied by the ratio of non-interest expenses-to-total fixed assets) and x2 (the price of funds, measured by the ratio of interest expenses-to-purchased funds). The total operating costs (the sum of personnel expense and non-interest expense)

In order to control for heteroskedasticity and reduce scale biases in the estimation, we normalized each of the total costs (profits before-tax), and output variables are normalized by total assets, which are considered as a fixed netput z. as is presented by Lin et al. (2016). Following Williams (2012) and (Bos and Koetter, 2011), we include independent variable NPI (for Negative Profit Indicator). NPI is equal to one for observations where positive profits and equal to the absolute value for a loss incurring bank. All financial items are in millions of $US, and inflation-adjusted to the price level of the year 2010. Table 3-4 shows the summary statistics of basic variables used in the profit efficiency estimations. We estimate Eq. 3-8 separately for each country. Profit and cost-efficiency scores range between 0 and 1 with values closer to 1, indicating a higher level of bank efficiency.

Table 3-4 Summary statistics of the variables for stochastic frontier models (in a million US$)

Variable	Obs.	Mean	Std. Dev.	CV
Operating costs (OC)	30806	416.191	2476.785	5.951
Pre-tax-profit (PBT)	30881	225.057	1749.82	7.775
Outputs				
Total loans (y1)	30423	14718.6	494837.7	33.62
customer deposits (y2)	30422	11068.68	85738.16	7.746
Input prices				
Price of labor (x1)	29276	3.897	9.422	2.417
Price of Capital (x2)	30579	0.37	2.772	7.483
Total assets	30866	21447.52	142000	6.636
Net Profit Indicator NPI	30885	23.98	786.02	32.78

Notes: The data are denominated in millions of US dollars at 2010 prices, except for the input prices that are expressed as ratios. This table shows the descriptive statistics of essential variables used in the profit and cost efficiency estimations. In our translog-based estimations of profit (cost) efficiency levels, output variables considered are total loans, costumer deposits. The input variables are: x1, price of labour is the ratio of personnel expense-to-total assets; x2, price of physical capital is the ratio of non-interest expense-to-total fixed assets; the input prices are winsorized at the 0.01 and 0.99 levels. Total assets is treated as a netput—meaning that it enters the cost and profit functions. NPI, net profit indicator. All financial values are denominated in millions of US dollars at 2010 prices.
Source: BankScope, 1985–2015.

3.4.3 **Other Bank Performance indicators**

We are interested in the impact of bank business models on performance and the stability of newly privatised banks. Following Mergaerts and Vander Vennet (2016), we employ three key indicators as dependent variables to assess bank performance commonly used in the literature, return on equity (ROE) is defined as pre-tax profit-to-equity; return on assets (ROA) is pre-tax profit-to-total assets. We also used the ratio of net interest income-to-earning assets (NIM) which reflects the banks' ability to invest the various funding sources and transform those funds into profitable assets.

Consistent with several studies on banking (e.g., Kohler, 2014; Kohler, 2015; Mergaerts and Vander Vennet, 2016; Williams, 2016), our main proxy for bank stability is the z-score. We

compute standard measures of risk for each bank throughout the period under study based on annual accounting data following (Barry et al., 2011; Mohsni and Otchere, 2014; Kohler, 2014; Kohler, 2015; Mergaerts and Vander Vennet, 2016). The z-score is defined as the inverse of the probability of insolvency and it depends on the relation between bank i profitability ROA_{it}, the riskiness of its returns (σ_i ROA) and its existing level of capital reserves CAR_{it} over a rolling window with three observations of ROA over the period t − 2 to t. Higher values of Z indicate lower probabilities of failure Mergaerts and Vander Vennet (2016). It represents bank exposure to operating losses which would reduce the buffer (capital reserves) against potential shocks to the returns. So, the bank level of z-score is calculated as:

$$Z - score = \frac{ROA_{it} + CAR_{it}}{SDROA_{ip}} \qquad \text{Eq. 3-10}$$

Where the volatility of ROA (SDROA) is the standard deviation of the ratio of pre-tax profit to-total-assets for bank i in year t, requiring at least three years of non-missing observations. Similarly, we calculate the return of assets ROA and average of CAR (defined as the ratio of equity-to-total assets) for each bank over a rolling window with three observations of ROA and CAR over the period t − 2 to t. We use the logarithm of the inverse of the Z-score to smooth the effect of extreme values.

3.5 Description Independent Variables: Definitions and measurements

Bank performance can be affected by bank-specific variables and country-specific variables. Depending on the previous studies (e.g., Berger et al., 2005; Williams and Nguyen, 2005; Beck et al., 2005; Lin and Zhang, 2009), we include bank characteristics and macroeconomic variables, which linked to bank performance. To reduce outliers' effect, we winsorise all accounting variables at the bottom and top 1 percent of the distribution. The descriptions and expected effects of the variables are as follows.

3.5.1 Privatisation dummy variables

The literature on ownership and bank performance, such as Boubakri et al. (2005), Di Patti and Hardy (2005) and Omran (2007), suggested that improvements in bank performance depend on the ownership structure. We include dummy variables to identify those banks that have faced a change in ownership over the study period. Three dummy variables capture the effect

of bank privatisation on performance and bank risk-taking. We examine how performance and risk-taking differ between newly privatised banks and non-privatised banks using Priv, a dummy variable which equals 1 for privatised banks and zero otherwise. The Post is a dummy variable which equals 1 for the post-privatisation period and zero otherwise. It is based on the privatisation programme started for each country; finally, to capture the changes in the performance of newly privatised banks post-privatisation, we create an interaction Post*Priv dummy variable that equals 1 for a privatised bank in the period following privatisation and zero otherwise.

We include the privatisation dummy variables to capture the effect of bank privatisation over the long term based on Boardman et al. (2016): Priv-short term is a dummy variable interaction which takes a value of 1 for the short-term post-privatisation period (1–3 years) and 0 otherwise. Priv-medium term is a dummy variable interaction which takes a value of 1 for the medium-term post-privatisation period (4–10 years) and 0 otherwise. Priv-long term is dummy variable interaction which takes a value of 1 for the long-term post-privatisation period (11 or more years) and 0 otherwise.

3.5.2 **Macroeconomic variables:**

To incorporate the effects of the business cycle and monetary policy, we select the growth rate of real GDP and the inflation rate, which have been linked to bank efficiency.

The first country variable is the inflation rate; it is an important macroeconomic variable, which reflects the stability of prices in a country. The rate of inflation is presumed to have a negative association with bank efficiency, and this means that the higher inflation rate, the lower the efficiency of a bank, and vice versa. The second country variable is GDP growth (GDPGR) which measured the level of economic growth in a country. It is also an indicator of the economic activities in the country. Economic growth is presumed to have a positive effect on bank efficiency. Lin et al. (2015) found that the growth in real GDP per capita has a positive relation with bank efficiency in developing Asian economies. Micco and Panizza (2004) reported a positive relationship between GDP growth rate and bank profitability in Latin America.

We expect that the inflation rate will have a positive effect on banking risk. Kohler (2015) investigated the effect of business models on bank stability using a sample of listed banks from the European Union during the period 2002 to 2011. He found that the inflation rate has a

significantly adverse effect on bank stability with higher rates of inflation leading to lower bank stability. This result supports Prabha and Wihlborg (2014) who reached the same conclusions regarding GDP growth and inflation.

Kunt and Huizinga (2010) demonstrated that countries which have an increase both rate of inflation and GDP growth have a related increase in fee income share and return on assets. This means the macroeconomic environment affects the share of bank resources allocated to fee generating and interest.

Furthermore, we include a Developed dummy variable to control for differences between developed and developing countries. It has value of 1 for developed countries and 0 otherwise. The GFC dummy variable captures the potential impact of the global financial crisis, and it has a value of 1 for the years 2007- 2015 and 0 otherwise. Finally, we include country-year fixed effects to control for all country-specific information.

3.5.3 **Bank characteristics**

We used two dummy variables to indicate bank business models which are as follows. The focused retail model is a dummy variable, which equals 1 for yearly observations of a focused retail business model and zero otherwise. The trader model is a dummy variable, which equals 1 for annual observations of trader business model and zero otherwise.

We employed several control variables to capture differences which are not directly related to a bank business model but are essential to determine bank performance and stability. We include Foreign as a dummy variable, which equals 1 for foreign banks and 0 otherwise (Williams, 2012). The Bank size variable captures the effect of scale bias on bank efficiency (Hao et al., 2001). It is measured by the logarithm of total bank assets. Previous studies for example, Berger et al. (2005), Williams and Nguyen (2005) and Beck et al. (2005) reported a positive and significant relationship between efficiency and bank size. Furthermore, Beck et al. (2005) suggested that large banks enjoy economies of scope and/or scale which affect bank efficiency positively. In contrast, Bonin et al. (2005) and Lin et al. (2015) suggest that bank size has a negative effect on bank efficiency, i.e., small banks are more efficient than large banks in transition countries. We expected bank size and risk to be negatively related. The banking literature suggests that diversification increases with the size of the bank. So, the larger banks are expected to be more diversified than smaller banks. Kohler (2015) indicates that

bigger banks are less stable than other banks, which confirms results reported elsewhere (see Berger et al., 2010; Curi et al., 2015; Kohler, 2014).

According to the Basel Committee, capital regulations have been measured using the ratio of equity to the total asset. This ratio reflects the probability of bankruptcy and financial distress of the banks. The impact of capital regulations on bank efficiency has been discussed in the literature, e.g., Li Lin et al. (2015), and Westman (2011) suggested a negative and significant impact of bank capitalisation on bank efficiency. It was also concluded that a reduction of the minimum capital requirements led to improving bank efficiency in developing Asian economies (Li Lin et al., 2015). It can be argued that banks which have free capital have an excellent opportunity to invest more money in loans and securities to increase their profitability. However, Naceur and Omran (2011) suggested that the ratio of equity to total assets positively affects bank efficiency in MENA countries. We used the ratio of loans-to-total assets to capture the loan portfolio orientation of the banks see Beck et al. (2005) and Naceur and Omran (2011). The choice of operational efficiency allows previous studies, such as, Prabhaand Wihlborg (2014), and Mergaerts and Vander Vennet (2016), to find that operational efficiency is essential to determine bank performance and, it could be regarded as an outcome of strategic choices. We use the cost-income ratio, which is the ratio of non-interest operational expenses-to-non-interest and net interest income. We include two variables to capture bank business orientation, the ratio of non-interest income-to-total operating income listed in previous studies (e.g., Hao et al., 2001; Lin and Zhang, 2009; Altunbas et al., 2011; Köhler, 2015; Mergaerts, and Vander Vennet, 2016). This ratio captures the degree of income diversification and reflects to what extent banks have moved towards non-traditional banking activities. The second variable is the ratio of non-deposit funding-to-total liabilities. It reflects the impact of financing structure on bank efficiency. Köhler (2015) suggested the share of non-deposit financing has a different effect on bank profitability and stability. It is expected to be negatively or positively related to the specialisation of banks (retail; savings; cooperative; and investment banks).

We employed loan loss reserves-to-gross loans ratio as a measure of credit risk. This ratio reflects the quality of banks assets; and how well it protects itself from losses caused by problematic loans.

Table 3-5 List of variables

Variable	Symbol	Variable Definition	Source
Panel A: Performance and banks stability variables			
Cost Efficiency	CE	Estimated from a cost functions for each year.	BankScope and own calculations
Profit Efficiency	PE	Estimated from a profit functions for each year.	BankScope and own calculations
Return on Assets	ROA	Winsorised fraction of pre-tax profits divided by total assets.	BankScope and own calculations
Return on Equity	ROE	Winsorised fraction of pre-tax profits divided by total equity.	BankScope and own calculations
Net Interest Margin	NIM	Winsorised fraction of the net interest revenue divided by earning assets.	BankScope and own calculations
Bank stability	Z-score	The ratio of the return on assets (ROA) plus the capital ratio (CAR) divided by the standard deviation of the return on assets (SDROA). A 3-year moving average is used to calculate the annual standard deviation of return on assets.	BankScope and own calculations
Panel B: Variables used to estimation profit and cost-efficiency			
profit before-tax	PBT	Profit before-tax of a bank.	BankScope
total operating costs	TOC	Summation of interest expense and non-interest expenses of a bank.	BankScope and own calculations

Input price			
Price of physical capital	x1	The ratio of non-interest expenses-to-total fixed assets.	BankScope and own calculations
Price of labour	x2	The ratio of personnel expenses-to-total assets.	BankScope and own calculations
Outputs			
Total loans	y1	Loans to all sectors of each commercial bank.	BankScope
Customer deposits	y2	Customer deposits of a bank.	Bankscope
Total assets	Z	Total assets of a bank as fixed netputs.	Bankscope
Negative Profit Indicator	NPI	Equal to one for observations where positive profits and equal to the absolute value for a loss incurring bank.	Bankscope and own calculations
Panel B: Variables used in cluster analysis			
Loans-to-total assets ratio	Loans	Winsorised fraction of Loans divided by total assets.	BankScope and own calculations
The ratio of trading assets-to-total assets	TRA	Winsorised fraction of total other earning assets.	BankScope and own calculations
Deposits and short-term funding	Dep	Winsorised fraction of deposits and short-term funding-to-total assets	BankScope and own calculations
Non-deposit funding ratio	Non-Dep	Winsorised fraction of debt liabilities-to-total assets.	BankScope and own calculations

Panel C: Independent variables

The ownership dummies variables

Privatised banks	Priv	Dummy variable that equals 1 for privatised banks and zero otherwise.	Source of data Megginson (2005) and World Bank
Post	Post	Dummy variable time, which equals 1 for the period since a country began its privatisation program and 0 otherwise.	Source of data Megginson (2005) and World Bank
Priv*Post	Priv*Post	Dummy variable interaction that takes a value of 1 for the privatised banks in post-privatisation period and 0 otherwise.	Source of data Megginson (2005) and World Bank
Priv-short term		Dummy variable interaction that takes a value of 1 for the short-term post-privatisation period (1–3 years) and 0 otherwise	Source of data Megginson (2005) and World Bank
Priv-medium term		Dummy variable interaction that takes a value of 1 for the medium-term post-privatisation period (4–10 years) and 0 otherwise	Source of data Megginson (2005) and World Bank
Priv-long term		Dummy variable interaction that takes a value of 1 for the long-term post-privatisation period (11 or more years) and 0 otherwise	Source of data Megginson (2005) and World Bank

Country control variables

Real GDP Growth	GDPG	The real annual growth gross domestic product (GDP). This rate changes from year to another.	World Bank
Inflation	Inflation	The annual growth rate of GDP deflator	World Bank
Developed countries	Developed	Dummy variable equal to one developed for countries and zero otherwise.	S&P Dow Jones Indices 2016
Global financial crisis	GFC	Dummy variable equal to one before the GFC and zero otherwise.	

Bank control variables			
Focused retail business model	FBM	Equals 1 for yearly observations of focused retail business model and zero otherwise.	Cluster analysis outputs using Stata
Trader business model	TBM	Equals 1 for yearly observations of trader business model and zero otherwise	Cluster analysis outputs using Stata
Foreign ownership	Foreign	Dummy variable, which equals 1 for foreign banks and 0 otherwise.	Claessens and Van Horen Bank Ownership Database
Bank size	Size	The logarithm of total bank assets.	BankScope and own calculations
Cost-to-income ratio	Cost	Winsorised fraction of operating expenses-to-operating income.	BankScope and own calculations
Total equity-to-total assets ratio	Equity	Capital as a percentage of total assets	BankScope and own calculations
The ratio of non-deposit funding-to-total liabilities	NOD	The debt liabilities (other interest bearing liabilities for example derivatives; trading liabilities; and long-term funding) divided by total liabilities.	BankScope and own calculations
Non-interest income share	NII	The non- interest income-to-total income.	Bankscope and own calculations
Loan Loss Reserves-to-gross loans ratio	LLR	The ratio of loan loss reserves-to-gross loans. It measures credit risk.	Bankscope and own calculations

Note: All bank variables are Winsorised at the 1- and 99-percentile level.

3.6 Descriptive Statistics

This section provides summary statistics of variables used in our analysis. Table 3-6 presents descriptive statistics for all variables included in the empirical models. That is, this section explores means, medians, standard deviation, and coefficient of variation for six performance and bank stability proxies, independent variables include a set of country control variables and bank control variables. We winsorised all bank variables at the 1- and 99-percentile level to mitigate the impact of outliers.

Panel A represents summary statistics of dependent variables, including profit and cost efficiency estimations and other performance indicators. The findings show the means of profit and cost efficiency of 44.7% and 75.9% respectively. The other dependent variables ROA have a mean value of 1.44%. Not surprisingly, ROE and NIM show high mean values (11.9% and 4.2%, respectively) during the investigated period. Regarding bank stability, the average Ln Z-score is 3.154.

Panel B shows the privatisation dummies variables that take values 0 and 1. In addition to the country and bank's characteristics, we included the Priv, Post, and Priv*Post dummies variables to examine the effect of bank privatisation and ascertaining whether privatised banks can show different performance and risk-taking compared to the non-privatised banks. The table shows that Priv (privatised banks) account for 11.8% of the sample observation, Post (non-privatised banks) dummy represents those with means around 82.9 % of sample observation while the foreign banks account for 17.6 % of the sample.

As for the control variables, Panel C shows the descriptive statistics for the country control variables. The independent variable GFC is included to capture the potential impact of the global financial crisis. It takes 1 for the years 2007- 2015 and 0 otherwise.

A Developed dummy variable is included to capture the differences between developed and developing countries. It takes 1 for developed countries and 0 otherwise.

The mean values of GDP growth and inflation rate are 2.613 and 1.239, respectively, during the investigated period.

Also, panel D shows the descriptive statistics for the bank control variables. We include three dummies variables to capture bank business models, Focused retail, Trader and Diversified

retail models. The means of these models are 0.562, 0.436 and 0.0126, respectively. Ownership dummy represents foreign ownership with means around 17.6 % of sample observation. Bank size represents mean log of total assets 2.878.

Loans-to-total assets ratio represents those with means around 48.1%. Total equity -to- total assets ratio represents those with means around 14.1%. Concerning the financing structure, commercial banks depend on non-deposits funding of about 10.8%. Non-interest income share represents those with means around 29.4%. The mean of Loan loss reserves-to-gross loans ratio (LLR) about 3.65%

Table 3-6 descriptive statistics for all variables.

Variables	Obs	Mean	Median	St.Dev	CV
Panel A: Dependent variables					
Profit efficiency	25235	0.447	0.46	0.234	0.523
Cost efficiency	25204	0.759	0.801	0.17	0.224
Return on assets (ROA)	30782	0.014	0.01	0.034	2.387
Return on equity (ROE)	30724	0.119	0.117	0.253	2.131
Net interest margin (NIM)	30829	0.042	0.03	0.048	1.135
Bank stability (z-score)	30234	45.39	24.41	64.91	1.430
Panel B: Privatisation dummies variables					
Priv	30886	0.118	0	0.323	2.732
Post	30886	0.829	1	0.377	0.455
Priv*post	30886	0.084	0	0.278	3.296
Priv-short term	30891	0.016	0	0.125	1
Priv-medium term	30891	0.032	0	0.176	1
Priv-long term	30891	0.036	0	0.186	1
Panel C: Country control variables					
GFC	30886	0.312	0	0.463	1.486
Developed	30886	0.494	0	0.05	1.013
GDPG	30875	2.613	2.291	3.163	1.211
Inflation	29733	1.239	1.163	1.233	0.995
Panel D: Bank control variables					
Focused retail model	30886	0.562	1	0.496	0.883

Trader model	30886	0.436	0	0.496	1.137
Foreign	30886	0.176	0	0.381	2.166
Bank size	30873	2.878	2.971	1.352	0.47
Cost-income	30226	0.825	0.721	0.707	0.858
Equity-to-assets (CAR)	30886	0.141	0.088	0.162	1.151
Loans-to-total assets ratio	30891	0.481	0.495	0.249	0.517
Non-deposits funding ratio (NOD)	30891	0.108	0.0263	0.187	1.725
Non-interest income share (NII)	30886	0.294	0.276	0.355	1.207
Loan Loss Reserves-to-gross loans ratio (LLR)	30266	0.0365	0.181	0.0629	1.723

Notes: this table presents descriptive statistics for all variables included in the empirical models. The data are denominated in millions of US dollars at 2010 prices. To reduce the impact of outliers, all variables are winsorised at the 1% and 99% levels. The overall sample is an unbalanced panel and consists of 2260 bank-year observations (184 commercial privatised banks); all country-level variables are averaged for the period 1985–2015. A detailed description of the definition and the sources of the variables is given in Table 3-5.

3.7 Research methodology

In this section, we show the empirical models employed to test, firstly, the effect of bank business models on performance and bank stability. Secondly, the impact of privatisation on bank performance over the long-term.

3.7.1 Tobit Regression

The Tobit model is used to estimate linear relationships between variables when there is either left- or right-censoring in the dependent variable. It is also called a censored regression model.

In our analysis, we used a Tobit regression model to employ profit and cost efficiency as the dependent variable. Since the efficiency scores derived from Stochastic Frontier Analysis (SFA) techniques are in between 0 and 1(not continuous), it is evident that the scores of profit and cost efficiency are of the censored dependent variables. Thus, the fittest model for the censored dependent variable is Tobit regression. We employed the Tobit model to examine the regression on the efficiency because efficiency scores have properties that correspond to the Tobit model which are censored at zero, with positive probability, but roughly continuously distributed over strictly positive values (Wooldridge, 2013)

We estimate censored Tobit regressions when our dependent variables are profit efficiency scores and cost efficiency scores; A negative (positive) coefficient associated to a given explanatory variable in the cost or profit efficiency scores regression implies that an increase in this variable is related with a higher (lower) efficiency score. We use the Tobit model to deal with the characteristics of the distribution of profit and cost efficiency scores for providing estimated results and this is in line with several previous studies which use Tobit regressions to investigate how bank efficiency is affected by privatisation. For instance, (Clarke and Cull, 2005; Lin et al., 2016; Claessens and Horen, 2010; Akhigbe and McNulty, 2011). Li Lin et al. (2016) employed Tobit estimation to identify the impact of the changes in bank ownership on cost efficiency across twelve Asian developing countries during the period 2003–2012.

Thus, we also conduct the regressions using the Tobit maximum likelihood procedure in our multivariate analysis. We specify a standard Tobit -regression model as follow Verbeek (2012):

$$y_i^* = \beta' xi + \ \varepsilon_i \qquad \text{Eq. 3-11}$$

$$y_i = y_i^* \ if \ y_i^* >= 0 \ and \ \ y_i = 0 \ otherwise$$

Where $y*_i$ is a latent variable and y_i is profit (cost) efficiency score obtained from the stochastic frontier approach (SFA). $\beta' xi$ represents the set of parameters to be estimated. $\varepsilon_i \sim N\ (0, \sigma 2)$ is the error term. To examine the effect of bank business models on bank efficiency, we specify the equation of the regression as follows:

$$EF_{ijt} = \alpha_1\, Priv \ + \ \alpha_2\, Post \ + \ \alpha_3\, Post * \ Priv + \ \sum_{n=4}^{M} \alpha_n Coun - char_{ijt} \ + \ \sum_{n=M+1}^{L} \alpha_n Bank - char_{ijt} \ \ + \sum_{n=K+1}^{T} Post * Priv * \ \alpha_n BBM_{ijt} + \ \varepsilon_{ijt} \qquad \text{Eq. 3-12}$$

Where i is for a bank, j is for the country, and t denotes the year. The dependent variable EF_{ijt} is measure profit (cost) efficiency; *Priv* is a treatment dummy variable that takes the value 1 for the newly privatised banks and 0 for control the sample. This variable allows us to estimate performance and bank stability for the privatised banks. The *Post* is a dummy variable time, which equals 1 for the period since a country began its privatisation programme and 0 otherwise. We include an essential variable, *Post*Priv*, is a dummy variable interaction that takes a value

of 1 for the post-privatisation period and 0 for the pre- privatisation period in privatised banks. This variable allows us to capture the changes in performance and stability by the newly privatised banks in the post-privatisation period. The inclusion of this variable enables us to isolate the effects of privatisation on bank performance and bank stability from any change in performance due to the industry-wide impacts in the post-privatisation period.

Bank performance may also be affected by macroeconomic control variables; therefore, we include control variables $Coun - char_{ijt}$that have been related to performance namely global financial crisis (GFC) is a dummy variable that equals 1 for the years 2007 to 2015 and zero otherwise, Developed is a dummy variable which equals one if the bank is from a developed country and 0 otherwise, and lastly, GDP growth, inflation rate. These variables measure the country's level of development,

We examine the effects of bank-specific variables; BBM_{ijt} is bank business models represented by two dummies variables. Based on the cluster analysis, we grouped banks into two categories: focused retail model is a dummy variable, which equals 1 for yearly observations of focused retail business model. Trader model is a dummy variable, which equals 1 for yearly observations of trader business model. We determine business models based on the results of k-medians cluster analysis using the assets and funding structures. This categorical variable, i.e. the business model, includes two values (focused retail model, trader model). Hence, it is applied separately for both of focused retail model and trader model.

As a rule of thumb, to create dummy variables for k groups, we have to choose one of the variables as a base and use only (k-1) dummy variables. In the first stage of our study, we represented the bank business models with focused retail as a dummy variable, whereas the second dummy variable (trader model) is redundant, and it carries no new information. Furthermore, it creates a severe multi-collinearity problem for the analysis. As a result, using only one dummy variable avoids the dummy variable trap. While in the second stage, we represented the bank business models with the trader model as a dummy variable, and the base is the focused retail model.

We also include other control variables which have been related to performance and bank stability, including the *Foreign* dummy variable. We expected that foreign ownership might import international best practice and technological benefits; equity-to-total assets ratio; bank size is measured by the log of total assets; ratio of cost to income is defined as the ratio of total

expenses to operating income (interest and non-interest income). We also examine the interaction effects of the post-privatisation dummy with bank business models $Post * Priv * \alpha_n BBM_{ijt}$ to ascertaining whether privatised banks performed better and exhibit different risk taking compared to the non-privatised banks after privatisation. ε_{ijt} is the error term.

3.7.2 Multiple Regressions for Panel Data

To answer some of the research questions set out in this study, we applied multiple regression models, a regression model with more than one explanatory variable, to capture the effects of bank business models on performance and stability. Practically, there are various types of multiple regressions in practice and the regression model used must be adapted to the characteristics of the data. Besides, the regression techniques chosen should be based on the prevailing econometric theory.

Our sample includes time series and cross-sectional data. The panel data consider the unobservable and constant heterogeneity, that is, the specific features of each bank. We estimate the following regression model:

To examine the impact of bank business models on performance and bank stability in privatised banks and non-privatised banks, we used two types of regression estimates: Ordinary Least Squares regression (OLS) and Generalised Least Squares (GLS) regression for the panel data.

Ordinary Least Squares (OLS)

We use Ordinary Least Squares (OLS) regression to examine the differences of performance, stability and business models in post-privatisation among newly privatised and non-privatised banks.

Accordingly, all the models are estimated by multiple regression with clustering at the bank level. Robust standard errors are used to correct potential heteroskedasticity and potential time-series autocorrelation within each bank. We examine the impact of bank business models on bank performance in privatised banks. That is done by estimating the OLS models as follow:

$$pref_{ijt} = \alpha_0 + \alpha_1 Priv + \alpha_2 Post + \alpha_3 Post * Priv + \sum_{n=4}^{M} \alpha_n Coun - char_{ijt} + \sum_{n=M+1}^{L} \alpha_n Bank - char_{ijt} + \sum_{n=K+1}^{T} Post * Priv * \alpha_n BBM_{ijt} + u_{ijt} \quad \text{Eq. 3-13}$$

Where i is for a bank, j is for the country, and t denotes the year. The dependent variable $pref_{ijt}$takes alternatively the form of return on equity (ROE), return on assets (ROA), net interest margin (NIM), and Ln z-score to measure bank stability. u_{ijt} is the error term. We applied both of focused retail model and trader model separately.

Generalised Least Squares (GLS)

Many previous studies investigated the effects of privatisation on bank performance and displayed mixed evidence. While existing literature provides ample evidence of the impact of privatisation on the risk-taking behaviour of newly privatised banks. They exhibited a significant reduction in risk in post-privatisation. We hypothesise that bank business models have an impact on performance and stability in the newly privatised. We, therefore, expect the coefficients of bank business models to be significantly positive in the regression models of ROE, ROA and NIM regressions, and significantly negative in the regression model of Ln z-score.

To further check the robustness of our findings, we employ a panel data set which covers the combination of cross-sectional and time-series aspects of the unit observations. Based on the results of Breusch–Pagan tests, we selected the random-effects GLS estimator to control for unobserved, individual bank-specific characteristics which may or may not influence the predictor variables. Random effects assume that the entity's error term is not correlated with the predictors which allow for time-invariant variables to play a role as explanatory variables. The Breusch–Pagan test has been conducted to choose an appropriate effect, whether Ordinary Least Squares (OLS) regression or Generalised Least-Squares method (GLS). This test is designed to detect any linear form of heteroscedasticity. The null hypothesis in the LM test is that variances across banks are zero. This mean, no significant difference across banks (i.e. no panel effect). Based on the results of Breusch–Pagan tests, we select the generalised least-squares (GLS) estimator, the variation across banks is assumed to be random and uncorrelated with the predictor or independent variables included in the model. To examine the impact of bank business models on performance among newly privatised banks using panel data, a random-effects GLS estimator is used to estimate Eq. 3-14:

$$pref_{ijt} = \alpha_0 + \alpha_1 Priv + \alpha_2 Post + \alpha_3 Post * Priv + \sum_{n=4}^{M} \alpha_n Coun - char_{ijt} + \sum_{n=M+1}^{L} \alpha_n Bank - char_{ijt} + \sum_{n=K+1}^{T} Post * Priv * \alpha_n BBM_{ijt} + \omega_{ijt} \quad \text{Eq. 3-14}$$

$$\omega_{ijt} = u_{ijt} + \varepsilon_{ijt} \quad \text{Eq. 3-15}$$

Where $pref_{ijt}$is the performance indicators (ROE, ROA, NIM) and Ln z-score measures bank stability.In addition, u_{ijt} represents within-entity error whereas ε_{ijt} is the between-entity error. This means there are differences across banks which may influence bank performance and its stability.

3.7.3 **Difference-in-differences regression model**

In this section, we discuss the empirical model used in testing the long-term effects of privatisation on bank performance and efficiency and briefly describe some additional independent variables. Those include bank-specific and macroeconomic variables which may affect bank performance which we use to explore the sources of changes in bank performance.

To validate our hypothesis concerning whether the improvements in performance and efficiency after privatising state banks are sustainable over the long-term, we examine the effect of bank privatisation on bank efficiency using a natural experiment approach. Only a few studies investigate how privatisation strategy affects bank performance over the long-term, as mentioned earlier.

Several empirical studies (e.g. Hao et al., 2001; Berger et al., 2005; Williams and Nguyen, 2005) adopted a practical approach by using analysis of the static, selection, and dynamic effects for assessing how bank efficiency is affected by a privatisation strategy. We employed a difference-in-differences model to identify whether bank efficiency significantly differs from the trend for other banks after privatising state banks. This approach enables us to determine the impacts of bank privatisation over the long term; this is in line with several previous studies which used the difference-in-differences (DID) model to investigate the effect of privatisation on bank performance, for instance, (Berger et al., 2009; Williams,2012; King et al., 2013; Mohsni and Otchere, 2014; and Boardman et al., 2016).

To estimate the impact of privatisation on state banks which underwent privatisation, the most straightforward comparison is with non-privatised banks, either state or private. Given our focus on cost and profit efficiency, the relevance of the former comparison group is clear: does bank privatisation result in better cost and profit efficiency? The latter comparison is also valuable to reveal whether privatised banks "catch up" to similar non-privatised banks in terms of cost and profit efficiency.

Our study is similar to Boardman et al. (2016) in some methodological aspect. However, it has some significant differences as mentioned before, and we studied the long-run effects of bank privatisation on bank efficiency. Our analysis uses data from 1985 to 2015. Levels for cost (profit) efficiency are computed for the pre-privatisation period and the entire post-privatisation period. Standard errors are calculated using the robust cluster method with clustering on bank level in each model. The difference-in-differences (DID) model is presented in the following Tobit regression equation:

$$EF_{ijt} = \alpha_1 Priv + \alpha_2 Post + \alpha_3 Post * Priv + \sum_{n=4}^{M} \alpha_n Count\_Char_{ijt} + \sum_{n=M+1}^{L} \alpha_n Bank\_Char_{ijt} + \varepsilon_{ijt} \quad \text{Eq. 3-16}$$

Where i identifies the cross-sectional dimension across commercial banks, and t denotes the time. $\boldsymbol{EF_{ijt}}$ is the dependent variable in Eq.3-11, which is alternatively profit efficiency or cost efficiency. Efficiency estimated using stochastic frontier translog cost and profit functions approaches with a half-normal distribution of the inefficiency term and time-varying efficiency. Dummy variables identify those banks that underwent to privatisation and change in ownership over the study period. The coefficient α_1 identifies average differences across groups (privatised or non-privatised banks) for the full period. Post is a time dummy variable, which reflects the effects of the technical progress and other factors which could affect bank performance. The coefficient α_2 represents the differences in changes over periods within each group. *Post ∗ Priv* is the dummy variable, which is set equal to one for the privatised banks in the post-privatisation period and zero otherwise. The coefficient α_3 on the interaction term (Post ∗ Priv) show the difference between treatment and control in the period following application of treatment (privatisation). $Coun - char_{ijt}$that have been related to performance namely global financial crisis (GFC), Developed is a dummy variable, and lastly, GDP growth, inflation rate.

In line with the previous literature, we also consider a set of control variables that includes bank-specific and macroeconomic variables which may affect a bank efficiency. Bank_ Char is the bank characteristics, which include bank Foreign is dummy variable, bank size (log of total assets), loan portfolio orientation (Loan), and capital regulations (CAR); ratio of non-interest income-to-total operating income (NII); the ratio of non-deposit funding-to-total liabilities (NOD); loan loss reserves-to-gross loans ratio (LLR). ε_{ijt} represents error terms.

We also examine the relationship between bank governance, performance and bank stability over the long-term using random-effects GLS estimator. Standard errors are calculated using the robust cluster method with clustering on bank level in each model:

$$pref_{ijt} = \alpha_0 + \alpha_1 Priv + \alpha_2 post + \alpha_3 post * priv + \sum_{n=4}^{M} \alpha_n Count\_Char_{ijt} + \sum_{n=M+1}^{L} \alpha_n Bank\_Char_{ijt} + \omega_{ijt} \quad \text{Eq. 3-17}$$

Where i identifies the cross-sectional dimension across commercial banks, and t denotes the time. $pref_{ijt}$ is the dependent variable, which is alternatively ROA, ROE, NIM, and Ln z-score.

Bank-specific characteristic variables and macroeconomic control variables are included as explanatory variables. We include bank-specific variables that are considered in the literature as important control variables affect the bank performance and stability. ω_{ijt} this term represents the error.

We also conduct difference-in-means tests to examine whether and how performance and risk-taking differ between privatised banks and rival banks in the pre- and post-global financial crisis (see also Williams, 2012; Mohsni and Otchere, 2014; Boardman et al. 2016; Cheng et al., 2017). We investigate the outcomes of the global financial crisis using a difference-in-differences (DID) model to identify the effects of GFC on bank performance. Bank-specific characteristic variables and macroeconomic control variables are included as explanatory variables. Standard errors are calculated using the robust cluster method with clustering on bank level in each model. The difference-in-differences (DID) model is presented in the following Tobit regression equation:

$$EF_{ijt} = \alpha_1 Priv + \alpha_2 GFC + \alpha_3 Post * GFC + \sum_{n=4}^{M} \alpha_n Count\_Char_{ijt} + \sum_{n=M+1}^{L} \alpha_n Bank\_Char_{ijt} + \varepsilon_{ijt} \quad \text{Eq. 3-18}$$

Where EF_{ijt} presents profit efficiency and cost efficiency; Dummy variables identify those banks, which underwent privatisation and change in ownership over the study period. These dummy variables are introduced as follows: *Priv* is a treated dummy variable, which equals to one for privatised banks and zero for the control sample, we expect it to have a negative coefficient. *GFC* is a time dummy variable, which equals one for the period since global financial crisis at 2007-2015 and 0 otherwise.

Post ∗ GFC is the dummy variable, which equals to one for the privatised banks in the post-global financial crisis period and zero otherwise. The inclusion of this variable helps us to capture changes in bank performance and stability by the privatised banks following GFC.

In line with the previous literature, we also consider a set of control variables which includes macroeconomic and bank-specific variables that may affect a bank performance. In the country characteristics (Count_ Char), we include the GDP growth rate, inflation rate. Bank_ Char is the bank characteristics which include *Foreign* dummy variable, bank size (log of total assets), loan portfolio orientation (Loan), and capital regulations (CAR); ratio of non-interest income-to-total operating income (NII); the ratio of non-deposit funding-to-total liabilities (NOD); loan loss reserves-to-gross loans ratio (LLR). All variables included in these models are as defined in Table 3-5. ε_{ijt} is error term

We employ the difference-in-differences (DID) model using random-effects GLS estimator to examine the effect of GFC on performance and bank stability, we specify the equation of the regression as follows:

$$pref_{ijt} = \alpha_0 + \alpha_1 Priv + \alpha_2 GFC + \alpha_3 post * GFC + \sum_{n=4}^{M} \alpha_n Count\_Char_{ijt} + \sum_{n=M+1}^{L} \alpha_n Bank\_Char_{ijt} + \omega_{ijt} \quad \text{Eq. 3-19}$$

Where i identifies the cross-sectional dimension across banks and t denotes time. $pref_{i,j,t}$ is the dependent variable, which are the bank performance indicators return on equity (ROE), return on assets (ROA) and net interest margin (NIM)) and the Ln z-score to measure bank stability. ω_{ijt} represents the random error.

Table 3-7 Summary of the Hypothesis and its relating key variables.

Hypothesis	Equation	key variables
H1, H2, H3 and H4	Eq. 3-20, Eq. 3-21	Profit efficiency and cost efficiency
H5	Eq. 3-4	Loans, TRA, Dep, and Non-Dep.
H6 and H7	Eq. 3-12 and Eq. 3-14	**Dependent variables:** Profit efficiency, cost efficiency, ROE, ROA, NIM, and Ln z-score. **Independent variables**: The ownership dummies variables: Priv, Post, and Priv*Post. Country control variables: GDPG, Inflation, Developed, and GFC. Bank control variables: FBM, TBM, Foreign, Equity, Size, and Cost.
H8 and H9	Eq. 3-16 and Eq. 3-17	**Dependent variables**: Profit efficiency, cost efficiency, ROE, ROA, NIM, and Ln z-score **Independent variables:** The ownership dummies variables: Priv, Post, and Priv*Post. Country control variables: GDPG, Inflation, Developed, and GFC. Bank control variables: Foreign, Equity, Size, loans, NOD, NII, and LLR.
H10	Eq. 3-18 and Eq. 3-19	**Dependent variables:** Profit efficiency, cost efficiency, and Ln z-score **Independent variables**: The ownership dummies variables: Priv, GFC, and Priv*GFC Country control variables: GDPG, Inflation, Developed, and GFC. Bank control variables: Foreign, Equity, Size, loans, NOD, NII, and LLR

3.8 Conclusion

This chapter presents the research methodology of this thesis. It starts by present the data and sample selection. Then we identified bank business models using cluster analysis, followed by introducing methods employed to construct proxies for bank performance and description independent variables. We introduce the stochastic frontier analysis for panel data to estimate profit and cost efficiency, which considers the time-invariant and individual-specific effects. Furthermore, to examine the effect of bank business models on performance and stability, we employed the Tobit regression and Generalised Least Squares (GLS) regression for the panel data.

We used the difference-in-differences (DID) model to investigate the long-term effects of privatisation on bank performance and efficiency and briefly describe some additional independent variables. These include bank-specific and macroeconomic variables which may affect bank performance. The next chapter is the first empirical chapter of this thesis that estimates alternative profit frontier and cost frontier using parametric technique Stochastic Frontier Analysis (SFA) and discusses the empirical results of the directions of profit and cost efficiencies and after privatisation.

Chapter 4 Estimation of Profit and Cost Efficiency

4.1 Introduction

This chapter aims to assess commercial banks' efficiency, including privatised and non-privatised banks using the parametric technique Stochastic Frontier Analysis (SFA) to estimate profit and cost-efficiency. To accomplish this estimation, we used the balance sheet and profit, and loss account data for all commercial banks in 26 developed and developing countries between 1985 and 2015. This chapter discusses the empirical results of the directions of profit and cost efficiencies before and after privatisation. Based on the empirical evidence; we would either accept or reject the following hypotheses:

H1: There are immediate improvements in privatised bank efficiency, followed by subsequent continuous improvements and sustainable change in privatised bank efficiency over the long-term.

H2: There are immediate improvements in privatised bank efficiency followed by diminishing marginal improvements or no further improvement.

H3: There is no performance change or a small negative change during the first few years, but a positive impact over time that more than compensates for any short-run negative effects.

H4: There is a decline in some of performance indicators following privatisation either short-term or long-term.

This chapter has been organised as follow. Section 4.2 presents descriptive statistics of the profit and cost efficiency by country and year. Then, section 4.3 shows the descriptive statistics of the profit and cost efficiency by bank business models. Section 4.4 presents the descriptive statistics of profit and cost efficiency pre-and post-privatisation. We report descriptive statistics of the profit and cost efficiency pre- and post-GFC in section 4.5. Finally, we present Inter-temporal analysis of bank efficiency in pre and post privatisation period in section 4.6.

4.2 Descriptive statistics of profit and cost efficiency by country and year

This section reveals descriptive statistics of the profit and cost efficiency of commercial banks in 26 developed and developing countries which are estimated using stochastic frontier translog cost and profit functions approaches with a half-normal distribution of the inefficiency term and time-varying efficiency. Efficiency scores were determined for each bank in the country.

The profit and cost efficiency reflect the real performance of the banking industry during the study period.

We estimate translog cost and profit equations to get estimates of ln u. The results of the stochastic frontier regressions are presented in Appendix C. The translog cost and alternative profit functions are estimated yearly for each country. describes statistics for estimated cost efficiency for 31 years in our sample. The table reveals means of the cost efficiency scores range from 70.3% to 85.3 % during the period 1985 – 2015, whereas the overall mean is 75.9 percent. The results indicate that, on average, all banks could have produced their outputs using 70.3 percent to 85.3 percent of the inputs that they spent from the years1985 to 2015.

Besides, we find that after the global financial crisis, cost efficiency decreased to 0.703 in 2015. Interestingly, the average costs of banks decreased during the global financial crisis, which improved cost efficiency. The results show that the cost efficiency score improved from more than 0.77 in 2007 to less than 0.70 in 2015. The findings also suggest that cost efficiency levels seemed to be much higher than profit efficiency levels, indicating that banks operated closer to the less efficient cost frontier than the efficient profit frontier.

Table 4-1 shows the results for our profit efficiency estimates for each country. Profit efficiency scores range between 0 and 1, with values closer to 1 indicate a high level of bank efficiency. These tabulated results indicate that banks in Chile are less profit efficient at 33.3%.

Table 4-2 presents the average estimated profit efficiency scores of commercial banks for the entire sample of banks for each of the 31 years. The profit efficiency value on average declined during the global financial crisis from more than 0.48 in 2007 to less than 0.43 in 2009. However, although there was an improvement in profit efficiency later, the average profit efficiency value did not move back to that of early 2007.

Cost efficiency scores range between 0 and 1, with values closer to 0 suggests that a bank has greater cost efficiency. Alternatively, a higher value close to 1 indicates that the bank is less cost efficient. Table 4-3 provides a summary of statistics of cost efficiency for each country and shows that the highest scores of cost efficiency are in Australia, Malaysia, and the Philippine at about 92.3%, 91.6% and 90.85%, respectively. Banks in Austria and the Czech Republic are more cost efficient

Table 4-4 describes statistics for estimated cost efficiency for 31 years in our sample. The table reveals means of the cost efficiency scores range from 70.3% to 85.3 % during the period 1985

– 2015, whereas the overall mean is 75.9 percent. The results indicate that, on average, all banks could have produced their outputs using 70.3 percent to 85.3 percent of the inputs that they spent from the years1985 to 2015.

Besides, we find that after the global financial crisis, cost efficiency decreased to 0.703 in 2015. Interestingly, the average costs of banks decreased during the global financial crisis, which improved cost efficiency. The results show that the cost efficiency score improved from more than 0.77 in 2007 to less than 0.70 in 2015. The findings also suggest that cost efficiency levels seemed to be much higher than profit efficiency levels, indicating that banks operated closer to the less efficient cost frontier than the efficient profit frontier.

Table 4-1 Average profit efficiency scores by country: 1985-2015

Country	Obs	Mean	Std. Dev.	CV
Argentina	1528	0.422	0.173	0.409
Australia	252	0.499	0.211	0.422
Austria	1171	0.478	0.186	0.389
Belgium	876	0.399	0.217	0.546
Brazil	2499	0.741	0.102	0.138
Egypt	402	0.421	0.253	0.601
Greece	211	0.438	0.332	0.759
Hungary	331	0.396	0.303	0.764
Italy	2084	0.385	0.221	0.574
Mexico	828	0.369	0.222	0.601
Thailand	595	0.382	0.230	0.603
Turkey	308	0.500	0.300	0.599
UK	884	0.389	0.226	0.581
Chile	680	0.333	0.249	0.747
China	1954	0.349	0.191	0.547
Czech Republic	238	0.515	0.289	0.562
France	3173	0.391	0.182	0.464
Indonesia	1712	0.476	0.205	0.431
Korea	556	0.370	0.255	0.689
Malaysia	773	0.509	0.232	0.456
Philippine	729	0.483	0.238	0.492
Poland	724	0.417	0.244	0.586
Portugal	326	0.426	0.243	0.571
Spain	933	0.378	0.210	0.554
Venezuela	835	0.552	0.109	0.198
Vietnam	638	0.354	0.242	0.683

Note: all country-level variables are averaged for the period 1985–2015. Profit efficiency for each country is estimated from Eq. 3-8 separately.

Table 4-2 Average profit efficiency scores: Full sample, by Years

year	Obs	Mean	Std. Dev.	CV
1985	169	0.422	0.232	0.551
1986	218	0.436	0.229	0.525
1987	309	0.442	0.222	0.502
1988	408	0.45	0.208	0.463
1989	455	0.439	0.203	0.463
1990	465	0.446	0.212	0.476
1991	427	0.444	0.21	0.474
1992	517	0.445	0.21	0.473
1993	588	0.457	0.204	0.447
1994	707	0.455	0.214	0.47
1995	779	0.47	0.218	0.463
1996	979	0.455	0.221	0.486
1997	1071	0.431	0.23	0.532
1998	1087	0.44	0.233	0.528
1999	1126	0.438	0.237	0.541
2000	1104	0.446	0.238	0.535
2001	1098	0.434	0.231	0.532
2002	1103	0.418	0.244	0.583
2003	1078	0.415	0.241	0.581
2004	1083	0.444	0.234	0.527
2005	982	0.459	0.227	0.494
2006	960	0.468	0.226	0.482
2007	924	0.487	0.235	0.483
2008	898	0.454	0.243	0.536
2009	871	0.432	0.239	0.555
2010	898	0.447	0.243	0.545
2011	910	0.46	0.24	0.522
2012	965	0.457	0.254	0.556
2013	1043	0.446	0.249	0.559
2014	1062	0.457	0.244	0.533
2015	956	0.441	0.25	0.566

Note: Profit efficiency is estimated from Eq. 3-8.

Table 4-3 Average cost efficiency scores : by Country, 1985-2015

Country	Obs	Mean	Std. Dev.	CV
Argentina	1528	0.722	0.100	0.139
Australia	252	0.923	0.098	0.106
Austria	1171	0.562	0.174	0.310
Belgium	876	0.708	0.266	0.376
Brazil	2499	0.795	0.081	0.102
Egypt	402	0.784	0.082	0.105
Greece	211	0.872	0.082	0.094
Hungary	329	0.818	0.160	0.196
Italy	2079	0.772	0.106	0.137
Mexico	828	0.608	0.162	0.267
Thailand	595	0.884	0.027	0.030
Turkey	308	0.702	0.181	0.258
UK	884	0.681	0.176	0.258
Chile	680	0.763	0.127	0.167
China	1953	0.884	0.084	0.095
Czech Republic	238	0.529	0.223	0.421
France	3173	0.659	0.190	0.288
Indonesia	1712	0.846	0.111	0.131
Korea	556	0.723	0.130	0.180
Malaysia	773	0.916	0.084	0.091
Philippine	729	0.908	0.131	0.144
Poland	724	0.804	0.111	0.138
Portugal	326	0.859	0.127	0.148
Spain	910	0.726	0.159	0.219
Venezuela	835	0.751	0.168	0.224
Vietnam	638	0.758	0.147	0.194
Overall	25209	0.759	0.170	0.224

Note: all country-level variables are averaged for the period 1985–2015. Cost efficiency for each country is estimated from Eq. 3-9 separately.

Table 4-4 Average cost efficiency: by Years

year	Obs	Mean	Std. Dev.	CV
1985	165	0.831	0.144	0.173
1986	213	0.842	0.135	0.160
1987	304	0.853	0.118	0.139
1988	405	0.837	0.121	0.145
1989	451	0.825	0.126	0.153
1990	465	0.827	0.122	0.147
1991	426	0.824	0.125	0.152
1992	517	0.813	0.131	0.161
1993	588	0.81	0.127	0.156
1994	706	0.80	0.128	0.160
1995	779	0.799	0.130	0.162
1996	979	0.774	0.146	0.188
1997	1071	0.775	0.144	0.185
1998	1087	0.759	0.157	0.207
1999	1126	0.759	0.156	0.205
2000	1104	0.738	0.173	0.235
2001	1098	0.744	0.167	0.224
2002	1103	0.738	0.177	0.240
2003	1078	0.742	0.176	0.237
2004	1078	0.743	0.170	0.229
2005	982	0.757	0.169	0.224
2006	960	0.768	0.164	0.214
2007	924	0.774	0.162	0.210
2008	898	0.758	0.170	0.225
2009	871	0.754	0.176	0.233
2010	897	0.741	0.190	0.257
2011	910	0.725	0.191	0.264
2012	964	0.716	0.190	0.266
2013	1043	0.713	0.197	0.277
2014	1061	0.709	0.200	0.282
2015	956	0.703	0.206	0.293

Note: Cost efficiency is estimated from Eq. 3-9.

4.3 Descriptive statistics of profit and cost efficiency by bank business models

Table 4-5 and Table 4-6 compare business models in terms of profit and cost efficiencies variables across countries for the entire sample period. As is clear from Table 4-5, commercial banks with a focused business model are more profit efficient than other models in Australia, Brazil, Turkey, Malaysia, and Venezuela. While banks with a trader business model are more profit efficient than other models in Philippines, Czech Republic Thailand, and Egypt.

The distribution cost efficiency of the business models is summarised in Table 4-6. The results show that commercial banks with a focused business model operate more efficiently in Belgium, Italy, UK, Chile, and Vietnam, while banks with a trader business model are more cost efficient than other models in Austria, Turkey, Czech Republic, Spain, France, and Venezuela.

Table 4-5 Distribution profit efficiency by Bank Business Models,1985-2015

Country	Focused retail			Trader model		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Argentina	0.427	0.448	0.169	0.414	0.443	0.178
Australia	0.506	0.537	0.206	0.439	0.463	0.247
Austria	0.480	0.500	0.182	0.475	0.496	0.192
Belgium	0.417	0.439	0.215	0.391	0.393	0.218
Brazil	0.753	0.771	0.103	0.733	0.742	0.101
Egypt	0.381	0.314	0.252	0.445	0.457	0.252
Greece	0.442	0.391	0.333	0.420	0.351	0.330
Hungary	0.414	0.379	0.307	0.354	0.287	0.291
Italy	0.38	0.405	0.215	0.392	0.392	0.229
Mexico	0.372	0.363	0.218	0.363	0.337	0.228
Thailand	0.379	0.405	0.231	0.408	0.409	0.223
Turkey	0.516	0.541	0.288	0.476	0.471	0.317
UK	0.395	0.392	0.231	0.384	0.378	0.222
Chile	0.312	0.143	0.377	0.333	0.294	0.246
China	0.346	0.336	0.200	0.354	0.366	0.175
Czech Republic	0.507	0.539	0.302	0.522	0.506	0.278
France	0.392	0.428	0.173	0.391	0.404	0.192
Indonesia	0.475	0.487	0.200	0.476	0.525	0.224
Korea	0.359	0.321	0.254	0.427	0.420	0.254
Malaysia	0.517	0.565	0.228	0.478	0.468	0.245
Philippine	0.462	0.448	0.254	0.515	0.527	0.207
Poland	0.415	0.399	0.246	0.421	0.405	0.239
Portugal	0.433	0.453	0.247	0.415	0.396	0.237
Spain	0.377	0.401	0.205	0.381	0.383	0.219
Venezuela	0.56	0.576	0.105	0.535	0.561	0.116
Vietnam	0.361	0.314	0.248	0.340	0.295	0.227

Note: all country-level variables are averaged for the period 1985–2015.

Table 4-6 Distribution cost efficiency by Bank Business Models, 1985-2015

Country	Focused retail			Trader model		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Argentina	0.723	0.736	0.091	0.720	0.745	0.113
Australia	0.920	0.960	0.098	0.946	0.986	0.094
Austria	0.568	0.603	0.158	0.553	0.593	0.196
Belgium	0.593	0.688	0.314	0.753	0.864	0.229
Brazil	0.804	0.819	0.076	0.789	0.804	0.084
Egypt	0.780	0.801	0.091	0.786	0.801	0.077
Greece	0.876	0.895	0.079	0.863	0.892	0.089
Hungary	0.815	0.861	0.150	0.825	0.914	0.182
Italy	0.762	0.785	0.094	0.787	0.831	0.119
Mexico	0.625	0.648	0.145	0.582	0.624	0.185
Thailand	0.884	0.888	0.026	0.887	0.896	0.030
Turkey	0.725	0.757	0.157	0.669	0.715	0.206
UK	0.679	0.728	0.183	0.682	0.713	0.170
Chile	0.652	0.711	0.224	0.765	0.797	0.124
China	0.882	0.899	0.077	0.887	0.908	0.096
Czech Republic	0.542	0.524	0.203	0.517	0.486	0.239
France	0.677	0.733	0.172	0.636	0.675	0.209
Indonesia	0.845	0.883	0.106	0.849	0.890	0.126
Korea	0.724	0.760	0.134	0.719	0.728	0.105
Malaysia	0.924	0.949	0.063	0.886	0.934	0.134
Philippine	0.920	0.974	0.133	0.890	0.921	0.124
Poland	0.800	0.830	0.115	0.816	0.838	0.100
Portugal	0.868	0.904	0.110	0.844	0.910	0.152
Spain	0.752	0.780	0.119	0.670	0.760	0.211
Venezuela	0.759	0.787	0.155	0.736	0.789	0.191
Vietnam	0.737	0.795	0.155	0.799	0.842	0.122

Note: all country-level variables are averaged for the period 1985–2015.

4.4 Descriptive statistics of profit and cost efficiency by pre- and post-privatisation

Table 4-7 provides the descriptive statistics for the cost and profit efficiencies estimates of privatised and non-privatised banks in pre-and post-privatisation, based on the stochastic frontier approach with a half-normal distribution of the inefficiency term and time-varying efficiency. Panel A presents the level of profit efficiency for privatised and non-privatised banks pre- and post- privatisation. Profit efficiency estimates values fall into the range between 0 and 1. A smaller value close to 0 suggests that the bank has lower profit efficiency.

Alternatively, a greater value close to 1 suggests that the bank is more profit efficient. The findings show that privatised banks achieved an improvement in profit efficiency from 0.416 to 0.447 following privatisation. While profit efficiency of non-privatised banks dropped slightly from 0.458 in pre-privatisation to 0.445 post-privatisation.

Table 4-7 panel B reports the cost efficiency values for privatised and non-privatised banks pre- and post- privatisation. Cost efficiency estimates values fall into the range between 0 and 1. A smaller value close to 0 suggests that the bank has greater cost efficiency. Alternatively, a greater value close to 1 suggests that the bank is less cost efficient. The findings also show that after privatisation, privatised banks improved their levels of cost efficiency. The cost efficiency value of privatised banks on average declines from more than 0.81 in pre-privatisation to less than 0.764 following privatisation. Regarding non-privatised banks, cost efficiency value has decreased from more than 0.79 in pre-privatisation to less than 0.75.

4.5 Descriptive statistics of profit and cost efficiency pre- and post-GFC

Table 4-8 provides the descriptive statistics for the profit efficiency estimates pre- and post-GFC in 26 countries based on the stochastic frontier approach with a half-normal distribution of the inefficiency term and time-varying efficiency. Profit efficiency estimates scores ranged between 0 and 1. A smaller score close to 0 suggests that the bank has lower profit efficiency. Alternatively, a greater value close to 1 suggests that the bank is more profit efficient.

Table 4-8 reports that profit efficiency values for commercial pre- and post-GFC. After the GFC, most of the banks significantly improved their levels of profit efficiency for example, Argentina, Brazil, Egypt, Thailand, Turkey, Chile, China, Czech Republic, Korea, Poland, and Malaysia. Interestingly, some commercial banks decreased their levels of profit efficiency for example, Austria, Belgium, Greece, Hungary, Italy, the UK, Portugal, Spain, Venezuela, and Vietnam. We employed t-test to check any significant difference in means between profit efficiency scores pre-and post-global financial crisis. We concluded that mean is statistically significantly greater or less than zero. The positive values mean the profit efficiency is improved post-GFC, but the negative values point to decline profit efficiency post-GFC. A t-test also reported that there are no significant differences (p-value = > 0.05) between the scores of profit efficiency scores pre- and post-GFC in Austria, Belgium, Hungary, Indonesia, Venezuela, and Vietnam.

Table 4-9 reports the cost efficiency values for commercial banks pre- and post-GFC. The cost efficiency variable was also tested using the difference of means test, the results indicating that there is significant difference (p-value = 0.000) in cost-efficiency between countries pre-and post-global financial crisis. We concluded that mean is statistically significantly greater or less than zero. The negative values mean the cost efficiency is improved post- GFC, but the positive values point to decline cost efficiency post-GFC. The results show that cost efficiency value on average improves from more than 0.77 in pre-GFC to less than 0.737 in post-GFC. After GFC, most of the commercial banks significantly improved their levels of cost efficiency for example, Argentina, Australia, Austria, Belgium, Hungary, Italy, Mexico, UK, Chile, France, Indonesia, Malaysia, Poland, Portugal, Spain, and Venezuela. While some commercial banks demonstrate significant lower cost efficiency compared to other banks for example, Brazil, Greece, Turkey, Czech Republic, Korea, and Vietnam.

Table 4-7 Descriptive statistics of profit and cost efficiency scores by pre- and post-privatisation.

Panel A Profit efficiency scores by pre- and post-privatisation

Ownership banks	N	Mean	Median	Std. Dev.	CV
Pre-privatisation					
State-owned banks underwent privatisation	933	0.416	.0421	0.213	0.513
Non- privatised banks	3618	0.458	0.495	0.219	0.477
Post-privatisation					
Privatised banks	2429	0.447	0.469	0.23	0.515
Non- privatised banks	18260	0.445	0.452	0.236	0.529

Panel B Cost efficiency scores by pre- and post-privatisation

Ownership banks	N	Mean	Median	Std. Dev.	CV
Pre-privatisation					
State-owned banks underwent privatisation	932	0.816	0.859	0.131	0.161
Non- privatised banks	3599	0.79	0.814	0.145	0.183
Post-privatisation					
Privatised banks	2429	0.764	0.794	0.146	0.191
Non- privatised banks	18249	0.75	0.798	0.175	0.233

Table 4-8 Descriptive statistics for profit efficiency scores pre- and post-GFC

Country	Pre-GFC		Post-GFC		Diff
	Mean	Std. Dev	Mean	Std. Dev	
Argentina	0.374	0.185	0.517	0.110	0.143***
Australia	0.381	0.279	0.505	0.209	0.124***
Austria	0.421	0.253	0.387	0.194	-0.034**
Belgium	0.360	0.245	0.301	0.215	-0.059**
Brazil	0.639	0.206	0.849	0.023	0.21***
Egypt	0.342	0.265	0.505	0.223	0.163***
Greece	0.266	0.335	0.373	0.355	0.107*
Hungary	0.422	0.306	0.350	0.301	-0.072*
Italy	0.315	0.252	0.338	0.229	0.023*
Mexico	0.353	0.233	0.359	0.219	0.006
Thailand	0.355	0.251	0.407	0.194	0.052**
Turkey	0.376	0.323	0.515	0.300	0.139***
UK	0.164	0.243	0.336	0.235	0.172***
Chile	0.288	0.228	0.416	0.282	0.128***
China	0.270	0.186	0.395	0.180	0.125***
Czech Republic	0.455	0.313	0.545	0.276	0.09*
France	0.249	0.238	0.398	0.174	0.149***
Indonesia	0.472	0.212	0.468	0.205	-0.004
Korea	0.313	0.267	0.464	0.217	0.151***
Malaysia	0.467	0.242	0.589	0.201	0.122***
Philippine	0.429	0.271	0.490	0.232	0.061***
Poland	0.360	0.256	0.440	0.239	0.08***
Portugal	0.223	0.284	0.351	0.254	0.128***
Spain	0.238	0.254	0.25	0.205	0.012
Venezuela	0.509	0.206	0.494	0.119	-0.015*
Vietnam	0.363	0.262	0.335	0.226	-0.028*

Note: all country-level variables are averaged for the period 1985–2015.
* Significant in two-sided tests at 10%.
** Significant in two-sided tests at 5%.
*** Significant in two-sided tests at 1%

Table 4-9 Descriptive statistics for cost efficiency scores pre- and post-GFC

Country	Pre-GFC		Post-GFC		Diff
	Mean	Std. Dev	Mean	Std. Dev	
Argentina	0.724	0.100	0.717	0.100	-0.007*
Australia	0.994	0.008	0.867	0.099	-0.127***
Austria	0.589	0.163	0.503	0.184	-0.086***
Belgium	0.794	0.178	0.284	0.216	-0.51***
Brazil	0.762	0.074	0.872	0.023	0.11***
Egypt	0.788	0.082	0.777	0.082	-0.011*
Greece	0.868	0.086	0.892	0.053	0.024*
Hungary	0.934	0.039	0.700	0.149	-0.234***
Italy	0.801	0.082	0.677	0.117	-0.124***
Mexico	0.652	0.126	0.531	0.189	-0.121***
Thailand	0.895	0.021	0.862	0.024	-0.033***
Turkey	0.646	0.217	0.725	0.158	0.079**
UK	0.692	0.171	0.638	0.186	-0.054***
Chile	0.798	0.097	0.677	0.147	-0.121***
China	0.891	0.085	0.879	0.084	-0.012**
Czech Republic	0.487	0.208	0.561	0.229	0.074**
France	0.68	0.181	0.598	0.203	-0.082***
Indonesia	0.885	0.074	0.773	0.130	-0.112***
Korea	0.705	0.135	0.803	0.055	0.098***
Malaysia	0.952	0.033	0.830	0.105	-0.122***
Philippine	0.926	0.107	0.872	0.165	-0.054***
Poland	0.832	0.097	0.788	0.116	-0.044***
Portugal	0.936	0.028	0.767	0.138	-0.169***
Spain	0.740	0.158	0.684	0.155	-0.056***
Venezuela	0.824	0.087	0.589	0.191	-0.235***
Vietnam	0.661	0.164	0.839	0.051	0.178***

Note: all country-level variables are averaged for the period 1985–2015.
* Significant in two-sided tests at 10%.
** Significant in two-sided tests at 5%.
*** Significant in two-sided tests at 1%.

4.6 Inter-temporal analysis of bank efficiency: pre-and post-privatisation period

We examined an additional set of robustness checks of the long-term effects of privatisation on bank efficiency. We first conducted cost and profit efficiency comparisons of privatised banks for 26 countries. Our analysis used data from up to 20 years before privatisation to up to 31 years following privatisation. We computed means for cost and profit efficiency for the pre-privatisation period based on the years when a bank began its privatisation programme, the short-term post-privatisation period (1–3 years), the medium-term post-privatisation period (4–10 years), and the long-term post-privatisation period (11 or more years). We then calculated the difference between the means of cost and profit efficiencies for different periods and determined the statistical significance of these differences. To test the equality of means, we employ the Satterthwaite t statistic following Boardman et al. (2016) to determine the statistical significance of the difference between the mean cost and profit efficiency for different periods.

Table 4-10 shows profit and cost efficiency estimations for the pre- and post-privatisation and the difference in their tests' mean. As our study focused on the longer run relative performance of privatised commercial banks after privatisation, the coverage period extended widely into post-privatisation. To capture the impact of privatisation over the long-term, we analysed the difference in means of profit and cost efficiency over the long-term using different sub-samples by three dummies variables. The first is Priv-short-term dummy variable interaction which takes a value of 1 for the short-term post-privatisation period (1–3 years) and 0 otherwise. The other one is Priv-medium-term dummy variable interaction that takes a value of 1 for the medium-term post-privatisation period (4–10 years) and 0 otherwise. The last dummy variable is Priv-long-term which takes a value of 1 for the long-term post-privatisation period (11 or more years) and 0 otherwise.

Columns (1) and (3) of Table 4-10 and Figure 4-1 show the difference between entire post-privatisation and pre-privatisation periods. We observed that the profit efficiency scores of privatised banks increased from a pre-privatisation level of 41.6% to 44.67% in post-privatisation. The findings show that profit efficiency improved by (3.07%) and the change is significant at 1%. The increase in profit efficiency indicates an improvement in bank performance following privatisation. Cost efficiency estimations provided the same results; privatised banks experienced a reduction in cost efficiency from a pre-privatisation level of 81.59% to 77.8% post-privatisation. The mean of cost efficiency reduced by (-3.73) and the

change was significant at the 1% level. The reduction in cost efficiency scores reflected an improvement in cost efficiency following privatisation.

The results in Table 4-10 column (2) show a positive and significant difference between profit efficiency pre-privatisation and short-term post-privatisation which is about (1.7%), and the change was significant at 1%. In addition, there was a positive and significant difference between profit-efficiency medium-term and long-term post-privatisation periods at about (4.6%). Our results are consistent with Jiang et al. (2013) and found that privatised banks in China had a positive and significant impact on profit and cost efficiency in both the short and long term. Besides, Williams and Nguyen (2005) employed a sample of South-East Asia (Indonesia, Korea, Malaysia, the Philippines, and Thailand) during the period 1990–2003, and found a noticeable improvement in profit efficiency and productivity performance in privatised banks after privatisation. The results in column (4) show a negative and significant difference between cost efficiency pre-privatisation and short-term post-privatisation at about (-1.7%) which is significant at 1%.

Furthermore, there is the negative and significant difference between means of cost efficiency short-term and medium post-privatisation periods, and in the same way the difference between cost-efficiency medium-term and long-term post-privatisation periods that are about (-1.3%) and (-5.5%) respectively. These results provide evidence that privatised banks achieved an improvement in cost efficiency either short-term or medium-term and long-term post-privatisation. Our results provide evidence that profit and cost efficiency improved immediately in privatised banks followed by subsequent continuous improvements and sustainable change in privatised bank efficiency over the long-term. These results are consistent with the first hypothesis.

Table 4-10 Difference in means of profit and cost efficiency in privatised banks pre and post privatisation

	Profit efficiency		Cost efficiency	
	(1)	(2)	(3)	(4)
Average bank efficiency Pre-privatisation	41.6		80.59	
Short-term (1–3 years) post-privatisation		43.3		79.9
Medium-term (4–10 years) post-privatisation		43.5		78.6
Long term (11 or more years) post-privatisation		47.1		73.1
(Entire) Post-privatisation period	44.67		77.86	
Average differences in efficiency between periods				
Difference between pre-privatisation and short-term post-privatisation periods		1.7***		-1.7*
Difference medium-term and short-term post-privatisation		0.2***		-1.3
Difference long-term and medium-term post-privatisation		4.6***		-5.5***
Difference entire post-privatisation and pre-privatisation	3.07***		-3.73***	
No. obs. in pre-privatisation period	932		932	
No. obs. in the short-term post-privatisation period		450		450
No. obs. in medium-term post-privatisation period		918		918
No. obs. in the long-term post-privatisation period		1061		1061
Total observations	2429		2429	

Note: Columns (1) and (3) compare pre-privatisation profit (cost) efficiency to post-privatisation. Columns (2) and (4) separate the sample into two groups Group 0 contains commercial banks pre- privatisation and the second one post-privatisation group. We sort the post- privatisation observations into three sub-groups, where Group 1 represents the short term post-privatisation (1–3 years), Group 2 represents the medium-term post-privatisation (4–10 years), while Group 3 includes the long term post-privatisation (11 or more years).The values of the Satterthwaite t statistic are in parentheses. *, ** and *** indicate estimations that are significant at the 10%, 5% and 1% levels, respectively.

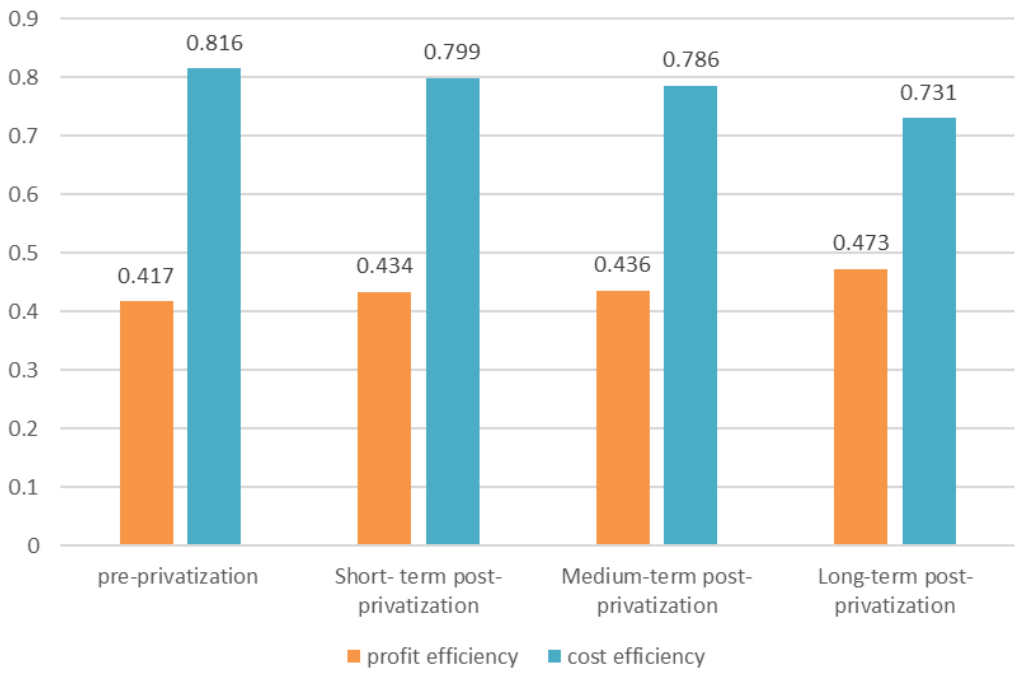

Figure 4-1 Bank efficiency scores across short, medium and long terms for post-privatisation beside to the pre- privatisation.

4.7 Conclusion

In this chapter, we summarised the results of the estimation of profit and cost efficiency of commercial banks in 26 countries over the period 1985-2015. We use stochastic frontier translog cost and profit functions approaches with a half-normal distribution of the inefficiency term and time-varying efficiency. We employed the Satterthwaite t statistic to determine the statistical significance of the difference between the mean cost and profit efficiency for different periods following privatisation. We computed means for cost and profit efficiency for the pre- and post-privatisation by dummy variables to represent pre-privatisation, short-term post-privatisation period (1–3 years), medium-term post-privatisation period (4–10 years), long-term post-privatisation period (11 or more years). The findings show privatised banks achieved an improvement in profit and cost efficiencies either short-term or medium-term and long-term post-privatisation. Our results provide evidence that profit and cost efficiencies of privatised banks improved immediately after privatisation followed by subsequent continuous improvements and a sustainable change in bank efficiency over the long-term.

The next chapter is the first empirical chapter of this thesis that identified bank business models using k-medoids cluster algorithm and determine whether bank business models change after privatisation or not.

Chapter 5 Identification of Bank Business Models

5.1 Introduction

This chapter attempts to answer research questions concerning whether privatised banks change their business models following privatisation or not and whether privatised banks become similar to other private-owned banks following privatisation. We identified bank business models using k-medoids cluster algorithm with the Calinski and Harabasz criterion as a stopping rule for the optimal number of clusters and discussed the empirical results. Based on our findings, we either accept or reject the following research hypothesis:

H5: Bank business models of privatised banks became similar to those non-privatised banks.

5.2 Descriptive analysis

Table 5-1 provides descriptive statistics for the main variables describing the differences in assets and funding strategies across privatised and non-privatised banks. The results showed privatised banks primarily use deposits and short-term liabilities to fund their activities while privatised banks and non-privatised banks tend to increase less-traditional sources of funding besides deposits and short-term liabilities in post-privatisation. The descriptive statistics show that the average loans in state banks which underwent privatisation later at about 52.8 percent of total assets against 50.1 percent for privatised banks. The mean of loans is 45.5 percent for non-privatised banks in pre-privatisation against 48.2 percent for non-privatised banks in the post privatisation period. The mean other earning assets of state banks which underwent privatisation later was about 34.3 percent of total assets against 38.5 percent for privatised banks. The mean other earning assets of non-privatised banks was about 45.7 percent in pre-privatisation against 40.7 percent post-privatisation. Regarding bank-funding sources, the mean of deposit and short-term funding state banks which underwent privatisation later was about 77.7 percent of total liabilities decreased to 75.9 percent following privatisation. Privatised banks depend on deposits more than other sources. Furthermore, the mean of debt liabilities-to-total assets in state banks which underwent privatisation later was about 6.2 percent of total liabilities, against 6.9 percent for privatised banks.

Given the aforementioned, we can determine that the privatised banks are traditional banks which generate earnings from loans to households and companies or loans in general including loans to other banks, while the non-privatised banks are traders' dependant on the balanced

proportion of loans and securities and other earning assets. The results also show privatised banks primarily use deposits and short-term liabilities to fund their activities. In contrast, privatised banks and non-privatised banks tend to increase less-traditional sources of funding besides deposits and short-term liabilities in post-privatisation.

Table 5-1 Descriptive statistics of assets and funding variables by Ownership Structures: % of assets, 1985-2015

Variables		Loans	Other earning assets	Deposits and Short-term funding	Debt liabilities
State banks underwent privatisation	Obs.	1046	1046	1046	1046
	Mean	0.528	0.343	0.777	0.062
	Median	0.53	0.345	0.818	0.013
	St.Dev	0.201	0.174	0.151	0.105
Privatised banks	Obs.	2603	2601	2603	2590
	Mean	0.501	0.385	0.759	0.069
	Median	0.512	0.354	0.807	0.029
	St.Dev	0.198	0.197	0.164	0.108
Non-privatised banks pre- privatisation	Obs.	4579	4579	4578	4577
	Mean	0.455	0.457	0.715	0.048
	Median	0.458	0.429	0.798	0.002
	St.Dev	0.235	0.252	0.225	0.122
Non-privatised banks post-privatisation	Obs.	22658	22647	22627	22629
	Mean	0.482	0.407	0.704	0.076
	Median	0.498	0.371	0.78	0.014
	St.Dev	0.258	0.252	0.229	0.139
All banks	Obs.	30892	30879	30860	30847
	Mean	0.481	0.411	0.713	0.071
	Median	0.495	0.377	0.788	0.013
	St.Dev	0.249	0.246	0.222	0.133

Note: The data are denominated in millions of US dollars at 2010 prices. All variables have been calculated using data from BankScope.

5.3 Differences between banking business models

Table 5-2 shows descriptive statistics of the two business models resulting from the cluster analysis on the sample of commercial banks in 26 developed and developing countries during the study period and based on the four instruments used to define models.

Looking at the differences in the bank business models, the focused retail banks are, on average, most active in traditional intermediary activities. Deposits and short-term funding accounts for 74.0 % of total assets, while bank loans account for 64.8% of total assets. The remaining exposures, such as other earning assets is around 24.6 % of total assets, and debt liabilities and relatively limited at 8.3%. The focused retail model represents about 56.86% of the sample. Trader business model has substantial trading activities accounting for 62.3% of total assets with loans at for only 26.8 % of total assets. In funding, the focus is on less stable and less traditional sources, such as debt liabilities. Deposits and short-term funding account for 67.8% of the total funding while debt liabilities account for 5.6% of total assets. The trader model represents about 42.92% of the sample

Table 5-3 presents the frequency distribution of bank business models for the privatised banks and non-privatised banks in pre- and post-privatisation. In the pre-privatisation, the most common business models of state-owned banks that underwent to privatisation is focused retail business models at 60.78%. While non-privatised banks tend to be trader, and focused retail business models dramatically, account for 55.47% and 46.16%, respectively. In the post-privatisation period, privatised banks and non-privatised banks tend to be more focused on retail banks at 63.31% and 57.19%, respectively. Thus, the privatised banks behaved a little differently following privatisation, and they became similar to those non-privatised banks in the post-privatisation period. This result is consistent with the seventh hypothesis which states that the bank business models in privatised banks became similar to those of rival banks.

Table 5-2 Descriptive statistics: Assets and Funding by Business Models; % of assets

Variables		Loans	Other earning assets	Deposits and Short-term funding	Debt liabilities
Focused retail	Obs	17360	17360	17360	17360
	Mean	0.648	0.246	0.74	0.083
	Median	0.636	0.248	0.803	0.021
	St.Dev	0.159	0.128	0.19	0.14
Trader	Obs	13477	13477	13477	13477
	Mean	0.268	0.623	0.678	0.056
	Median	0.284	0.602	0.758	0.005
	St.Dev	0.165	0.194	0.253	0.123
All banks	Obs	30891	30878	30859	30846
	Mean	0.481	0.411	0.713	0.071
	Median	0.495	0.377	0.788	0.013
	St.Dev	0.249	0.246	0.222	0.133

Note: The data are denominated in millions of US dollars at 2010 prices. All variables have been calculated using data from BankScope.

Table 5-3 Frequency distribution of bank business models by bank ownership in the pre- and post-privatisation period

Bank Business Models	Focused retail		Trader model		Total
	Freq	%	Freq	%	
Pre-Privatisation					
State banks underwent privatisation	640	60.78	412	39.13	1053
Non- Privatised banks	2112	46.16	2460	53.77	4575
Post-Privatisation					
Privatised banks	1646	63.31	939	36.12	2600
Non- Privatised banks	12961	57.19	9666	42.65	22663
Total	17359	56.86	13477	42.92	30891

Source: outputs of cluster analysis

5.4 Conclusion

The main objectives of this chapter were to identify the bank business models of privatised banks and determine whether bank business models change after privatisation or not. Business models are identified using k-medoids cluster analysis. We employed the following variables to capture bank business models: the ratio of net loans-to-total assets, the ratio of deposits and short-term funding-to-total assets, the ratio of deposits and short-term funding-to-total assets, the ratio of other interest-bearing liabilities-to- total assets, and non-interest-bearing liabilities-to-total assets. Our findings showed two main banking business models, namely focused retail, and trader model business model. In addition, the newly privatised banks have witnessed some changes in bank business models in the post-privatisation where they tend to be more focused retail and rely on traditional intermediary activities.

The next chapter is the third empirical chapter of this thesis that examine the effect of bank business models and bank performance using a sample of commercial banks from 26 developed and developing countries over the period 1985 to 2015 and discusses the empirical findings regarding the relationship between bank business models and performance.

Chapter 6 Empirical results of the impact of bank business models on performance and bank stability

6.1 Introduction

The purpose of this chapter is to present the results of the research hypotheses tests concerning the effect of bank business models on bank performance and stability using a sample of commercial banks from 26 developed and developing countries over the period 1985 to 2015. In this chapter we discuss the empirical findings regarding the relationship between bank business models and performance. To further address the question of whether bank business models affect bank performance and risk-taking in newly privatised banks, we used the Tobit regression model to estimate the effect of bank business models on profit and cost efficiency, following Clarke and Cull (2005), Lin et al. (2016), Claessens and Van Horen (2010) and Akhigbe and McNulty (2011). The efficiency scores derived from Stochastic Frontier Analysis (SFA) techniques are in between 0 and 1 (not continuous). Thus, the fittest model for the censored profit and cost efficiency is Tobit regression. We also report the results of Generalised Least Squares (GLS) regressions following the method of Hryckiewicz and Kozłowski (2017). The estimations were conducted using robust standard errors which were corrected by bank clustering in all regressions. Based on our findings, we either accepted or reject the research hypotheses, which are:

H6: Bank business models have an impact on the performance of newly privatised banks.

H6a: A focused business model affects bank performance in newly privatised banks.

H6b: A trader business model affects bank performance in newly privatised banks.

H7: Privatised banks have become more prudent and more stable after privatisation based on the work of Mohsni and Otchere (2014)

Accordingly, the outline of this chapter is as follow. Section 6.2 represents the empirical results of the effects of bank business models on bank efficiency. While section 6.3 shows the empirical results of the relationship between bank business models and other performance indicators. Then, section 6.4 reports the empirical results of the impact of bank business models on stability. After that, various robustness checks are presented in section 6.5 and finally, section 6.6 summaries the main results of this chapter.

6.2 Effects of bank business models on bank efficiency

Table 6-1 presents the results of the relationship between bank business models and profit efficiency where Eq. 3-12 was estimated using the Tobit regressions. In our first specification, we examine how the profit efficiency differs between newly privatised banks and non-privatised banks using *Priv* as a dummy variable which equals 1 if the sample firm is a privatised bank and 0 otherwise. The findings show that the *Priv* dummy variable's coefficients are negative and significant in all models, suggesting that the state banks that underwent privatisation later were less profit efficient than their counterparts.

Similarly, the Post dummy variable's coefficients are negative and significant in all models; this indicates that non-privatised banks were less profit efficient. Post* Priv dummy variable coefficients are positive and significant in Model 1; this reveals that privatisation has produced significant profit efficiency gains in post-privatisation. Models 2, 3, 4, 5 and 6 of Table 6-1 show that the interaction Post* Priv coefficients are insignificant, indicating that there is no difference in the effect of government ownership on profit efficiency after including the characteristics of country and bank to the model.

We included country characteristics control variables in Model 2, intending to separate the effect of privatisation on profit efficiency. The findings show that commercial banks in developed countries are less profit efficient than their counterparts in developing countries. The coefficients of *GDP* growth and inflation rate have a positive and significant impact on profit efficiency.

We included bank characteristics control variables in Models 3 and 5. The regression results using the Tobit model show that the focused retail business model's coefficients have a positive and significant impact on profit efficiency. Whereas, the Trader business model's coefficients are negative and significant, suggesting that commercial banks with a trader business model are less profit efficient. Concerning other bank control variables, we found that foreign dummy variable's coefficients are negative and significant, indicating that commercial banks taken over by foreign ownership are less profit efficient. The coefficients of the ratio of equity-to-assets were positive and significant, which suggest that commercial banks with higher capital tend to enhance their profit efficiency.

We also included bank size (measured as the natural logarithm of the total assets) as a control variable. The coefficients of bank size were negative and statistically significant, suggesting

that larger banks are less profit efficient than smaller banks. The coefficient of cost-to-income ratio showed that banks with a lower level of cost-to-income were more profit efficient.

Table 6-2 presents the results for the relationship between bank business models and cost efficiency as the dependent variable using Tobit regressions. Note that a lower efficiency value indicates greater cost efficiency. The cost efficiency was estimated from the two outputs frontier model shown in Eq. 3-9. As shown in the table, the coefficients of the *Priv* dummy variable are significantly positive in models 1 and 2. While the coefficients of the *Post* dummy variable are negative and significant, suggesting that non-privatised banks were more efficient. It can also be noticed that the coefficients of the *Post* Priv* dummy variable are negative and significant in models 1and 4, suggesting that privatised banks performed better than their counterparts in post-privatisation. This result is in line with the study of Williams (2012), which show that after privatisation, privatised banks improved their cost efficiency.

Furthermore, the regression results on country characteristics control variables with the view of separating the effects of privatisation on performance by newly privatised banks in the post-privatisation indicate that the cost efficiency of privatised banks improved after GFC in developed and developing countries. We also reported the estimated results of other country control variables, which had a specific impact on cost efficiency. The coefficients of GDP growth were found to be negatively associated with cost efficiency. It is not surprising to see that faster economic growth can enhance cost efficiency. Besides, the coefficients of inflation rate were positive and significant in all regressions and its coefficients had a positive and significant impact on cost efficiency. This means the high inflation rate reduces the cost efficiency.

In addition, we included bank-specific control variables in Model 3, 4, 5 and 6 aiming at separating the effects of privatisation on cost efficiency from any confusing bank characteristics effects. Our variable of interest was the bank business models. The results found that commercial banks with a trader business model improved cost efficiency, while commercial banks with a focused retail business model were less cost efficient than other banks.

Analyzing the effects of the other bank control variables on the cost efficiency, we found that the ratio of equity-to-total assets enters negatively and significantly in model specifications 3, 4, 5 and 6, suggesting that lower minimum capital requirements tend to reduce cost efficiency.

Furthermore, a higher level of equity related to maximised profits or minimised costs gives results in line with Berger and Mester (1997), Lin et al. (2016).

We also found that the coefficient of bank size is positive and statistically significant, suggesting that smaller banks are more cost efficient than large banks. Besides, the results showed that the cost-to-income ratio remains negative and significant which indicates that commercial banks with a high ratio of cost to income are less cost efficient.

Table 6-1 Estimation of the relationship between profit efficiency and bank business models from Eq. 3-12; Tobit estimates.

	Dependent variables: profit efficiency					
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)
Priv	-0.0363***	-0.0314***	-0.0176**	-0.0176**	-0.0176**	-0.0177**
	(0.00787)	(0.00792)	(0.00783)	(0.00783)	(0.00783)	(0.00783)
Post	-0.0147***	-0.00954**	-0.00779*	-0.00777*	-0.00779*	-0.00777*
	(0.00400)	(0.00431)	(0.00431)	(0.00431)	(0.00431)	(0.00431)
Post*Priv	0.0375***	0.0146	0.0129	0.0146	0.0128	0.0118
	(0.00912)	(0.00912)	(0.00901)	(0.0110)	(0.00901)	(0.00971)
GFC		-0.00326	0.000476	0.000481	0.000480	0.000482
		(0.00334)	(0.00342)	(0.00342)	(0.00342)	(0.00342)
Developed		-0.188***	-0.160***	-0.160***	-0.160***	-0.160***
		(0.00602)	(0.00633)	(0.00634)	(0.00633)	(0.00634)
GDPG		0.0681***	0.0658***	0.0658***	0.0658***	0.0658***
		(0.00268)	(0.00272)	(0.00272)	(0.00272)	(0.00272)
Inflation		0.0165***	0.0136***	0.0136***	0.0136***	0.0136***
		(0.00133)	(0.00136)	(0.00136)	(0.00136)	(0.00136)
FBM			0.0130***	0.0133***		
			(0.00296)	(0.00309)		
TBM					-0.0129***	-0.0132***
					(0.00296)	(0.00309)
Foreign			-0.00844**	-0.00840**	-0.00844**	-0.00840**
			(0.00377)	(0.00377)	(0.00377)	(0.00377)
Equity			0.163***	0.163***	0.163***	0.163***
			(0.0115)	(0.0115)	(0.0115)	(0.0115)
Bank size			-0.0094***	-0.00941***	-0.00941***	-0.00941***
			(0.00125)	(0.00125)	(0.00125)	(0.00125)
Cost			-0.0576***	-0.0576***	-0.0576***	-0.0576***
			(0.00207)	(0.00207)	(0.00207)	(0.00207)
Post*Priv* FBM				-0.00278		
				(0.0100)		
Post*Priv*TBM						0.00294
						(0.0100)
Constant	0.459***	-0.118***	-0.0590**	-0.0591**	-0.0460**	-0.0458**
		(0.0230)	(0.0235)	(0.0235)	(0.0231)	(0.0231)
Observations	25,235	24,238	24,203	24,203	24,203	24,203
Log likelihood	1078.8	1794.6385	2312.2678	2312.3	2312.1	2312.16
LR chi2(13)	29.79***	1552***	2585.21***	2585.29***	2584.9***	2584.99***
Pseudo R2	0.0140	0.7621	-1.2677	-1.2677	-1.2675	-1.2676

This table reports the results of Tobit regressions conducted to determine the effects of bank business models on profit efficiency, which is estimated for commercial banks in 26 developed and developing countries. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at 10%.

Table 6-2 Estimation of the relationship between cost efficiency and bank business models from Eq. 3-12; Tobit estimates.

	Dependent variables: Cost efficiency					
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)
Priv	0.0460***	0.0505**	-0.0225***	-0.0225***	-0.0225***	-0.0225***
	(0.00567)	(0.0239)	(0.00526)	(0.00526)	(0.00526)	(0.00526)
Post	-0.0375***	-0.161***	-0.0376***	-0.0377***	-0.0376***	-0.0376***
	(0.00288)	(0.0125)	(0.00290)	(0.00290)	(0.00290)	(0.00290)
Post*Priv	-0.0342***	-0.0360	-0.00872	-0.0131*	-0.00873	-0.00812
	(0.00656)	(0.0276)	(0.00605)	(0.00741)	(0.00605)	(0.00652)
GFC		-0.0620***	-0.0585***	-0.0585***	-0.0585***	-0.0585***
		(0.00986)	(0.00230)	(0.00230)	(0.00230)	(0.00230)
Developed		-0.0730***	-0.0156***	-0.0157***	-0.0155***	-0.0156***
		(0.0179)	(0.00425)	(0.00425)	(0.00425)	(0.00425)
GDPG		-0.0704***	-0.0604***	-0.0604***	-0.0604***	-0.0604***
		(0.00822)	(0.00182)	(0.00182)	(0.00182)	(0.00182)
Inflation		0.0259***	0.00176*	0.00176*	0.00173*	0.00173*
		(0.00404)	(0.000914)	(0.000914)	(0.000914)	(0.000914)
FBM			0.00985***	0.00924***		
			(0.00199)	(0.00208)		
TBM					-0.00924***	-0.0091***
					(0.00199)	(0.00208)
Foreign			0.00408	0.00399	0.00408	0.00406
			(0.00253)	(0.00253)	(0.00253)	(0.00253)
Equity			-0.135***	-0.134***	-0.135***	-0.135***
			(0.00770)	(0.00770)	(0.00770)	(0.00770)
Bank size			0.0244***	0.0244***	0.0244***	0.0244***
			(0.000839)	(0.000839)	(0.000839)	(0.000839)
Cost			-0.0252***	-0.0252***	-0.0252***	-0.0252***
			(0.00139)	(0.00139)	(0.00139)	(0.00139)
Post*Priv* FBM				0.00690		
				(0.00672)		
Post*Priv* TBM						-0.00171
						(0.00674)
Constant	0.788***	0.375***	1.345***	1.346***	1.355***	1.355***
	(0.00266)	(0.0706)	(0.0158)	(0.0158)	(0.0155)	(0.0155)
Observations	25,204	29,143	24,179	24,179	24,179	24,179
Log likelihood	9385	31511	11952.896	11953.424	11951.438	11951.47
LR chi2(13)	281.81***	391***	6069.4***	6070.45***	6066.48***	6066.54***
Pseudo R2	0.0152	0.0062	-0.3403	-0.3403	-0.3401	-0.3401

This table reports the results of Tobit regressions conducted to determine the effects of bank business models on cost efficiency, which is estimated for commercial banks in 26 developed and developing countries. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at 10%.

6.3 Effects of bank business models on performance

In this section, we studied the impacts of bank business models on the performance of newly privatised banks. Table 6-3, Table 6-4, and Table 6-5 present the regression results from using dependent variables return on assets (ROA), return on equity (ROE), and net interest margin (NIM) as the performance indicators. All the models are estimated by multiple regression with Ordinary Least Squares (OLS) with clustering at the bank level. Robust standard errors are used to correct potential heteroskedasticity and potential time-series autocorrelation within each bank. We also reported the GLS results with the random effect. We applied the Breusch–Pagan test and the results rejected the null-hypothesis for the constant variance which confirmed that the generalised least-squares method (GLS) was appropriate for the multivariate analysis.

The results of the regressions using different specifications of the return on assets (ROA) as the dependent variable are presented in Table 6-3. Our first specification examined how ROA has differed between privatised banks and non-privatised banks using the (Priv) dummy variable. Post* Priv dummy variable coefficients were positive and significant in all regressions, which confirmed that the newly privatised banks were more profitable (ROA) than their counterparts in the post-privatisation period. Our results are consistent with the previous studies' findings, including Mohsni and Otchere (2014) and Megginson (2005), who reported significant improvements in the profitability of the newly privatised banks.

We also include country characteristics control variables in Model 2 to separate the effects of privatisation on performance by newly privatised banks. We found that the global financial crisis dummy (GFC) was positive and significant, suggesting that commercial banks' profitability ROA increased after GFC. In addition, the coefficient of a developed dummy variable in GLS results with the random effect, suggesting that commercial banks in developed countries are less ROA in Model 2. The regression results on other control variables show that GDP growth's coefficient had a negative and significant effect on commercial banks. The coefficient of inflation had a positive impact on ROA.

Additionally, we included the bank characteristics control variables in Model 3 with the intention of separating the effects of bank business models on performance (ROA). The results of Model 3 showed that the focused retail business model had a significant and positive impact

on profitability (ROA), indicate that commercial banks with a focused retail model performed better than the trader business model. Our findings support Mergaerts and Vennet (2016) who studied the impacts of bank business models on performance and risk for 30 European countries between1998 to 2013 and documented that retail-oriented banks appeared to be more profitable and stable. We included the ratio of equity-to-total assets and the findings indicated that commercial banks with a higher ratio of equity-to-assets had higher profitability (ROA). The coefficients of the cost-to-income ratio show that commercial banks with a lower level of cost-to-income could have better performance. This is in line with the results of existing studies, for example, Roengpitya et al. (2014), who documented that the commercial banks which were based on traditional banking activities had lower costs and more stable profitability than those banks which were heavily involved in capital market activities, mainly trading.

Besides, we tested the interaction of the privatisation dummy variable Post*Priv with bank business variables in Models (4 and 6) to capture the effect of the bank business model on ROA in privatised banks. The coefficients of Post* Priv* FBM and Post* Priv* TBM showed that the privatised banks with a focused retail business model were less profitable (ROA) post-privatisation. While privatised banks with the trader business model were more profitable (ROA) post-privatisation.

Table 6-4 presents the results of the regressions with the return on equity (ROE) as a dependent variable. We examined the relationship between return on equity ROE and bank business models in newly privatised banks. The coefficient of the Post* Priv dummy variable was significantly positive in the Model 4, suggesting that privatised banks were more profitable compared with their counterparts non-privatised banks. In our six specifications, priv and post* priv dummies of privatisation characteristics lost some of their significance.

We also considered country characteristics control variables in Model 2, and the results revealed that commercial banks in developed countries were less profitable than their counterparts in developing countries. At the macroeconomic level, we included the real economic growth GDP and inflation to control for the general economic environment over the sample period. The coefficients of GDP growth were significantly positive, and a higher rate of inflation was found to increase the profitability (ROE) of commercial banks.

We included bank-specific control variables in Models 3 and 5 with a view to separating the effects of privatisation on ROE by newly privatised banks from any confusing bank-

characteristics effects. Our variable of interest is bank business models, the findings showed that commercial banks with a focused retail business model had a positive effect on (ROE), suggesting that banks with a focused retail business model appear to be more ROE than trader business model.

Concerning other bank control variables, the impact of foreign ownership on bank performance is captured by the Foreign dummy variable, which equals 1 for foreign ownership and zero otherwise. The results found the coefficients of a foreign dummy variable significantly negative, indicating that commercial banks taken over by foreign ownership performed less well than their counterparts, domestic owned banks. The findings also showed that commercial banks with a high equity-to-assets ratio had lower profitability (ROE). The coefficients of bank size were positive and statistically significant, suggesting that large banks were more profitable than small banks. We also found that the cost-to-income ratio remained negative and significant.

On the other hand, we tested the interaction of the privatisation dummy Post* Priv with other explanatory variables (bank business models) in Models 4 and 6. The privatisation strategy had a positive and significant effect on ROE in the post-privatisation period in Model 4. The results also showed that privatised banks which depend on a focused retail business model were less profitable in the post-privatisation period. In contrast, privatised banks with a trader business model were more profitable (ROE).

The regressions' results using different specifications of the net interest margin (NIM) as the dependent variable are presented in Table 6-5. In our first specification, we examined how the net interest margin (NIM) differs between newly privatised banks and non-privatised banks using Priv a dummy variable. The coefficients of Priv* Post dummy variable were positive and significant in models 3, 4, 5, and 6; this confirms that the newly privatised banks were more profitable (NIM) than non-privatised banks.

At the macroeconomic level, we included the GFC dummy variable, developed dummy variable, GDP growth, and inflation rate to control for the general economic environment over the sample period. The global financial crisis dummy variable (GFC) coefficients were negative and significant, suggesting that the global financial crisis negatively impacted all commercial banks (privatised, non-privatised banks). The findings showed that the coefficients of the Developed dummy variable were negative and significant, suggesting that commercial banks in developed countries were less net interest margin than their counterparts in developing

countries. The coefficients of growth in real GDP and inflation rate were positively associated with bank profitability (NIM).

We included bank characteristics control variables in Model 3, 4, 5 and 6. The results indicate that commercial banks with a focused retail business model were more profitable (NIM). In contrast, commercial banks with a trader business model were less profitable (NIM) than other banks.

Concerning other bank control variables, we included the ratio of equity-to-total assets; the findings indicated that commercial banks with a higher ratio of equity-to-assets had high profitability (NIM). We found that the coefficients of bank size were negative and statistically significant; this finding is consistent with Mergaerts and Vander Vennet (2016), who found that large banks had an adverse effect on bank performance. Besides, the coefficient of cost-to-income ratio showed that banks with a lower level of cost-to-income could have better performance.

The results provided important evidence for hypothesis 6; hence, based on our findings, we accept the sixth hypothesis, which states that bank business models impacted the performance of newly privatised banks.

Table 6-3 Estimation of the relationship between return on assets (ROA) and bank business models from Eq. 3-14; random-effects GLS estimator.

Independent variables	Dependent variable: ROA					
	(1)	(2)	(3)	(4)	(5)	(6)
Priv	-0.00682***	-0.0107***	-0.00637***	-0.00652***	-0.00638***	-0.00652***
	(0.00221)	(0.00223)	(0.00198)	(0.00199)	(0.00198)	(0.00199)
Post	-0.00359***	-0.00196**	-0.00370***	-0.00373***	-0.00370***	-0.00373***
	(0.000916)	(0.000952)	(0.000912)	(0.000913)	(0.000912)	(0.000913)
Post*Priv	0.00838***	0.00959***	0.00816***	0.0112***	0.00815***	0.00660***
	(0.00197)	(0.00203)	(0.00163)	(0.00214)	(0.00163)	(0.00169)
GFC		0.00113	0.000347	0.000356	0.000347	0.000353
		(0.000709)	(0.000665)	(0.000665)	(0.000665)	(0.000665)
Developed		-0.00339*	0.00117	0.00106	0.00118	0.00106
		(0.00199)	(0.00195)	(0.00196)	(0.00195)	(0.00195)
GDPG		-0.0037***	-0.00445***	-0.00436***	-0.00445***	-0.00435***
		(0.00118)	(0.00116)	(0.00116)	(0.00116)	(0.00116)
Inflation		0.00139***	0.000822***	0.000825***	0.000824***	0.000829***
		(0.000283)	(0.000268)	(0.000268)	(0.000268)	(0.000268)
FBM			0.000679*	0.00111*		
			(0.000560)	(0.000584)		
TBM					-0.000745*	-0.00119**
					(0.000561)	(0.000585)
Foreign			-0.00121	-0.00121	-0.00121	-0.00121
			(0.000960)	(0.000959)	(0.000960)	(0.000959)
Equity			0.0528***	0.0528***	0.0528***	0.0528***
			(0.00429)	(0.00427)	(0.00429)	(0.00427)
Bank size			0.000340	0.000325	0.000340	0.000328
			(0.000298)	(0.000298)	(0.000298)	(0.000298)
Cost			-0.0149***	-0.0149***	-0.0149***	-0.0149***
			(0.000750)	(0.000748)	(0.000750)	(0.000748)
Post*Priv* FBM				-0.00456**		
				(0.00183)		
Post*Priv* TBM						0.00470**
						(0.00186)
Constant	0.0169***	0.0506***	0.0612***	0.0602***	0.0619***	0.0613***
	(0.000958)	(0.0103)	(0.00999)	(0.0100)	(0.00997)	(0.00999)
Observations	30,782	29,621	29,128	29,128	29,128	29,128
Number of id	2,499	2,495	2,489	2,489	2,489	2,489
Breusch–Pagan test	27851***	18649***	18512***	18527***	18512***	18527***

Notes: This table reports the results from the generalised least-squares method (GLS). All variables are defined in the Table 3-5. Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level.

Table 6-4 Estimation of the relationship between return on equity (ROE) and bank business models from Eq. 3-14; random-effects GLS estimator.

Independent variables	Dependent variable: ROE					
	(1)	(2)	(3)	(4)	(5)	(6)
Priv	0.0325*	0.0200	0.0205*	0.0198	0.0205*	0.0197
	(0.0180)	(0.0182)	(0.0122)	(0.0122)	(0.0122)	(0.0122)
Post	-0.0197***	-0.0139**	-0.0310***	-0.0311***	-0.0310***	-0.0311***
	(0.00641)	(0.00668)	(0.00504)	(0.00504)	(0.00504)	(0.00504)
Post*Priv	0.00966	0.0106	0.00650	0.0207*	0.00650	-0.00146
	(0.0181)	(0.0185)	(0.00926)	(0.0118)	(0.00926)	(0.00997)
GFC		0.00784	-0.00421	-0.00414	-0.00420	-0.00415
		(0.00505)	(0.00358)	(0.00358)	(0.00358)	(0.00358)
Developed		-0.0550***	-0.0724***	-0.0726***	-0.0725***	-0.0727***
		(0.0129)	(0.0112)	(0.0112)	(0.0112)	(0.0112)
GDPG		0.0141**	0.0252***	0.0254***	0.0252***	0.0255***
		(0.00565)	(0.00511)	(0.00511)	(0.00511)	(0.00511)
Inflation		0.0163***	0.0136***	0.0136***	0.0136***	0.0136***
		(0.00207)	(0.00146)	(0.00146)	(0.00146)	(0.00146)
FBM			0.00468*	0.00663*		
			(0.00332)	(0.00347)		
TBM					-0.00427	-0.00642*
					(0.00332)	(0.00347)
Foreign			-0.0164***	-0.0164***	-0.0164***	-0.0164***
			(0.00550)	(0.00550)	(0.00550)	(0.00550)
Equity			-0.0317***	-0.0317***	-0.0319***	-0.0319***
			(0.0121)	(0.0121)	(0.0121)	(0.0121)
Bank size			0.00607***	0.00603***	0.00607***	0.00603***
			(0.00163)	(0.00163)	(0.00163)	(0.00163)
Cost			-0.110***	-0.110***	-0.110***	-0.110***
			(0.00199)	(0.00199)	(0.00199)	(0.00199)
Post*Priv* FBM				-0.0214*		
				(0.0110)		
Post*Priv* TBM						0.0240**
						(0.0111)
Constant	0.125***	-0.00703	0.000516	-0.00263	0.00518	0.00372
	(0.00611)	(0.0466)	(0.0434)	(0.0434)	(0.0433)	(0.0432)
Observations	30,724	29,566	29,076	29,076	29,076	29,076
Number of id	2,490	2,486	2,480	2,480	2,480	2,480
Breusch–Pagan test	10404***	9556.5***	7973***	7908***	7973***	7908***

Notes: This table reports the results from the generalised least-squares method (GLS). All variables are defined in the Table 3-5. Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level.

Table 6-5 Estimation of the relationship between net interest margin (NIM) and bank business models from Eq. 3-14; random-effects GLS estimator.

Independent variables	Dependent variable: NIM					
	(1)	(2)	(3)	(4)	(5)	(6)
Priv	0.00132	-0.00888***	-0.00189	-0.00184	-0.00191	-0.00186
	(0.00341)	(0.00323)	(0.00278)	(0.00278)	(0.00278)	(0.00278)
Post	-0.00706***	-0.00212	0.000805	0.000817	0.000804	0.000816
	(0.00151)	(0.00129)	(0.000753)	(0.000753)	(0.000753)	(0.000753)
Post*Priv	0.00163	0.00384	0.00452***	0.00339**	0.00450***	0.00507***
	(0.00312)	(0.00307)	(0.00130)	(0.00167)	(0.00130)	(0.00140)
GFC		-0.00851***	-0.00526***	-0.00526***	-0.00525***	-0.00525***
		(0.000836)	(0.000526)	(0.000526)	(0.000526)	(0.000526)
Developed		-0.0412***	-0.0342***	-0.0341***	-0.0342***	-0.0341***
		(0.00313)	(0.00236)	(0.00236)	(0.00236)	(0.00236)
GDPG		0.00676***	0.00658***	0.00654***	0.00659***	0.00655***
		(0.00138)	(0.00102)	(0.00102)	(0.00102)	(0.00102)
Inflation		0.00503***	0.00410***	0.00410***	0.00410***	0.00409***
		(0.000489)	(0.000209)	(0.000209)	(0.000209)	(0.000209)
FBM			0.00659***	0.00643***		
			(0.000485)	(0.000508)		
TBM					-0.00647***	-0.00631***
					(0.000486)	(0.000508)
Foreign			-0.00129	-0.00129	-0.00127	-0.00127
			(0.000877)	(0.000877)	(0.000877)	(0.000877)
Equity			0.0736***	0.0736***	0.0736***	0.0736***
			(0.00188)	(0.00188)	(0.00188)	(0.00188)
Bank size			-0.00481***	-0.00481***	-0.00482***	-0.00481***
			(0.000255)	(0.000255)	(0.000255)	(0.000255)
Cost			-0.00298***	-0.00298***	-0.00298***	-0.00299***
			(0.000284)	(0.000284)	(0.000284)	(0.000284)
Post*Priv* FBM				0.00169		
				(0.00156)		
Post*Priv* TBM						-0.00173
						(0.00158)
Constant	0.0491***	-0.00156	-0.00488	-0.00442	0.00159	0.00189
	(0.00159)	(0.0117)	(0.00864)	(0.00865)	(0.00864)	(0.00864)
Observations	30,829	29,671	29,114	29,114	29,114	29,114
Number of id	2,511	2,507	2,488	2,488	2,488	2,488
Breusch–Pagan test	63553***	42226***	37498***	37475***	37498***	37475***

Notes: This table reports the results from the generalised least-squares method (GLS). All variables are defined in the Table 3-5. Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level.

6.4 Effects of bank business models on stability

In this section, we examined the impacts of bank business models on bank stability. Table 6‑6 presents the regression results of the natural logarithm of the z-score to capture bank stability as the dependent variable. All the models are estimated by multiple regression with the generalised least-squares method (GLS). Robust standard errors clustered at the bank level. We applied the Breusch–Pagan test, and the results rejected the null hypothesis for the constant variance, which confirmed that the generalised least-squares method (GLS) was appropriate to run the multivariate analysis.

We examined how bank stability differs between newly privatised banks and non-privatised banks using Priv a dummy variable. In our six specifications, the dummies of privatisation characteristics lost some of their significance. Consistent with the regression results, the Priv dummy was negative and significant in Models 1, 4 and 6, suggesting that state banks that were later privatised significantly exhibited a higher risk. In our six specifications, the Priv* Post dummy of privatisation characteristics lost their significance. The Post dummy's coefficients were negative and significant, suggesting that generally, non-privatised banks exhibited higher risk than the control sample.

We included the GFC dummy variable to capture the impact of the recent financial crisis. The coefficients were significant and positive, suggesting that commercial banks exhibited a higher z-score (lower risk-taking) after the GFC. The finding is also consistent with a study of Dong et al. (2014), which state the banks tended to take less risk after the global financial crisis.

The Developed dummy variable's coefficients were positive and significant, suggesting that commercial banks in developed countries exhibited a lower risk than their counterparts in developing countries. The results are consistent with Mohsni and Otchere (2014) finding that banks in developed countries are more stable (high z-scores) than their counterparts in developing countries.

We included country variables in the regression model 2; and found that GDP growth and inflation rate have a negative and significant effect, suggesting that a higher level of GDP growth and inflation are related to higher risk-taking and less stability. Our findings are consistent with other studies like Kohler (2015), who found that the banks from countries with a higher inflation rate had reduced bank stability.

Regarding the impact of bank business models on bank stability, the results of Models 3, 4, 5 and 6 indicate that commercial banks with a focused retail model exhibited lower risk-taking (more stable), this finding is consistent with Berger et al. (2010), who suggested that focused banks are associated with lower risk-taking. In contrast, commercial banks with a trader business model appeared to be less stable than other banks.

To analyse the effects of other control variables on the z-score measure in Models 3, 4, 5 and 6 of Table 6-6, the impact of foreign ownership on bank stability is captured by the Foreign dummy variable. The results showed that the foreign dummy variable was negative and significant, suggesting that foreign investors' existence as owners of commercial banks led to reducing stability and exposure to high risk-taking in developed and developing countries. Our results are consistent with Boubakri et al. (2013), who found that foreign investors' presence as owners of newly privatised firms could lead to higher efficiency and higher risk-taking by the newly privatised firm.

We also include bank size (measured as the natural logarithm of the total assets) as a bank control variable to capture the impact of bank size on risk-taking; the bank size coefficients were positive and significant, suggesting that larger banks participated in less risky activities than smaller banks. Altunbas et al. (2011) reached the same conclusion, i.e., bank size could help to find the relationship between risk-taking and diversification and other economies of scope, such as access to markets. Their findings also revealed that bank size is positively related to bank stability as larger banks reduce the risk levels. The coefficients of the ratio of equity-to-assets were positive and significant, suggesting that commercial banks with a higher ratio of equity-to-assets exhibited lower risk. This finding is consistent with Köhler (2015), who found that bank size and capitalisation are the most important determinants of bank stability. Besides, the findings also indicate that the ratio of cost-to-income had a negative effect on bank stability.

We tested the interaction of the privatisation dummy Post*Priv with other explanatory variables (bank business models) in Models 4 and 6. Our initial findings are reported in Table 6 6, which show that the coefficients of both focused retail and trader dummies variables were insignificant in Models 4 and 6; suggesting no significant effect among banking business models on bank stability in the newly privatised banks. The results provided important evidence for hypothesis 7; hence, based on our findings, we reject the seventh hypothesis, stating that privatised banks have become more prudent and more stable after privatisation.

Table 6-6 Estimation of the relationship between bank stability measured by z-score and bank business models from Eq. 3 14; random-effects GLS estimator.

Independent variables	Dependent variable: Ln z-score					
	(1)	(2)	(3)	(4)	(5)	(6)
Priv	-0.244***	-0.135	-0.116	-0.118*	-0.116	-0.118*
	(0.0939)	(0.0858)	(0.0713)	(0.0713)	(0.0713)	(0.0713)
Post	-0.00968	-0.151***	-0.243***	-0.243***	-0.243***	-0.243***
	(0.0382)	(0.0405)	(0.0256)	(0.0256)	(0.0256)	(0.0256)
Post*Priv	0.0989	0.0233	0.00770	0.0383	0.00722	-0.00953
	(0.0835)	(0.0818)	(0.0462)	(0.0590)	(0.0462)	(0.0496)
GFC		0.311***	0.262***	0.263***	0.262***	0.263***
		(0.0305)	(0.0179)	(0.0179)	(0.0179)	(0.0179)
Developed		0.409***	0.508***	0.507***	0.507***	0.506***
		(0.0817)	(0.0644)	(0.0644)	(0.0645)	(0.0644)
GDPG		-0.117***	-0.161***	-0.160***	-0.161***	-0.160***
		(0.0393)	(0.0291)	(0.0292)	(0.0292)	(0.0292)
Inflation		-0.0553***	-0.0485***	-0.0485***	-0.0487***	-0.0486***
		(0.0102)	(0.00732)	(0.00732)	(0.00732)	(0.00732)
FBM			0.154***	0.158***		
			(0.0167)	(0.0175)		
TBM					-0.151***	-0.156***
					(0.0168)	(0.0175)
Foreign			-0.195***	-0.195***	-0.195***	-0.195***
			(0.0287)	(0.0287)	(0.0287)	(0.0287)
Equity			1.417***	1.417***	1.416***	1.416***
			(0.0633)	(0.0633)	(0.0633)	(0.0633)
Bank size			0.0700***	0.0699***	0.0699***	0.0698***
			(0.00845)	(0.00845)	(0.00845)	(0.00845)
Cost			-0.302***	-0.302***	-0.302***	-0.302***
			(0.0111)	(0.0111)	(0.0111)	(0.0111)
Post*Priv* FBM				-0.0458		
				(0.0549)		
Post*Priv* TBM						0.0511
						(0.0553)
Constant	3.128***	4.121***	4.363***	4.354***	4.514***	4.510***
	(0.0371)	(0.330)	(0.247)	(0.247)	(0.247)	(0.247)
Observations	29,677	28,574	28,222	28,222	28,222	28,222
Number of id	2,378	2,377	2,376	2,376	2,376	2,376
Breusch–Pagan test	15452***	11254***	9216***	9201***	9216***	9201***

Notes: This table reports the results from the generalised least-squares method (GLS). All variables are defined in the Table 3-5. Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level.

6.5 Robustness checks

To further examine issues related to the influence of bank business models on performance and bank stability, we carry out a deeper investigation of our sample using the country development indicator, global financial crisis, and bank size as follow:

6.5.1 The country's level of development

The subsamples include commercial banks in developed and developing countries. We created a developed dummy variable, which equals one for developed countries and zero otherwise. We estimated Tobit regression and Generalised Least Squares (GLS) regressions on two sub-samples, developed and developing countries. Bank business models were applied separately for each focused retail model and trader model.

The results show that in developed countries, privatised banks are more profit efficient and less stable, whereas, in developing countries, privatised banks were less profit efficient but more cost efficient and stable. Our results are consistent with Mohsni and Otchere (2014), who found that privatised banks become more stable after privatisation; however, the risk is higher for banks privatised in developed countries. That means banks in developed countries have higher z-scores (lower risk) than their counterparts in developing countries.

According to our results, the commercial banks with foreign ownership are less profit efficient and more cost efficient in developed countries, while they are less cost efficient in developing countries. We also found the commercial banks with the focused retail model are more stable than banks with the trader model.

6.5.2 Global Financial Crisis (GFC)

To check whether there are variations between our initial findings and during the GFC period, we created a global financial crisis subsamples using the GFC dummy variable (equals one if the period is between 2007 and 2015 and 0 otherwise). Bank business models were applied separately for each focused retail model and trader model. Tables 6-10, 6-11 and 6-12 show that privatised banks are more profit efficient after the GFC. The findings also confirmed that commercial banks with foreign ownership are less profit efficient, less cost efficient and more risky post-GFC. Our results are more consistent with Curi et al. (2015), who found that foreign

banks with a focused asset, funding and income strategy appear to be the most efficient business model.

Although commercial banks with a focused retail model were less cost efficient but more stable post-GFC, commercial banks with a trader model were more cost efficient post-GFC. Our finding is inconsistent with Roengpitya et al. (2014), who suggested that commercial banks with focused retail exhibited the least volatile earnings post the financial crisis.

6.5.3 **Bank size**

The subsamples include large banks and small banks, where the size defined as the log of total assets. We created a large banks dummy variable, which equals 1 if (total assets > $1 billion) and 0 for a small bank (total assets < $1 billion). We also conducted our estimations separately for large banks and small banks to further check the bank size effects on the relationship between bank business models and banks' behaviour regarding efficiency and risk-taking. Bank business models were applied separately for each focused retail model and trader model. Table 6-13 shows that the focused retail model is positively correlated with profit efficiency. Furthermore, larger privatised banks are more profit efficient than smaller banks. Our findings are in line with the studies of Beck et al. (2005), who suggested that large banks affect bank efficiency positively.

On the other hands, table 6-15 shows the results of the large banks, which demonstrate a significant and negative impact of foreign ownership on bank stability; this means that larger banks with foreign ownership are more exposed to risk-taking.

Table 6-7 The impact of bank business models on profit efficiency for developed and developing countries

Independent variables	Dependent variables: Profit efficiency			
	Developed countries		Developing countries	
	(1)	(2)	(1)	(2)
Post	-0.110***	-0.110***	0.0630***	0.0631***
	(0.00577)	(0.00577)	(0.00612)	(0.00612)
Post*priv	0.0447***	0.0447***	-0.0184***	-0.0184***
	(0.00864)	(0.00864)	(0.00614)	(0.00614)
GFC	-0.0273***	-0.0274***	0.0136***	0.0136***
	(0.00498)	(0.00498)	(0.00460)	(0.00460)
GDPPC	0.0256***	0.0257***	0.0698***	0.0697***
	(0.00733)	(0.00733)	(0.00307)	(0.00307)
Inflation	0.00527**	0.00528**	0.0185***	0.0185***
	(0.00261)	(0.00261)	(0.00169)	(0.00169)
FBM	0.0282***		0.00232	
	(0.00397)		(0.00417)	
TBM		-0.0285***		-0.00191
		(0.00397)		(0.00417)
Foreign	-0.0243***	-0.0243***	-0.00157	-0.00158
	(0.00702)	(0.00702)	(0.00449)	(0.00449)
Equity	0.580***	0.580***	0.0663***	0.0660***
	(0.0230)	(0.0230)	(0.0136)	(0.0136)
Size	-0.0160***	-0.0160***	-0.0121***	-0.0121***
	(0.00249)	(0.00249)	(0.00157)	(0.00157)
Cost	-0.0674***	-0.0674***	-0.0670***	-0.0670***
	(0.00252)	(0.00252)	(0.00327)	(0.00327)
Constant	0.280***	0.308***	-0.130***	-0.128***
	(0.0783)	(0.0782)	(0.0261)	(0.0255)
Observations	10,296	10,296	13,907	13,907
Log likelihood	2235.6	2236.04	732.07	732.02
LR chi2(10)	1692.5***	1693.4***	1317.2***	1317.1***
Pseudo R2	-0.6091	-0.6094	-8.9616	-8.9610

This table reports the results of Tobit regressions conducted to determine the effects of bank business models on profit efficiency for developed and developing countries, which is estimated for commercial banks in 26 developed and developing countries. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at 10%.

Table 6-8 The impact of bank business models on cost efficiency for developed and developing countries

Independent variables	Dependent variables: Cost efficiency			
	Developed countries		Developing countries	
	(1)	(2)	(1)	(2)
Post	-0.0693***	-0.0693***	-0.00560*	-0.00549
	(0.00499)	(0.00499)	(0.00334)	(0.00334)
Post*Priv	0.00480	0.00480	-0.0383***	-0.0383***
	(0.00744)	(0.00744)	(0.00335)	(0.00335)
GFC	-0.0715***	-0.0715***	-0.0335***	-0.0335***
	(0.00429)	(0.00429)	(0.00251)	(0.00251)
GDPPC	-0.0653***	-0.0653***	-0.0594***	-0.0595***
	(0.00632)	(0.00632)	(0.00168)	(0.00168)
Inflation	0.0291***	0.0291***	-0.00767***	-0.00774***
	(0.00225)	(0.00225)	(0.000924)	(0.000924)
FBM	0.0112***		0.00723***	
	(0.00342)		(0.00228)	
TBM		-0.0113***		-0.00615***
		(0.00342)		(0.00228)
Foreign	-0.0119**	-0.0119**	0.00461*	0.00459*
	(0.00605)	(0.00605)	(0.00245)	(0.00245)
Equity	-0.280***	-0.280***	-0.0929***	-0.0937***
	(0.0198)	(0.0198)	(0.00743)	(0.00743)
Size	0.0207***	0.0207***	0.0142***	0.0141***
	(0.00214)	(0.00214)	(0.000858)	(0.000858)
Cost	-0.0260***	-0.0260***	-0.0329***	-0.0329***
	(0.00217)	(0.00217)	(0.00178)	(0.00178)
Constant	1.418***	1.429***	1.345***	1.352***
	(0.0676)	(0.0674)	(0.0143)	(0.0139)
Observations	10,272	10,272	13,907	13,907
Log likelihood	3766.6	3766.656	9151.9	9150.55
LR chi2(10)	1959.16***	1959.25***	2983.25***	2980.47***
Pseudo R2	-0.3515	-0.3515	-0.1947	-0.1945

This table reports the results of Tobit regressions conducted to determine the effects of bank business models on cost efficiency for developed and developing countries, which is estimated for commercial banks in 26 developed and developing countries. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at 10%.

Table 6-9 The impact of bank business models on bank stability for developed and developing countries

Independent variables	Dependent variable: Ln z-score			
	Developed countries		Developing countries	
	(1)	(2)	(1)	(2)
Post	0.0561	0.0560	-0.232***	-0.232***
	(0.0388)	(0.0388)	(0.0318)	(0.0318)
Post*Priv	-0.257***	-0.257***	0.0758*	0.0763*
	(0.0712)	(0.0712)	(0.0447)	(0.0447)
GFC	-0.0876***	-0.0876***	0.444***	0.443***
	(0.0275)	(0.0275)	(0.0227)	(0.0227)
GDPPC	-0.393***	-0.393***	-0.176***	-0.175***
	(0.0682)	(0.0682)	(0.0280)	(0.0280)
Inflation	-0.115***	-0.115***	-0.0884***	-0.0881***
	(0.0130)	(0.0130)	(0.00840)	(0.00840)
FBM		0.0659***		0.147***
		(0.0249)		(0.0211)
TBM	-0.0646***		-0.140***	
	(0.0249)		(0.0211)	
Foreign	-0.175***	-0.175***	-0.0876***	-0.0878***
	(0.0550)	(0.0550)	(0.0304)	(0.0304)
Equity	1.483***	1.484***	1.595***	1.597***
	(0.0979)	(0.0979)	(0.0778)	(0.0778)
Size	0.125***	0.125***	0.0843***	0.0845***
	(0.0215)	(0.0215)	(0.00898)	(0.00898)
Cost	0.0587***	0.0587***	-0.0456***	-0.0455***
	(0.0130)	(0.0130)	(0.0145)	(0.0145)
Constant	7.191***	7.129***	4.524***	4.378***
	(0.700)	(0.698)	(0.235)	(0.236)
Observations	14,377	14,377	14,507	14,507
Number of id	1,135	1,135	1,233	1,233

Notes: This table reports the results from the generalised least-squares method (GLS). Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level.

Table 6-10 The impact of bank business models on profit efficiency pre- and post-global financial crisis

Independent variables	Dependent variables: Profit efficiency			
	Before Global Financial Crisis		After Global Financial Crisis	
	(1)	(2)	(1)	(2)
Post	-0.00734	-0.00736*	0.0902***	0.0902***
	(0.00447)	(0.00447)	(0.0182)	(0.0182)
Post*Priv	-0.0210***	-0.0210***	0.0341***	0.0341***
	(0.00629)	(0.00629)	(0.00820)	(0.00820)
Developed	-0.0927***	-0.0927***	-0.260***	-0.260***
	(0.00822)	(0.00822)	(0.00993)	(0.00993)
GDPPC	0.0440***	0.0440***	0.107***	0.107***
	(0.00343)	(0.00343)	(0.00459)	(0.00459)
Inflation	0.00851***	0.00850***	0.0285***	0.0285***
	(0.00162)	(0.00162)	(0.00265)	(0.00265)
FBM	0.0146***		0.00450	
	(0.00357)		(0.00523)	-0.00421
TBM		-0.0147***		(0.00523)
		(0.00357)		
Foreign	0.0120**	0.0120**	-0.0373***	-0.0373***
	(0.00472)	(0.00472)	(0.00616)	(0.00616)
Equity	0.172***	0.173***	0.198***	0.198***
	(0.0135)	(0.0135)	(0.0220)	(0.0219)
Size	-0.0160***	-0.0160***	-0.00770***	-0.00771***
	(0.00142)	(0.00142)	(0.00289)	(0.00289)
Cost	-0.0492***	-0.0492***	-0.103***	-0.103***
	(0.00223)	(0.00223)	(0.00510)	(0.00510)
Constant	0.124***	0.139***	-0.490***	-0.485***
	(0.0287)	(0.0281)	(0.0459)	(0.0459)
Observations	16,232	16,232	7,971	7,971
Log likelihood	1881.02	1881.2	671.38	671.339
LR chi2(13)	1508.63	1509	1468.55	1468.46
Pseudo R2	-0.6695	-0.6697	11.6759	11.6752

This table reports the results of Tobit regressions conducted to determine the effects of bank business models on profit efficiency pre- and post-GFC, which is estimated for commercial banks in 26 developed and developing countries. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at 10%.

Table 6-11 The impact of bank business models on cost efficiency pre- and post-global financial crisis

Independent variables	Dependent variables: Cost efficiency			
	Before Global Financial Crisis		After Global Financial Crisis	
	(1)	(2)	(1)	(2)
Post	-0.0332***	-0.0332***	-0.0693***	-0.0693***
	(0.00291)	(0.00291)	(0.0129)	(0.0129)
Post*Priv	-0.0190***	-0.0190***	-0.0468***	-0.0468***
	(0.00409)	(0.00409)	(0.00581)	(0.00581)
Developed	0.0157***	0.0158***	-0.0584***	-0.0585***
	(0.00536)	(0.00536)	(0.00704)	(0.00704)
GDPPC	-0.0656***	-0.0657***	-0.0535***	-0.0534***
	(0.00223)	(0.00223)	(0.00325)	(0.00326)
Inflation	-0.00376***	-0.00378***	0.00966***	0.00968***
	(0.00106)	(0.00106)	(0.00188)	(0.00188)
FBM	0.00211		0.0273***	
	(0.00232)		(0.00371)	
TBM		-0.00155		-0.0267***
		(0.00232)		(0.00371)
Foreign	0.00339	0.00339	0.00993**	0.00987**
	(0.00307)	(0.00307)	(0.00436)	(0.00437)
Equity	-0.133***	-0.133***	-0.120***	-0.121***
	(0.00880)	(0.00880)	(0.0156)	(0.0156)
Size	0.0165***	0.0165***	0.0348***	0.0348***
	(0.000926)	(0.000926)	(0.00205)	(0.00205)
Cost	-0.0199***	-0.0199***	-0.0509***	-0.0509***
	(0.00145)	(0.00145)	(0.00361)	(0.00362)
Constant	1.402***	1.404***	1.229***	1.256***
	(0.0187)	(0.0183)	(0.0325)	(0.0325)
Observations	16,210	16,210	7,969	7,969
Log likelihood	8841.6299	8841.4387	3417.411	3416.1824
LR chi2(11)	3490.90	3490.52	2629.35	2626.89
Pseudo R2	-0.2460	-0.2459	-0.6252	-0.6246

This table reports the results of Tobit regressions conducted to determine the effects of bank business models on cost efficiency pre- and post-GFC, which is estimated for commercial banks in 26 developed and developing countries. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at 10%.

Table 6-12 The impact of bank business models on bank stability pre- and post-global financial crisis

Independent variables	Dependent variables: Ln z-score			
	Before Global Financial Crisis		After Global Financial Crisis	
	(1)	(2)	(1)	(2)
Post	-0.0910***	-0.0908***	0.226**	0.226**
	(0.0264)	(0.0264)	(0.104)	(0.104)
Post*Priv	-0.0781*	-0.0782*	-0.0216	-0.0222
	(0.0437)	(0.0437)	(0.0739)	(0.0740)
Developed	1.176***	1.176***	0.151*	0.150*
	(0.0730)	(0.0730)	(0.0795)	(0.0795)
GDPPC	-0.335***	-0.335***	-0.0882**	-0.0878**
	(0.0323)	(0.0323)	(0.0383)	(0.0383)
Inflation	-0.0672***	-0.0673***	-0.136***	-0.136***
	(0.00892)	(0.00892)	(0.0118)	(0.0118)
FBM	0.0824***		0.157***	
	(0.0190)		(0.0305)	
TBM		-0.0790***		-0.153***
		(0.0190)		(0.0306)
Foreign	0.00155	0.00170	-0.150***	-0.150***
	(0.0365)	(0.0365)	(0.0385)	(0.0386)
Equity	1.532***	1.530***	1.741***	1.740***
	(0.0720)	(0.0720)	(0.108)	(0.108)
Size	0.0838***	0.0837***	0.166***	0.166***
	(0.00914)	(0.00914)	(0.0204)	(0.0204)
Cost	0.00934	0.00938	0.0387*	0.0384*
	(0.0107)	(0.0107)	(0.0222)	(0.0222)
Constant	5.550***	5.633***	3.354***	3.505***
	(0.270)	(0.269)	(0.358)	(0.357)
Observations	20,037	20,037	8,847	8,847
Number of id	2,019	2,019	1,423	1,423

Notes: This table reports the results from the generalised least-squares method (GLS). Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level.

Table 6-13 The impact of bank business models on profit efficiency for large and small banks

Independent variables	Dependent variables: Profit efficiency			
	Large banks		Small banks	
	(1)	(2)	(3)	(4)
Post	-0.0501***	-0.0501***	0.00685	0.00687
	(0.00686)	(0.00686)	(0.00552)	(0.00552)
Post*Priv	0.00972*	0.00965*	-0.0488***	-0.0488***
	(0.00571)	(0.00571)	(0.00970)	(0.00970)
GFC	0.0127***	0.0127***	-0.0156***	-0.0157***
	(0.00444)	(0.00444)	(0.00530)	(0.00530)
Developed	-0.220***	-0.220***	-0.102***	-0.103***
	(0.00868)	(0.00868)	(0.00927)	(0.00927)
GDPPC	0.104***	0.104***	0.0373***	0.0373***
	(0.00391)	(0.00391)	(0.00378)	(0.00378)
Inflation	0.0409***	0.0409***	0.00920***	0.00917***
	(0.00233)	(0.00233)	(0.00165)	(0.00165)
FBM	0.0139***		0.0138***	
	(0.00411)		(0.00424)	
TBM		-0.0138***		-0.0133***
		(0.00411)		(0.00424)
Foreign	-0.00612	-0.00607	-0.0148***	-0.0149***
	(0.00534)	(0.00534)	(0.00527)	(0.00527)
Equity	0.0955***	0.0955***	0.171***	0.170***
	(0.0206)	(0.0206)	(0.0139)	(0.0139)
Cost	-0.0870***	-0.0870***	-0.0412***	-0.0412***
	(0.00332)	(0.00332)	(0.00261)	(0.00261)
Constant	-0.403***	-0.389***	0.157***	0.171***
	(0.0339)	(0.0336)	(0.0315)	(0.0309)
Observations	12,365	12,365	11,838	11,838
Log likelihood	1342	1341.94	1236.059	1235.74
LR chi2(10)	2090.17	2090.05	730.12	729.49
Pseudo R2	-3.5198	-3.5196	-0.4191	-0.4188

This table reports the results of Tobit regressions conducted to determine the effects of bank business models on profit efficiency for large and small banks, which is estimated for commercial banks in 26 developed and developing countries. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at 10%.

Table 6-14 The impact of bank business models on cost efficiency for large and small banks

Independent variables	Dependent variables: Cost efficiency			
	Large banks		Small banks	
	(1)	(2)	(3)	(4)
Post	-0.0524***	-0.0523***	-0.0112***	-0.0112***
	(0.00453)	(0.00453)	(0.00387)	(0.00387)
Post*Priv	-0.0220***	-0.0220***	-0.0124*	-0.0124*
	(0.00376)	(0.00376)	(0.00680)	(0.00680)
GFC	-0.0433***	-0.0432***	-0.0600***	-0.0601***
	(0.00292)	(0.00292)	(0.00371)	(0.00371)
Developed	-0.0296***	-0.0294***	0.0126*	0.0126*
	(0.00572)	(0.00572)	(0.00650)	(0.00650)
GDPPC	-0.0432***	-0.0433***	-0.0736***	-0.0736***
	(0.00258)	(0.00258)	(0.00265)	(0.00265)
Inflation	0.0106***	0.0106***	-0.00749***	-0.00751***
	(0.00154)	(0.00154)	(0.00115)	(0.00115)
FBM	0.0102***		0.00633**	
	(0.00271)		(0.00297)	
TBM		-0.00925***		-0.00608**
		(0.00271)		(0.00297)
Foreign	-0.0137***	-0.0136***	0.0229***	0.0228***
	(0.00352)	(0.00352)	(0.00369)	(0.00369)
Equity	-0.104***	-0.105***	-0.163***	-0.164***
	(0.0136)	(0.0136)	(0.00972)	(0.00971)
Cost	-0.0217***	-0.0216***	-0.0282***	-0.0282***
	(0.00219)	(0.00219)	(0.00183)	(0.00183)
Constant	1.279***	1.290***	1.499***	1.505***
	(0.0224)	(0.0221)	(0.0221)	(0.0216)
Observations	12,350	12,350	11,829	11,829
Log likelihood	6493.075	6491.7687	5445.9555	5445.7757
LR chi2(10)	2391.74	2389.13	3387.68	3387.32
Pseudo R2	-0.2258	-0.2255	-0.4514	-0.4514

This table reports the results of Tobit regressions conducted to determine the effects of bank business models on cost efficiency for large and small banks, which is estimated for commercial banks in 26 developed and developing countries. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at 10%.

Table 6-15 The impact of bank business models on bank stability for large and small banks

Independent variables	Dependent variables: Ln z-score			
	Large banks		Small banks	
	(1)	(2)	(3)	(4)
Post	-0.0783*	-0.0781*	-0.0389	-0.0387
	(0.0411)	(0.0411)	(0.0305)	(0.0305)
Post*Priv	-0.0476	-0.0478	0.0992	0.0990
	(0.0480)	(0.0480)	(0.0697)	(0.0698)
GFC	0.142***	0.142***	0.299***	0.298***
	(0.0238)	(0.0238)	(0.0269)	(0.0269)
Developed	0.423***	0.423***	0.808***	0.807***
	(0.0790)	(0.0790)	(0.0807)	(0.0807)
GDPPC	-0.140***	-0.140***	-0.161***	-0.161***
	(0.0352)	(0.0352)	(0.0365)	(0.0365)
Inflation	-0.130***	-0.131***	-0.0777***	-0.0778***
	(0.0116)	(0.0116)	(0.00876)	(0.00876)
FBM	0.110***		0.0906***	
	(0.0241)		(0.0220)	
TBM		-0.107***		-0.0853***
		(0.0241)		(0.0220)
Foreign	-0.195***	-0.194***	-0.0147	-0.0146
	(0.0363)	(0.0363)	(0.0430)	(0.0430)
Equity	2.079***	2.078***	1.277***	1.275***
	(0.144)	(0.144)	(0.0678)	(0.0678)
Cost	0.0184	0.0184	-0.000251	-0.000183
	(0.0162)	(0.0162)	(0.0120)	(0.0120)
Constant	4.544***	4.653***	4.260***	4.351***
	(0.298)	(0.297)	(0.309)	(0.308)
Observations	14,103	14,103	14,782	14,782
Number of id	1,480	1,480	1,827	1,827

Notes: This table reports the results from the generalised least-squares method (GLS). Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level.

6.6 Conclusion

In this chapter, we examined the relationship between bank business models and performance. We employed the Tobit regression model to estimate the effect of bank business models on profit and cost-efficiency. We also used the Generalised Least Squares (GLS) regressions to examine bank business models' effect on performance and stability. The estimations were conducted using robust standard errors, which corrected by bank clustering in all regressions.

The results suggest that the focused retail business model appeared to perform better since they exhibited higher profitability in terms of profit efficiency, ROA, ROE, NIM and more stable but it was less cost-efficient. While trader business models were associated with lower performance in terms of profit efficiency, ROA, ROE, NIM and z-score, but it was significantly more cost-efficient than the focused retail model.

Our results also suggest that commercial banks with foreign ownership were less profit efficient, less ROE and exhibit more risk-taking than their counterparts, domestic banks. Furthermore, we documented that commercial banks with a high ratio of equity-to-assets enhanced profit efficiency, ROA, NIM and risk-taking but less cost-efficient.

The next chapter is the fourth empirical chapter of this thesis that examined the long- term effect of bank privatisation over 1985 to 2015 using difference-in-differences (DID) estimation. We will also discuss the empirical findings regarding the relationship between governance changes and bank performance over the long-term.

Chapter 7 Empirical results on the long–term effects of privatisation

7.1 Introduction

The objective of this chapter was to investigate the long-term effects of bank privatisation. This study attempts to address the proposed research issue by answering the following related questions: how do privatisation strategies affect bank efficiency? Are the outcomes of bank privatisation sustainable over the long-term? Finally, were the privatised banks more resilient to face the global financial crisis than other banks?

Furthermore, this chapter discusses the practical results of the relationship between bank governance, efficiency and bank stability over the long-term. Based on our findings, we either accept or reject the research hypotheses.

H8: Privatised banks become more efficient over the long-term.

H8a: Privatised banks become more profit-efficient over the long-term.

H8b: Privatised banks become more cost-efficient over the long-term.

H8c: privatised banks become more stable over the long-term.

H9: Commercial banks by foreign ownership are more efficient than (perform better than) their counterparts (domestic banks) over the long-term.

H10: Privatised banks were more resilient to face the global financial crisis than other banks.

H10a: Privatised banks performed better following the global financial crisis.

H10b: Privatised banks became more stable following the global financial crisis.

The remainder of this chapter is organised as follows. Section 7.2 shows a correlation analysis. Section 7.3 presents comparisons of bank performance, efficiency, and stability between the pre-and post-privatisation periods using the difference-in-differences model. Section 7.4 reports and analyses the main empirical results of privatisation on bank efficiency over a long time. Section 7.5 reports comparisons of bank performance, efficiency, and stability between the pre-and post-global financial crisis using the difference-in-differences model. While section 7.6 presents the empirical results of the impact of governance changes on bank performance and risk-taking before and after the global financial crisis.

7.2 Pearson correlation

The correlation coefficients for profit efficiency and control variables are presented in Table 7‑1. Pearson correlation coefficients measure the strength and direction for the linear association between any pair of variables. The overall correlation matrix shows that no perfect linear relationship exists between independent variables (i.e., multicollinearity). Multicollinearity will be a serious problem if the correlation coefficient between the two predictors is over 0.8. Since neither Pearson correlation coefficients exceed 0.6 ($r < 0.6$), multicollinearity does not constitute a threat to interpreting the correlation coefficients of independent variables.

The matrix indicates that foreign banks performed better than other banks. Furthermore, we found that banks with a higher share of non-deposits funding are more profit efficient than banks whose based on deposits funding. Banks with a higher share of non-interest income were less profit efficient than those that depend on interest income activities. The matrix also shows that bank size is negatively correlated with profit efficiency at the 0.01 level of significance. The Larger banks are less profit efficient than smaller banks.

Table 7-1 Pearson correlation matrix

Variables	PE	Post	Post*Priv	GFC	Developed	GDPG	Inflation	Foreign	Equity	Bank size	Loan	NOD	NII	LLR
PE	1.000													
Post	-0.018***	1.000												
Post*Priv	0.001	0.090***	1.000											
GFC	0.025***	0.264***	0.054***	1.000										
Developed	-0.159***	0.013**	-0.122***	-0.193***	1.000									
GDPG	-0.063***	-0.070***	0.012**	-0.022***	-0.291***	1.000								
Inflation	0.144***	-0.281***	0.005	-0.229***	-0.316***	0.076***	1.000							
Foreign	0.057***	0.065***	0.052***	0.064***	-0.259***	0.017***	0.070***	1.000						
Equity	0.158***	-0.038***	-0.040***	0.041***	-0.124***	-0.026***	0.037***	0.108***	1.000					
Size	-0.122***	0.266***	0.190***	0.297***	0.208***	0.072***	-0.368***	-0.032***	-0.273***	1.000				
Loan	-0.026***	0.041***	0.025***	0.055***	-0.012**	0.047***	-0.054***	-0.025***	-0.259***	0.095***	1.000			
NOD	0.014**	0.038***	-0.018***	0.015***	0.080***	-0.089***	-0.009	0.018***	0.049***	0.039***	0.030***	1.000		
NII	-0.014**	0.152***	0.042***	0.067***	0.029***	-0.091***	-0.066***	0.030***	0.047***	0.009*	-0.191***	-0.005	1.000	
LLR	0.058***	0.085***	0.081***	-0.003	-0.241***	-0.083***	0.070***	0.053***	0.113***	-0.110***	-0.106***	0.029***	0.043***	1.000

Note: This table shows the Pearson correlation analysis between all variables. PE, profit efficiency; Foreign, foreign ownership banks; Equity, total equity-to-total assets ratio; Bank size, log of total assets; Loan, loans-to-total assets ratio; NOD, non-deposits funding ratio; NII, non-interest income share; LLR, loan loss reserves-to-gross loans ratio. The numbers represent the linear Pearson coefficients, while p-values are given in parentheses. *, **, *** indicate significance at 0.1, 0.05 and 0.01, respectively. The definitions for all variables are the same as in Table 3-5.

7.3 Comparisons of bank performance, efficiency, and stability between pre- and post-privatisation using the difference-in-differences model

In this section, we first estimated the differences in means before and after the privatisation. Similar to many previous studies on operating performance, firstly, we conducted the difference-in-means tests to examine whether a significant change in performance and bank efficiency can be inferred from the privatisation process, following the previous studies of Williams (2012) and Boardman et al. (2016). The covariates were the GDP growth, inflation rate as country control variables, whereas the foreign dummy variable, total equity-to-total assets ratio, bank size (Log of total assets), loans-to-total assets ratio, non-deposit funding-to-total liabilities ratio, non-interest income-to-total operating income ratio, and loan loss reserves-to-gross loans ratio were the bank control variables. We analysed the impact of privatisation on bank efficiency and performance by estimating Eq. 3-16 and Eq. 3-17.

The results of the means of the profit (cost) efficiency for the pre-and post-privatisation period and the difference in mean tests are presented in Table 7 2. As discussed in the methodology section, the analysis compares the means of the profit (cost) efficiency for the privatised banks with the means of the profit (cost) efficiency of non-privatised banks in the pre-and post-privatisation period controlling for the country-level macroeconomic factors as well as the bank-specific factors. The differences-in-differences model is used for investigating the research questions. The results indicated that privatised banks' profit efficiency improved in post-privatisation, and the difference between the means of the profit efficiency of privatised banks and non-privatised banks was positive and statistically significant. Our findings support the study of Williams (2012), which stated that privatised banks enhanced their profit efficiency after privatisation. Accordingly, these results help in accepting hypothesis 8a.

Also, we found a negative and significant difference between the means of the cost efficiency of privatised banks and non-privatised banks in the post-privatisation. This finding suggests that privatised banks improved their cost efficiency, which is significantly greater than other banks in the post-privatisation. This result provides important evidence for hypothesis 8b, hence on our findings, we accept the sub-hypothesis 8b, which states that privatised banks become more cost-efficient over the long-term.

The results also indicated that return on assets (ROA) and net interest margin (NIM), on average, increased more for the newly privatised banks than the non-privatised banks post-

privatisation. The differences between means of return on assets (ROA) and net interest margin (NIM) were positive and statistically significant, suggesting that privatised banks performed better than their counterparts after privatisation.

On the other hand, the difference between the means of return on equity (ROE) was negative and statistically significant, suggesting that non-privatised banks performed better than privatised banks following privatisation, concerning return on equity (ROE).

Regarding bank stability, the results show that the newly privatised banks experienced higher risk-taking than the state banks that underwent privatisation later post-privatisation. Our results are consistent with Mohsni and Otchere (2014) study, which found that privatised banks exhibited a higher risk than their counterpart's post-privatisation. Besides, we did not observe significant differences in risk-taking between the state-banks (banks that privatised later) and non-privatised banks in the pre-privatisation. While the difference in z-scores was negative and significant, suggesting that privatised banks exhibited a higher risk than their counterparts following privatisation. Our results provide substantial evidence for hypothesis 8c, and hence, based on our findings, we shall reject the 8c hypothesis, which states that privatised banks become more stable over the long-term.

Table 7-2 Difference in means profit and cost efficiencies of privatised and non-privatised banks before and after privatisation

	PE	CE	ROA	ROE	NIM	Ln z-score
Pre –privatisation						
Mean of non-privatised bank efficiency post-privatisation (C2)	0.400	0.874	0.066	0.225	0.038	3.730
Mean of privatised bank efficiency pre-privatisation (T1)	0.375	0.872	0.060	0.271	0.040	3.669
Difference between privatised and non-privatised banks in base line (T1-C2)	-0.025**	-0.003	-0.006***	0.047***	0.001	-0.061
	(0.010)	(0.007)	(0.001)	(0.011)	(0.002)	(0.051)
Post-privatisation						
Mean of non-privatised banks efficiency pre-privatisation (C1)	0.419	0.838	0.068	0.229	0.053	3.528
Mean of privatised bank efficiency post-privatisation (T2)	0.413	0.814	0.067	0.241	0.056	3.356
Difference between privatised and non-privatised banks in follow up (T2-C1)	-0.006	-0.024***	-0.002**	0.012**	0.003***	-0.172***
	(0.005)	(0.003)	(0.001)	(0.005)	(0.001)	(0.025)
Difference between post-privatisation and pre-privatisation (T1-C2)- (T2 - C1)	0.019*	-0.021***	0.005***	-0.035***	0.002	-0.111**
	(0.011)	(0.007)	(0.001)	(0.012)	(0.002)	(0.56)
No. of obs. in privatised banks	3196	3351	3454	3453	3454	3322
No. of obs. in non-privatised banks	21003	21846	25670	25619	25646	24700
No. of obs.	24199	25197	29124	29072	29100	28022
R^2	0.08	0.22	0.20	0.12	0..29	0.10

Notes: This table compares the average change in efficiency between privatised banks and non- privatised banks before and after privatisation using a difference-in-differences model. Where T1 is the mean outcome for the treated group (privatised banks) in the post-privatisation; C2 the mean outcome for the control group (non- privatised banks) on the pre-privatisation; (T1) - (C2) is the single difference between treated and control groups on the baseline (pre-privatisation); Diff (BL) is difference between treated and control groups on the baseline. T2 is the mean outcome for the treated group (privatised banks) in the pre-privatisation; C1 is the mean outcome for the control group (non- privatised banks) on the post-privatisation; Diff (FU) is difference between privatised and non-privatised banks on the follow-up. Diff-in- diff is the impact of privatisation. Robust standard errors clustered at the bank level are reported. Absolute values of t-statistics for differences of means are also reported. ***, **, * represent 1%, 5%, and 10% significance levels, respectively.

7.4 Impact of governance changes on bank efficiency and stability over the long-term

Table 7-3 presents the findings of the impact of governance changes on bank efficiency over the long-term using the Tobit regressions. The results found that the Priv dummy variable's coefficient was negative and significant in the first column, indicating that state banks that underwent privatisation later were less profit efficient than other banks. Furthermore, the Developed dummy variable's coefficient was negative and significant, indicating that commercial banks in developed countries were less profit efficient than their counterparts in developing countries. We also included country control variables, namely, inflation rate and GDP per capita, to control the economic development level differences. The results indicated that the inflation rate and the GDP growth demonstrated a significant positive correlation with profit efficiency.

Regarding bank control variables, commercial banks with foreign ownership were less profit efficient than their domestic banks. Bonin and Wachte (2005) reached the opposite conclusions. They highlighted that the foreign banks in transition countries positively affected profit efficiency because of their high ability to attract further depositors and borrowers with the best service. Our empirical results reject the ninth hypothesis that commercial banks by foreign ownership are more efficient than (performed better than) their counterparts (domestic banks) over the long-term.

Furthermore, there was a robust positive and significant correlation between profit efficiency and the ratio of equity-to-total assets; this indicates commercial banks with higher capital buffers are more profit efficient. This finding is in line with Olson and Zoubi (2011) study, which revealed the positive and significant relationship between the equity-to-assets ratio and profitability in MENA countries.

The profit efficiency has been adversely affected by bank size, where large banks tend to less profit efficient than small banks. In contrast, smaller banks are more cost-efficient in developed countries. Our finding is in line with these of Bonin et al. (2005) study which showed that smaller banks are more efficient in these transition countries. We also included the ratio of loans-to-total assets to capture the loan portfolio quality where the bank loans provide the highest return of bank asset. Moreover, the results showed a positive and significant relationship between the ratio of loans-to-total assets and profit efficiency. This trend indicates that commercial banks with a higher loan-to-asset ratio enhance their profit efficiency but at

the expense of increasing the bank costs due to exposure to bad loans. Our findings support those of Olson and Zoubi (2011).

To capture the effect of bank business orientation on profit efficiency, we employed the ratio of non-deposit funding-to-total liabilities and the non-interest income-to-total income. In column 1, the significant positive coefficient of share of non-deposits suggests that commercial banks with a high share of non-deposits were more profit efficient than their counterparts which depend on deposits in their activities. Whereas the share of non-interest income has a negative and significant relationship with profit efficiency. Based on our finding, commercial banks with a higher percentage of non-interest income were less profit efficient than their counterparts which depend on interest income. This finding is in line with Lin and Zhang (2009), who found a negative and significant impact of non-interest income on Chinese bank efficiency. Furthermore, DeYoung and Torna (2013) suggested that non-interest income would negatively affect bank profits and increase its risk.

We also employed the ratio of loan loss reserves-to-gross loans (LLR) to capture the credit quality of bank assets and measure the exposure to credit risk. Our results showed a robust positive and significant association between the ratio of loan loss reserves-to-gross loans and profit efficiency.

Table 7 3 reports the results of Tobit regression and random-effects GLS estimator using cost efficiency and z-score as the dependent variables in column 2 and column 3, respectively. We examined the impact of privatisation on cost efficiency and bank stability over the long-term. It can notice that a lower efficiency value indicates greater cost efficiency. The tabulated results showed the Post* Priv dummy variable's coefficient is negative and significant, suggesting that generally privatised banks were more cost efficient following privatisation. This finding contributed to assessing sub-hypothesis 4b, which states that privatised banks become more cost efficient over the long-term.

The Post dummy variable's coefficient is negative and significant, indicating that the non-privatised banks related negatively with cost efficiency. Thus, it is clear that cost efficiency improved in both privatised and non-privatised banks in the post-privatisation period.

Moreover, we used the GFC dummy variable to capture the global financial crisis's impact on cost efficiency and risk-taking. The results show that the commercial banks increased their cost efficiency following GFC and became more stable than pre- GFC. It also found that

commercial banks in developed countries had a higher cost-efficiency and were more stable than their counterpart in developing countries.

We also included other country control variables to capture the impact of the inflation rate and the real GDP growth on cost efficiency over the long-term. The results indicate that the inflation rate is found to be positively and significantly associated with cost efficiency. The high inflation rate led to an increase in bank costs, while the real GDP growth led to a decrease in bank costs. Our finding is consistent with Lin et al. (2015) study, which shows that the real GDP per capita is associated with more cost efficiency in developing Asian economies.

The foreign dummy variable's coefficient in column 2 is positive and significant, indicating that the commercial banks with foreign ownership are less cost efficient and less stable than the control group's trend. This result is contradicted with Hao et al. (2001), who expected that increasing foreign ownership could improve bank efficiency because the foreign banks have best management practices and new technology. We also found that commercial banks with foreign ownership were less stable than domestic banks over the long-term. Our empirical results reject the ninth hypothesis that the commercial banks owned by foreign ownership are more efficient or perform better than their counterparts (domestic banks) over the long-term.

Regarding the bank control variables, the findings indicated that increasing capital requirements improve cost efficiency and bank stability. Hence, the commercial banks tend to have a more aggressive response to asset deterioration and an exceptional ability to absorb losses which promote stability in the banking sector. This negative effect of total equity-to-total asset ratio on cost efficiency supports Lin et al. (2016) results.

Besides, there is a positive and statistically significant association between bank size and cost efficiency, indicating that large banks tend to be less effective in cost management. These results are in line with the findings of Altunbas, Carbo Valverde and Molyneux (2003), who showed that smaller banks were more cost efficient than larger banks. In contrast, large banks were more stable than small banks.

We also included the ratio of loans-to total assets to capture the loan portfolio quality. The results show a positive and significant relationship between the proportion of loan-to-total assets and cost efficiency. It indicates that banks with a higher loan-to-asset ratio raised costs and increased bank exposure to bad and refused loans, and this leads banks to exhibit a high credit risk.

The coefficients of non-interest income share have a negative and significant effect on cost efficiency and z-score, suggesting that commercial banks with a higher non-interest income tended to be more effective in cost management but less stable than other banks. This finding supports Lin et al. (2015), who suggested the negative impact of the non-interest income ratio on cost efficiency in Asian developing countries. Busch and Kick (2015) found commercial banks that expand their non-interest activities exhibit a higher risk than cooperative and savings banks, which means that an increase of non-interest income could negatively influence the banking system's stability. Demirgüç-Kunt and Huizinga (2010) and Erji et al. (2012) showed that reliance on non-interest income could boost bank risk and reduce bank profits. Hunjra et al. (2020) reveal that non-interest income has a negative impact on bank risk.

We also employed the ratio of loan loss reserves-to-gross loans (LLR) to capture the credit risk. The results found that the proportion of loan loss reserves-to-gross loans negatively associated cost efficiency and bank stability, suggesting that commercial banks with high LLR were more cost efficient but exposed to higher risk than the control group.

Table 7-3 Estimation of impact of governance change on bank efficiency and stability using Eq. 3-16 and Eq. 3-17.

Independent variables	Dependent variables:		
	PE	CE	Ln z-score
Priv	-0.021***	-0.017***	-0.089
	(0.00797)	(0.00524)	(0.0714)
Post	0.00545	-0.022***	-0.135***
	(0.00445)	(0.00293)	(0.0255)
Post*Priv	0.0135	-0.0100*	0.0231
	(0.00915)	(0.00602)	(0.0459)
GFC	0.00424	-0.059***	0.241***
	(0.00349)	(0.00229)	(0.0181)
Developed	-0.162***	-0.022***	0.417***
	(0.00645)	(0.00424)	(0.0649)
GDPG	0.062***	-0.060***	-0.190***
	(0.0028)	(0.00182)	(0.0293)
Inflation	0.015***	0.00205**	-0.049***
	(0.00139)	(0.00091)	(0.00731)
Foreign	-0.0093**	0.00421*	-0.200***
	(0.00383)	(0.00252)	(0.0287)
Equity	0.157***	-0.125***	1.700***
	(0.0116)	(0.00765)	(0.0695)
Bank size	-0.007***	0.0241***	0.0754***
	(0.00128)	(0.00084)	(0.00851)
Loans	0.020***	0.0347***	0.500***
	(0.00654)	(0.00430)	(0.0415)
NOD	0.0190**	-0.00338	0.0152
	(0.00946)	(0.00622)	(0.0478)
NII	-0.0095**	-0.058***	-0.158***
	(0.00430)	(0.00283)	(0.0227)
LLR	0.083***	-0.101***	-3.644***
	(0.0246)	(0.0162)	(0.133)
Constant	-0.095***	1.316***	4.313***
	(0.0243)	(0.0160)	(0.250)
Observations	24,241	24,212	28,022
Log likelihood	1939.4	12107	
LR chi2(13)	1839***	6352***	
Pseudo R2	0.9014	0.3557	
Number of id			2,344

Notes: This table reports the results of Tobit regressions conducted to determine the long-term privatisation effects on the cost and profit efficiencies, which is estimated for commercial banks in 26 countries. Our statistics based on annual data for the years 1985–2015. Model (1) presents the basic regression results that include main independent variables and bank-specific control variables for all sample periods. Models (2) shows estimated results. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at the 10%, 5% and 1% levels, respectively.

7.5 Comparisons of bank performance, efficiency and stability between pre- and post-global financial crisis using the difference-in-differences model

In this section, we tried to determine if privatised banks were more resilient during the global financial crisis than other banks. To answer this question, we looked at the difference-in-differences DID across two groups (privatised and non-privatised banks) and two periods (pre- and post-global financial crisis) using a multivariate regression which controls for changes in bank characteristics. Table 7‑4 shows the regressions estimated using Eq. 3‑18 and Eq. 3-19.

The panel regressions are estimated with random effects due to the time-invariant group dummies. The covariates are GDP growth, inflation rate as country control variables, ownership dummy, total equity-to-total assets ratio, bank size, loans-to-total assets ratio, non-deposit funding-to-total liabilities ratio, non-interest income-to-total operating income ratio, and loan loss reserves-to-gross loans ratio. A positive value indicates the privatised banks have a higher value than non-privatised banks for the pre-and post-global financial crisis period. Each regression contains a global financial crisis (CFG) dummy set to 1 for 2007- 2015 and zero otherwise.

Table 7‑4 presents the difference in means approximate performance and stability of privatised banks before and after the global financial crisis. It shows comparative results for the impact of the global financial crisis on bank efficiency and performance. After the global financial crisis, privatised banks achieved an improvement in both profit and cost efficiency. The results also confirm that the privatised banks performance indicators (ROA, ROE and NIM) were significantly better than the control sample.

Regarding bank stability, our results indicate that newly privatised banks experienced a risk reduction (exhibit higher z-scores) compared with non-privatised banks following the global financial crisis. Thus, the main finding is that privatised banks were more resilient during the global financial crisis than non-privatised banks. These results provide evidence for hypothesis 10; hence on our findings, we shall accept the tenth hypothesis, which states that privatised banks were more resilient to face the global financial crisis than other banks.

7.6 Impact of governance changes on bank efficiency and stability pre- and post-global financial crisis

Table 7-5 presents the results for the impact of GFC on the relationship between governance changes and bank efficiency using the Tobit regression model. The first three columns in

Table 7-5 reports the findings of the impact of governance changes on the profit efficiency for all sample periods. Models 2 and 3 report the estimation results of the effects of governance changes on profit efficiency before and after the global financial crisis. The following three columns in Table 7-5 show the results of the impact of governance changes on cost efficiency for all sample periods in Model 4. Models 5 and 6 report the estimation results of the effects of governance changes on cost efficiency before and after the GFC.

Our main findings are as follows. Firstly, privatised banks and other commercial banks appeared to improve both profit efficiency and cost efficiency after the financial crisis. These results best serve hypothesis 10.

Besides, foreign banks tend to be less efficient post-GFC in terms of profit and cost efficiencies. We also found that commercial banks in developed countries were less profit efficient after the GFC, but they were more cost efficient than their counterparts in developing countries. The findings also indicated that commercial banks with a higher ratio of equity-to-total assets enhanced both of profit efficiency and cost efficiency post-GFC. These findings are in line with previous studies, for example, Lin et al. (2016) and Westman (2011), who found that banks with lower minimum capital requirements enhanced their cost efficiency post-crisis. The bank size enters negatively and significantly in pre-GFC, suggesting that large banks were less profit efficient, while they tended to be more profit efficient post-GFC. However, the coefficient of bank size is insignificant. This finding is in line with Akhigbe and McNulty (2011), who found that larger banks are more profit efficient. The ratio of loans-to-total assets refers to the bank asset utilisation ratio since loans achieve the highest bank asset return. The findings reveal that commercial banks with a higher ratio of loans-to-total assets tended to be more profit efficient. Simultaneously, this led to an increase in costs post-GFC. This finding supports Olson and Zoubi (2011), who suggested that the ratio of loans-to-total assets related positively with profitability in MENA countries. We also included non-interest income and non-deposit short-term funding share to capture business models. Our results suggest that non-interest income share also contributed to the enhancement of cost efficiency. We documented that before GFC, commercial banks with higher non-deposit short-term funding tended to improve profit efficiency, while non-deposit short-term funding share contributed to enhanced cost efficiency. In addition, after GFC, we found that the increase in non-deposit short-term funding share in commercial banking led to a reduction in both profit efficiency. These findings are consistent with Mergaerts and Vander Vennet (2016), who showed that banks refocused on traditional

intermediary activities following GFC. We also included the ratio of loan loss reserves-to-total loans to measure risk. The finding suggested a positive relationship between LLR and profit efficiency, whereas the ratio of loan loss reserves-to- total loans is negatively correlated with cost efficiency. The result shows that the banks with a high ratio of loan loss provisions to assets tend to be more effective in cost management following GFC.

The last three columns in

Table 7-5 show the results of the impact of changes in bank ownership structure on bank stability for all sample periods in model 7. Models 8 and 9 report the estimation results, which include the effects of bank ownership on bank stability before and after the global financial crisis. The results suggest that although privatised banks and other commercial banks exhibited reductions in risk-taking following GFC, they were less stable before the GFC.

The results also indicated that foreign banks were less stable than domestic banks post-GFC. The coefficients of growth in real GDP and inflation were negatively associated with bank stability for both pre-and post-financial crisis. It is not surprising that faster economic growth could signify more bank stability. Increasing the inflation rate leads to an increase in risk-taking in the post-crisis.

We included bank control variables, and foreign banks appeared to be less stable post-GFC. The ratio of total equity-to-total asset enters positively and significantly in all regression specifications, suggesting that a higher equity-to-assets ratio tends to enhance bank stability. Besides, bank size has a significant coefficient indicating that z-score increases with larger bank size. The ratio of loans-to-total assets shows a positive and statistically significant association with the z-score for the prior and post-financial crisis, suggesting that commercial banks with high ratio loans-to-total assets were more stable either pre-or post-GFC. We also included non-interest income and non-deposit short-term funding share to capture business models. Our results suggest that the non-deposit short-term funding share coefficient was negatively and insignificantly related to bank stability. Some studies that confirmed the positive

impact of non-interest income on bank stability, such as Altunbas et al. (2011), Hryckiewicz et al. (2017), and Köhler (2014), our results revealed that commercial banks with higher non-interest income share tended to be less stable in pre- GFC. This finding is in line with Köhler (2015) and Cheng et al. (2020), who found that the increase in non-interest income led to a higher level of bank risk; he also revealed diversifying non-deposit funding in the retail bank is associated with higher risk-taking. Moreover, DeYoung and Torna (2013) argued that the probability of commercial bank failure had increased because of the reliance on non-interest income from investment activities during the GFC. Our results reveal commercial banks tended to refocus on traditional intermediary activities following GFC, supporting Mergaerts and Vander Vennet (2016), who found the same. The loan loss reserves-to-total loans ratio enters negatively and significantly in all model specifications, and this suggests that lower loan loss reserves-to-total loans tended to enhance bank stability.

Table 7-4 Bank performance and stability measures in the post-global financial crisis period and the difference in mean test

Bank Performance variables	Pre- global financial crisis period			Post- global financial crisis period			Diff-in – diff (T1-C2) - (T2 - C1)	No. of obs. in privatised banks	No. of obs. in Non-privatised banks	No. of obs.	R^2
	Non-privatised banks (C2)	Privatised banks (T1)	Difference (T1-C2)	Non-privatised banks (C1)	Privatised banks (T2)	Difference (T2 - C1)					
Profit efficiency	0.458	0.431	-0.027** (0.012)	0.472	0.524	0.052*** (0.017)	0.079*** (0.016)	3352	21876	25228	0.05
Cost efficiency	0.849	0.821	-0.027*** (0.010)	0.788	0.763	-0.025** (0.013)	0.002 (0.012)	3351	21846	25197	0.23
ROA	0.017	0.013	-0.004*** (0.001)	0.018	0.022	0.004** (0.002)	0.008*** (0.002)	3610	26551	30161	0.09
ROE	0.130	0.154	0.024** (0.011)	0.141	0.225	0.083*** (0.020)	0.059*** (0.059)	3618	26512	30130	0.12
NIM	0.057	0.063	0.006 (0.002)	0.062	0.072	0.011*** (0.002)	0.005*** (0.002)	3628	26620	30248	0.25
LN z-score	2.587	2.355	-0.231*** (0.054)	2.654	2.812	0.158** (0.063)	0.389*** (0.073)	3492	25622	29114	0.09

Notes: This table reports multivariate regressions on measures of profitability and bank stability in pre- and post- the global financial crisis period in developed and developing countries: profit efficiency, cost efficiency, ROA, ROE, NIM, and z-score respectively. A higher ROA, ROE, and NIM imply better performance. ROA is the ratio of pre-tax income -to-total assets, ROE is the ratio of pre-tax income -to-total equity, NIM the net interest margin, z-score is the sum of Equity/Total Assets plus ROA, divided by the standard deviation of ROA over the previous three years. A higher z-score implies a lower risk of default. All control variables are described in Table 3-5 Panel A and B show regression results based on three alternative measures of bank performance and stability measured by LN z-score, respectively. For each measure, we examine the relationship over the period before the financial crisis (1985-2006) and after the financial crisis (2007- 2015). Difference tests compare the mean statistics of privatised banks to mean statistics of rival banks. Robust standard errors clustered at the bank level are reported. The *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table 7-5 Estimation of impacts of global financial crisis on profit, cost efficiency and bank stability using Eq. 3-18 and Eq. 3-19; 1985–2015.

Independent variables	Dependent variables: Profit efficiency			Dependent variables: Cost efficiency			Dependent variables: Ln z-score		
	Full sample (1985–2015)	Before GFC	After GFC	Full sample (1985–2015)	Before GFC	After GFC	Full sample (1985–2015)	Before GFC	After GFC
Post	0.00211	0.00406	0.0786***	-0.0207***	-0.021***	-0.0773***	-0.132***	-0.0476	0.115
	(0.00441)	(0.00461)	(0.0186)	(0.00290)	(0.00295)	(0.0129)	(0.0400)	(0.0411)	(0.139)
Post*Priv	-0.00614	-0.025***	0.0295***	-0.0264***	-0.018***	-0.0404***	-0.00310	-0.139**	0.101
	(0.00509)	(0.00638)	(0.00847)	(0.00335)	(0.00407)	(0.00584)	(0.0650)	(0.0709)	(0.0758)
GFC	0.00512			-0.0578***			0.242***		
	(0.00347)			(0.00228)			(0.0311)		
Developed	-0.162***	-0.091***	-0.269***	-0.0216***	0.00944*	-0.0579***	0.417***	1.048***	0.0808
	(0.00646)	(0.00842)	(0.0102)	(0.00424)	(0.00538)	(0.00706)	(0.0797)	(0.102)	(0.0915)
GDPG	0.0629***	0.0409***	0.103***	-0.0594***	-0.064***	-0.0530***	-0.187***	-0.420***	-0.159***
	(0.00276)	(0.00347)	(0.00481)	(0.00181)	(0.00222)	(0.00332)	(0.0380)	(0.0470)	(0.0429)
Inflation	0.0150***	0.0102***	0.0283***	0.00198**	-0.0027**	0.00958***	-0.0489***	-0.0361**	-0.114***
	(0.00139)	(0.00165)	(0.00273)	(0.000914)	(0.00106)	(0.00189)	(0.0104)	(0.0142)	(0.0141)
Foreign	-0.00849**	0.0112**	-0.036***	0.00486*	0.00351	0.00949**	-0.198***	-0.0990	-0.184***
	(0.00382)	(0.00479)	(0.00633)	(0.00251)	(0.00306)	(0.00436)	(0.0438)	(0.0619)	(0.0444)
Equity	0.160***	0.169***	0.187***	-0.123***	-0.124***	-0.113***	1.704***	1.727***	2.009***
	(0.0116)	(0.0137)	(0.0227)	(0.00763)	(0.00874)	(0.0156)	(0.109)	(0.122)	(0.207)
Size	-0.00753***	-0.0146***	0.00409	0.0240***	0.0167***	0.0367***	0.0748***	0.0481***	0.220***

	(0.00128)	(0.00144)	(0.00302)	(0.000839)	(0.000922)	(0.00209)	(0.0138)	(0.0151)	(0.0306)
Loans	0.0196***	0.0239***	0.0211*	0.0341***	0.0289***	0.0612***	0.499***	0.532***	0.614***
	(0.00654)	(0.00775)	(0.0123)	(0.00430)	(0.00495)	(0.00846)	(0.0690)	(0.0772)	(0.116)
NOD	0.0190**	0.0286**	-0.0388**	-0.00344	-0.0150**	0.00369	0.0155	-0.0629	-0.0197
	(0.00946)	(0.0115)	(0.0167)	(0.00622)	(0.00737)	(0.0115)	(0.0773)	(0.0928)	(0.116)
NII	-0.0101**	-0.00682	0.00508	-0.0587***	-0.048***	-0.0913***	-0.159***	-0.150***	-0.0404
	(0.00429)	(0.00468)	(0.0104)	(0.00283)	(0.00299)	(0.00719)	(0.0350)	(0.0381)	(0.0767)
LLR	0.0809***	0.121***	0.118**	-0.103***	-0.048***	-0.154***	-3.648***	-3.461***	-3.221***
	(0.0246)	(0.0279)	(0.0514)	(0.0162)	(0.0179)	(0.0354)	(0.258)	(0.287)	(0.487)
Constant	-0.101***	0.0902***	-0.564***	1.311***	1.367***	1.204***	4.279***	6.101***	3.549***
	(0.0242)	(0.0297)	(0.0484)	(0.0159)	(0.0190)	(0.0334)	(0.323)	(0.392)	(0.429)
Observations	24,241	16,269	7,972	24,212	16,242	7,970	28,022	19,492	8,530
Number of id							2,344	2,017	1,380

Notes: This table reports the results of Tobit regressions conducted to determine the effects of global financial crisis on the b efficiency, cost efficiency and bank stability, which is estimated by Tobit regressions for commercial banks in 26 countries. Our statistics based on annual data for the years 1985–2015. Models 1, 4 and 7 present regression results that include main independent variables and bank-specific control variables for all sample periods. Models 2, 5 and 8 shows estimated results pre- GFC. While models 3, 6 and 9 report estimated results post-GFC. Robust standard errors clustered at the bank level are reported. The values of the t-statistics are in parentheses. *, ** and *** indicate estimations that are significant at the 10%, 5% and 1% levels, respectively. Equity-to-Asset Ratio (CAR) loan loss reserve-to-gross loans (LLR) Non-Interest Income Share (NII) Non-Deposit Funding Share (NOD) Loans to Assets (Loans) Bank size (lnTA).

7.7 Robustness checks

This section provides some robustness checks of our main results using different thresholds and endogeneity concerns. First, we examined the effect of governance changes on bank performance over the long-term for several subsamples to test whether specific factors influence our results. We chose the country's development level to examine whether the destructive consequences of the country's level of development have had a notable impact on performance and bank stability. Mohsni and Otchere (2014) found that privatised banks stability is affected by the country's development level.

Moreover, many previous studies such as Boubakri et al. (2005), Sathye (2005), Di Patti and Hardy (2005), Hauner and Peiris (2007) and Omran (2007) showed the improvements in bank performance depend on the ownership structure. Thus, including such a variable allows one to investigate whether bank efficiency and stability are influenced by ownership structure.

Finally, we chose bank size to further check the bank size effects on the relationship between governance changes and bank efficiency and stability over the long-term. Some previous studies, for example, Berger et al. (2005), Williams and Nguyen (2005) and Beck et al. (2005), Bonin et al. (2005) and Lin et al. (2015), showed that bank efficiency and stability influenced by bank size.

7.7.1 The country's level of development

The subsamples include commercial banks in developed and developing countries have been created using a developed dummy variable, which equals one for developed countries and zero otherwise. We estimated Tobit regression and Generalised Least Squares (GLS) regressions on two sub-samples that different countries with relatively developed and developing countries, including 26 countries in our sample. We summarised that the bank risk-taking in developed countries would be different from that of banks in developing countries. Our results in tables 7-6 and 7-7 showed that privatised banks are more profit efficient and less stable in developed countries. In contrast, privatised banks are less profit efficient but more cost efficient and more stable in developing countries. This finding is consistent with Otchere (2009), who suggested that privatised banks in developed countries have experienced significant operating performance improvements in the post-privatisation period. Mohsni and Otchere (2014) found that privatised banks in developed countries exhibit higher risk than banks in developing

countries. Moreover, Boubakri et al. (2005), in developing countries, privatised banks with domestic ownership were exposed to high credit risk and interest rate risk. However, the newly privatised banks that are controlled by domestic and foreign become more efficient.

Furthermore, we found that commercial banks with foreign ownership are less profit efficient but more cost efficient in developed countries, while they are less cost efficient in developing countries. The results also show that commercial banks with high non-deposit funding share in developed countries are more cost efficient, and their performance is worse in terms of ROE. On the other hand, commercial banks are more efficient for the developing countries in terms of profit and cost, whereas their performance is worse in terms of ROA, ROE, and NIM. In their study, Micco et al. (2007) found that the retail banks with a higher ratio of demand deposits tend to be more profitable in developing countries.
In addition, the results show that in developed countries, the increase in non-interest income in commercial banks leads to an increase in profit efficiency, cost efficiency, ROA, and ROE; however, they are exposed to high taking risk. While in developing countries, the results show that commercial banks with a high non-interest income share are more cost efficient and perform better in terms of ROA and ROE; however, they are less profit efficient and less stable.

7.7.2 **Bank ownership**

To create subsamples that included privatised and non-privatised banks, we used the Priv dummy variable, which equals one for privatised banks and zero otherwise. We estimated Tobit regression and Generalised Least Squares (GLS) regressions on two sub-samples that examine whether privatisation affects the bank efficiency and stability over the long-term. Tables 7-8 and 7-9 show that the country's development indicator also influences bank efficiency and risk-taking behaviour of privatised banks. We further found that privatised banks with high non-deposit funding share are less profit efficient, and their performance is worse in terms of ROE and NIM. While non-privatised banks are more profit efficient but less stable than their counterparts.

Furthermore, the results show that the increase in non-interest income in non-privatised banks leads to a lower profit efficiency and are exposed to the high level of bank risk. At the same time, they are more cost efficient than their counterparts.

We also found that privatised banks in developed countries are less efficient in terms of profit and cost but are more stable than their counterparts in developing countries. Our results also show that non- privatised banks were more cost efficient than privatised banks.

7.7.3 **Bank size**

To further check the bank size effects on the relationship between governance change and bank performance over the long-term, we created sub-samples include large banks and small banks, where the size defined as the log of total assets. We also created a large banks dummy variable, which equals 1 if (total assets > $1 billion) and 0 for small banks (total assets < $1 billion).

Table 7-10 shows the results for large banks, which indicate that privatised banks are more cost efficient and have a better performance in terms of ROA, ROE, and NIM than the smaller commercial banks. These findings are consistent with the studies of Berger et al. (2005), Williams and Nguyen (2005) and Beck et al. (2005), who showed a positive and significant relationship between efficiency and bank size. Furthermore, we found that the large banks with foreign ownership are more cost efficient, and their performance is better in terms of ROA, ROE, and NIM than the small banks, but they are less profit efficient.

Moreover, our findings showed that the large banks with high non-deposit funding share are less profit efficient and performed worst in terms of ROA, ROE, and NIM, but more cost efficient. While the small banks are more profit efficient, but they are less cost efficient and less stable. Regarding the non-interest income share, the results found that the large banks are more cost efficient and more profitable in terms of ROA, ROE but less stable. However, the small banks with high non-interest income share are less profit efficient and less stable but more cost efficient. These results are consistent with the studies of Lepetit et al. (2008) and Chen et al. (2017), who showed that the increase in the share of non-interest income is related to the higher risk-taking either in large or small banks. Our findings also are in line with the studies of Altunbas et al. (2011), Kohler (2014, 2015) and Hryckiewicz and Kozłowski (2017), which reported that a significant negative relationship between bank size and stability.

Table 7-6 The impact of governance change on bank performance and stability for developed countries

Independent variables	Dependent variables:					
	PE	CE	ROA	ROE	NIM	Ln z-score
	(1)	(2)	(3)	(4)	(5)	(6)
Post	-0.0882***	-0.0352***	0.000284	-0.000728	0.00134**	0.0501
	(0.00608)	(0.00510)	(0.000488)	(0.00382)	(0.000638)	(0.0383)
Post*Priv	0.0442***	0.00919	0.00243***	0.0163**	-0.000124	-0.260***
	(0.00885)	(0.00739)	(0.000922)	(0.00720)	(0.00121)	(0.0718)
GFC	-0.0311***	-0.0742***	-0.00184***	-0.0288***	-0.00334***	-0.0894***
	(0.00519)	(0.00434)	(0.000348)	(0.00275)	(0.000453)	(0.0283)
GDPPC	0.0300***	-0.0523***	0.00496***	0.0325***	-0.0102***	-0.344***
	(0.00751)	(0.00628)	(0.000959)	(0.00724)	(0.00128)	(0.0686)
Inflation	0.00545**	0.0285***	0.000369**	0.00453***	0.000807***	-0.111***
	(0.00269)	(0.00225)	(0.000157)	(0.00125)	(0.000203)	(0.0131)
Foreign	-0.0273***	-0.0129**	0.000461	0.0117**	0.00100	-0.103*
	(0.00720)	(0.00601)	(0.000694)	(0.00542)	(0.000909)	(0.0539)
Equity	0.567***	-0.268***	0.0580***	-0.109***	0.0494***	1.475***
	(0.0233)	(0.0195)	(0.00141)	(0.0109)	(0.00185)	(0.111)
Size	-0.0109***	0.0229***	-0.00344***	-0.0086***	-0.00506***	0.102***
	(0.00264)	(0.00221)	(0.000313)	(0.00234)	(0.000419)	(0.0220)
Loan	0.0914***	0.0475***	0.00227***	0.00601	0.00891***	0.274***
	(0.00836)	(0.00699)	(0.000756)	(0.00586)	(0.000995)	(0.0579)
NOD	0.00839	-0.0228**	-0.000711	-0.0364***	0.00043	-0.0350
	(0.0131)	(0.0109)	(0.000846)	(0.00668)	(0.00110)	(0.0682)
NII	0.0549***	-0.0610***	0.00363***	0.0252***	-0.00839***	-0.200***
	(0.00543)	(0.00455)	(0.000371)	(0.00294)	(0.000483)	(0.0303)
LLR	-0.484***	0.0508	0.00455	-0.101***	0.0198***	0.672***
	(0.0508)	(0.0425)	(0.00287)	(0.0227)	(0.00373)	(0.236)
Constant	0.0989	1.225***	-0.0371***	-0.169**	0.139***	6.730***
	(0.0800)	(0.0669)	(0.00973)	(0.0737)	(0.0129)	(0.703)
Observations		10,292	14,590	14,559	14,585	14,476
Number of id	10,320		1,181	1,172	1,180	1,123
Log likelihood	1992.25	3844.1116				
LR chi2(12)	1215.25	2095.43				
Pseudo R2	-0.4388	-0.3747				

Notes: Columns (1) and (2) report the results of Tobit regressions conducted to determine the long-term of privatisation for developed countries, which is estimated for commercial banks in 26 developed and developing countries. Columns (3) to (6) report the results of the generalised least-squares method (GLS). Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level

Table 7-7 The impact of governance change on bank performance and stability for developing countries

Independent variables	Dependent variables:					
	PE	CE	ROA	ROE	NIM	Ln z-score
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.0497***	-0.00469	0.00130*	-0.00709	0.00170	-0.150***
	(0.00629)	(0.00342)	(0.000711)	(0.00548)	(0.00118)	(0.0321)
Post*Priv	-0.0205***	-0.0362***	0.00282***	-0.0119	0.00452***	0.0858*
	(0.00622)	(0.00338)	(0.00101)	(0.00794)	(0.00174)	(0.0448)
GFC	0.0226***	-0.0353***	-0.0041***	-0.0254***	-0.00667***	0.385***
	(0.00470)	(0.00255)	(0.000509)	(0.00395)	(0.000862)	(0.0230)
GDPPC	0.0638***	-0.0612***	0.00297***	0.0329***	0.0143***	-0.188***
	(0.00312)	(0.00169)	(0.000669)	(0.00566)	(0.00135)	(0.0284)
Inflation	0.0185***	-0.0071***	0.00186***	0.0125***	0.00476***	-0.0867***
	(0.00171)	(0.000928)	(0.000185)	(0.00142)	(0.000306)	(0.00838)
Foreign	-0.000632	0.00459*	-0.00233	-0.00414	-0.00162	-0.103***
	(0.00455)	(0.00247)	(0.000696)	(0.00551)	(0.00121)	(0.0308)
Equity	0.0516***	-0.0866***	0.0749***	-0.115***	0.105***	1.842***
	(0.0138)	(0.00751)	(0.00187)	(0.0147)	(0.00323)	(0.0836)
Size	-0.00817***	0.0156***	-0.00163***	-0.00683***	-0.0043***	0.0910***
	(0.00158)	(0.000860)	(0.000203)	(0.00159)	(0.000346)	(0.00911)
Loan	-0.0200**	0.0235***	0.00724***	-0.00279	0.0261***	0.384***
	(0.00968)	(0.00526)	(0.00122)	(0.00947)	(0.00206)	(0.0546)
NOD	0.0743***	0.00866	-0.0038***	-0.0200*	-0.0118***	-0.0561
	(0.0136)	(0.00741)	(0.00139)	(0.0108)	(0.00235)	(0.0625)
NII	-0.0483***	-0.0363***	0.00271***	0.0112**	-0.0507***	-0.0558*
	(0.00660)	(0.00359)	(0.000679)	(0.00521)	(0.00112)	(0.0310)
LLR	0.212***	-0.122***	0.0366***	0.0753***	0.0584***	-2.121***
	(0.0291)	(0.0158)	(0.00301)	(0.0232)	(0.00497)	(0.137)
Constant	-0.124***	1.337***	-0.0186***	-0.0546	-0.0787***	4.416***
	(0.0274)	(0.0149)	(0.00571)	(0.0482)	(0.0115)	(0.243)
Observations	13,921	13,920	14,515	14,505	14,515	14,376
Number of id			1,289	1,289	1,289	1,229
Log likelihood	601.85	9096.159				
LR chi2(12)	1049.58	2869.54				
Pseudo R2	-6.810	-0.1873				

Notes: Columns (1) and (2) report the results of Tobit regressions conducted to determine the long-term of privatisation for developing countries. Columns (3) to (6) report the results of the generalised least-squares method (GLS). Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level

Table 7-8 The impact of governance change on bank efficiency and stability for privatised banks

Independent variables	Dependent variables:					
	PE	CE	ROA	ROE	NIM	Ln z-score
	(1)	(2)	(3)	(4)	(5)	(6)
Developed	-0.0909***	0.0793***	-0.00387	-0.181***	-0.0128**	0.726***
	(0.0183)	(0.0111)	(0.00393)	(0.0353)	(0.00506)	(0.153)
GFC	0.0740***	-0.0388***	-0.000682	-0.0124	-0.000339	0.343***
	(0.0105)	(0.00633)	(0.000856)	(0.00803)	(0.00119)	(0.0555)
GDPPC	0.0404***	-0.0816***	-0.000748	0.0563***	0.000243	-0.324***
	(0.00836)	(0.00506)	(0.00173)	(0.0158)	(0.00228)	(0.0724)
Inflation	0.00114	-0.00313	0.00174***	0.00777**	0.00262***	-0.0825***
	(0.00475)	(0.00287)	(0.000373)	(0.00351)	(0.000523)	(0.0251)
Foreign	0.00911	-0.00782	-.00014	0.000708	0.00217	-0.100
	(0.0108)	(0.00655)	(0.00114)	(0.0107)	(0.00160)	(0.0710)
Equity	0.194***	0.108***	0.114***	0.0427	0.0924***	2.083***
	(0.0394)	(0.0238)	(0.00497)	(0.0465)	(0.00724)	(0.287)
Size	0.00667	0.00874***	-0.00161***	-0.00839*	-0.00678***	0.158***
	(0.00455)	(0.00275)	(0.000471)	(0.00440)	(0.000652)	(0.0277)
Loan	-0.0362	0.0974***	0.00547**	0.00599	-0.00401	0.568***
	(0.0267)	(0.0162)	(0.00242)	(0.0227)	(0.00344)	(0.155)
NOD	-0.262***	-0.00902	0.00335	-0.0723***	-0.00863**	0.263
	(0.0420)	(0.0254)	(0.00281)	(0.0265)	(0.00411)	(0.189)
NII	0.0251	-0.0131	0.00414***	0.0640***	-0.0354***	0.141
	(0.0204)	(0.0124)	(0.00155)	(0.0146)	(0.00217)	(0.105)
LLR	-0.209***	-0.157***	0.0113*	-0.290***	-0.0104	-1.367***
	(0.0756)	(0.0457)	(0.00634)	(0.0600)	(0.00889)	(0.421)
Constant	0.0681	1.429***	0.0133	-0.237*	0.0703***	4.946***
	(0.0768)	(0.0465)	(0.0149)	(0.136)	(0.0196)	(0.635)
Observations	2,309	2,309	2,460	2,459	2,457	2,456
Number of id			184	184	184	181
Log likelihood	203.055	1362.45				
LR chi2(12)	200.24***	393.81***				
Pseudo R2	-0.9726	-0.1689				

Notes: Columns (1) and (2) report the results of Tobit regressions conducted to determine the long-term of privatisation in privatised banks, which is estimated for commercial banks in 26 developed and developing countries. Columns (3) to (6) report the results of the generalised least-squares method (GLS). Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level

Table 7-9 The impact of governance change on bank efficiency and stability for non-privatised banks

Independent variables	Dependent variables:					
	PE	CE	ROA	ROE	NIM	Ln z-score
	(1)	(2)	(3)	(4)	(5)	(6)
Developed	-0.211***	-0.0417***	-0.0119***	-0.116***	-0.0403***	0.573***
	(0.00747)	(0.00503)	(0.00139)	(0.0110)	(0.00264)	(0.0696)
GFC	-0.00376	-0.0654***	-0.00248***	-0.0281***	-0.00307***	0.0777***
	(0.00392)	(0.00264)	(0.000365)	(0.00274)	(0.000570)	(0.0207)
GDPPC	0.0821***	-0.0541***	0.00372***	0.0304***	0.0101***	-0.173***
	(0.00342)	(0.00231)	(0.000639)	(0.00501)	(0.00118)	(0.0323)
Inflation	0.0250***	0.00932***	0.000524***	0.00475***	0.00134***	-0.0972***
	(0.00191)	(0.00129)	(0.000158)	(0.00118)	(0.000241)	(0.00916)
Foreign	-0.0199***	0.00224	-0.000586	0.00383	-0.00224**	-0.0999***
	(0.00444)	(0.00299)	(0.000603)	(0.00457)	(0.000976)	(0.0328)
Equity	0.247***	-0.151***	0.0610***	-0.131***	0.0651***	1.869***
	(0.0150)	(0.0101)	(0.00139)	(0.0105)	(0.00220)	(0.0779)
Size	-0.0109***	0.0270***	-0.00447***	-0.0138***	-0.00857***	0.222***
	(0.00194)	(0.00131)	(0.000261)	(0.00200)	(0.000441)	(0.0139)
Loan	0.0110	0.0409***	0.00373***	-0.00490	0.0169***	0.333***
	(0.00738)	(0.00497)	(0.000820)	(0.00620)	(0.00131)	(0.0455)
NOD	0.0385***	-0.00415	-0.000949	-0.0109	-0.00468***	-0.0921*
	(0.0110)	(0.00741)	(0.000911)	(0.00682)	(0.00141)	(0.0516)
NII	-0.0133**	-0.0895***	0.00317***	0.0133***	-0.0295***	-0.165***
	(0.00588)	(0.00398)	(0.000499)	(0.00374)	(0.000771)	(0.0286)
LLR	0.0924***	-0.122***	0.0198***	0.0181	0.0480***	-1.072***
	(0.0286)	(0.0193)	(0.00242)	(0.0181)	(0.00372)	(0.139)
Constant	-0.261***	1.247***	-0.0102*	-0.00922	-0.0199**	3.961***
	(0.0308)	(0.0208)	(0.00543)	(0.0424)	(0.00990)	(0.277)
Observations	17,586	17,576	21,457	21,418	21,447	21,234
Number of id			2,158	2,149	2,157	2,053
Log likelihood	1442.8784	8376.1117				
LR chi2(12)	2016.22***	5345.56***				
Pseudo R2	-2.3187	-0.4686				

Notes: Columns (1) and (2) report the results of Tobit regressions conducted to determine the long-term of privatisation in non-privatised banks, which is estimated for commercial banks in 26 developed and developing countries. Columns (3) to (6) report the results of the generalised least-squares method (GLS). Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level

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Table 7-10 The impact of governance change on bank efficiency and stability for large banks

Independent variables	Dependent variables:					
	PE	CE	ROA	ROE	NIM	Ln z-score
	(1)	(2)	(3)	(4)	(5)	(6)
Post	-0.0268***	-0.0353***	0.000620*	0.00139	-0.00127**	-0.0628
	(0.00723)	(0.00465)	(0.000375)	(0.00466)	(0.000621)	(0.0412)
Post * Priv	0.00894	-0.0201***	0.00308***	0.0207***	0.00176**	-0.0468
	(0.00589)	(0.00377)	(0.000479)	(0.00598)	(0.000818)	(0.0488)
Developed	-0.233***	-0.0379***	-0.00921***	-0.142***	-0.0252***	0.394***
	(0.00895)	(0.00573)	(0.000955)	(0.0121)	(0.00194)	(0.0813)
GFC	0.0166***	-0.0451***	-0.00127***	-0.0231***	-0.0031***	0.118***
	(0.00456)	(0.00292)	(0.000218)	(0.00271)	(0.000363)	(0.0242)
GDPPC	0.102***	-0.0415***	0.00246***	0.0413***	0.00408***	-0.133***
	(0.00403)	(0.00258)	(0.000399)	(0.00502)	(0.000737)	(0.0361)
Inflation	0.0412***	0.0105***	0.000622***	0.00794***	0.00191***	-0.132***
	(0.00240)	(0.00154)	(0.000101)	(0.00125)	(0.000164)	(0.0117)
Foreign	-0.0106*	-0.0153***	0.00147***	0.0201***	0.000854	-0.191***
	(0.00548)	(0.00351)	(0.000343)	(0.00427)	(0.000572)	(0.0367)
Equity	0.123***	-0.0797***	0.0486***	-0.121***	0.0726***	2.212***
	(0.0211)	(0.0135)	(0.00155)	(0.0194)	(0.00274)	(0.153)
Loan	0.0531***	0.0496***	0.000631	-0.00423	0.00827***	0.398***
	(0.00976)	(0.00625)	(0.000626)	(0.00782)	(0.00107)	(0.0647)
NOD	-0.0305**	-0.0332***	-0.00230***	-0.0472***	-0.0043***	0.0244
	(0.0126)	(0.00806)	(0.000637)	(0.00792)	(0.00106)	(0.0695)
NII	0.00596	-0.0281***	0.000638**	0.0103***	-0.0131***	-0.139***
	(0.00657)	(0.00422)	(0.000303)	(0.00377)	(0.000498)	(0.0343)
LLR	-0.183***	-0.170***	-0.0305***	-0.466***	0.00633	-0.666**
	(0.0496)	(0.0317)	(0.00239)	(0.0298)	(0.00393)	(0.268)
Constant	-0.489***	1.231***	-0.0116***	-0.130***	-0.000149	4.452***
	(0.0353)	(0.0226)	(0.00339)	(0.0427)	(0.00629)	(0.307)
Observations	12,384	12,367	14,269	14,254		14,181
Number of id			1,515	1,511	14,267	1,473
Log likelihood	1031.3369	6542.2674			1,515	
LR chi2(12)	1466.69***	2477.80***				
Pseudo R2	-2.4610	-0.2336				

Notes: Columns (1) and (2) report the results of Tobit regressions conducted to determine the long-term of privatisation for large banks, which is estimated for commercial banks in 26 developed and developing countries. Columns (3) to (6) report the results of the generalised least-squares method (GLS). Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level

Table 7-11 The impact of governance change on bank efficiency and stability for small banks

Independent variables	Dependent variables:					
	PE	CE	ROA	ROE	NIM	Ln z-score
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.0114**	0.00175	-0.000453	-0.00832*	-0.000940	0.0285
	(0.00559)	(0.00385)	(0.000698)	(0.00466)	(0.00112)	(0.0304)
Post * Priv	-0.0506***	-0.00388	-0.000777	-0.0227**	0.00165	0.0750
	(0.00978)	(0.00672)	(0.00161)	(0.0107)	(0.00265)	(0.0696)
Developed	-0.0983***	0.00761	-0.0107***	-0.0914***	-0.0511***	0.816***
	(0.00937)	(0.00645)	(0.00186)	(0.0124)	(0.00352)	(0.0805)
GFC	-0.0121**	-0.0586***	-0.00788***	-0.0487***	-0.00954***	0.289***
	(0.00536)	(0.00369)	(0.000627)	(0.00419)	(0.00100)	(0.0274)
GDPPC	0.0328***	-0.0745***	0.00262***	0.0147***	0.0138***	-0.183***
	(0.00380)	(0.00262)	(0.000837)	(0.00557)	(0.00158)	(0.0362)
Inflation	0.00851***	-0.00772***	0.00191***	0.00995***	0.00532***	-0.0776***
	(0.00167)	(0.00115)	(0.000201)	(0.00134)	(0.000320)	(0.00877)
Foreign	-0.0157***	0.0236***	-0.00198**	-0.0235***	-0.00682***	0.0231
	(0.00531)	(0.00365)	(0.000993)	(0.00662)	(0.00172)	(0.0430)
Equity	0.152***	-0.164***	0.0750***	-0.0941***	0.0925***	1.429***
	(0.0140)	(0.00963)	(0.00169)	(0.0113)	(0.00278)	(0.0741)
Loan	-0.00595	0.0175***	0.00714***	0.00203	0.0245***	0.282***
	(0.00875)	(0.00602)	(0.00118)	(0.00786)	(0.00194)	(0.0513)
NOD	0.0978***	0.0248**	-0.000652	-0.00839	-0.00740***	-0.146**
	(0.0145)	(0.00994)	(0.00146)	(0.00976)	(0.00236)	(0.0637)
NII	-0.0174***	-0.0806***	0.00529***	0.0214***	-0.0376***	-0.120***
	(0.00565)	(0.00388)	(0.000637)	(0.00426)	(0.00101)	(0.0278)
LLR	0.149***	-0.109***	0.0439***	0.161***	0.0594***	-1.630***
	(0.0281)	(0.0194)	(0.00310)	(0.0208)	(0.00492)	(0.136)
Constant	0.162***	1.495***	-0.0172**	0.0809*	-0.0776***	4.445***
	(0.0324)	(0.0223)	(0.00714)	(0.0475)	(0.0134)	(0.308)
Observations	11,857	11,845	14,837	14,811	14,834	14,672
Number of id			1,889	1,882	1,888	1,805
Log likelihood	1155.3625	5589.81				
LR chi2(12)	566.03***	3661.27***				
Pseudo R2	-0.3244	-0.4870				

Notes: Columns (1) and (2) report the results of Tobit regressions conducted to determine the long-term of privatisation for small banks, which is estimated for commercial banks in 26 developed and developing countries. Columns (3) to (6) report the results of the generalised least-squares method (GLS). Robust standard errors clustered at the bank level are reported. Standard errors are in parentheses * Indicates estimations that are significant at 10% level. ** Indicates estimations that are significant at 5% level. *** Indicates estimations that are significant at 1% level

7.8 Conclusion

In this chapter, difference-in-differences (DID) estimation was used to examine whether privatisation strategies had the expected positive effect on performance and bank stability in the post-privatisation period. In addition, we examined the differences in performance and risk-taking in the pre-and post-privatisation period and among the privatised banks and non-privatised banks. The results showed that in post-privatisation, the banking sector recorded a significant increase in profit efficiency due to a significant cost efficiency reduction. Governance changes impacted as much on bank efficiency. Privatised banks that underwent privatisation achieved a significantly higher efficiency.

Furthermore, the findings revealed that privatisation is an essential treatment in the long-term as privatised banks make significant improvements in profit efficiency, cost efficiency, and ROA and NIM compared with the trend of non-privatised banks following privatisation.

We also included non-deposit short-term funding share and non-interest income share to capture business models. Our findings revealed that commercial banks with a high share of non-deposits short-term funding were more profit efficient than their counterparts that depend on deposits in their activities. The non-interest income share had a negative and significant effect on profit efficiency, cost efficiency, and z-score, suggesting that commercial banks with a higher non-interest income share tended to be more effective in costs management but less profit efficient and less stable than their counterparts which depend on interest income.

Also, we examined the impact of governance changes on bank performance and risk-taking pre- and post-global financial crisis. The results showed that in the post-GFC, privatised banks improved both profit and cost efficiency and performed better in terms of ROA, ROE, and NIM than the control sample. Our results also indicated that newly privatised banks experienced a risk reduction compared with non-privatised banks following the global financial crisis.

Chapter 8 Conclusion and Recommendations

8.1 Introduction

This chapter consists of the summary of conclusions derived from earlier chapters and it also includes recommendations and suggestions for future research.

8.2 Summary of conclusion

This chapter summarises the empirical findings to answer the research questions identified in Chapter 1 of this thesis. This thesis applied k-medoids cluster analysis to capture bank business models based on the bank's strategic choices related to assets and funding structures. The cluster analysis results revealed two main banking business models, namely focused retail and trader business model. The empirical analysis indicated that the newly privatised banks had witnessed slight changes in bank business models in the post-privatisation where they became more prudent and relied more on deposits and short-term funding. We also found that privatised banks were most active in traditional intermediary activities adopting a focused retail business model.

Using a sample comprising 26 country-banking sectors between 1985 and 2015, this thesis employs Stochastic Frontier Analysis (SFA) to estimate the profit and cost efficiencies. The findings provide evidence that profit and cost efficiency improved immediately in privatised banks, followed by subsequent continuous improvements and sustainable change in privatised bank efficiency over the long-term.

The first part of our study examined the relationship between bank business models and performance and privatised banks' stability. The Tobit model was used to investigate the relationship between bank business models and bank efficiency. The empirical evidence suggests that privatisation produced mixed effects depending on which variable is examined. The findings revealed that commercial banks with a focused-retail model performed better since they exhibited higher profitability in terms of profit efficiency, return on assets (ROA), return on equity (ROE), net interest margin (NIM), and more stability. However, they were less cost efficient. In contrast, privatised banks with a focused retail model exhibited lower profitability in terms of ROA and ROE. On the other hand, Commercial banks with trader business models performed significantly worse in terms of profit efficiency, ROA, ROE, NIM

and less stable, but they were significantly more cost efficient. In contrast, privatised banks with trader model performed better in terms of ROA and ROE.

Our results also suggested that commercial banks under foreign ownership were less profit efficient than their counterpart domestic banks; they performed worst in terms of ROE and exhibited more risk-taking. We also found that banks with higher capital requirements tended to enhance profit efficiency, ROA, NIM, and more stability. While commercial banks with lower capital requirements were more cost efficient. Furthermore, our results suggest that large banks had an adverse effect on profit efficiency, cost efficiency and ROE but significantly were more stable.

The second part of our study examined the effect of privatisation on bank performance over the long-term. We employed difference-in-differences models to identify the impact of privatisation on efficiency and bank performance. The findings revealed that privatisation is an important treatment in the long-term as privatised banks made significant improvements in profit efficiency, cost efficiency, ROA and NIM, compared with the trend of non-privatised banks following privatisation. These results are supportive of Williams (2012) who found a significant improvement in both of profit and cost efficiency. While the privatised banks tend to be less stability than non-privatised banks following privatisation.

The second part of our study examined the effect of privatisation on bank performance over the long-term. We employed difference-in-differences models to identify the impact of privatisation on efficiency and bank performance. The findings revealed that privatisation is an essential treatment in the long-term as privatised banks made significant improvements in profit efficiency, cost efficiency, ROA and NIM, compared with the trend of non-privatised banks following privatisation. These results support the study of Williams (2012), who found a significant improvement in both profit and cost efficiency. At the same time, the privatised banks tend to be less stable than non-privatised banks following privatisation.

We summarised our main findings: the privatised banks with majority foreign ownership were less profit efficient, less cost-efficient, and less stable. The results also revealed that equity-to-total assets have a positive impact on profit efficiency and z-score; however, they have a negative impact on cost efficiency, suggesting that privatised banks with a higher ratio of equity-to-total assets were more profit and cost efficient and more stable in post-privatisation. Besides, bank size had a negative and significant relationship with profit efficiency in

privatised banks, while bank size had a positive and significant association with cost efficiency and z-score; this suggests that larger banks were less profit and cost efficient but more stable.

Our results also showed that non-deposit short-term funding has a negative and strongly significant relationship with profit efficiency; this means privatised banks with a high share of non-deposit funding are less profit efficient post-privatisation. It was suggesting that privatised banks refocused on traditional intermediary activities following privatisation. Furthermore, commercial banks with a higher non-interest income share improved cost efficiency, while they were less profit efficient and less stable in the long-term. The ratio of loan loss reserves-to-gross loans (LLR) has a positive impact on profit efficiency, indicating that banks with a higher LLR were more profit efficient and tended to be more cost efficient but less stable over the long-term.

We estimated the difference-in-difference model to understand the impact of GFC on the relationship between change in governance, and bank performance and stability. Our results are summarised as follows: the privatised banks experienced a significant improvement in profit efficiency and cost efficiency after the financial crisis. In addition, foreign banks tended to be less profit and cost efficient and were significantly less stable post-GFC. We also find that, after the global financial crisis, commercial banks in developed countries were less profit efficient than their counterparts in developing countries, but it had improved cost efficiency following the GFC. Furthermore, commercial banks with lower minimum capital requirements enhanced cost efficiency and bank stability post-GFC. The bank size enters negatively and significantly in pre-GFC, suggesting that larger banks appeared to be less profit efficient before the GFC while they tended to be more profit efficient and less risk-taking in the post-GFC, although the coefficient of bank size was insignificant. The findings reveal that commercial banks with a higher ratio of loans-to-total assets tended to be more profit efficient and stable. Simultaneously, this led to increased bank costs post-crisis.

Furthermore, we included non-interest income and non-deposit short-term funding share to capture business orientation. Our results suggest that banks with higher non-interest income were associated with more profit efficiency but were less stable post-GFC. Non-deposit short-term funding share was negatively and insignificantly related to bank stability. The higher non-deposit short-term funding share tended to be less stable pre-and-post GFC. Moreover, non-interest income share also contributed to enhanced cost efficiency. We document that before GFC, commercial banks with higher non-deposit short-term funding tended to improve profit

efficiency, while non-deposit short-term funding share contributed to enhancing cost efficiency. After the GFC, we find that the increase in non-deposit short-term funding share in commercial banking led to a reduction in both profit efficiency and cost efficiency.

The findings suggest a positive relationship between LLR and profit efficiency. In contrast, the ratio of loan loss reserves-to-total loans is negatively correlated with cost efficiency. These findings suggest that the banks with a high ratio of loan loss provisions to assets tended to be more profit efficient and more effective in cost management but less stable following the GFC.

Overall, our findings suggest that bank privatisation contributed to change bank orientation in the banking industry by improving bank efficiency and performance in the long-term.

Some previous studies, which addressed privatisation reforms in many developed and emerging market countries, reached different privatisation programs' outcomes. Some of these studies implemented with a little moderate success, and other studies report improvements in performance over the short-term and long-term, for example, Lin and Zhang (2009). On the other hands, Bonin et al. (2005) found that privatisation by itself is not sufficient to increase bank efficiency.

Our results have broad implications for policymakers. First, empirical studies that examine the effects of privatisation report that privatisation benefits are a long-term process. Our analyses show that changing managerial strategy and implementing new strategies might take many years to be realised. Thus, the benefits of privatisation are a long-term process rather than short-term. Therefore, governments require to be patient to achieve privatisation results in terms of performance and efficiency accurately.

Second, we should draw the policy makers' attention to the impact of governance changes on bank performance, provide them adequate information, and provide extensive analysis to help them decide whether they should go further implementing the bank privatisation process.

8.3 Recommendations for Future Research:

This thesis results have brought to some recommendations that could be undertaken as the potential research in the future as follows:

- As discussed in the Chapter 3, there are many techniques for estimate bank efficiency. Although this study used Greene's true random-effects approach to estimate a half-

normal stochastic frontier model using maximum likelihood, we recommend Kumbhakar, Lien, and Hardaker (2014) model to separate firm effects, persistent inefficiency, and time-varying inefficiency. In this way, it could help to overcome the limitations of previous models and produce more accurate estimates of overall efficiency.

- It is very beneficial to investigate and compare the performance of commercial privatised banks over long-term with other kinds of privatised banks such as saving banks, cooperative banks, and investment banks over long-term.
- Furthermore, this study investigated the effect of bank business models on commercial privatised bank performance. So, it is important to examine the relationship between bank business models and performance and risk-taking in other types of privatised banks, such as saving banks, cooperative banks, and investment banks.

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Appendix A

Table A- 1 Average values of ratios to total assets for 1985

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	37.12	48.53	70.85	4.65	109	52.66
Focused retail	63.79	22.03	75.25	8.61	98	47.34
Total	49.75	35.99	72.93	6.53	207	100

Source: outputs of cluster analysis

Table A- 2 Average values of ratios to total assets for 1986

	Loans	Trading assets	Deposits	Other interest	Obs.	%
Trader	35. 60	50.30	74.44	14.67	158	57.45
Focused retail	65.60	21.06	74.04	16.18	117	42.55
Total	48.36	37.85	74.27	6.46	275	100

Source: outputs of cluster analysis

Table A- 3 Average values of ratios to total assets for 1987

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	61.53	22.31	72.86	11.23	164	43.97
Trader	34.39	54.96	78.77	2.19	209	56.03
Total	46.32	40.61	76.17	6.16	373	100

Source: outputs of cluster analysis

Table A- 4 Average values of ratios to total assets for 1988

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	35.99	53.03	75.98	2.42	311	63.60
Focused retail	65.44	20.30	73.30	11.05	178	36.40
Total	46.71	41.12	75.01	5.56	489	100

Source: outputs of cluster analysis

Table A- 5 Average values of ratios to total assets for 1989

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	66.46	22.45	73.29	8.93	216	39.27
Trader	33.49	53.75	72.93	3.43	334	60.73
Total	46.44	41.46	73.07	5.59	550	100

Source: outputs of cluster analysis

Table A- 6 Average values of ratios to total assets for 1990

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	66.70	21.89	70.77	8.07	259	43.02
Trader	35.11	53.03	72.09	3.82	343	56.98
Total	48.70	39.63	71.52	5.65	602	100

Source: outputs of cluster analysis

Table A- 7 Average values of ratios to total assets for 1991

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	29.91	60.41	73.50	4.75	292	39.51
Focused retail	61.75	26.03	67.36	8.37	447	60.49
Total	49.17	39.62	69.78	6.94	739	100

Source: outputs of cluster analysis

Table A- 8 Average values of ratios to total assets for 1992

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	60.86	29.47	52.18	22.19	273	29.84
Trader	44.36	45.69	77.92	2.37	642	70.16
Total	49.28	40.85	70.24	08.28	915	100

Source: outputs of cluster analysis

Table A- 9 Average values of ratios to total assets for 1993

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	27.85	64.61	69.87	06.85	443	43.69
Focused retail	64.03	26.01	72.94	09.11	571	56.31
Total	48.22	42.87	71.60	08.13	1014	100

Source: outputs of cluster analysis

Table A- 10 Average values of ratios to total assets for 1994

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	27.44	63.35	67.74	7.81	514	44.62
Focused retail	66.28	24.78	71.52	9.44	637	55.38
Total	48.93	42.00	69.83	08.71	1151	100

Source: outputs of cluster analysis

Table A- 11 Average values of ratios to total assets for 1995

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	65.35	25.23	71.94	09.43	712	57.19
Trader	25.68	64.76	67.17	06.63	533	42.81
Total	48.36	42.15	69.90	08.23	1245	100

Source: outputs of cluster analysis

Table A- 12 Average values of ratios to total assets for 1996

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	24.39	65.55	67.62	06.09	543	41.87
Focused retail	64.45	25.53	74.52	07.07	754	58.13
Total	47.68	42.28	71.63	06.66	1297	100

Source: outputs of cluster analysis

Table A- 13 Average values of ratios to total assets for 1997

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	61.97	25.91	74.62	6.47	813	62.93
Trader	23.50	69.09	69.18	4.19	479	37.07
Total	47.71	41.92	72.60	5.63	1292	100

Source: outputs of cluster analysis

Table A- 14 Average values of ratios to total assets for 1998

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	22.07	68.07	67.23	4.37	491	39.03
Focused retail	61.04	26.88	75.51	7.74	767	60.97
Total	45.83	42.96	72.28	06.43	1258	100

Source: outputs of cluster analysis

Table A- 15 Average values of ratios to total assets for 1999

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	62.03	25.80	75.82	06.94	762	59.72
Trader	21.96	67.45	66.74	04.43	514	40.28
Total	45.89	42.58	72.17	05.93	1276	100

Source: outputs of cluster analysis

Table A- 16 Average values of ratios to total assets for 2000

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	21.41	67.44	66.80	03.91	528	42.14
Focused retail	62.73	25.36	75.02	06.63	725	57.86
Total	45.32	43.09	71.55	05.48	1253	100

Source: outputs of cluster analysis

Table A- 17 Average values of ratios to total assets for 2001

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	19.29	69.99	65.80	4.03	494	39.18
Focused retail	62.79	25.79	74.42	6.31	767	60.82
Total	45.75	43.11	71.05	05.42	1261	100

Source: outputs of cluster analysis

Table A- 18 Average values of ratios to total assets for 2002

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	22.77	66.11	65.13	3.77	584	46.24
Focused retail	65.55	24.46	74.36	7.08	679	53.76
Total	45.77	43.72	70.09	05.55	1263	100

Source: outputs of cluster analysis

Table A- 19 Average values of ratios to total assets for 2003

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	66.15	24.40	74.42	07.74	697	55.14
Trader	21.87	67.46	66.08	04.61	567	44.86
Total	46.29	43.72	70.68	06.34	1264	100

Source: outputs of cluster analysis

Table A- 20 Average values of ratios to total assets for 2004

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	20.41	69.61	65.42	5.30	493	38.28
Focused retail	65.03	25.87	74.97	8.13	762	61.72
Total	47.50	43.05	71.22	7.02	1255	100

Source: outputs of cluster analysis

Table A- 21 Average values of ratios to total assets for 2005

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	22.18	68.58	66.10	6.28	466	41.35
Focused retail	66.20	25.41	75.14	7.51	661	58.65
Total	48.00	43.26	71.40	07.21	1127	100

Source: outputs of cluster analysis

Table A- 22 Average values of ratios to total assets for 2006

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	25.02	65.02	65.94	7.07	484	44.53
Focused retail	66.67	24.85	76.53	7.39	603	55.47
Total	48.12	42.74	71.81	7.25	1087	100

Source: outputs of cluster analysis

Table A- 23 Average values of ratios to total assets for 2007

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	66.68	24.03	75.60	07.84	589	57.30
Trader	26.67	62.60	67.23	07.34	439	42.70
Total	49.59	40.50	72.02	07.62	1028	100

Source: outputs of cluster analysis

Table A- 24 Average values of ratios to total assets for 2008

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	25.91	61.71	60.02	9.45	390	39.04
Focused retail	65.49	24.05	75.59	8.66	609	60.96
Total	50.04	38.75	69.90	8.97	999	100

Source: outputs of cluster analysis

Table A- 25 Average values of ratios to total assets for 2009

BBM093	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	29.05	59.44	67.01	6.78	427	44.62
Focused retail	67.01	22.74	75.95	8.45	530	55.38
Total	50.08	39.11	71.97	7.70	957	100

Source: outputs of cluster analysis

Table A- 26 Average values of ratios to total assets for 2010

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	28.15	59.79	66.97	6.73	433	43.43
Focused retail	67.93	22.13	73.43	10.50	564	56.57
Total	50.65	38.49	70.62	08.86	997	100

Source: outputs of cluster analysis

Table A- 27 Average values of ratios to total assets for 2011

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	26.42	60.03	63.84	08.35	444	42.17
Focused retail	66.96	22.85	73.95	09.58	609	57.83
Total	49.87	38.53	69.69	09.06	1053	100

Source: outputs of cluster analysis

Table A- 28 Average values of ratios to total assets for 2012

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	27.17	58.29	64.44	7.26	468	42.28
Focused retail	66.88	22.46	74.77	8.64	639	57.72
Total	50.09	37.61	70.40	8.06	1107	100

Source: outputs of cluster analysis

Table A- 29 Average values of ratios to total assets for 2013

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	24.41	61.74	63.94	6.72	440	36.73
Focused retail	64.97	23.71	75.45	7.64	758	63.27
Total	50.08	37.68	71.22	7.30	1198	100

Source: outputs of cluster analysis

Table A- 30 Average values of ratios to total assets for 2014

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Focused retail	64.08	24.35	75.40	07.90	789	64.99
Trader	24.22	62.20	63.62	06.77	425	35.01
Total	50.13	37.60	71.28	07.51	1214	100

Source: outputs of cluster analysis

Table A- 31 Average values of ratios to total assets for 2015

BBM	Loans	Trading assets	Deposits	Debt liabilities	Obs.	%
Trader	29.51	55.46	66.91	7.55	491	45.00
Focused retail	67.33	21.95	74.95	8.17	600	55.00
Total	50.31	37.03	71.33	07.89	1091	100

Source: outputs of cluster analysis

Appendix B

Table B - 1 Pseudo-F values for clustering configurations for the period (1985- 2015)

Cluster	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
2	61.72	102.64	188.68	247.01	306.73	301.74	408.37	229.63	709.20	760.63
3	99.69	74.31	134.13	210.15	260.01	254.71	329.44	444.04	588.16	608.51
4	88.57	61.95	124.72	171.23	213.85	256.78	342.21	426.54	557.49	707.98
5	60.34	69.19	101.71	223.16	181.81	240.49	282.74	439.01	538.40	655.30

Table B – 1 (Continued)

Cluster	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2	854.50	937.22	1029.14	973.90	994.46	1012.55	1091.77	1006.63	1023.89	996.28
3	699.19	715.08	827.93	733.40	780.39	805.85	839.09	793.75	771.47	770.35
4	717.28	702.32	672.71	66.68	647.54	637.00	693.92	645.33	596.33	674.28
5	658.83	657.75	658.98	579.21	597.88	558.05	599.42	437.13	687.68	573.21

Table B – 1 (Continued)

Cluster	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2	891.12	795.34	724.37	634.82	641.56	639.53	633.63	656.75	726.12	697.88	554.24
3	685.60	630.08	605.07	516.56	542.73	528.27	513.78	537.31	589.87	608.13	621.28
4	538.66	541.81	535.92	479.73	430.85	519.75	575.40	514.85	651.46	643.39	508.34
5	533.63	561.00	462.22	485.88	423.04	454.36	573.26	480.01	583.88	559.26	401.98

Source: outputs of cluster analysis

Appendix C

Table C - 1 Coefficient estimates for the translog profit function for each country

Variables	Poland	Czech Republic	Austria	Belgium
lx1	-0.00115	-0.623*	0.328**	-0.172
	(0.193)	(0.378)	(0.151)	(0.188)
lx2	-0.237	0.326	-0.419	0.500
	(0.473)	(0.366)	(0.264)	(0.423)
ly1	1.606***	-0.712	-1.530***	-0.183
	(0.513)	(0.622)	(0.207)	(0.214)
ly2	-0.788***	0.379	0.375**	-0.309
	(0.293)	(0.313)	(0.152)	(0.195)
lx1lx1	0.00965	-0.264**	0.0512*	-0.0874***
	(0.0375)	(0.109)	(0.0301)	(0.0282)
lx2lx2	0.166	1.031***	0.145*	0.792***
	(0.133)	(0.266)	(0.0766)	(0.161)
lx1lx2	-0.154	0.269	0.355***	-0.365**
	(0.127)	(0.171)	(0.103)	(0.159)
ly1ly1	0.700***	-0.393***	0.0235	0.0762*
	(0.221)	(0.108)	(0.0576)	(0.0411)
ly1ly2	-0.0926	0.250**	-0.202***	-0.0793***
	(0.0858)	(0.125)	(0.0312)	(0.0243)
ly2ly2	0.0814*	-0.0624	0.0965***	0.0586**
	(0.0432)	(0.0905)	(0.0301)	(0.0274)
lx1ly1	0.115	-0.641***	-0.0782***	-0.0528
	(0.0802)	(0.167)	(0.0293)	(0.0365)
lx1ly2	0.000107	-0.0172	0.0211	0.0662**
	(0.0400)	(0.0655)	(0.0221)	(0.0321)
lx2ly1	0.145	-0.288*	-0.253***	-0.204***
	(0.135)	(0.174)	(0.0624)	(0.0762)
lx2ly2	-0.274***	-0.0271	0.0955**	-0.161**
	(0.0535)	(0.145)	(0.0445)	(0.0750)
T	-0.0856	0.200***	0.154***	0.213***
	(0.0632)	(0.0432)	(0.0271)	(0.0375)
T^2	0.00359	0.00988***	-0.00291**	0.00253
	(0.00392)	(0.00382)	(0.00145)	(0.00173)
ly1t	-0.0132	0.00130	0.0135*	-0.0211***
	(0.0183)	(0.0200)	(0.00777)	(0.00814)
ly2t	0.00783	-0.0227	-0.00202	-0.0144**
	(0.00742)	(0.0156)	(0.00446)	(0.00683)
lx1t	-0.00146	0.0338**	0.0148***	-0.0178***
	(0.00850)	(0.0155)	(0.00510)	(0.00670)
lx2t	0.0278	0.133***	0.0251***	0.0871***
	(0.0182)	(0.0295)	(0.00957)	(0.0140)
NPI	-0.0130***	-0.0148***	-0.00710***	-0.000762***
	(0.000902)	(0.000327)	(0.000515)	(5.71e-05)
Constant	-1.544**	-5.108	-7.453***	-5.595***
	(0.716)	(0.000)	(0.577)	(0.645)
Observations	724	238	1,171	876

Table C – 1 (Continued)

Variables	France	Greece	Hungary	Italy
lx1	0.339***	2.301***	0.489**	-0.0258
	(0.0771)	(2.62e-07)	(0.233)	(0.0851)
lx2	0.261*	-2.675***	2.280***	0.253
	(0.136)	(3.13e-07)	(0.421)	(0.167)
ly1	0.347***	-0.347***	-2.262***	-0.524**
	(0.100)	(8.64e-07)	(0.425)	(0.210)
ly2	0.187*	-8.248***	-0.360	0.226
	(0.109)	(1.47e-06)	(0.358)	(0.143)
lx1lx1	-0.0115	-0.674***	0.0100	-0.00969
	(0.0130)	(1.38e-07)	(0.0132)	(0.0127)
lx2lx2	0.261***	-1.381***	0.522***	0.0172
	(0.0421)	(2.54e-07)	(0.131)	(0.0425)
lx1lx2	-0.0403	2.036***	0.0147	-0.00343
	(0.0434)	(3.83e-07)	(0.0719)	(0.0409)
ly1ly1	0.149***	-1.881***	-0.0816	-0.127***
	(0.0179)	(5.25e-07)	(0.0733)	(0.0389)
ly1ly2	-0.0335**	1.666***	-0.464***	-0.0416
	(0.0152)	(4.12e-07)	(0.0888)	(0.0269)
ly2ly2	0.141***	-4.560***	-0.107***	-0.0241
	(0.0205)	(4.56e-07)	(0.0175)	(0.0169)
lx1ly1	0.0615***	-1.013***	0.159**	0.0285
	(0.0167)	(2.35e-07)	(0.0709)	(0.0212)
lx1ly2	0.0189	0.499***	0.0593***	0.0250
	(0.0120)	(2.34e-07)	(0.0113)	(0.0180)
lx2ly1	-0.112***	1.301***	-0.510***	0.0702*
	(0.0292)	(3.33e-07)	(0.0705)	(0.0422)
lx2ly2	-0.0305	-1.150***	-0.153	0.0314
	(0.0275)	(3.32e-07)	(0.132)	(0.0274)
T	0.146***	-0.262***	-0.279***	0.0462**
	(0.0180)	(6.60e-08)	(0.0422)	(0.0190)
T^2	-0.00386***	-0.0433***	0.00104	-0.00455***
	(0.00107)	(8.39e-09)	(0.00264)	(0.000741)
ly1t	-0.0209***	0.365***	0.0174	0.0129*
	(0.00451)	(7.72e-08)	(0.0169)	(0.00697)
ly2t	0.00470	-0.161***	-0.0327***	-0.0167***
	(0.00351)	(5.53e-08)	(0.0116)	(0.00449)
lx1t	-0.0136***	0.179***	-0.0239***	0.00440**
	(0.00356)	(4.01e-08)	(0.00862)	(0.00204)
lx2t	0.0267***	-0.233***	-0.0713***	-0.00548
	(0.00650)	(4.98e-08)	(0.00973)	(0.00368)
NPI	-0.00210***	-0.000768***	-0.00713***	-0.000500***
	(0.000103)	(0.00012)	(0.000365)	(2.47e-05)
Constant	-4.197***	-8.549***	1.848	-3.676***
	(0.327)	(5.43e-07)	(0.001)	(0.417)
Observations	3,173	211	331	2,084

Table C – 1 (Continued)

Variables	Portugal	Spain	UK	Australia
lx1	-0.210	0.167	-0.0257	0.294
	(0.295)	(0.187)	(0.0908)	(0.532)
lx2	-0.454	0.222	-0.884***	0.901
	(0.574)	(0.327)	(0.318)	(1.352)
ly1	-0.967*	0.285	0.232	-7.076***
	(0.547)	(0.263)	(0.141)	(2.521)
ly2	-1.160***	-0.351*	-0.355***	2.274**
	(0.286)	(0.186)	(0.0950)	(1.076)
lx1lx1	-0.0853	-0.0555*	-0.0418***	-0.0725
	(0.130)	(0.0292)	(0.0155)	(0.106)
lx2lx2	-0.241	0.257**	0.144*	0.527
	(0.161)	(0.115)	(0.0789)	(0.576)
lx1lx2	0.0830	0.543***	0.0189	0.204
	(0.198)	(0.114)	(0.0712)	(0.431)
ly1ly1	-1.011***	0.0444	0.141***	-1.819
	(0.200)	(0.0429)	(0.0297)	(1.292)
ly1ly2	-0.339***	0.0461**	-0.0200	-0.374
	(0.0932)	(0.0205)	(0.0221)	(0.282)
ly2ly2	-0.110***	0.0216	-0.0521***	0.0263
	(0.0425)	(0.0250)	(0.0146)	(0.0702)
lx1ly1	-0.0419	0.0195	-0.000147	0.0964
	(0.104)	(0.0374)	(0.0193)	(0.229)
lx1ly2	0.0415	-0.0179	0.0196	-0.193**
	(0.0532)	(0.0193)	(0.0198)	(0.0931)
lx2ly1	0.191	0.124*	-0.136***	-1.511
	(0.118)	(0.0686)	(0.0404)	(0.974)
lx2ly2	-0.291***	-0.132**	0.0915**	0.609
	(0.0695)	(0.0669)	(0.0363)	(0.458)
T	0.161*	0.121**	0.110***	0.0757
	(0.0922)	(0.0508)	(0.0307)	(0.0665)
T^2	-0.0167***	-0.000524	0.00252	-0.00438
	(0.00499)	(0.00321)	(0.00205)	(0.00293)
ly1t	-0.0188	0.0206	-0.0107	0.0150
	(0.0192)	(0.0142)	(0.00688)	(0.0508)
ly2t	-0.0268***	0.000863	0.0193***	-0.00189
	(0.00948)	(0.00997)	(0.00748)	(0.0228)
lx1t	0.0247*	0.0384***	-8.94e-05	0.00520
	(0.0140)	(0.00967)	(0.00502)	(0.0118)
lx2t	-0.0369**	0.0207	0.0525***	0.00908
	(0.0183)	(0.0217)	(0.0106)	(0.0271)
NPI	-0.00394***	-0.000312***	-0.00452***	-0.0172***
	(0.000217)	(2.93e-05)	(0.000204)	(0.000959)
Constant	-7.801***	-5.163***	-6.180***	-3.805**
	(1.315)	(0.817)	(0.608)	(1.768)
Observations	326	933	884	252

Table C – 1 (Continued)

Variables	Indonesia	Korea	Malaysia	Philippine
lx1	0.154	0.183	-0.459**	0.378
	(0.0991)	(0.501)	(0.214)	(0.240)
lx2	0.584***	-9.668***	0.145	0.244
	(0.196)	(1.202)	(0.409)	(0.369)
ly1	-0.131	1.399	-1.055***	-0.0351
	(0.197)	(1.236)	(0.279)	(0.464)
ly2	-1.425***	-1.418**	-1.070***	-2.225***
	(0.194)	(0.578)	(0.375)	(0.520)
lx1lx1	0.0124	-0.201***	-0.00227	-0.0182
	(0.0291)	(0.0517)	(0.0327)	(0.0636)
lx2lx2	0.472***	-3.892***	-0.0147	0.0817
	(0.0929)	(0.465)	(0.168)	(0.133)
lx1lx2	0.140*	0.414	-0.325**	0.364**
	(0.0760)	(0.398)	(0.154)	(0.155)
ly1ly1	0.127	0.961	0.0319	0.533**
	(0.0963)	(0.692)	(0.0797)	(0.234)
ly1ly2	0.315***	-0.188	0.0938	-0.311
	(0.0800)	(0.274)	(0.0678)	(0.241)
ly2ly2	-0.306***	-0.185***	-0.0235	-1.068***
	(0.0608)	(0.0533)	(0.0784)	(0.198)
lx1ly1	0.00160	0.188	0.0901	0.123
	(0.0535)	(0.162)	(0.0551)	(0.105)
lx1ly2	-0.0618	-0.0570	-0.197*	0.0826
	(0.0397)	(0.0960)	(0.101)	(0.126)
lx2ly1	-0.132	0.717	-0.0110	0.249
	(0.0819)	(0.438)	(0.0921)	(0.169)
lx2ly2	-0.408***	-0.343	-0.350***	0.00276
	(0.0705)	(0.258)	(0.122)	(0.132)
T	0.0842***	-0.278***	0.0327	-0.0538*
	(0.0187)	(0.0680)	(0.0384)	(0.0316)
T^2	-0.00360***	-0.0143***	-0.00383***	0.0100***
	(0.000745)	(0.00246)	(0.000926)	(0.00134)
ly1t	0.00447	0.0837***	0.0422***	0.0545***
	(0.0125)	(0.0311)	(0.0106)	(0.0168)
ly2t	-0.00562	-0.0318**	0.00354	0.0430***
	(0.00677)	(0.0153)	(0.0120)	(0.0136)
lx1t	0.00560*	0.0309**	-0.00646	0.0235***
	(0.00317)	(0.0123)	(0.00533)	(0.00680)
lx2t	0.00992	-0.170***	-0.0142	0.0210*
	(0.00783)	(0.0301)	(0.0134)	(0.0111)
NPI	-0.00341***	-0.00172***	-0.0117***	-0.025***
	(0.000296)	(0.00012)	(0.000498)	(0.00157)
Constant	-3.870***	-17.57***	-3.873***	-3.169***
	(0.312)	(2.187)	(0.614)	(0.654)
Observations	1,712	556	773	729

Table C – 1 (Continued)

Variables	Thailand	China	Argentina	Brazil
lx1	0.490	0.654***	0.128	0.422***
	(0.322)	(0.237)	(0.183)	(0.116)
lx2	-0.765	-0.542	0.189	1.574***
	(0.519)	(0.394)	(0.140)	(0.188)
ly1	-0.634	0.0246	0.676**	0.605***
	(1.203)	(0.855)	(0.284)	(0.205)
ly2	-0.454	0.557	-0.838***	-0.641***
	(0.708)	(0.485)	(0.253)	(0.161)
lx1lx1	-0.103	0.00466	-0.00999	0.0817***
	(0.104)	(0.0321)	(0.0343)	(0.0300)
lx2lx2	-0.502**	-0.565***	-0.0294	0.131*
	(0.236)	(0.0997)	(0.0586)	(0.0717)
lx1lx2	0.301	0.225**	-0.250***	-0.0943
	(0.279)	(0.0961)	(0.0788)	(0.0925)
ly1ly1	0.926	-0.932***	0.223***	0.163***
	(0.574)	(0.319)	(0.0717)	(0.0517)
ly1ly2	0.426	-0.510**	-0.0505	-0.0829**
	(0.319)	(0.203)	(0.0592)	(0.0342)
ly2ly2	-0.146**	0.160*	-0.173***	-0.0204
	(0.0666)	(0.0958)	(0.0608)	(0.0285)
lx1ly1	0.179	-0.0848	0.0842**	-0.0267
	(0.195)	(0.104)	(0.0416)	(0.0388)
lx1ly2	-0.109	0.157**	0.0442	0.0864***
	(0.0870)	(0.0669)	(0.0330)	(0.0241)
lx2ly1	-0.468	-0.113	0.0112	0.0640
	(0.451)	(0.183)	(0.0613)	(0.0546)
lx2ly2	0.245	-0.179*	-0.0249	-0.149***
	(0.236)	(0.0967)	(0.0526)	(0.0413)
T	-0.0207	-0.504***	-0.172***	-0.150***
	(0.0577)	(0.0625)	(0.0479)	(0.0359)
T^2	-0.00796***	0.0150***	0.00661***	-0.00329
	(0.00283)	(0.00254)	(0.00223)	(0.00207)
ly1t	-0.0187	-0.0558**	-0.0172	-0.0109
	(0.0563)	(0.0265)	(0.0106)	(0.00985)
ly2t	0.0596***	-0.0566***	0.00298	0.00376
	(0.0227)	(0.0165)	(0.00898)	(0.00691)
lx1t	0.00698	-0.0325***	-0.0157**	-0.0174***
	(0.0140)	(0.00636)	(0.00694)	(0.00566)
lx2t	-0.0522*	-0.0715***	-0.00713	-0.0703***
	(0.0289)	(0.0152)	(0.00811)	(0.0101)
NPI	-0.00352***	-0.148***	2.057***	0.0065***
	(0.000196)	(0.0180)	(0.122)	(0.010)
Constant	-4.414***	7.595***	-0.748	-0.625*
	(0.888)	(1.212)	(0.470)	(0.342)
Observations	595	1,954	1,528	2,499

Table C – 1 (Continued)

Variables	Chile	Mexico	Venezuela	Turkey	Egypt
lx1	1.203***	0.369***	-0.101	1.312***	-0.757
	(0.00969)	(0.103)	(0.225)	(0.000428)	(0.688)
lx2	-0.925***	0.171	0.362	-0.0425***	-0.688
	(0.0746)	(0.162)	(0.246)	(0.000218)	(2.567)
ly1	0.803***	-0.302	0.237***	0.361***	-1.814
	(0.0160)	(0.193)	(0.0918)	(0.00214)	(2.277)
ly2	-0.983***	-0.255	-1.978***	-3.145	-2.819
	(0.0813)	(0.226)	(0.272)	(0.000)	(3.721)
lx1lx1	0.152***	-0.0466	-0.0217	0.537***	-0.236***
	(0.00714)	(0.0367)	(0.0614)	(0.000481)	(0.0660)
lx2lx2	-0.0525	0.221***	0.00737	-0.00791***	-0.460
	(0.001)	(0.0493)	(0.100)	(0.000114)	(1.057)
lx1lx2	0.481***	0.291***	-0.458***	-0.0679***	-0.347
	(0.0164)	(0.0846)	(0.129)	(0.000183)	(0.492)
ly1ly1	0.0793***	0.0221	0.0219*	-0.0346***	1.286
	(0.00443)	(0.0558)	(0.0124)	(0.000352)	(0.869)
ly1ly2	0.347***	0.0114	-0.0320**	-0.0846***	-2.147*
	(0.0528)	(0.0424)	(0.0146)	(0.000171)	(1.098)
ly2ly2	-0.616***	-0.116*	-0.0438	-0.346***	-2.223
	(0.0528)	(0.0701)	(0.0460)	(0.000117)	(3.467)
lx1ly1	0.0527***	-0.0272	0.0306	0.371***	-0.0114
	(0.00474)	(0.0450)	(0.0204)	(0.000538)	(0.220)
lx1ly2	0.254***	-0.0563	0.0351	-0.155***	-0.824*
	(0.0224)	(0.0481)	(0.0374)	(0.000452)	(0.425)
lx2ly1	0.290***	0.111**	0.0522**	-0.0778***	-1.097
	(0.0168)	(0.0465)	(0.0255)	(0.000151)	(0.887)
lx2ly2	-0.309***	-0.0289	-0.117***	0.181***	0.866
	(0.0217)	(0.0341)	(0.0338)	(7.04e-05)	(1.588)
T	-0.0440**	0.0563**	0.0954**	0.0772***	-0.240***
	(0.0190)	(0.0256)	(0.0399)	(0.000122)	(0.0887)
T^2	0.00305***	0.000640	-.0078***	-0.00270***	0.000884
	(0.000697)	(0.00218)	(0.00184)	(3.50e-06)	(0.00238)
ly1t	0.0242***	0.0381***	-0.00126	-0.0438***	-0.0337
	(0.00403)	(0.00913)	(0.00395)	(0.000131)	(0.0348)
ly2t	-0.0325***	0.00202	0.0691***	0.0825***	0.122
	(0.00676)	(0.00952)	(0.0117)	(3.43e-05)	(0.0841)
lx1t	0.000978***	0.00322	-0.0123	-0.0634***	0.00533
	(0.000231)	(0.00565)	(0.00978)	(1.56e-05)	(0.00617)
lx2t	0.0310***	0.0181*	-0.0169	0.00554***	-0.0812**
	(0.00118)	(0.00969)	(0.0113)	(6.80e-06)	(0.0367)
NPI	-0.0498***	-0.019***	-0.0078**	-9.321***	-0.054***
	(0.00154)	(0.00166)	(0.00347)	(3.04e-09)	(0.00433)
Constant	-3.805	-3.727***	-3.496***	-5.216***	-3.650
	(0.012)	(0.282)	(0.507)	(0.00194)	(3.430)
Observations	680	828	835	308	402

Note: This table profit function coefficient estimates. In our translog-based estimations of profit efficiency levels, output variables considered are total loans (y1), costumer deposits (y2). The input variables are price of labour which is the ratio of personnel expense-to-total assets(x1); price of physical capital which is the ratio of non-interest expense-to-total fixed assets (x2); total assets which is treated as a netput and the net profit indicator (NPI). Coefficients with ***, ** and * are statistically different from zero at the 1%, 5%, 10% levels of significance. All variables are in log term.

Table C - 2 Coefficient estimates for the translog cost function for each country

Variables	Poland	Czech Republic	Austria	Belgium
lx1	0.328***	0.159	0.173*	-0.166**
	(0.0947)	(0.295)	(0.101)	(0.0653)
lx2	0.314	2.713***	0.363*	1.443***
	(0.228)	(0.822)	(0.202)	(0.178)
ly1	0.672**	-0.336	-0.332**	-0.208**
	(0.262)	(0.608)	(0.155)	(0.0899)
ly2	0.114	0.688*	0.495***	-0.335***
	(0.132)	(0.384)	(0.113)	(0.0831)
lx1lx1	-0.0131	-0.103	-0.0303	-0.00468
	(0.0207)	(0.102)	(0.0201)	(0.00903)
lx2lx2	-0.0676	1.093***	0.0391	0.229***
	(0.0755)	(0.314)	(0.0679)	(0.0686)
lx1lx2	0.183***	0.456***	0.339***	-0.240***
	(0.0674)	(0.172)	(0.0682)	(0.0554)
ly1ly1	-0.0508	0.0396	0.332***	0.00555
	(0.114)	(0.340)	(0.0406)	(0.0142)
ly1ly2	0.170***	-0.0953	-0.158***	0.0286**
	(0.0408)	(0.126)	(0.0189)	(0.0120)
ly2ly2	0.0918***	-0.120	0.208***	0.0116
	(0.0244)	(0.0761)	(0.0233)	(0.00877)
lx1ly1	0.126***	-0.564***	0.0516**	0.0395***
	(0.0399)	(0.104)	(0.0206)	(0.0151)
lx1ly2	-0.0796***	-0.0779	-0.0493***	0.0264**
	(0.0183)	(0.0589)	(0.0143)	(0.0108)
lx2ly1	0.0582	-0.576***	-0.101**	-0.119***
	(0.0735)	(0.208)	(0.0464)	(0.0287)
lx2ly2	-0.0330	0.00244	-0.00640	-0.115***
	(0.0330)	(0.123)	(0.0320)	(0.0277)
T	-0.00462	0.1000	0.00986	-0.0258
	(0.0315)	(0.0998)	(0.0202)	(0.0169)
T^2	-0.00360*	-0.00287	-0.00848***	-0.0133***
	(0.00186)	(0.00481)	(0.00105)	(0.00100)
ly1t	-0.0151	-0.0534	0.0157***	-0.0120***
	(0.0102)	(0.0370)	(0.00506)	(0.00398)
ly2t	0.0151***	-0.0316**	0.00362	0.0172***
	(0.00401)	(0.0124)	(0.00301)	(0.00244)
lx1t	0.00228	0.0130	0.0261***	-0.00534**
	(0.00471)	(0.0145)	(0.00353)	(0.00239)
lx2t	-0.0193**	0.0400	-0.0310***	-0.0321***
	(0.00972)	(0.0343)	(0.00753)	(0.00633)
Constant	-2.401***	-0.0503	-3.717***	0.356
	(0.367)	(1.317)	(0.413)	(0.265)
Observations	724	238	1,171	876

Table C – 2 (Continued)

Variables	France	Greece	Hungary	Italy
lx1	0.0436	-0.132	0.318**	0.0544
	(0.0514)	(0.226)	(0.156)	(0.0371)
lx2	0.823***	1.833***	0.715	0.123*
	(0.0919)	(0.330)	(0.445)	(0.0713)
ly1	0.571***	-1.950***	-1.644***	0.137*
	(0.0686)	(0.565)	(0.563)	(0.0770)
ly2	0.525***	3.316***	-0.202	-0.230***
	(0.0718)	(0.480)	(0.172)	(0.0562)
lx1lx1	-0.0564***	-0.134*	0.00367	0.000233
	(0.00856)	(0.0700)	(0.0323)	(0.00564)
lx2lx2	0.206***	0.388***	0.152	0.0270
	(0.0276)	(0.0903)	(0.0957)	(0.0175)
lx1lx2	-0.0761**	0.465***	0.000672	0.0164
	(0.0298)	(0.0980)	(0.0707)	(0.0178)
ly1ly1	0.0769***	-2.182***	1.078***	0.0157
	(0.0112)	(0.476)	(0.193)	(0.0162)
ly1ly2	-0.0370***	1.245***	-0.241**	-0.0297***
	(0.00909)	(0.301)	(0.0940)	(0.00957)
ly2ly2	0.0759***	0.706**	-0.0450***	-0.0115
	(0.0131)	(0.286)	(0.0169)	(0.00783)
lx1ly1	0.0480***	-0.315**	-0.129	0.0317***
	(0.0111)	(0.135)	(0.0803)	(0.00852)
lx1ly2	-0.0349***	-0.0958	0.168***	0.00168
	(0.00795)	(0.130)	(0.0352)	(0.00636)
lx2ly1	0.0162	0.626***	-0.319**	0.0478***
	(0.0210)	(0.144)	(0.134)	(0.0164)
lx2ly2	0.0434**	0.134	-0.0189	-0.0257**
	(0.0183)	(0.151)	(0.0567)	(0.0113)
T	0.183***	0.310***	0.0439	-0.00543
	(0.0135)	(0.0349)	(0.0534)	(0.00792)
T^2	-0.0103***	-0.0135***	-0.00133	-0.00233***
	(0.000817)	(0.00228)	(0.00199)	(0.000334)
ly1t	-0.0177***	0.177***	0.0658***	0.00224
	(0.00301)	(0.0355)	(0.0138)	(0.00264)
ly2t	0.00216	-0.0729***	-0.00884	0.00244
	(0.00226)	(0.0200)	(0.00674)	(0.00165)
lx1t	-0.00268	0.0385***	-0.0123***	0.000972
	(0.00236)	(0.0114)	(0.00413)	(0.000934)
lx2t	0.0109**	-0.00424	-0.0165*	0.00147
	(0.00428)	(0.0136)	(0.00941)	(0.00152)
Constant	-2.067***	-3.380***	-3.646***	-2.338***
	(0.224)	(0.649)	(1.146)	(0.176)
Observations	3,173	211	329	2,079

Table C – 2 (Continued)

Variables	Portugal	Spain	UK	Australia
lx1	0.0500	-0.0589	-0.0510	-0.322
	(0.0693)	(0.0366)	(0.0381)	(0.344)
lx2	1.039***	0.937***	0.510***	-2.304***
	(0.147)	(0.147)	(0.113)	(0.873)
ly1	0.299**	0.0250	0.00643	0.619
	(0.144)	(0.0710)	(0.0572)	(1.404)
ly2	-0.0441	0.147***	0.112*	0.571
	(0.0878)	(0.0530)	(0.0593)	(0.631)
lx1lx1	0.0433	-0.0103**	0.00884	-0.152**
	(0.0282)	(0.00509)	(0.00593)	(0.0686)
lx2lx2	0.0224	0.147**	-0.0908***	-0.899**
	(0.0378)	(0.0588)	(0.0252)	(0.397)
lx1lx2	-0.152***	-0.0514*	-0.0490*	0.0883
	(0.0433)	(0.0300)	(0.0280)	(0.264)
ly1ly1	0.0214	-0.00665	0.0310***	-3.942***
	(0.0465)	(0.00986)	(0.00858)	(0.909)
ly1ly2	-0.0541***	-0.0174	-0.00761	0.0232
	(0.0176)	(0.0111)	(0.00731)	(0.155)
ly2ly2	0.0145	0.0364***	0.0466***	0.0617
	(0.0101)	(0.00875)	(0.0103)	(0.0415)
lx1ly1	0.141***	0.0460***	0.00124	-0.607***
	(0.0271)	(0.00742)	(0.00715)	(0.163)
lx1ly2	0.000145	0.0171***	0.0122	-0.211***
	(0.0144)	(0.00578)	(0.00771)	(0.0613)
lx2ly1	-0.0916***	-0.0640***	-0.0335**	0.542
	(0.0296)	(0.0182)	(0.0151)	(0.560)
lx2ly2	-0.00377	0.0559***	-0.0501***	-0.0798
	(0.0182)	(0.0202)	(0.0120)	(0.262)
T	-0.145***	0.00548	0.0120	-0.158***
	(0.0241)	(0.0166)	(0.0127)	(0.0498)
T^2	0.00120	0.000355	-0.00478***	0.000436
	(0.00129)	(0.00129)	(0.000767)	(0.00247)
ly1t	-0.0286***	-0.0120***	0.00103	-0.0768***
	(0.00530)	(0.00305)	(0.00227)	(0.0291)
ly2t	0.00255	0.0141***	-0.00635***	0.00230
	(0.00223)	(0.00266)	(0.00210)	(0.0122)
lx1t	-0.00940***	-0.000966	-0.000958	0.0211***
	(0.00341)	(0.00201)	(0.00169)	(0.00756)
lx2t	-0.0173***	0.00756	-0.0209***	-0.0186
	(0.00483)	(0.00811)	(0.00341)	(0.0199)
Constant	2.019***	-0.468**	-1.562***	-5.166***
	(0.310)	(0.205)	(0.247)	(1.066)
Observations	326	722	702	252

Table C – 2 (Continued)

Variables	Indonesia	Korea	Malaysia	Philippine
lx1	0.00607	-0.291	-0.0341***	0.318***
	(0.0172)	(0.196)	(0.00962)	(0.104)
lx2	1.063***	-0.720	1.026***	0.0694
	(0.0387)	(0.570)	(0.0114)	(0.165)
ly1	0.267***	1.216**	0.0854***	0.863***
	(0.0459)	(0.475)	(0.0146)	(0.209)
ly2	0.224***	0.681***	0.151***	-0.221
	(0.0369)	(0.199)	(0.0132)	(0.220)
lx1lx1	-0.0118**	0.0752***	-0.0128***	0.00875
	(0.00545)	(0.0221)	(0.00209)	(0.0267)
lx2lx2	0.0636***	-0.282	0.150***	-0.0885
	(0.0186)	(0.236)	(0.00208)	(0.0575)
lx1lx2	-0.0206	-0.517***	-0.0126**	0.0734
	(0.0155)	(0.162)	(0.00508)	(0.0684)
ly1ly1	0.0660***	-1.789***	-0.00439***	0.330***
	(0.0178)	(0.322)	(0.00133)	(0.0823)
ly1ly2	-0.0677***	0.577***	-0.0189***	-0.0801
	(0.0181)	(0.143)	(0.00235)	(0.0900)
ly2ly2	0.130***	0.193***	0.0178***	-0.0216
	(0.0104)	(0.0281)	(0.00260)	(0.0931)
lx1ly1	0.0103	0.286***	0.00567**	0.290***
	(0.00884)	(0.0819)	(0.00284)	(0.0445)
lx1ly2	0.00644	-0.00329	0.0167***	-0.139***
	(0.00659)	(0.0380)	(0.00210)	(0.0522)
lx2ly1	0.0693***	0.676***	0.00771**	0.270***
	(0.0165)	(0.201)	(0.00371)	(0.0754)
lx2ly2	0.0407***	-0.289***	0.0329***	-0.00321
	(0.0135)	(0.0876)	(0.00280)	(0.0567)
T	0.0117***	-0.0131	0.0542***	0.00745
	(0.00384)	(0.0339)	(0.00371)	(0.0142)
T^2	-0.000890***	-0.00356***	-0.00290***	0.000319
	(0.000147)	(0.00118)	(0.000178)	(0.000672)
ly1t	0.00139	0.0156	-0.00175**	0.0201**
	(0.00258)	(0.0150)	(0.000695)	(0.00784)
ly2t	0.0140***	-0.0380***	0.00112**	0.0145**
	(0.00144)	(0.00726)	(0.000513)	(0.00638)
lx1t	-0.00136**	-0.00271	0.00589***	0.00283
	(0.000674)	(0.00548)	(0.000404)	(0.00303)
lx2t	-0.00264*	-0.0113	0.00139***	0.00268
	(0.00157)	(0.0153)	(0.000449)	(0.00448)
Constant	0.0406	-4.481***	-0.614***	-2.603***
	(0.0607)	(0.927)	(0.0443)	(0.306)
Observations	1,712	556	25,210	729

Table C – 2 (Continued)

Variables	Thailand	China	Vietnam	Argentina
lx1	0.790***	0.297***	0.515***	0.201***
	(0.144)	(0.0613)	(0.144)	(0.0637)
lx2	-0.179	-0.359***	0.592***	0.290***
	(0.228)	(0.105)	(0.181)	(0.0444)
ly1	-1.555***	0.335	0.424**	0.508***
	(0.529)	(0.228)	(0.175)	(0.0902)
ly2	-0.0806	-0.158	-0.156	0.531***
	(0.269)	(0.125)	(0.306)	(0.0899)
lx1lx1	-0.145***	-0.127***	0.133***	-0.0389***
	(0.0463)	(0.00801)	(0.0262)	(0.0130)
lx2lx2	-0.151	-0.141***	0.0161	-0.00116
	(0.102)	(0.0229)	(0.0317)	(0.0198)
lx1lx2	0.360***	0.121***	-0.0561	-0.0864***
	(0.122)	(0.0239)	(0.0610)	(0.0285)
ly1ly1	-0.576***	0.147**	-0.0377***	0.119***
	(0.179)	(0.0677)	(0.00683)	(0.0268)
ly1ly2	0.288**	0.444***	0.0355**	0.0631***
	(0.139)	(0.0467)	(0.0177)	(0.0220)
ly2ly2	0.00624	-0.0583**	0.121*	-0.0623***
	(0.0302)	(0.0246)	(0.0674)	(0.0230)
lx1ly1	0.121	-0.0637***	0.0396*	0.0427***
	(0.0950)	(0.0239)	(0.0213)	(0.0158)
lx1ly2	0.0369	-0.171***	-0.159***	0.0341***
	(0.0306)	(0.0166)	(0.0339)	(0.0127)
lx2ly1	-0.502***	0.0302	-0.0421	-0.0138
	(0.195)	(0.0421)	(0.0306)	(0.0224)
lx2ly2	-0.0691	-0.0474**	-0.168***	-0.00538
	(0.0913)	(0.0232)	(0.0622)	(0.0199)
T	-0.00744	0.133***	-0.00582	-0.0198
	(0.0239)	(0.0152)	(0.0316)	(0.0132)
T^2	-0.00354***	-0.00556***	-0.000958	-0.00117
	(0.00119)	(0.000608)	(0.00108)	(0.000710)
ly1t	-0.0311	0.0153**	-0.0105	-0.00707*
	(0.0230)	(0.00681)	(0.00697)	(0.00378)
ly2t	0.00565	0.0188***	-0.00229	-0.0244***
	(0.0104)	(0.00415)	(0.00933)	(0.00325)
lx1t	0.00219	0.000310	-0.0202***	-0.00290
	(0.00640)	(0.00152)	(0.00395)	(0.00250)
lx2t	-0.0154	-0.00897**	-0.0183***	-0.00688**
	(0.0118)	(0.00386)	(0.00661)	(0.00286)
Constant	-3.815***	-6.895***	-3.381***	-1.550***
	(0.409)	(0.344)	(0.558)	(0.131)
Observations	595	1,954	638	1,528

Table C – 2 (Continued)

Variables	Brazil	Chile	Mexico	Venezuela
lx1	0.278***	0.537***	0.101*	0.0147
	(0.0409)	(0.102)	(0.0609)	(0.0911)
lx2	-0.220***	0.459***	0.109	0.476***
	(0.0669)	(0.140)	(0.0941)	(0.104)
ly1	0.485***	0.492***	0.135	0.0670*
	(0.0726)	(0.0923)	(0.114)	(0.0350)
ly2	0.536***	0.947***	0.282**	-0.380***
	(0.0575)	(0.153)	(0.139)	(0.108)
lx1lx1	-0.0365***	0.0288	0.0264	-0.145***
	(0.0104)	(0.0311)	(0.0229)	(0.0239)
lx2lx2	0.0470*	0.153***	0.0848***	0.168***
	(0.0253)	(0.0526)	(0.0290)	(0.0412)
lx1lx2	0.145***	0.120**	0.161***	-0.243***
	(0.0324)	(0.0594)	(0.0493)	(0.0516)
ly1ly1	0.0595***	0.0719***	0.126***	-0.00276
	(0.0182)	(0.0143)	(0.0353)	(0.00473)
ly1ly2	-0.00236	-0.00388	-0.155***	-0.0381***
	(0.0120)	(0.0307)	(0.0272)	(0.00655)
ly2ly2	0.0763***	0.485***	0.246***	0.0755***
	(0.00992)	(0.0924)	(0.0408)	(0.0200)
lx1ly1	0.0234*	0.0243	0.0230	0.0124
	(0.0136)	(0.0220)	(0.0258)	(0.00789)
lx1ly2	0.0297***	0.139***	-0.0470	-0.0311**
	(0.00838)	(0.0331)	(0.0286)	(0.0147)
lx2ly1	-0.0514***	0.0526*	0.00125	-0.000671
	(0.0193)	(0.0302)	(0.0278)	(0.00996)
lx2ly2	-0.00986	0.00797	0.0621***	-0.00128
	(0.0145)	(0.0543)	(0.0185)	(0.0144)
T	0.0322*	0.0200	0.00174	0.119***
	(0.0195)	(0.0190)	(0.0152)	(0.0223)
T^2	-0.00322***	-0.00205*	0.00107	-0.00753***
	(0.000939)	(0.00118)	(0.00129)	(0.00123)
ly1t	-0.0194***	0.00298	-0.00133	-0.00399***
	(0.00344)	(0.00532)	(0.00589)	(0.00151)
ly2t	-0.00889***	-0.0264***	0.0218***	0.0298***
	(0.00242)	(0.00780)	(0.00652)	(0.00512)
lx1t	0.00643***	-0.000195	0.0105***	-0.00558
	(0.00197)	(0.00507)	(0.00372)	(0.00409)
lx2t	0.0119***	0.00977	0.0123**	0.0105**
	(0.00353)	(0.00718)	(0.00574)	(0.00470)
Constant	-2.759***	-2.204***	-3.101***	-2.657***
	(0.177)	(0.214)	(0.171)	(0.210)
Observations	2,499	680	828	835

Table C – 2 (Continued)

Variables	Turkey	Egypt
lx1	0.340	0.591**
	(0.226)	(0.279)
lx2	1.250***	-2.185**
	(0.100)	(1.005)
ly1	-0.771**	-0.839
	(0.373)	(1.061)
ly2	1.406***	-0.993
	(0.280)	(1.495)
lx1lx1	-0.113**	-0.0483*
	(0.0489)	(0.0259)
lx2lx2	0.215***	-0.662
	(0.0346)	(0.453)
lx1lx2	-0.0214	0.460**
	(0.0418)	(0.205)
ly1ly1	0.0303	0.773**
	(0.0930)	(0.368)
ly1ly2	-0.152***	-0.525
	(0.0501)	(0.474)
ly2ly2	0.111*	-0.738
	(0.0567)	(1.338)
lx1ly1	-0.0589	0.0780
	(0.0593)	(0.0834)
lx1ly2	-0.191***	-0.509***
	(0.0422)	(0.166)
lx2ly1	0.0156	-0.608
	(0.0408)	(0.420)
lx2ly2	0.0903***	-0.405
	(0.0307)	(0.586)
T	-0.127**	-0.111***
	(0.0578)	(0.0429)
T^2	0.00402*	0.00106
	(0.00230)	(0.00108)
ly1t	0.0343**	-0.0137
	(0.0155)	(0.0159)
ly2t	-0.0435***	-0.0819**
	(0.00893)	(0.0383)
lx1t	-0.0135	0.00449
	(0.00876)	(0.00285)
lx2t	-0.00663*	-0.0259
	(0.00342)	(0.0168)
Constant	1.168*	-7.348***
	(0.710)	(1.354)
Observations	308	402

Notes: This table cost function coefficient estimates. In our translog-based estimations of cost efficiency levels, output variables considered are total loans (y1), costumer deposits (y2). The input variables are price of labour which is the ratio of personnel expense-to-total assets(x1);

price of physical capital which is the ratio of non-interest expense-to-total fixed assets (x2); total assets which is treated as a netput. Coefficients with ***, ** and * are statistically different from zero at the 1%, 5%, 10% levels of significance. All variables are in log term.