UNIVERSITY OF NOTTINGHAM

Bank Efficiency and Determinants of Bank Profitability: Recent Evidence from Vietnamese Banking System, 2006-2013

NGUYEN LE VAN QUYNH

Student ID: 4211377

MSc. Banking and Finance

Nottingham University Business School

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2014

"A Dissertation presented in part consideration for the degree of Master of Science in Banking and Finance"

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ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to the following people who supported me much during the master course for the year 2013 - 2014. Without their support, I would never have been able to finish my course and my dissertation with the current result.

My deepest gratitude goes first and foremost to my supervisor, Dr. Richard Simper for his valuable guidance, enthusiastic support, and dedicated supervision. He gave me detailed instructions on how to apply advanced techniques and methodology appropriately in my project. He was very approachable whenever I encountered academic problems, and he provided me useful advice to overcome these difficulties. Without his tremendous support, this dissertation would not have reached its present forms.

Second, I would like to send my sincere thanks to my mentor, Tran Duy Hung, who encouraged me much throughout the academic year. He walked with me through not only all stages of this dissertation but also every single moment of my course. He instructed me carefully on how to prepare for the topic of dissertation, how to organize a ton of work relating to the project and how to arrange my timeline efficiently. His strong encouragement helped me much to achieve my great results in both academic terms and to overcome the stress during revision as well as dissertation periods.

Third, I would like to express my heartfelt gratitude to my best friends, Tra Nguyen and Kiet Phi, who were always beside me, willing to help and give their best suggestions. We have been together with our ups and downs and thank you for cheering me up whenever I had negative outlook. I am also very grateful to my friends: Linh Lai, Ha Chi Chi, Green Mango, Chi Nguyen, Ha Mai who always supported me during my course time.

Finally, I would specially like to thank my mother, my aunt, my sisters and brothers who were always cared about me and encouraged me with their best wishes.

ABSTRACT

This paper adopts a two-step research design. In the first stage, this study examines the efficiency scores of Vietnamese commercial banks during the period 2006-2013. The paper employs stochastic frontier analysis (SFA) technique with input distance function and one-sided inefficiency u, and suppose that the scale of u depends on some environmental factors z. A "one-step" procedure that specifies the frontier and the way in which z affects u will be estimated by maximum likelihood technique. This procedure is in contrast to a "two-step" model that comprises two separated steps: estimate the stochastic frontier first and then using the regression model to assess the effects of z variables on inefficiency level u. The phase of measuring bank-specific efficiency levels aims to (i) evaluate the economics performance changes of Vietnamese banking system throughout period 2006-2013, and (ii) determine whether there are differences regarding to efficiency levels across different bank categories in terms of size and ownership. It shows that average efficiency score of Vietnamese banking system during 2006-2013 was 64%, and in general, technical efficiency level was on an increasing trend with two peaks at 74% and 86.5% in 2008 and 2011, respectively. No efficiency level difference was found between either bank size groups or bank ownership groups.

In the second stage, using panel data estimation with system generalized method of moments (GMM) technique, this paper assesses the impacts of possible bank-specific (including technical efficiency level estimated in the first stage), industry-specific and macroeconomic variables on Vietnamese bank profitability. It is found that the level of capital to assets ratio (EQASS), the liquidity ratio (LODEP), technical efficiency (TE) and GDP Growth (GDPGR) have positive impacts on accounting bank performance (ROA); while concentration ratio (CR4) is negatively related to ROA. Remaining variables, namely impaired loan reserve to gross loan ratio (LORES), market share of individual banks (MS) and unemployment rate (UNEMP) are found to have no effects on bank profitability.

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
DEA	Data Envelopment Analysis
IMF	International Monetary Fund
FOBs	Foreign-owned banks
GFC	Global Financial Crisis
JSCBs	Joint-stock commercial banks
JVBs	Joint-venture banks
NPL	Non-performing loans
SBV	State Bank of Vietnam
SFA	Stochastic Frontier Analysis
SOCBs	State-owned commercial banks
SOEs	State-owned enterprises
TE	Technical efficiency
VND	Vietnam Dong – Vietnamese currency
WTO	World Trade Organization

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INTRODUCTION

Over the past two decades since *Doi Moi* (i.e. Renovation in 1990s that aims to transform a centrally planned economy into a market economy), Vietnam has achieved a remarkable record of economic development (Nguyen et al., 2013a). Vietnam is now considered as a rising economic star in the ASEAN region with the relatively high level of economic performance compared to other ASEAN countries (Pomfret, 2013). Annual economic growth in the period 1991-2003 was 7.46% (Nguyen and Bui), reaching the peak in 2004-2007 at 7%-8% (ADB, 2014), and then decreasing slightly during the period 2008-2013 to 5%-6% according to World Bank Data. Vietnam also witnessed a rapid economic structure shift towards reducing the proportion of agriculture and rising the share of industry and services, with service industries making the biggest contribution to GDP growth (ADB, 2014). The development of services in general, and that of banking sector in particular have contributed much to the great performance of Vietnamese economy.

Realizing the important role of financial intermediation towards the development of Vietnamese economy in which capital and debt markets remain undeveloped and immature, the government and banking regulators made enormous amount of effort to develop a competitive and efficient banking system. The participation in international agreements, especially Vietnam's entry into US-Vietnam Bilateral Trade Agreement (BTA) and World Trade Organization (WTO), required (i) commercial banks to comply international regulations such as the Basel capital framework and the International Financial Reporting Standards (IFRS), and (ii) a level playing field in which domestic banks and foreign banks are equally treated. Therefore, since 1990s, a comprehensive series of reforms had been implemented with an aim to decentralize, privatize financial activities, strengthen bank capitalization and integrate banking system into the global financial systems. As a result, Vietnamese banking system has gradually evolved from a traditional monobank system of the central-planning period to a two-tiered system of today. The banking system has increasingly become more important. Total assets of banking system more than doubled between 2007 and 2010, increasing enormously from VND1,097 trillion (USD52.4 billion) to VND2,690 trillion (USD128.7 billion) according to IMF's data. Branches, transactions offices, ATMs, bank accounts and bank cards have been growing tremendously, with both deposits

and credits witnessing an impressive growth during period 2001-2010 (VPBank Securities, 2014). Although banking services have been developed and supervisory system have been formed to sustain the financial stability, promoting the performance of banking sector still remains an important concern for bank managers, banking supervisors and the Vietnamese government.

The performance of Vietnamese commercial banks is of research interest and policy relevance for several reasons. First, since capital markets are still in a developing stage, Vietnamese economy have primarily based on commercial banks system which acts as a direct capital distribution channel. In other word, more than two-thirds of domestic enterprises are being financed by the banking system. Therefore, performance of the banking industry is playing an essential role in economic growth and operation of industrial sectors. Second, because of reform policies that open local banking markets to foreign players and enhance financial capacity of domestic banks, Vietnamese banking sector have been witnessing the active involvement of foreign banks as well as the equitization process of state-owned banks over recent years. That increases the competitiveness level in banking industry, which requires domestic banks to focus more on their efficiency and improve their competitiveness among other foreign counterparts. Finally, as Vietnam are gradually experiencing a deep integration into globalization process, it is important to examine banking ability to compete and survive under different economic circumstances ranging from economic stability to global financial crisis. Therefore, for both managerial and policy concerns, it is of great importance to (i) understand the efficiency level of banking industry; (ii) determine which banking firms are likely to have less competitive capabilities than the others; and (iii) which factors could help banks to boost their operational performance.

While the performance of banking sectors has been investigated rather thoroughly in the U.S., Europe and Asian developing countries such as China, Philippines, Indonesia, Thailand, this topic still remains a rather new topic among Vietnamese literature studies. The majority of studies regarding to Vietnamese banking industry have only paid attention to either accounting performance proxy from financial statements (see Dinh, 2013; Bui, 2013) or economic performance – efficiency level (see Nguyen, 2007; Vu and Turnell, 2012; Ngo, 2010 and 2012; Nguyen, 2012; Nguyen et al., 2013a; Nguyen et al., 2013b; and Nahm and

Vu, 2013). However, it is believed that both accounting-based and economics-based performance should be examined to give a comprehensive picture of banking performance aspects to bank managers and regulators. In recent years, world-wide literature have combined aspects of both approaches. For example, Olson and Zoubi (2011), Maudos et al. (2002), Yildirim and Philippatos (2007) have examined the accounting-based correlates of economic efficiency measures and vice versa.

In light of the above discussion and following the recent strand banking performance literature, this paper studies both economic and accounting performance of Vietnamese banking industry. First, in terms of economic-based performance, the paper estimates the efficiency levels of Vietnamese commercial banks during the period 2006 – 2013 to determine whether the banking reforms bring more advantages to Vietnamese banking system. The study utilizes unbalanced panel data over seven years and employs the 'stochastic frontier approach' (SFA) to evaluate bank-specific efficiency relative to predictive input distance function. Additionally, to have more understanding about accounting-based banking performance, this study analyses the potential correlates of bank profitability by regressing the return on assets (ROA) on economics efficiency scores and other bank-specific, market structure and macroeconomic variables. The empirical results of study should be timely and helpful to policymakers in Vietnam, as well as to bank scholars.

There are five chapters in this paper. Chapter 2 provides a brief review of Vietnamese banking system since *Doi Moi* as well as Vietnam's economy during period 2006 – 2013. Chapter 3 discusses the existing literature on both bank efficiency and determinants of bank profitability. Chapter 4 describes bank efficiency estimation technique, methodology employed to assess determinants of bank profitability, and data collection. Chapter 5 presents empirical results and policy suggestions for bank managers and supervisors.

CHAPTER 2: THE VIETNAMESE BANKING SYSTEM

This chapter briefly reviews Vietnamese banking reforms since 1990s; the structure and the economic environment of Vietnamese banking system over the period 2006 – 2013.

2.1. Reforms in the Vietnamese banking sector

According to Leung (2009), a significant progress in socio-economic development had been witnessed since Doi Moi (Renovation)[1] which had two phases of political and economic reforms: Doi Moi I (1986-1996) and Doi Moi 2 (2001-2007). The success of Doi Moi was to transfer Vietnam from one of the poorest countries in the world, with per capita income below $100, to a lower middle income country with per capita income of $1,130 by the end of 2010 (World Bank, 2014a). Also, Doi Moi – a set of market-oriented reforms – brought early reforms to Vietnamese banking sector which focused on decentralizing, privatizing financial activities and strengthening bank capitalization (Ho and Baxter, 2011). The reforms of Vietnamese banking system had been partly motivated by (i) the establishment of Enterprises Law in 2000, the Unified Enterprises Law in 2005 (Leung, 2009), and (ii) Vietnam's entry into international trade and investment agreements, such as the U.S.-Vietnam Bilateral Trade Agreement (BTA) in 2001, WTO in 2007 (World Bank, 2002). Table 2.1 provides a summary of banking reforms since 1986.

[1] Doi Moi is a comprehensive reform package which includes various reforms from tax reform, price reform, agricultural reform, state-owned enterprise reform, to banking reform (Nahm and Vu, 2013).

Table 2.1 Highlights in the Vietnamese banking industry, 1986 – 2013

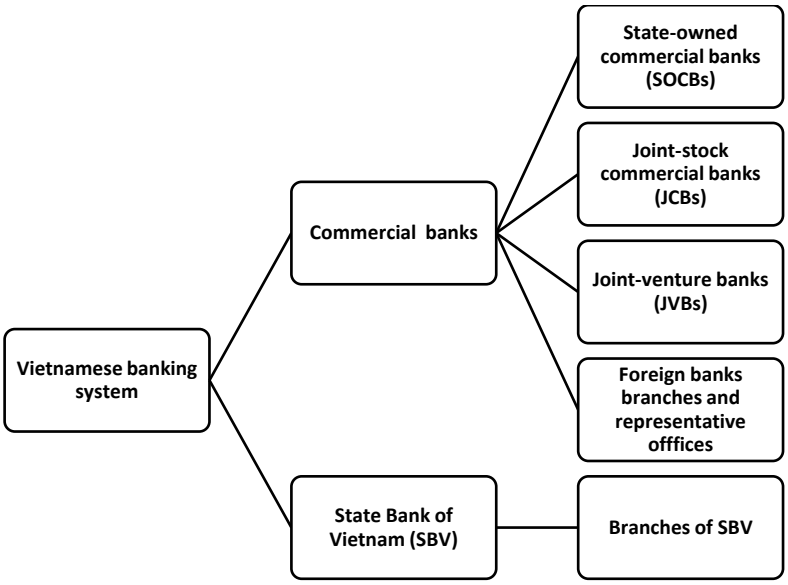
Year	Events
Prior to 1990	• Vietnamese financial system followed a mono-bank model. SBV acted as both a central bank and a commercial bank.
1990	• SBV issued 1990 Ordinance, introducing a two-tiered banking system. • SBV acted as a true central bank and devolved all its commercial bank activities to four new specialized state-owned banks: Agribank, VietcomBank, VietinBank and BIDV.
1991	• JSCBs have been permitted and foreign banks have been allowed to enter the market.
2001	• Vietnam's entry into US-Vietnam Bilateral Trade Agreement (BTA)
2004	• Government amended 1998 Law on Credit Institutions to comply with the term of US-Vietnam BTA • Vietnam must allow 100% US-owned subsidiary banks by 2010
2006	• Government issued Decree 22/2006/ND-CP specifying the requirements for establishing wholly foreign-owned banks and regulating the operation of foreign bank branches and joint venture banks • Government issued Decree 69/2007/ND-CP to equitize, or partially privatize, the SOCBs and reduce government ownership in these SOCBs to 51% by 2010 • Government issued Decree 141/2006/ND-CP that requires all banks have to hold at least 3 trillion VND (USD 143 million) in capital before 31 Dec 2010
2007	• Vietnam's entry into WTO (World Trade Organization)
2010	• SBV issued Circular 13/TT-NHNN that raises the minimum capital adequacy ratio from 8% to 9%
2011	• SBV extended the deadline of increasing minimum capital to at least 3 trillion VND to 31 Dec 2011 • Vietnam further leveled the playing field for foreign banks on Jan 1 2011 by granting foreign branches equal treatment as domestic banks, complying with its WTO commitments
2013	• The Vietnam Asset Management Company (VAMC) was set up in July 2013 with a mission to clean up non-performing loans (NPLs) of commercial banks

Note: Author's summary from two papers: Ho and Baxter (2011) and VPBank Securities (2014)

The first noticeable event with a purpose of decentralizing bank activities was the separation of the central bank's function and commercial bank's function of State Bank of Vietnam (SBV) (Nahm and Vu, 2013). With the establishment of two important Decrees in 1990s (i.e. Decree on the State Bank of Vietnam and Decree on Banks, Credit Cooperative and Financial Companies), banking sector was transformed from a 'mono' system (i.e. SBV operated as both central bank and commercial bank) to a two-tier system (Ngo, 2010). The commercial banking functions were devolved from SBV. The SBV delegated its commercial banking activities to four new state-owned commercial banks (SOCBs), with each SOCB operating in a specified sector of the economy (Nahm and Vu, 2013). The SBV was thereby free to serve as a true central bank with the narrowed roles including management of monetary policy, foreign exchange activities and supervision of credit institutions (Ho and Baxter, 2011). In terms of the first four SOCBs, these banks were limited to serve only their

designated sector of the economy, which was similar to the Chinese banking reform (see Berger, 2009)[2]. Vietnam Industrial and Commercial Bank (Vietinbank) is responsible for industrial and commercial lending sector; Vietnam Bank for Agriculture and Rural Development (Agribank) specializes in agriculture lending activities; Bank for Foreign Trade of Vietnam (Vietcombank) focuses on international trade sector; and finally, Bank for Investment and Development of Vietnam (BIDV) is in charge of infrastructure development projects (World Bank, 1995). The second event is that since 1991, the banking industry had developed rapidly with the permitted presence of joint-stock commercial banks (JSCBs) and foreign banks. However, foreign banks were restricted to certain kinds of banking activities, and they were also restricted to exist only under the form of joint-venture banks, foreign bank branches and representative offices (Fitch Ratings, 2002). Figure 2.1 presents the structure of Vietnamese two-tier banking system after May 1990.

Figure 2.1 Vietnamese two-tier banking system after May 1990



Source: Ngo (2012, p.5)

The Vietnamese banking system had continued to experience fundamental reforms since Vietnam (i) joined into international trade and investment agreements, with a major one being US-Vietnam Bilateral Trade Agreement (BTA) in 2001, and (ii) became the 150th

[2] Under reforms begun in 1978, four state-owned Chinese banks were established to serve only their designated sector of the economy: The Bank of China, China Construction Bank, Agricultural Bank of China, and Industrial and Commercial Bank of China. People's Bank of China which originally combined the roles of both central and commercial banking before 1978 was transformed into "a true central bank" and no longer had commercial bank's functions (Berger, 2009).

member of WTO in January 2007. As mentioned before, initially, since 1990s, foreign banks had been restricted to exist only under the form of joint-venture banks, foreign bank branches and representative offices. However, in 2004, the amendments of the 1998 Law on Credit Institutions required Vietnam to allow 100% U.S.-owned subsidiary banks by 2010[3]. Later, to comply with the terms of WTO, Vietnam also had to accept the establishment of wholly foreign-owned banks by investors from any country[4]. As a result, until now, foreign investors such as Citigroup, HSBC, ANZ Group have actively invested into Vietnam, creating a more competitive environment for Vietnamese commercial banks. In deed, foreign banks and domestic banks are now treated equally, permitted to provide the same banking services and under the same deposit and lending rules (Ho and Baxter, 2011).

Another significant change in Vietnamese banking system was the partial privatization of state-owned commercial banks. The idea of privatization program was motivated by (i) the poor performance of SOEs in general (Sjoholm, 2006) and SOCBs in particular, and (ii) the fact that these SOCBs served mainly as policy-lending banks for the government. Also, the entry into WTO of Vietnam required the reforms in banking sector to prepare its industry into a globally competitive market (Radies, 2010). The plan of the government was to reduce the state-owned capital percentage to 51% by 2010 (Federal Reserve Bank of San Francisco, 2008). Thus, the government issued a series of new Decrees to support SOCBs in their privatization process. According to Decree 69/2007/ND-CP on the Purchase by Foreign Investors of Share-holding in Vietnamese Commercial Banks, the maximum level over bank's chartered capital that a strategic foreign investor could possess in a domestic commercial bank, including SOCBs, increased from 10% to 15%. In addition, the highest level for non-strategic foreign investors and all other foreign investors were 10% and 5%, respectively. As stated in Article 12.4 of Decree 69/2007/ND-CP, Vietnam also required a foreign investors' commitment that is to assist domestic banks in developing banking products, improving technical and managerial efficiency. Examples of initial privatization steps of SOCBs are as follows. The successful initial public offering (IPO) of Vietcombank on 26/7/2007 was happened via Hochiminh Stock Exchange (HOSE), with 6.5% charter capital that equals to

[3] U.S.-Vietnam Trade Council

[4] Please refer to Decree 22/2006/ND-CP for more details. According to Article 7.6 and Article 8.2(b) of The Decree, foreign banks applying for a wholly foreign-owned banking license is required to have at least USD 20 Billion in assets and a single parent bank is required to own at least 50% of the new bank's capital.

VND 10.5 trillion (USD 652 million) being sold. Vietinbank became the second SOCB that successfully holds an IPO, selling 4% stake to private sectors for VND 1.1 trillion that is equivalent to USD 64 million (Nguyen, 2008). An additional 10% of Vietinbank's shares (USD 182 million) was sold to International Finance Corporation, which became its sole strategic foreign investor (Saigon Times, 2011). Finally, the equitization plan of Mekong Housing Bank (MHB) was approved in April 2010; and on the 20th of July 2011, MHB offered 17.74 million shares for IPO to 3,744 individual and institutional investors (Mekong Housing Bank, 2014). However, the partial privatizations of two remaining SOCBs are likely to be at very slow pace. Even though planning to sell its share since 2008, BIDV had to postponed the privatization twice, replanned to make IPO in December 2011 with about 22% of its chartered capital, 15% of which might go to foreign strategic partners (Stockbiz.vn, 2011). And by the end of 2011, only 3% of BIDV's stake was successfully sold to investor with the starting price VND18.500 per share (BIDV, 2011). In February 2009, the SBV approved a plan for Agribank to become a single-member limited liability company entirely under government ownership (VietFinanceNews, 2011); but, there had not been any evidence that the government-held shares are sold to private investors by the end of 2013. In Vietnam Development Partnership Forum held in December 2013, the Government showed commitment to privatization of SOEs in general and SOCBs in particular, and stated that the State will continue to sell its shares in the four largest SOCBs during the next two years (VPBank Securities, 2014).

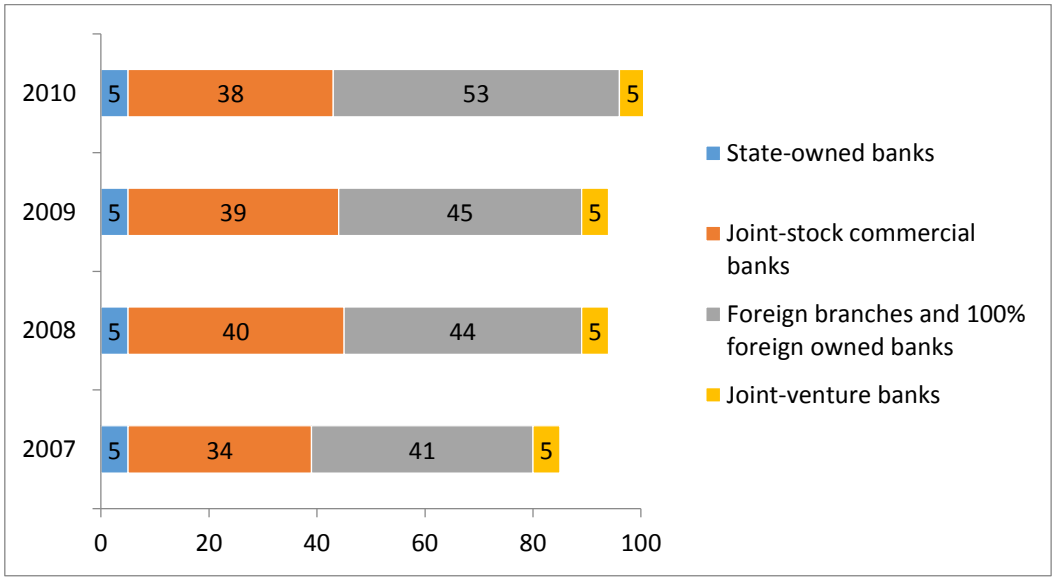
Another strategy of the banking regulators to strengthen and enhance financial capacity of Vietnamese banking system is to force commercial banks into increasing their regulated capital. First, as stated in Decree 141/2006/ND-CP, all commercial banks are required to hold at least VND3 Trillion (USD143 million) in capital by December 31, 2010 (the original amount was only VND70 Billion). Any commercial banks that could not meet the requirement would be forced to merged, or have its banking license revoked. This requirement was extended until December 31, 2011 according to Decree 10/2011/ND-CP due to the fact that by the end of the year 2010, there were 29 commercial banks out of 49 banks were unable to increase their capital to VND3 Trillion. Second, Circular 13/TT-NHNN issued by the SBV stated that effective from October 2010, capital adequacy ratio will increase from 8% to 9%. That effort of the SBV aimed to reform the local banking sector to

correspond to international bank regulation such as Basel II and Basel III capital framework, increase the strength of Vietnamese commercial banks that have been operating in a globally competitive market since 2007. Besides, the government focused to enhance internal strength of commercial banks. Specifically, IMF (2002) confirmed that reform programs aimed to replace and reorganize the management board operations, improve staff skill, strengthen the transparency to examine the true amount of non-performing loans (NPLs), increase profitability, reduce policy and non-commercial 'directed lending' from SOCBs.

2.2. Structure of the Vietnamese banking system

In general, according to Vietnam's Law on Credit Institutions – Law 47/2010/QH12, "Commercial banks are a type of credit institutions, which are established to conduct monetary business, provide payment services, and provide banking services in the form of receiving deposits and using those deposits to extent credits". Heavily regulated up since the 1990s, and thereby followed a deregulation since 2004, Vietnamese banking system witnessed a strong growth of financial institutions' network (VPBank Securities, 2014). The growth comprised two stages with the emergence of two bank groups. The 1990s was an era of JSCBs during which JSCBs had been permitted to enter the market. The liberation process in 2004 opened the way for foreign-owned banks that exists under the form of joint-venture banks, wholly foreign-owned banks or branches. In 2008, the two first 100% foreign owned banks were allowed to operate in Vietnam, HSBC and Standard Chartered Bank (Mai, 2013). At the end of 2013, there are 5 state-owned commercial banks (SOCBs), 34 joint-stock commercial banks (JSCBs), 4 joint-venture banks (JVBs), 5 100% foreign owned banks, 100 foreign bank branches and representative offices, 18 finance companies, 12 financial lease companies, and almost 1,100 cooperative credit funds (VPBank Securities, 2014). The following figure presents number of banks by types over period 2007-2010.

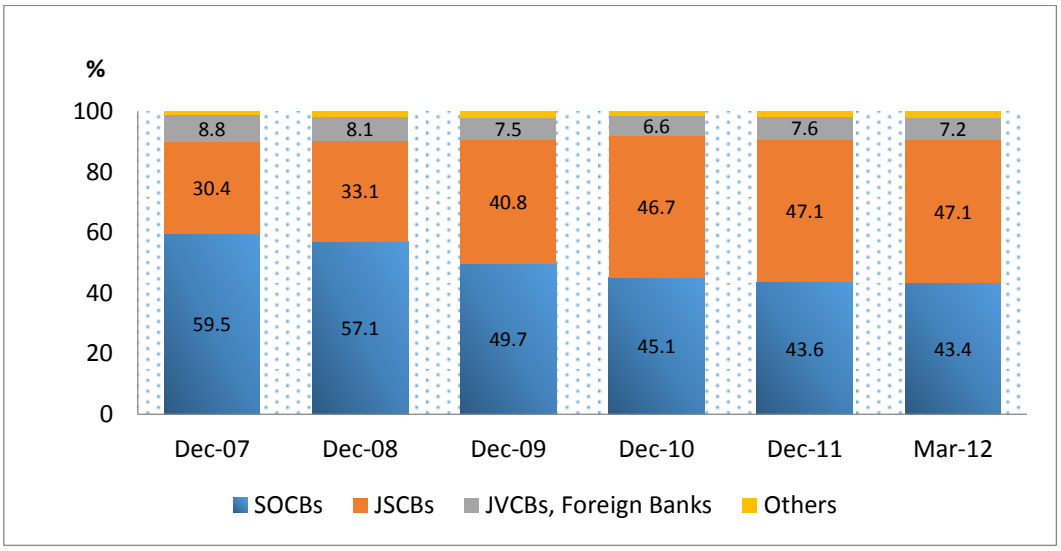
Figure 2.2 Number of banks by types, 2007 – 2010



Source: Mai (2013)

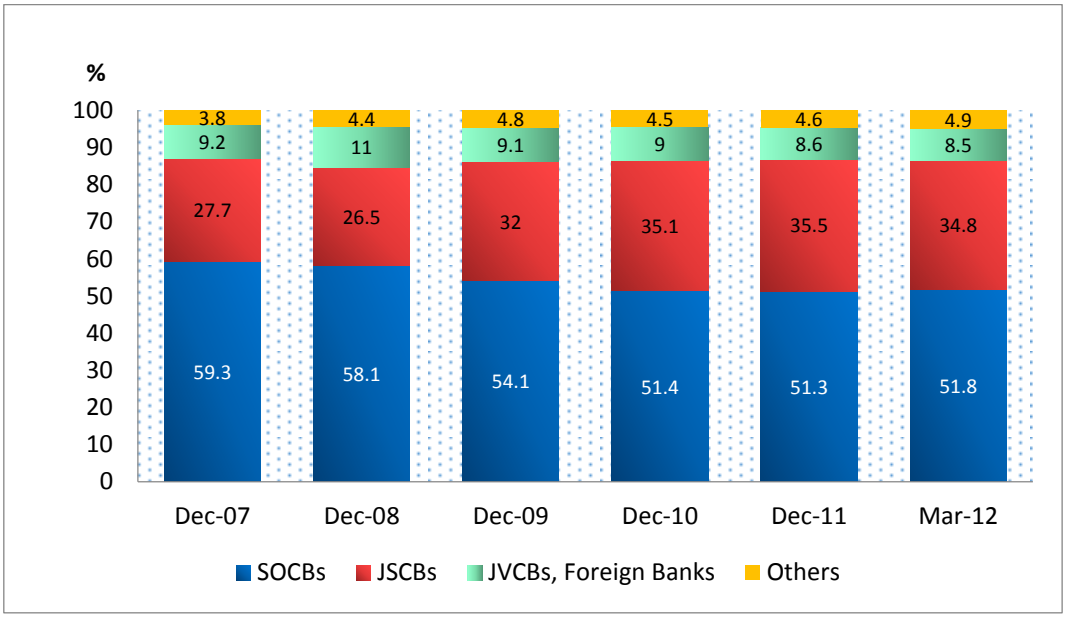
Overall, the Vietnamese banking system can be divided into three main competitive clusters: SOCBs, JSCBs and FOBs, with "SOCBs still leading the market although gradually losing share to JSCBs in both credit and deposit market" (Nahm and Vu, 2013). To exemplify, 5 SOCBs accounted for an excess of 45% of the total deposits and lending; however, these proportions of market shares witnessed an upward trend, as SOCBs gradually lost their market shares to JSCBs (Nguyen et al., 2013b). Figure 2.3 and 2.4 exhibit deposit market shares and credit market shares, respectively, of each banking group over the period from 2007 to 2012.

Figure 2.3 Deposit market share (%)



Source: VNEcoomy – The online Vietnam Economy Website

Figure 2.4 Credit market share (%)



Source: VNEconomy – The online Vietnam Economy Website

State-Owned Commercial Banks (SOCBs)

Currently, SOCBs include five banks: (i) Agribank, BIDV, Vietcombank, Vietinbank – four largest banks in Vietnamese banking system, and (ii) the fifth one, Mekong Housing Bank (MHB) which is much smaller and was more recently established in 1997 (VPBank Securities, 2014). Agribank is considered as a largest bank in terms of total assets, while Vietinbank is the largest bank with respect to capital. Generally, prior to 2000, the lending of SOEs was financed entirely by SOCBs so that the SOCBs were heavily exposed to non-performing loans of the SOEs when Asian financial crisis happened by the end of 20th century (Leung, 2009). Therefore, as mentioned before, the Vietnamese government planned to equitize SOCBs to enhance the competitiveness of domestic banks over foreign counterparts since 2006. However, the pace of this process has been quite low. To date, the State still owns the majority of stakes in these SOCBs. Agribank is currently the bank with highest level of state's ownership (100%) and the SBV announced that the government will hold this level of ownership in the next five years. As of 30 June 2013, the percentage of stake owned by Vietnamese government in BIDV, MHB, VCB and Vietinbank are 95.8%, 91%, 77.1% and 60.3%, respectively. Another distinguished characteristic of this bank group is that the majority of funding is still provided to projects specified by the government, although their

loan portfolio has been varied towards a more commercialized areas. For more details of state-owned banks, please refer to Appendix 1.

Joint-Stock Commercial Banks (JSCBs)

The second group JSCBs is considered as a bank group with the highest number of banks (34 commercial banks as at 31 December 2012). Compared to SOCBs, these JSCBs have much smaller amount of assets and charter capital. Over the period 2006-2013, more than half JSCBs are considered as small banks with average assets less than VND40 trillion according to Bankscope data. 50% of JSCBs have charter capital less than VND4 trillion and there are only 4 out of 34 banks[5] having capital greater than VND10 Trillion (VPBank Securities, 2014). However, this bank group is considered as the most dynamic competitors in the market due to the fact that they are holding more diversified lending portfolios and more commercialized than SOCB counterparts. Moreover, the increasing involvement of foreign investors in JSCBs (see, for example, An Binh Commercial Joint Stock Bank, Asia Commercial Joint-stock Bank, Vietnam Export Import Commercial Joint Stock Bank, Military Commercial Joint Stock Bank) enhanced the professionalism as well as the technology of joint-stock domestic banks. Another interesting note about JSCBs group is that this group experienced the most M&A transactions in the Vietnamese banking system. Prior to 2005, the existence of rural joint stock commercial banks was still very popular. These banks were operating in rural areas with small core deposits and limited banking services. Due to their small size, many of them were merger or acquired by larger JSCBs (see, for example, Rural Dong Thap JSCB, Chau Phu Bank, Dai Nam Bank, Cai San Bank, Thanh Thang Bank, Tay Do Rural Bank).

Foreign-Owned Banks (FOBs)

The third group is foreign-owned banks that include joint-venture banks (4 banks), foreign bank branches (50 branches), representative offices (50 offices) and foreign wholly-owned subsidiaries (5 banks) as at 31 December 2012. For more details of each bank type in this group, please refer to Appendix 1. First, the percentage of foreign involvement in the joint venture was limited to 49%. Thus, in the early 1990s, there were only foreign-owned banks under the category of joint-venture banks that are based on 50-50 ownership basis between

[5] These four banks are Vietnam Export Import Commercial Joint Stock Bank (Eximbank), Military Commercial Joint Stock Bank, Saigon Thuong Tin Commercial Joint-Stock Bank (Sacombank), Saigon Commercial Bank.

SOCBs and foreign banks. Second, the presence of foreign banks branches had not existed until 1999. The very first branches of foreign banks were Citibank Vietnam, Sumitomo Mitsui Bank, Deustche Bank, to name for a few. Until the year 2008, foreign banks marked a significant development in Vietnam, with the establishment of 5 wholly foreign-owned banks: ANZ, HSBC, Hong Leong Bank, Shinhan Bank and Standard Chartered. In addition, foreign investors actively and gradually have more investment in Vietnamese local banks by taking a stake in both SOCBs and JSCBs[6]. Outstanding examples of foreign investments during the period 2005 to 2012 include Mizuho Bank's purchase of about 15% ownership of Vietcombank (one of five SOCBs) in January 2011; a purchase of 10% and 19.73% stake in Vietinbank (the largest commercial bank in terms of capital) in 2011 and 2012 conducted by International Finance Corporation and Bank of Tokyo Mitsubishi UFJ (BTMU), respectively. In 2008, United Overseas Banks bought about 20% of Southern Joint Stock Commercial Bank, the largest level of controlling shares acquired by a foreign investor over period 2005-2012. A series of purchase transactions about 15% stake of JSCBs were finalized in 2007, 2008 and 2010 (see M&A transactions of Ocean Bank, Export Import Bank (Eximbank), An Binh Bank and Vietnam International Bank (VIB)). Other four JSCBs had also reached agreement with foreign investors, but with the level of stake less than 15%[7]. The growing involvement of foreign investors in Vietnamese banks was likely to bring more improvement to domestic banks in terms of their competitiveness and risk management capabilities (Ho and Baxter, 2011).

Gradually, restrictions on the entry and activities of foreign banks were relaxed. To exemplify, prior to 1994, foreign banks were restricted to operate only with foreign currency. After that, over the period 1994-2010, they were allowed to provide banking services in local currency, but with a restriction of local currency-dominated deposits less than 20% of their charter capital. Only until 2011, a level playing field between foreign banks and local banks was created, increasing the competition for the whole Vietnamese banking system (Nguyen et al., 2013b)

[6] Please refer to Appendix 2 for more details about M&A transactions in Vietnamese banking industry with foreign investors.

[7] These four commercial banks are: Asia Commercial Joint-stock Bank (ACB), Vietnam Technological and Commercial Joint-Stock Bank (TCB), Vietnam Prosperity Joint Stock Commercial Bank (VPBank), and Hanoi Building Commercial Joint Stock Bank (Habubank) that was acquired completely by Saigon-Hanoi commercial bank (SHB) in 2012.

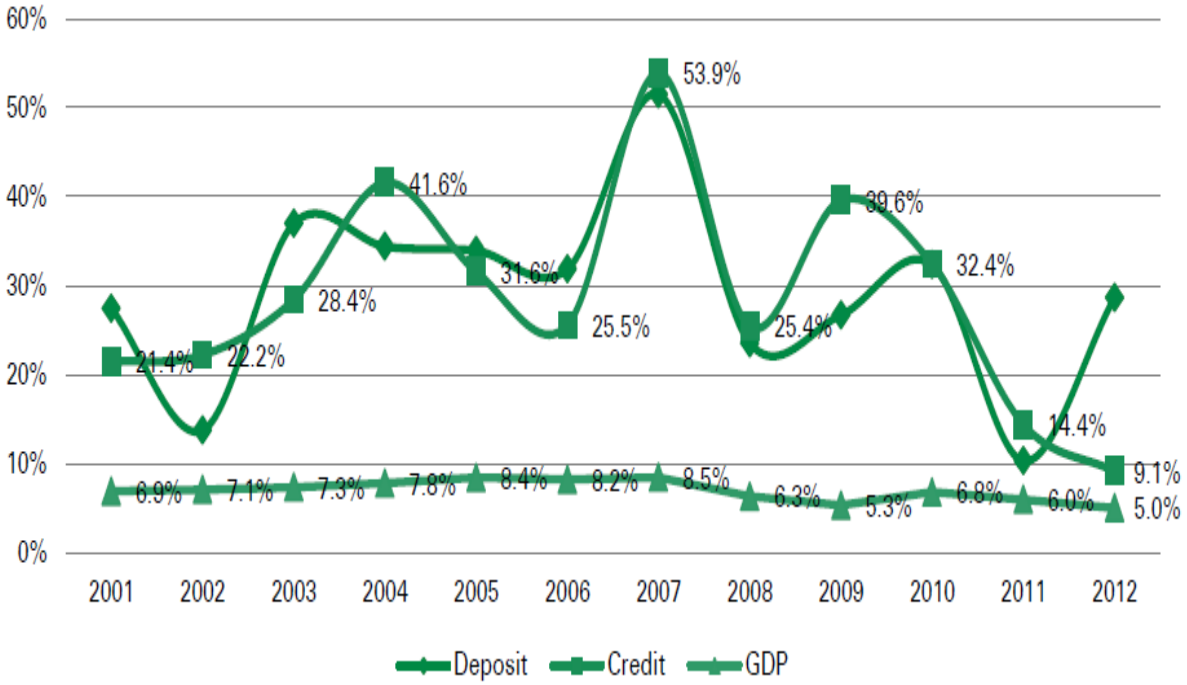
In conclusion, since Vietnam gained entry into international organizations (especially WTO), the government has attempted to liberate, recapitalize, and reform the Vietnamese commercial banks to achieve better performance banking system. From a banking system dominated by state-owned commercial banks and no presence of foreign banks, the Vietnamese banking system was transitioned into a more market-oriented industry with the participation of various types of banks including SOCBs, JSCBs and FOBs (Ho and Baxter, 2011).

2.3. The development of the Vietnamese banking system

Consistent with many emerging market, the reforms of Vietnamese banking system was followed by a development of not only in number of banking organizations, but also the size of banking industry, amount of banking services (deposits and lending) and technology (Ngo, 2012). First, from a mono-banking mechanism with only a state bank functioning as both a central and a commercial bank, Vietnamese banking network developed greatly with 150 banks and over 1,100 non-bank credit institutions in late 2013 (VPBank Securities, 2014). Second, total assets of banking system more than doubled between 2007 and 2010, increasing enormously from VND1,097 trillion (USD52.4 billion) to VND2,690 trillion (USD128.7 billion) according to IMF's data. Third, the ratio of deposits over GDP rose quickly from 78% in 2006 to 99% in 2007 before falling down to 92% in 2008, while bank lending as a percentage of GDP grew from 45% in 2002 to 93% in 2008. These figures indicate monetary deepening in the economy in the medium term (Leung, 2009). Moreover, as reported by VPBank Securities (2014), Vietnam banking system saw a substantial growth for not only deposits but also lending services (see Figure 2.5). The greatest growth was happened during 2002 – 2007, when the deposit growth rate and that of credit were recorded at 37.5% and 35.8%, respectively. The period from 2007 to 2012 still experienced an expansion of banking services, but at lower rates. Indeed in 2012, the growth of deposits and credits were about 30% and 9.1%. However, in the near future, it is believed that there are still great opportunities for the Vietnamese banking system to grow. This belief is originated from the fact that only 17% of the population hold bank accounts in 2009 (Moody, 2009). Therefore, banking services are becoming more common, with the number

of credit and debit cards experiencing a twofold growth over period 2008-2010 (Ho and Baxter, 2011).

Figure 2.5 Deposits and Credits Growth, 2001 – 2012



Source: VPBank Securities (2014, p.20)

Last but not least, e-banking application has risen very dramatically in the past 15 years since 2000. First adopted in 2001 by Asia Commercial Joint-Stock Bank, ATMs quickly became a common customer delivery channel in urban centres. The number of ATMs saw a huge increase from 1,800 in 2005 to 11,000 in 2010 (Vietnam Finance Banking New, 2010) and that of ATMs per 1,000km grew quickly from 2.72 in 2004 to 42.89 in 2010 (Ho and Baxter, 2011). Along with ATMs services, other technical innovations were introduced in the last ten years such as phone and internet banking which allows customers to use banking services from different locations and at any time. This was evidenced by the fact that in the first quarter of 2010, the non-cash and cash payment took up for 85% and 15% of payment revenue via banks, respectively (SBV, 2010). The increasingly deep involvement of technology in Vietnamese banking operations lowered the operating costs for commercial banks, improved their competitive advantage over other counterparts in Asian region and gained more customer loyalty.

2.4. The effects of financial crises on Vietnamese commercial banks from 2006 to 2013

Vietnamese banking system's operation is very much impacted by the macroeconomic conditions and also monetary policy monitored by SBV (VPBank Securities, 2014). Therefore, in this part, a brief review of financial crises that may have effects on macro environment, monetary policies and banking system will be presented.

From 2006 to 2013, the world experienced two financial crises including (i) global financial crisis (GFC) stemmed from the sub-prime mortgage market in the U.S. in 2007 and (ii) European sovereign debt crisis starting in 2010. Generally, as confirmed by Duane Morris Vietnam (2013), these global crises did not have direct impact on Vietnam economy (but had indirect impact in terms of trade, FDI, financial capital movement). This is because Vietnam did not deeply involve in global trade and had limited activities on international markets. During 2008, although GFC adversely affected the advance economies such as the U.S., the Eurozone, Japan[8], Asian developing countries including Vietnam only witnessed economic recession since early 2009 (SBV, 2009). As a result, Vietnam was still considered as a very stable economy in the year 2008 (Vu, 2011). Indeed, according to the Global Retail Development Index (GRDI) of A.T. Kearney, replacing the first position of India, Vietnam became the most attractive emerging market destination for retail investment. Moreover, thanks to flexible and timely management policy of SBV in 2008, Vietnamese banking system was likely to remain stable, and even had a relative growth (SBV, 2008). Specifically, the SBV maintained a tighten monetary policy to control inflation effectively and ensure the stability of macro-economy conditions from the beginning of the year, while monetary policy was loosened in the last six months. The SBV actively controlled the open market operations to stablize the money market and keep credit's liquidity under a reasonable level; reduced the reserve requirement ratios from 11% to 6% for local currency, and from 11% to 7% for foreign currency; conducted refinancing program for commercial banks to improve their financial capacity. Therefore, thanks to eight policy packages issued by the Government in April 2008, the macroeconomic was not likely to be affected. As a result, (i) the GDP growth rate was still at a relatively high level (i.e 6-7%) compared to other

[8] The U.S., the Eurozone, and Japan experienced a difficult year with average growth rates -0.15%, 0.75% and -0.3%, respectively.

counterparts in the Asian area; (ii) the inflation rate only rose in the first six months and then immediately decreased before reaching a negative number in the 4th quarter. Also, Vietnamese banking system witnessed a development of liquidity and capital mobilization of 20.31% and 22.87%, respectively, compared to the end of 2007. Credit growths of the SOCBs, JSCBs, FOBs were about 19%, 22% and 46%, respectively. Another positive sign of credit structure was that the percentage of credit for non-manufacturing sector decreased and financial resources were transferred more effectively into manufacturing and trading areas. However, 2009 witnessed the lagged effect of global financial crisis on Vietnamese economy. Reductions in demand for exports, foreign direct investment (FDI), and remittances caused a downturn in the Vietnam's economy. The inflow of FDI declined substantially from $64 billion of registered capital in 2008 to only around $10.4 billion in 2009. The financial crisis pushed three million people below the $2-a-day poverty line. The GDP growth rate in 2009 decreased to 5.39%, which is considered as the second lowest GDP growth in the last decade.

The second global financial crisis during period 2006-2013, namely European sovereign debt crisis, had negative impact on the Vietnam economy, but not much. Regarding trade sector, generally, Vietnam's trade with EU was not affected in the years 2010-2011. That was evidenced by the significant increase in terms of technology-intensive goods such as electronics and chemical goods thanks to competitive advantage of products as well as essential consumer products such as leather and shoes (Mai, 2012). However, since late 2011, when the EU debt crisis became worsen, Vietnam was vulnerable to slowing import demand growth in the EU (World Bank, 2012). In contrast, regarding capital sector, FDI inflows to Vietnam declined considerably from 2008 to 2012 due to large proportion of FDI in Vietnam stemmed from EU and deteriorated investment environment in Vietnam (Mai, 2012). Even though macroeconomic conditions were slightly affected (i.e. low GDP growth 5.25%; inflation: 6.81%), the Vietnamese banking system still recorded a relative growth in 2012. Specifically, the amount of chartered capital increased by 11% which equals to VND392,000 Billion, liquidity risk decreased dramatically, total liquidity developments and fund mobilization respectively increased by 18.5% and 17.9%, but much lower compared to previous years, particularly the year 2011 (SBV, 2012).

CHAPTER 3: LITERATURE REVIEW

This chapter represents both literature reviews of two stages that will be analysed in this paper: (i) the first stage to estimate technical efficiency for individual banks over 2006-2013 and (ii) the second stage to investigate the relationship between Vietnamese bank profitability and potential determinants.

3.1. Literature review of banking efficiency studies

Productivity and technical efficiency are important topics for the growth of any firms that are producing goods or operating in service industries. Production frontier that defines the relationship between the input and output and reflects current state of technology can be used to assess whether a firm is technically efficient or not (i.e. firm operates on or beneath the production frontier) (Coelli et al., 1998). A firm that is technically efficient would still be able to improve its productivity by exploiting scale economies. However, changing scale of operation of a firm may be difficult to achieve quickly. Thus, technical efficiency and scale efficiency can be considered as short-run and long-run interpretations, respectively (Coelli et al., 1998). While scale efficiency assesses whether banks with similar management and production technology are operating at optimal economies of scale, technical efficiency measures the efficiency with which banks employ their inputs to produce a given quantity of outputs or a given bundle of inputs to produce output.

Early studies estimated banking efficiency through examining economies of scale that can achieved from an improved division of labor, specialization in larger banks, and/or risk diversification (Deng, 2012). For instance, Benston et al. (1982) concluded that the very small and large unit banks could have inefficient scale operation (i.e. diseconomies of scale). Early studies on European banking markets realized little improved performance obtained through mergers due to overextended branch networks (e.g. Revell, 1987). In contrast, Lambson (1987) argued that a bank that fully exploiting economies of scale will have lower costs, and then higher profits. The same result was found in the study of Hughes and Mester (1998) who reported a positive relationship between size and economies of scale. However, Pastor et al. (1997) confirmed that costs would be reduced more easily through increasing existing technical efficiency than extending the size to an “adequate” scale. Further more,

according to McAllister and McManus (1993), there are several pitfalls of scale efficiency assessment. First, applying a translog cost function to all banks regardless of their size forces both small and large banks to lie on a symmetric upward sloping average cost curve, which would not be appropriate. Second, most studies do not use a frontier estimation method. Consequently, the use of data of banks that does not lie on the frontier could confound scales efficiency. Therefore, technical efficiency is considered as a more important factor relative to scale efficiency to examine efficiency of individual banks (Deng, 2012). And this paper will only focus on technical efficiency rather than scale efficiency.[9]

3.1.1. Efficiency studies across countries

The technical efficiency of commercial banks has been an appealed subject of banking literature since the 1990s[10]. Starting as a trend of research in the U.S., efficiency topic is now considered as an international subject (Zhang and Matthews, 2012). Researchers has examined the bank efficiency of not only single countries but also cross-countries. Several studies on the U.S. banking include Rogers (1998), Berger and DeYoung (2001), Berger and Mester (1997, 2003), among others. Specifically, Berger and Mester (1997) examined cost and profit efficiencies of 5,949 U.S. banks over the period 1990-1995. They found that, on average, cost and profit efficiencies of U.S commercial banks were 86% and 50%, respectively. Berger and Deyoung (2001) assessed the impact of geographical expansion on the U.S bank efficiency. They reported that small banks can improve their efficiency when they operated globally. Later studies were conducted on European countries (e.g. Lozano-Vivas et al., 2002; Vennet, 2002; Maudos et al., 2002) and then expanded to Asian regions (e.g. Drake et al., 2006; Sufian, 2007, 2009). In terms of European banking literature, Maudos et al. (2002) tried to find the difference between cost and profit efficiencies of banks in ten European countries including Austria, Belgium, Finland, France, Germany, Italy, Luxembourg, Portugal, Spain and the UK. It was founded that profit efficiency is lower than cost efficiency. However, the variation of the former is greater than that of the latter. Vennet (2002) also researched both cost and profit efficiency. Lozano-Vivas et al. (2002) studied technical efficiency across 10 countries by applying DEA model incorporating (i) only

[9] From this point to the end of the paper, the terminology "efficiency" will be used to indicate "technical efficiency"

[10] There was a special issue of the Journal of Banking and Finance (1993) on the financial institutions efficiency research.

banking variables and (ii) both environmental factors and banking variables. They confirmed that environmental conditions of individual countries exert a great influence on banking efficiency. With regard to Asian studies, Drake et al. (2006) incorporated environmental factors into the technical efficiency analysis of Hong Kong banking system and found relative high scores of technical inefficiency, significant variations in efficiency level across different bank size groups, and different impact of macroeconomic factors on different bank groups. Sufian (2007) found overall efficiency scores of Singaporean banking group over the period 1993 -2003 at 88.4%. Moreover, his research in the year 2009 investigated efficiency of Malaysian banking sector around Asian financial crisis 1997. Sufian (2009) found a high degree of inefficiency, especially a year after the East Asian Crisis.

3.1.2. Different techniques in efficiency studies

In terms of technique employed, a majority of studies examining efficiency apply either parametric techniques (see Rogers, 1998; Berger and Mester, 1997, 2003; Berger and DeYoung, 2001; Fu and Heffernan, 2005; Maudos et al., 2002) and/or non-parametric approaches (see Maudos and Pastor, 2003; Chen et al., 2005). On one hand, the parametric methods involve the estimation of an economic function and the derivation efficiency levels from either the residuals or dummy variables. On the other hand, in non-parametric methods, an objective function envelops the observed data, and efficiency scores are generated by measuring how far an observation is positioned from the frontier.

Until now, there remains no consensus among the researchers on the estimation technique that generate the most accurate efficiency estimates (Zhang and Matthews, 2012). To be more specific, first, the parametric approach, such as stochastic frontier analysis (SFA), specifies a functional form and allows for random errors which follow a symmetric normal distribution, while the inefficiencies follow a truncated distribution. However, this approach is exposed to several problems: potentially poor estimates for banking data (see McAllister & McManus, 1993); missepcification of the functional form; and potential multicollinearity (Zhang and Matthews, 2012). Second, even though the non-parametric method, such as Data Envelopment Analysis (DEA), does not require a specified form of the underlying production relationship, it is still criticized by the following reasons. DEA causes slower convergence rates that could lead to an inconsistency (especially when a firm has multiple

inputs and outputs), requires larger data samples. Also, DEA does not take errors due to chance, measurement errors, environmental differences into account, as it assumes that all deviations are inefficiency. In conclusion, each approach (parametric or non-parametric approach) has its own advantages and disadvantages However, it is likely that parametric approaches have received increasing attention from researchers among over the last two decades (Yildirim and Philippatos, 2007). The survey of 130 efficiency studies in 21 countries that conducted by Berger and Humphrey (1997) shows that about more than 52% percent of studies prefered parametric approaches over non-parametric approaches in measuring the financial institutions efficiency. In addition, SFA (a popular method of parametric approaches) is considered as much better than non-parametric frontiers because it allows researchers to distinguish between inefficiency and any shocks to production or cost, (Yildirim and Philippatos, 2007).

3.1.3. Incorporating environmental factors into efficiency studies

One another important thing of efficiency studies is on-going debate over whether we should incorporate the potential impact of environmental, economic and regulatory factors on bank efficiencies or not. It has been believed that exogenous environmental factors could considerably affect efficiency levels of commercial banks (Berger and Humphrey, 1997). For example, Zaim (1995) and Bhattacharya et al. (1997) found an improvement of banking efficiency thanks to financial liberation in Turkish and India, respectively. The effects of external variables on efficiency levels may eventually lead to a biased efficiency scores (Drake et al., 2006). Therefore, recently, both parametric and non-parametric studies have taken environmental factors into consideration, especially after the regional/global financial crisis or in case the country experienced significant banking reforms (Deng, 2012). In respect of parametric studies, Dietsch and Lozano-Vivas (2000) realized that the common frontier estimates that neglect country-specific variables generate overestimated inefficiency levels. Therefore, when comparing efficiency levels of banking industry across two countries French and Spanish by a distribution-free parametric approach, they incorporated both regulatory and economic variables in to cost frontier estimations. Other studies such as Berger and Mester (2003) and Chaffai et al. (2001) believed that external variables have direct effects on production/cost frontiers, thus assumed that each bank should have a different frontier. With regard to non-parametric studies, among others,

Lozano-Vivas et al. (2002) incorporated a set of environmental variables directly into the "basic" DEA model to standardize the environmental conditions, while Drake et al. (2006) incorporated the operating environment into the innovative slacks-based model.

3.1.4. Efficiency across different bank groups

Existing studies have also focused to examine whether there is any difference in efficiency level between different size groups and bank ownership groups. In terms of the relationship between bank size and efficiency, empirical findings are mixed. Some studies report a significant positive relationship (e.g. Hasan and Marton, 2000; Chen et al., 2005), while others confirm a negative relationship (e.g. Isik and Hassan, 2002; Girardone et al., 2004). Some studies find no relationship between size and efficiency (e.g. Berger and Mester, 1997; Pi and Timme, 1993). With regard to the effect of bank ownership on efficiency, previous studies report a contradicting results between advanced and developing banking markets. The efficiency of domestic banks is found to be higher than that of foreign-owned counterparts (Berger et al., 2000b). In contrast, in emerging market, on average, foreign banks are generally more efficient or roughly equally efficient relative to domestic private banks (see Hasan and Marton, 2000; Isik and Hassan, 2002 study Hungarian and Turkish banks, respectively). In addition, some studies in developing countries find that both groups operate with higher level of efficiency compared to state-owned commercial banks (see Berger et al., 2004; Delfino, 2003; Berger et al., 2005). However, the opposite result, that is, state-owned banks are more efficient than foreigned-owned and domestic private banks is found on studies of Chen et al. (2005), Bhattacharya et al. (1997), to name for a few. Researchers compare efficiency of different groups and/or used regression methods including OLS, Logistic and censored regression to assess whether differences in size and ownership significantly influence bank efficiency (see, for instance, Ariff and Can, 2008; Yildirim and Philippatos, 2007; Zhang and Matthews, 2012). However, due to limited time and length, this study will only present a comparison of efficiency between different groups and do not employ the regression model.

3.1.5. Efficiency studies in Vietnam

To date studies examining the efficiency of Vietnamese banking system have been relatively few, with the majority of studies using non-parametric approaches. Nguyen (2007) applied DEA approach to measure efficiency of 13 commercial banks during the period 2001-2003 and found that Vietnamese banks performed under inefficiency in both allocative (regulatory) and technical (managerial capacity). However, over the period 2001-2003, there was an improvement of total factor productivity (TFP) which was mainly contributed by technical enhancement. Other paper Nguyen et al. (2013a) used non-parametric, slacks-based DEA to calculate and compare efficiency of 32 commercial banks in Vietnam during 2001-2005. They found that the average efficiency scores for all banks in the whole studied period was 78.7% and concluded that "there would be a room for these banks to improve their production efficiency". In addition, efficiencies of 22 Vietnamese commercial banks in the year of 2008 were estimated by Ngo (2010). It was found that the average efficiency score of all banks under constant returns to scale was 91.7%, with the most inefficient bank being An Binh Commercial Joint Stock Bank (79.4%). Nonetheless, he believed that those banks could still increase their efficiency. Another study of Ngo (2012) employed DEA window analysis to assess efficiency of 21 commercial banks from 1990 to 2010. He found a decrease in Vietnamese banks' performance due to the expansion as well as the liberation of banking system. Nguyen (2012) also used DEA method to analyse the efficiencies of 20 commercial banks over the period 2007-2010. She reported an increase in efficiency level of Vietnamese banks from 70% in 2007 to 81.8% in 2010. Interestingly, she found that the efficiency of private banks (JSCBs) was greater than that of state-owned commercial banks (SOCBs) (78.3% in comparison with 63%). Her result is consistent with the common findings in developing countries (Ariff and Can, 2008). Only two studies used parametric methods. The first study of Vu and Turnell (2012) introduced a new parametric method – hyperbolic distance function – to estimate both technical change and scale efficiency of banking industry over 2000-2006, and found that Vietnamese commercial banks saw a modest productivity growth. They also confirmed that foreign-owned banks (FOBs) had the highest productivity growth, followed by JSCBs and SOCBs. The most recent study Nahm and Vu (2013) introduced a new approach to measure profit efficiency of Vietnamese commercial banks during 2000-2006 by applying a newly developed index approach which is based on

the directional distance function. Their findings indicated (i) a high inefficiency level of Vietnamese banks which was mainly stemmed from allocative inefficiency rather than technical efficiency, (ii) a modest productivity growth in Vietnamese banking industry, and (iii) SOCBs were more profit efficient than FOBs and JSCBs.

Overall, even though academic research has paid attention to assess the efficiency of Vietnamese commercial banks, literature of banking efficiency in Vietnam still has several limitations. First, these studies are limited to specific kinds of approaches including a non-parametric method DEA, a hyperbolic distance function and an index approach, with the majority using non-parametric method (DEA). Second, only a small sample size of commercial banks are investigated. Third, none has broadened the studied period to the most recent years (i.e. the period from 2011 until now) and has incorporated potential impact of environmental variables on banking efficiencies. Therefore, this paper will employ a parametric approach with a comprehensive set of samples (45 banks) covering the most recent period (2006-2013) and add external variables to the functional form equation. This study makes several contributions in terms of efficiency study. To our knowledge, it is the first study of Vietnamese bank efficiency to incorporate environmental factors into stochastic frontier analysis (SFA) with input distance function, allowing us to diversify the methodological choices for researchers and examine whether conclusions of previous studies hold if parametric methods are used. Second, this paper creates a base for us to compare our results estimated from parametric approach with the results generated from existing studies using non-parametric approaches.

3.2. Literature review of banking profitability's determinants studies

3.2.1. Hypotheses relating to bank profitability

In the banking literature, analysis of bank profitability's determinants can be conducted for either banking industry of cross-countries or individual countries' banking system of advanced economy and/or emerging market[11]. In general, the majority of researchers measure accounting bank performance by either return on equity (ROE) or return on assets

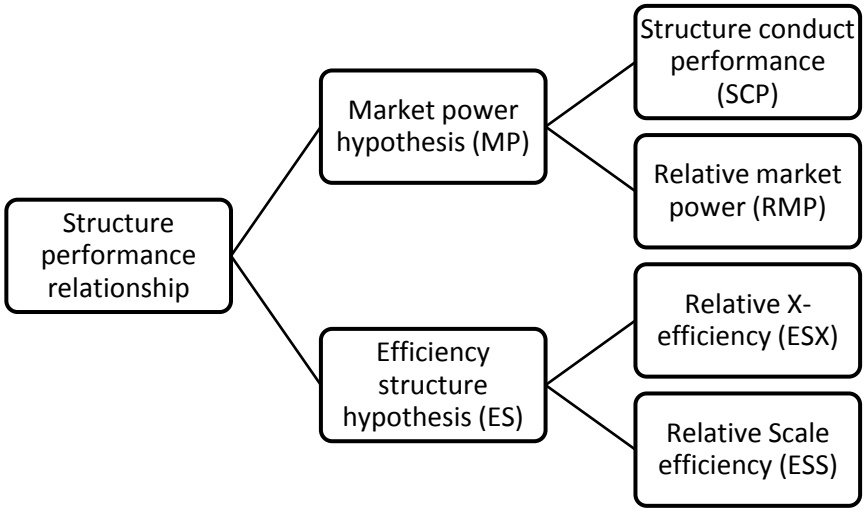
[11] In terms of single country analysis, for example, please refer to Kosmidou (2008) – Greek; Williams (2003) – Australia; Kosmidou et al. (2005) – UK; Sufian and Chong (2008) – Philippines; Sufian and Habibullah (2009) – China. For multinational research, please see Short (1979), Bourke (1989), Molyneux and Thornton (1992), Demirguc-Kunt and Huizinga (1999), Goddard et al. (2004), Athanasoglou et al. (2006), Pasiouras and Kosmidou (2007), Flamini et al. (2009).

(ROA) (Olson and Zoubi, 2011). Also, bank performance is usually explained by three different types of factors: bank-specific determinants (internal factors), industry-specific determinants and macro-environmental determinants (external factors) (Athanasoglou et al., 2005). Although bank profitability can be affected by various types of variables depending on each country, the general hypotheses relating to bank profits are presented below.

Market concentration, market share, efficiency and bank profitability

Two main hypotheses of early banking profitability literature include the market-power (MP) and the efficient-structure (ES) hypotheses.

Figure 3.1 Structure performance hypotheses



Source: Berger (1995a)

The MP hypothesis consists of the structure-conduct-performance (SCP) hypothesis and the relative-market-power (RMP) hypothesis. First, SCP paradigm argues that the causation flows mainly in one direction, from structure, which is assumed to be exogenously determined, to conduct performance. In other words, SCP hypothesis states that in highly concentrated market, banks would create collusion (explicit or tacit) and enjoy lower costs through the setting of higher rates charged on loans and fee, lower rates paid on deposits. Thus, it is expected to have a positive relationship between market concentration and bank profitability. However, in contrast to SCP paradigm, Boone and Weigand (2000) argue that market concentration can be negatively related to bank performance because higher bank concentration might lead to a tougher competition in the banking industry. Previous studies that find a negative relationship between market concentration and bank profitability are

studies of Ben Naceur (2003), Staikouras and Wood (2004). Second, RMP hypothesis states that only banks with large market share and well-differentiated products are able to employ market power in pricing policy (Shepherd, 1982). RMP sees any benefit from the banks' market share, or there is a positive relationship between market share and performance.

The ES paradigm includes relative X-efficiency hypothesis (ESX) and relative scale-efficiency (ESS). According to ESX hypothesis, more technical efficient banks (due to superior management and/or better technology) can reduce operating costs, thus increasing their profits. ESS hypothesis states that under the same management skills and production technology, banks operating at optimal economies of scale will have lower costs and higher profits (Lambson, 1987). Such firms (i.e. more technical efficient banks or banks operating at optimal scale) are likely to gain larger market share, which may lead to higher market concentration, but without any causal relationship from concentration to profitability. Therefore, in case increased market concentration is a result of the fact that more efficient banks gaining more market share, there would be no significant relationship between concentration and profitability.

With regard to empirical findings, the relationship between market concentration**,** market share, efficiency and bank profitability has become an interest of research since 1990s. Using data from 1986 to 1989 across 18 European countries, Molyneux and Thornton (1992) found a positive association between ROE and bank concentration. Smirlock (1985) examined US bank profitability from 1973 to 1978 and found a positive relationship between profitability and market share, but an insignificant relationship between profitability and concentration. Similarly, Berger (1995a) who developed four hypotheses of market power and efficiency found that profitability is positively correlated with market share and X-efficiency. In emerging market, study of Thailand banking system during the period 1995 – 2000, Chantapong (2005) explored that the profitability of foreign banks is higher than that of domestic banks thanks to advanced technology producing services.

Risk management and bank profitability

Another concern of profitability research is to examine whether risk management has impact on bank profitability. Several indicators of risk management include capital adequacy ratio, liquidity ratio and credit risk ratio. The effect of capitalization on bank profitability is

not clear. On one hand, banks with lower capital ratio could indicate that they are pursuing a risky investment strategy. Therefore, it is expected to have a negative relationship between capital ratio and bank profits (Berger, 1995b). On the other hand, there are several reasons that explain the positive relationship between capitalization and bank profitability. First, high level of capital to assets ratio signifies that banks follow a prudent lending policy. Second, banks with higher capital ratio would (i) send a positive signal to outsiders, increase the creditworthiness (Molyneux, 1993); (ii) borrow less in order to finance their assets; and (iii) increase expected earning by reducing the expected bankruptcy cost (Berger, 1995b); which eventually lead to an increase of profitability. With regard to empirical research, using data from 1972 to 1981, Bourke (1989) examined top 500 banks in the world in 1980 and found a positive relationship between capital ratio and profitability. Similar result was found in recent studies such as: (i) Goddard et al. (2004) used cross-sectional and dynamic panel data during 1990s over 6 European countries; and (ii) Kosmidou et al. (2007) examined determinants of performance of UK banks during the period 1995 – 2002.

In the banking literature, researchers include liquidity ratio as an independent variable to test its impact on bank profitability. Banks with high portion of liquid assets could have informational advantages, which is likely to reduce intermediation costs and improve profitability (Freixas, 2005). The empirical result of Molyneux and Thornton (1992)'s study is an evidence supporting for this argument. However, Rhoades (1985) with an analysis of US banking from 1969 to 1978 found that profitability is positively related to liquidity risk (i.e. banks with lower portion of liquid assets have lower profitability). This can be explained by the fact that holding a high level of liquidity (i.e. high portion of liquid assets), banks will be limited to profitable investments and unlikely to earn high profits. Managers would accept a lower return on equity due to the less exposure to risks.

The impact of credit risk on bank profitability would be tested by examining the relationship between the ratio of loan loss reserves to gross loan and profitability (LORES)[12] (see Kosmidou, 2008). This ratio is a measure of banks' assets quality and risk. The higher the

[12] Another measure of credit risk used in previous studies is the ratio of impaired loan to total loans. For recent examples, see Valverde and Fernandez (2007) who found a negative relationship between bank profitability and the ratio of loan defaults to total loan; Uchida and Nakagawa (2007) found the same result in Japanese banking system due to irrational herding in banks' lending decision prior to the onset of the banking crisis in the 1990s.

ratio means the poorer the quality of assets, and then the higher the credit risk of loan portfolio. On one hand, credit risk can have a positive impact on bank profitability according to risk-return hypothesis (i.e. the poorer the bank's asset quality, the higher rate charged, the higher return for banks) (see Dietrich and Wanzenried, 2011). On the other hand, bank performance would be negatively affected by poor asset quality due to increased provisions costs that cause decreased interest income. Kosmidou et al. (2007) reported a negative relationship between bank profitability and credit risk (i.e. the ratio of loan loss reserves to gross loans).

Business cycle and bank profitability

One more interesting issue is to determine to what extent bank profitability relate to the business cycle. There are several reasons suggested by Athanasoglou et al. (2005) why bank profitability may be procyclical. First, a business downturn is always associated with an increase in the risk of business loans. As a result, banks tend to overestimate credit risk, and thus become less forthcoming in expanding loans, which reinforcing the cyclical slowdown of the economy (also suggested by Bikker and Hu, 2002). Second, banks tend to hold more provisions due to the decreased quality of loans, and regulated capital requirement could also have a tendency to increase. Third, demand for credit and stock market transactions would be deteriorated during economic downturns, reducing bank profits. The opposite may hold true during economic booms. Empirical studies used different variables to measure the business cycle, and therefore, found different results of the existence of the correlation between business cycle and profits. For example, Demirguc-Kunt and Huizinga (1999) employed the annual GDP growth rate and GNP per capita to analyse such a relationship across 80 countries, but found no effect of GDP growth on profits. In contrast, utilizing GDP and unemployment rate variables, Bikker and Hu (2002) found respectively a positive and negative correlation with bank profitability.

In addition to three main above-mentioned hypotheses, there are other hypotheses relating to bank profitability that have an influence on the variables researchers choose in their model. First, size is believed to have a great impact on bank profitability because large firms are able to realize economies of scale and reduce the cost of collecting and analyzing information (Demirguc-Kunt and Huizinga, 1999; Dietrich and Wanzenried, 2011). However,

Berger et al. (1987) reported only a minimal cost reduction through expanding firms' size, while Pasiouras and Kosmidou (2007) found a negative relationship between bank profitability and size due to increased agency cost, complicated bureaucratic processes, and other costs relating to manage a large firm. Therefore, the effect of size on bank profits is not consistent. Second, besides traditional retail banks services, banks are increasingly involving non-traditional activities such as investment banking services, insurance underwriting and assets management. These activities are belived to bring more profits to banks. This is the reason why several previous studies examined the relationship between diversification and bank performance (see Liu and Wilson, 2010; Lepetit et al.,2008; Goddard et al., 2004).

In summary, although the empirical studies use different data sets and different variables, the majority of bank profitability studies focus on the analysis of the relationship between bank profitability and (i) micro-specific factors such as capital adequacy, liquidity risk, credit risk, market share, operational efficiency; (ii) macro-specific factors such as characteristic of banking industry concentration, the development of banking industry, and the scenario of the overall economy.

3.2.2. Different techniques in bank profitability's determinants studies

With regard to techniques used in regression model, a various types of techniques are employed by researchers such as: simple ordinary least square; generalized least square; weighted least square; panel techniques including fixed or random effects model, generalized method of moments (GMM). For example, Angbazo (1997) employed generalized least square; Demirguc-Kunt and Huizinga (1999) used weighted least square; Maudos and Fernandez de Guevava (2004) and Clays and Rennet (2005), respectively, applied fixed effects and random effects model. In general, empirical studies on bank performance's determinants may suffer from three severe problems: highly perisistent profit, endogeneity bias and unobserved heterogeneity across banks (Poghosyan and Hesse, 2009), which can lead to a potentially biased and inconsistent estimation obtained through least square method (Baltagi, 2001). Therefore, researchers are likely to prefer panel techniques over least square when examining accounting-based bank performance (Olson

and Zoubi, 2011). Among up-to-date panel techniques, using GMM system estimator is considered as a much better choice than other techniques to solve problems of (i) bank profitability's persistence, (ii) potential endogeneity and (iii) unobserved heterogenity across banks (Ameur and Mhiri, 2013). Studies in this genre include Baum and Schaffer (2003), Annacker and Hildebrandt (2004), Hoffman (2011), Ameur and Mhiri (2013).

3.2.3. Bank profitability's determinants studies in Vietnam

The current trend in analysing Vietnamese banking industry is limited to measure technical efficiency and find its determinants by using Tobit regression (e.g. Nguyen et al., 2013a; Ngo, 2012). Vietnamese researchers seem to pay more attention into economic performance rather than accounting performance. Therefore, in terms of Vietnamese studies of bank profitability's determinants, very few research investigate determinants of profitability. Until now, Dinh (2013) examined determinants of bank profitability of 51 commercial banks operating in Vietnam from 2000 to 2012. She divided her samples into two main groups including foreign banks and domestic banks and made a comparison of performance between these groups. Regarding to domestic banks, the ratio of equity to total assets and loan to total assets had a significant positive relationship with interest margin. Loan loss provision negatively related to interest margin of domestic banks, but did not impact that of foreign banks. She found that total assets and other income had positive influence on foreign bank performance, while parent bank profitability had negative impacts on its profitability. Another study was conducted by Bui (2013) who used data from 33 commercial banks over period 2007-2011. He found that there was no relationship between bank profitability and bank size or liquidity ratios. By using a dummy variable of ownership, SOCBs were found to have more profits than JSCBs. Another distinguished characteristic of Vietnamese banking profitability research is that these studies only utilize basic technique – fixed effects model – rather than advanced technique introduced in the worldwide literature review – GMM.

CHAPTER 4: METHODOLOGY AND DATA

This study adopts a two-step research design. In the first stage, a stochastic parametric input distance function as described by Coelli and Perelman (1999) is employed to estimate efficiency for individual banks in the sample. In the second stage, the profitability ratio of banks is used as a dependent variable, while the estimates of bank efficiency drawn from the first step along with macroeconomic, industry-specific and bank-specific variables are used as independent variables in regression model with method of two-step system GMM (Generalized Method of Moments). The objective of this paper is twofold. First, it assesses the technical efficiency through a period of time from 2006 to 2013 and investigates whether there is any considerable difference in efficiency levels across ownership and size groups. Second, this study examines the effect of possible factors including internal characteristics of banks and environmental factors on bank profitability with a purpose of finding policy suggestions for improvement.

4.1. Bank efficiency estimation methodology

4.1.1. Estimation technique

Among bank efficiency studies, as mentioned above, the efficiency measurement techniques are based on either parametric or non-parametric frontiers, with stochastic frontier approach (SFA) – a parametric method and data envelopment analysis (DEA), a non-parametric method being the two most widely used approaches (Delis et al., 2008). The selection of estimation technique has still been a debate among researchers. While some researchers have a preference for either parametric (e.g. Berger and Mester, 2003) or non-parametric (e.g. Ariff and Can, 2008), others use both approaches (e.g. Yildirim and Philippatos, 2007). In comparison with parametric methods, the non-parametric methods possess some severe problems. First, random error is not taken into account in parametric methods, which likely lead to the wrong shape and position of the frontier due to noise effect (Delis et al., 2008). Moreover, the hypothesis of correct set of non-controllable inputs or outputs used in non-parametric approach cannot be tested (Drake et al., 2006). Therefore, this study will only employ a parametric approach – SFA – to incorporate the potential effect of environmental factors on bank efficiency.

4.1.2. The input distance function

Differ from the DEA method which does not require a specific functional form of the underlying production relationship, the SFA method imposes a particular form for the cost, profit or production relationship that links the Decision Making Unit (DMU)'s output to input factors (Delis et al., 2008). Even though bank inefficiency has been estimated mainly through utilizing a cost and/or profit function (see Berger and DeYoung, 2001; Fu and Heffernan, 2005; Berger et al., 2006), both functions are rather difficult due to the requirement of price information. In contrast, Yamori and Harimaya (2010) state that by using input and output information, distance function permits the modelling of a multi-input and multi-output production process without price data. They highlight a competitive advantage of distance function over cost minimisation or profit maximisation. While the latter (i.e. stochastic cost or profit function) assumes perfect competition, the former bases on a competitive monopoly assumption. It is noted that the proposition of a competitive monopoly is better than perfect competition which assumes no barriers to entry or exit and minimisation of costs (which can never happen in banking due to stringent regulation and the Basel capital requirements respectively) (Bushman and Williams, 2012). Also, Sturm and Williams (2008) emphasis on the additional advantage of stochastic distance function which allows researchers to (i) choose different specification of inputs and outputs; and (ii) carry out some sensitivity analysis. Due to the above-mentioned merits, this paper uses distance function under SFA – based technique to analyse Vietnamese bank efficiency.

There are two kinds of stochastic distance functions: input distance functions and output distance functions. When firms have more control over inputs than outputs, input distance functions tend to be used instead of output distance function, and output distance function will be used in the opposite case. It is believed that in Vietnam, banks have more control over their inputs rather than outputs. Therefore, in this study, the input distance function will be used. Following Coelli and Perelman (1999), the input distance function used is defined as follows:

$$D(x, y) = \max\{\Theta : (x/\Theta \in L(y)\} \quad (1)$$

Within: $L(y)$ – the input set – represents the set of all inputs, $x \in R_+^K$, which can produce the output vector, $y \in R_+^M$. The input distance function $D(x, y)$ is non-decreasing, positively linearly homogeneous and concave in x, and non-increasing and quasi-concave in

y (Coelli et al., 2005). The distance function $D(x, y)$ will take a value which is greater than or equal to one if the input vector, x, is an element of the feasible input set, $L(y)$. That is $D(x, y) \geq 1$ if $x \in L(y)$. Furthermore, the distance function will take a value of unity if x is located on the inner boundary of the input set.

4.1.3. Functional form of input distance function

Functional form

For the functional form of the distance function, the second-order translog approximation of the input distance function which for the case of *M* outputs and *K* inputs is specified as follows:

$$\ln D = \alpha_0 + \sum_{m=1}^{M} \alpha_m \ln y_m + \frac{1}{2}\sum_{m=1}^{M}\sum_{n=1}^{M} \alpha_{mn} \ln y_m \ln y_n + \sum_{k=1}^{K} \beta_k \ln x_k + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K} \beta_{kl} \ln x_k \ln x_l + \sum_{k=1}^{K}\sum_{m=1}^{M} \delta_{km} \ln x_k \ln y_m \quad (2)$$

Where D denotes the input distance, ln is the natural logarithms, α, β, δ are parameters to be estimated, x_k and y_m are the k-th inputs and m-th outputs respectively. This function is applied for each bank in each year.

Symmetry implies $\alpha_{mn} = \alpha_{nm}$ and $\beta_{kl} = \beta_{lk}$. The restrictions required for homogeneity of degree +1 in inputs are:

$$\sum_{k=1}^{K} \beta_k = 1; \sum_{l=1}^{K} \beta_{kl} = 0, \quad k = 1, \dots, K$$
$$\sum_{k=1}^{K} {}^{\delta}{}_{km} = 0, \quad m = 1, \dots, M \quad (3)$$

Lovell et al. (1994) use these homogeneity restrictions to transform the Equation (2) into a form that can be estimated by maximum likelihood method. For that, this paper arbitrarily selects one of the inputs i.e. *K*th input, ω can be set as $1/x_k$. This paper obtains $D(x/x_M, y) = D(x, y)/x_K$. Also, one thing to note is that $\ln(D/x_K) = \ln(D) - \ln(x_K)$. Thus, the translog function can be expressed as following:

$$\ln(x_K) = -\alpha_0 - \sum_{m=1}^{M} \alpha_m \ln y_m - \frac{1}{2}\sum_{m=1}^{M}\sum_{n=1}^{M} \alpha_{mn} \ln y_m \ln y_n - \sum_{k=1}^{K-1} \beta_k \ln x_k^* - \frac{1}{2}\sum_{k=1}^{K-1}\sum_{l=1}^{K-1} \beta_{kl} \ln x_k^* \ln x_l^* - \sum_{k=1}^{K-1}\sum_{m=1}^{M-1} \delta_{km} \ln x_k^* \ln y_m + \ln(D) \quad (4)$$

Where $x_k^* = x_k/x_K$ and $ln(D)$ is the technical inefficiency term, which is assumed to be independently distributed as truncations at zero of the N (m_{it}, σ_U^2) distribution, where m_i is allowed to contain a trend. The distance from the frontier consists of both random error and also X-efficiencies, which can be obtained through SFA estimation using the STATA. With regard to panel data analysis, the official Stata *xtfrontier* command allows the estimation of a Normal-Truncated Normal model with time-invariant inefficiency (Battese and Coelli, 1988) and a time-varying version, named ''time-decay'' model proposed by Battese and Coelli (1992). However, in this study, *sfpanel* command is employed to obtain maximum likelihood estimates of the stochastic frontier production function, because it allows to estimate a wider range of time-varying inefficiency models and also allows the simultaneous modelling of heteroscedasticity in the idiosyncratic error term (Belotti et al., 2012).

Due to the fact that technical inefficiency $(\ln(D))$ consists of random error and X-efficiencies, the functional form of distance function (Equation (4)) can be expressed as following:

$$-\ln(x_K) = \alpha_0 + \sum_{m=1}^{3} \alpha_m \ln y_m + \frac{1}{2}\sum_{m=1}^{3}\sum_{n=1}^{3} \alpha_{mn} \ln y_m \ln y_n + \sum_{k=1}^{2} \beta_k \ln x_k^* + \frac{1}{2}\sum_{k=1}^{2}\sum_{l=1}^{2} \beta_{kl} \ln x_k^* \ln x_l^* + \sum_{k=1}^{2}\sum_{m=1}^{2} \delta_{km} \ln x_k^* \ln y_m + v - u \quad (5)$$

Where:

u: non–negative random variable associated with technical inefficiency

v: random variable introduced to account for errors of approximation and other sources of statistical noise

The random errors, v_i , are assumed to be independently and identically distributed as $N(0, \sigma^2 v)$ random variables and independent of the u_i's, which are assumed to be half-normal distribution $|N(0, \sigma_u^2)|$ or exponential distribution $EXP(\mu, \sigma_u^2)$ or truncated normal $N(\mu, \sigma_u^2)$ or gamma distributions. After generating parameters from applying maximum likelihood estimation of Equation (5), the technical efficiency of individual banks at a specific time is calculated following the below equation:

$$TE_i = \frac{1}{D_i} = E[\exp(u_i | v_i - u_i)] = \exp(-u_i) \quad (6)$$

It is noted that the TE estimated from model (6) does not take into account the possible effect of environmental factors on technical efficiency levels of individual banks.

Inputs and outputs specification

Even though distance functions allow several different combinations of inputs and outputs specification (Berger et al., 1993), there are only two different kinds of approaches in terms of output selection. Banks can be viewed as either a producer, or an intermediary (Margono et al., 2010)[13]. Elyasiani and Mehdian (1990) suggest that by including interest expenses associated with deposits as inputs, the traditional intermediary approach of Sealey and Lindley (1977) is more inclusive of banking cost. Therefore, this approach will be used in this paper (for example, see Beccalli and Frantz, 2009; Wheelock and Wilson, 2012). Moreover, some researchers argue that outputs may be understated if researchers measure solely the banks' balance sheets, especially with the fast growth of derivatives and securitization (see Jagtiani et al., 1995 and Stiroh, 2000). To address this issue, along with two kinds of outputs: gross loans and other earning assets, non-interest operating income is added as the third output. The selected inputs and outputs are presented in the following table:

[13] The producer view treats banks as firms that provide services to consumers such as account holders, while the intermediary view interprets the bank's role as an agent providing intermediation between borrowers and lenders. Thus, there is a difference in inputs definition between these two approaches. The former considers only labour and physical capital as inputs to produce earning assets, while the latter defines deposits and borrowed fund in addition.

Table 4.1 Summary of inputs and outputs used in distance function

Inputs	Outputs
(i) Borrowed funds	(i) Gross loans
(ii) Labour	(ii) Other earning assets
(iii) Physical capital	(iii) Non-interest operating income

This study considers banks as multi-product firms that produce three outputs (gross loans, other earning assets, and non-interest operating income) and employs three inputs (borrowed funds, labour, and physical capital). Loans (Y1) are measured as the gross loans. Other earning assets (Y2) are measured as the sum of loans and advances to banks, derivatives, other securities and remaining earning assets. The third output: non-interest operating income (NIOI) is calculated by the sum of income from trading and derivatives, other securities, insurance, fee and commissions, and other operating income. These outputs are produced by using three inputs. Borrowed funds (X1) are estimated as total interest expenses. The input labour (X2) is measured by personnel expenses. The third input: physical capital is defined as other operating expenses.

It is noted that all above financial figures are adjusted based on Vietnam GDP deflator with the base year of 2006 to reflect their real changes[14]. The purpose is to eliminate the inflation effects which can distort the efficiency estimation by magnifying or contracting the inputs and outputs from the real values. The summary of Vietnam GDP deflators for the studied period from 2006 to 2013 is presented in the following table.

Table 4.2 The summary of Vietnam GDP Deflators re-based to 2006

Year	2006	2007	2008	2009	2010	2011	2012	2013
GDP deflator re-based to 2006	100	109.63	134.49	142.85	160.09	194.13	215.34	233.81

Source: Author's calculation based on World Bank Data and data downloaded from website: economywatch.com

After the above inflation adjustment, as samples contain non-positive NIOI figures, this paper needs to use a computational adjustment to transform the non-positive figures into a form that can be used in the measurement. Thus, to avoid taking natural logarithm of zero

[14] Adjusted figure (t) = Orginal Figure (t)/GDP Deflator re-based to 2006 (t) *100 where t denotes year

or negative NIOI, for non-negative data of NIOI, a large enough constant is added to every bank's NIOI (see Maudos et al., 2002; Kasman and Yildirim, 2006 – studies use the same adjustment method to deal with non-positive profit when measuring profit efficiency by SFA).

Incorporating economic variables into bank efficiencies

Previous studies choose different sets of economic variables (Z-variables) because researchers have different points of views regarding to the variables that have effects on bank efficiencies. Overall, environmental variables explaining the features of each country's macroeconomic and banking industry such as regulatory conditions, banking structure and accessibility of banking services are selected. The following table shows examples from the literature of Z-variables.

Table 4.3 Examples from the literature of environmental variables (Z-variables)

Studies	Environmental variables used
Dietsch and Lozano-Vivas (2000)	They used three environmental variable groups: **(i) Main conditions**: include population per square kilometer, GNP per capita, deposits per square kilometer; **(ii) Bank structure and regulation**: include Herfindhal index of concentration, average equity/total assets ratio (%), loans/deposits ratio; **(iii) Accessibility of banking services**: Number of branches per square kilometer
Chaffai et al. (2001)	They used four environmental variables: **(i) Macroeconomic variables** representing the demand for banking products: population density and per capita income (GDP per inhabitant) **(ii) Banking structure and competition variable**: the number of banks per inhabitant **(iii) Accessibility of banking services:** the density of branches
Berger and Mester (2003)	They used: the market-average nonperforming loans to total loans ratio (MNPL); state income growth (STINC); unit banking (UNITB); limited branching (LIMITB); the degree of in-state holding company expansion permitted (LIMTBHC); whether out-of-state holding company expansion is prohibited (NOINTST); and the proportion of the US banking assets held in states allowed to enter the bank's own state (ACCESS); the Herfindahl index of local deposit market concentration (HERF); whether the bank is located in a metropolitan area (INMSA); and the identity of a bank's primary federal regulator (FED, FDIC, with OCC as the base case).
Kasman and Yildirim (2006)	Environmental variables are categorized into three sets: **(i) The first set includes measures of density of population, general development of the economy, and density of demand for each country.** These variables are measured by the ratio of inhabitants per square kilometre, income per capita, and the ratio of total deposits per square kilometre, respectively. **(ii) The second set includes average capital ratio, concentration ratio and intermediation ratio.** These variables are measured by equity over total assets, the Herfindahl index, and loans over deposits, respectively. (iii) **The final set includes macro economic variables:** inflation rate, M2 to GDP, GDP Growth, banking market size, proxied by total assets and market capitalization as a percentage of GDP.
Manlagnit (2011)	Three groups of environmental variables: **(i) Risk and asset quality variables:** Ratio of loan loss provisions to total loans and Ratio of financial capital to total assets. **(ii) Bank-specific variables**: Ratio of loans to deposits, Ratio of deposit to total liabilities , Dummy for merger and acquisition, Dummy variable for stock market listing, Dummy for commercial bank type. **(iii) Additional variables:** Bank concentration measured by ratio of assets of 3 largest commercial banks to total assets of commercial banks, and time trend.

Goddard et al. (2014)	To control the impact of cross-country differences on bank cost (or bank efficiency), they used a vector of banking sector and economic control variables for each country. This vector includes weighted annual averages of the banking industry descriptors, where the weight is the share of bank *i* in total assets in country *j* at time *t:* **(1) The ratio of equity-to-assets (ETA)**. **(2) The Z score (Z)** is constructed for each bank as Z = ROA + ETA/σ (ROA) which combines a performance measure (ROA, return on assets), a volatility measure to capture risk (σ (ROA)) over a 4-year rolling window, and book capital (ETA, equity-to-assets). **(3) The ratio of loan loss reserves-to-gross loans (LLR)** **(4) Income diversification (DIV)** measured by a Herfindahl type index **(5) The Herfindahl–Hirschman index of assets concentration** in each country by year **(6) The natural logarithm of GDP per capita** **(7) DGDP = annual rate of growth in GDP** **(8) The ratio of banking sector credit-to-GDP** indicates financial deepening **(9) The ratio of state-owned bank assets-to-banking sector assets** is a proxy for the level of financial repression
Lozano-Vivas et al. (2002)	They included various environmental variables including: **(i) Main economic conditions: Per capita income (IC)**: the ratio of the Gross National Product (in 1993 US$) to the number of inhabitants; **Salary per capita (SC):** the ratio of the total salary volume to the number of working inhabitants; **The population density (PD):** the ratio of inhabitants per square kilometer; **The density of demand (DD)** measured by the ratio of total value of deposits (measured in 1993US$) per square kilometer. **(ii) Bank performance**: Income per branch (IB); Total value of deposits per branch (DB); Branches per capita (BC). **(iii) The accessibility of banking services for customers:** Branch density (BD) is defined as the number of branches per square kilometer. **(iv) Regulatory and competitive conditions**: The average capital measured by equity over total assets (EOTA); and Profitability ratios defined by average return over equity ratio (ROE)
Drake et al. (2006)	They included both macroeconomic and regulatory variables that may have an effect on Hong Kong Bank Efficiency: **(i) Macroeconomic**: Private consumption expenditure; government expenditure; gross fixed capital formation; net export of goods; net export of services; discount window base rate; unemployment; retail sales values; expenditure on housing; and the current account balance. **(ii) Regulatory**: Dummy variable for the Hong Kong property crash/Asian financial crisis; dummy variable for handover to the People s Republic of China; dummy variable for 1999 (Hong Kong Monetary Authority agreed to phase out the remaining interest rate controls (i.e., caps); and a dummy variable for 2001 (remaining interest rate controls removed)

According to Coelli et al. (1999), there are two existing reasonable views in the literature regarding the way that the issue of environmental variables should be addressed. The first approach assumes that the environmental variables influence the shape of technology (see Good et al., 1993), while the second approach assumes that environmental factors affect the degree of technical inefficiency (see Battese and Coelli, 1995). The former adopts a two-stage estimation approach, where the first stage involves the specification and estimation of a stochastic frontier production function and the prediction of the technical efficiency scores. The second stage involves the specification of a regression model where the technical efficiencies are regressed upon environmental factors. Battese and Coelli (1995) points out an inconsistency in the two-stage method. In the first stage, the estimation of stochastic frontier production function follows the assumption that the inefficiency effects are identically distributed. However, in the second stage, the inefficiency effects are not identically distributed because the predicted technical efficiencies are regressed upon a number of factors. Moreover, Wang and Schmidt (2002) argues that even if z and inputs variables are independent, the estimated inefficiencies are underdispersed as it ignores the effect of z on inefficiency. This causes the estimate of effect of Z-variables on inefficiency in the second step to be biased.

Therefore, this study follows the second approach (i.e. one-step procedure). The study incorporates economic variables directly into input distance function and estimates the efficiency effects in one-step using maximum likelihood estimation. Exogenous variables (annual GDP per capita growth rate (GDPCAP), annual broad money growth rate (MSG), the ratio total assets of the commercial banks divided by the GDP (ASSGDP), the ratio total capital of commercial banks divided by their total assets (CAPASS), and concentration ratio calculated by dividing the loans of four largest banks to the loans of all banks operating in the market (CR4) are used in the analysis to capture the macro-economic environment and also industry-specific effects. GDPCAP and MSG variables measure the characteristics of the demand for banking products, while ASSGDP measures banking market size or the banking market development in the economy (Kasman and Yildirim, 2006). CAPASS is a proxy of capital strength and it is believed that there is an inverse relationship between capital ratio and inefficiency. That means higher equity implies lower risk taking which makes borrowed fund less expensive. Concentration ratio (CR4) can have either positive or negative impact

on bank efficiency. If higher concentration is the result of superior management or greater production efficiency, the concentration can lead to lower cost. However, if higher concentration is the result of market power, concentration may increase bank operation cost.

One-step procedure will be employed to take environmental factors into account when estimating the bank efficiency. Under one-step approach, inefficiency term (u_{it}) is made an explicit function of a vector of environmental characteristics, z_{it}, by specifying that the u_{it} are independently (but not identically) distributed as nonnegative truncations of a general normal distribution of the form:

$$N(m_{it}, \sigma^2) \; or \; N\left[\delta_0 + \sum_{j=1}^{M} \delta_j z_{j,it}, \sigma^2\right] \tag{7}$$

Where δ_0 and δ_j are parameters that need to be estimated.

The value of unknown parameters in (5) and (7): α_0, β_k, δ_0, δ_j, σ_u^2 and σ_v^2 are obtained simultaneously using maximum likelihood estimation. The estimator σ^2 calculated by $\sigma^2 = \sigma_v^2 + \sigma_u^2$

Battese and Coelli (1993) also present an expression for the conditional expectation of TE, given ε_{it}

$$TE_{it} = \left\{exp\left[-\mu_{it} + \frac{1}{2}\sigma_*^2\right]\right\} \times \left\{\Phi\left[\frac{\mu_{it}}{\sigma_*} - \sigma_*\right] \Big/ \Phi\left[\frac{\mu_{it}}{\sigma_*}\right]\right\} \tag{8}$$

Where $\Phi(.)$ denotes the distribution function of the standard normal random variable

$$\mu_{it} = (1-\gamma)\left[\delta_0 + \sum_{j=1}^{M} \delta_j z_{j,it}\right] - \gamma\varepsilon_{it}$$

And Gamma (γ), σ_*^2 are calculated by:

$$gamma\ (\gamma) = \frac{\sigma_u^2}{\sigma^2} = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}$$

$$\sigma_*^2 = \gamma(1-\gamma)\sigma^2$$

From functional form (8), an operational predictor for the technical efficiency including the influence of environment factors can be obtained. To compute net technical efficiency, researchers replace $\sum_{j=1}^{M} \delta_j z_{j,it}$ into (7) with min $[\sum_{j=1}^{M} \delta_j z_{j,it}]$ and recalculate the technical efficiency predictions. Net efficiency scores are the efficiency levels when all firms are assumed to face identical environmental conditions.

Determination of the fit of input distance function

One important thing in the first stage – estimating efficiencies – is to determine the fit of our input distance function. In this paper, this study will use the γ (Gamma) calculated by the variances of the inefficiencies to the total random error as a determination of the fit of input distance function.

If γ is close to one, that is, the inefficiencies are fully obtained from a truncated normal distribution (no noise). If γ is close to zero, that is, the inefficiencies are obtained from the total error which is distributed normally (no inefficiencies). Both these two cases (i.e. γ is close to zero or one) will be an indicator of misspecified distance function. Therefore, in this study, the acceptable range for γ is from 0.2 to 0.7.

4.2. Determinants of bank profitability assessment methodology

4.2.1. Model specification

Model

Given the literature review discussed above, there are a number of potential variables that have effect on the bank profitability. However, in general, internal factors that are bank related and reflect management performance and external variables (i.e. economic and industry conditions) are considered (Kosmidou, 2008). Therefore, with a purpose of developing a model to examine the factors that influence banks performance, this paper utilizes bank specific (endogenous), industry-specific and macroeconomic (exogenous) variables along with banks performance measure explained below. Also, this study employs a dynamic model by involving a lagged dependent variable as an explanatory variable because banks profitability is likely to persist overtime, indicating impediments to market competition, informational opacity and sensitivity to macroeconomic shocks (Berger et al.,

2000a)[15]. Another reasons to choose dynamic model is as flows. This study's panel data set has 45 banks (N) over 8 years (T). Roodman (2006) suggests that when "N" is bigger than "T", dynamic panel model should be used to control the dynamic panel bias.

The dynamic panel model is specified as

$$\pi_{it} = \alpha_i + \delta_i \pi_{i,t-1} + \beta_1 X_{it} + \beta_2 Z_t + \varepsilon_{it}$$

$$i = 1, \dots, N; \qquad t = 1, \dots, T \tag{9}$$

Where π_{it} is the profitability of bank i at time t and $\pi_{i,t-1}$ is one-period lagged profitability. X_{it} is a vector of bank-specific determinants (including TE) and Z_t is a vector of country-specific factors including industry-specific and macroeconomic variables. ε_{it} is the stochastic error term.

A value of δ between 0 and 1 implies that profitability persist. A value close to 0 means that the industry is fairly competitive (high speed of adjustment), while a value close to 1 indicates less competitive industry (low speed of adjustment).

It is noted that among bank-specific determinants, TE is believed to be endogenous to ROE. That is, TE is affected by factors inside the error term of the regression model (9). Empirical studies found evidence of bank-specific factors having impacts on efficiency. For instance, Berger and Deyoung (1997) reported efficiency is negatively affected by loan loss provisions. Yildirim and Philippatos (2007) found a positive relationship between off-balance sheet items to total assets ratio and efficiency. Maudos et al. (2002) concluded that medium-sized banks reach the highest levels of both cost and profit efficiency.

System GMM technique

The model used in this study has two distinguished characteristics: (i) the model uses an unbalanced dynamic panel data; (ii) the model includes technical efficiency (TE) as an independent variables and TE is believed to be endogenous to bank profitability (ROE). It should be noted that OLS models or static panel models are not appropriate in this study. The reasons are as follows. First, the OLS models and static panel models omit dynamics, which can lead to the problem of dynamic panel bias and model misspecification (Baum, 2006). Second, OLS estimator will be consistent only if TE is exogenous. Therefore, using

[15] Some studies treat bank profitability as persistent over time, for recent examples, see Eichengreen and Gibson (2001), Goddard et al. (2004) and Gibson (2005).

dynamic panel data and expected endogenous TE variable, this study needs to use the advanced technique to avoid dynamic panel bias.

The initial suggestion is the General Method of Moments (GMM) which provides consistent estimates under the dynamic panel models. However, it needs to determine whether to use difference-GMM (DGMM) developed by Arrelano and Bond (1991) or system-GMM (SGMM) introduced by Blundell and Bond (1998). First, DGMM technique addresses the most three severe problems: (i) instruments used in model could potentially suffer from endogeneity (Tan and Floros, 2012), (ii) unobserved heterogenity across banks which may be correlated with the lagged variable, leading to an inconsistency of standard estimators in fixed or random effects model (Liu and Wilson, 2010), and (iii) the persistence of the dependent variable – bank profitability that may cause bias in the estimates obtained from econometric models (Athanasoglou et al., 2005). However, the DGMM estimator can be biased if the autoregressive parameters are too large or the ratio of the variance of the panel-level effect to the variance of idiosyncratic error is too large (Liu and Wilson, 2010). Second, systems estimator (SGMM) bases on an additional assumption, that first differences of instrument variables are uncorrelated with the fixed effect. This allows the introduction of more instruments, and can dramatically improve efficiency (Roodman, 2006).

SGMM has competitive advantages over DGMM in this paper due to the following reasons. First, this study includes macroeconomic variables (i.e. GDP growth and unemployment rate) in the regression model. These economic variables are believed to have random walk statistical generating mechanism. SGMM is more appropriate than DGMM when dealing with "randomwalk" or close to be random-walk variables (Roodman 2006; Baum, 2006; and Roodman, 2007). Second, in general, estimates produced by SGMM are more precise than that produced by DGMM, because SGMM involves more instrument than DGMM (Baltagi (2008). Last but not least, if model uses unbalanced panel data, DGMM estimation could have a weakness of magnifying gaps (Roodman, 2006, p. 19). Thus, SGMM should be used in this paper which utilized unbalanced panel data with 45 banks over 8 years. Specifically, a System GMM (see Roodman, 2006) with two-step will be conducted for our analysis.

4.2.2. Validity of System GMM model

Various statistic tests will be performed to examine the validity of the model used.

Endogeneity test of technical efficiency

It is noted that in this paper, technical efficiency (TE) – one of independent variables is expected to be endogenous to bank profitability (ROE). Thus, TE will be tested for endogeity. The test is implemented by 'ivreg2' in Stata. Under the null hypothesis that the specified endogenous regressors can actually be treated as exogenous, the test statistic is distributed as chi-squared with degrees of freedom equal to the number of regressors tested.

The relevance and validity of instruments of technical efficiency

To solve the expected endogeneity problem of technical efficiency (TE), TE variable is instrumentalized by two other instruments: net interest income/total assets (NIIA) and net interest margin (NIM) measured by net interest income divided by average earning assets. Instruments are considered as strong instruments if they are correlated to the endogenous regressors (TE) and orthogonal to the error term (Baum et al, 2003). The relevance of suggested instruments will be tested through three separated tests implemented by 'ivereg2' in Stata for the first stage regression (i.e. it is a reduced form regression of the endogenous variable (TE) on the full set of instruments).

First, Angrist-Pischke (AP) multivariate F test of excluded instruments is examined. It can be used as a diagnostic for whether a particular endogenous regressor is "weakly identified". "Weak identification" occurs when the excluded instruments are weakly correlated with the endogenous regressor. When instruments are weak, estimators will perform poorly, and different estimators are more robust to weak instruments than others (Stock and Yogo, 2005). In the special case of a single endogenous regressor, the AP statistic reported is identical to underidentification statistics reported in the ffirst output, namely the Cragg-Donald Wald statistic (if i.i.d.) or the Kleibergen-Paap rk Wald statistic (if robust, cluster-robust, AC or HAC statistics have been requested). Critical values for the AP first-stage F as a test of weak identification are not available, but the test statistic can be compared to the Stock-Yogo (2002, 2005) critical values for the Cragg-Donald F statistic with K1=1.

The second test is an underindentification test which is an LM test of whether the equation is identified or not. The test is essentially the test of the rank of a matrix: under the null

hypothesis that the equation is underidentified. The matrix of reduced form coefficients on the L1 excluded instruments has rank=K1-1 where L1 = number of excluded instruments and K1=number of endogenous regressors. Under the null, the statistic is distributed as chi-squared with degrees of freedom=(L1-K1+1). A rejection of the null indicates that the matrix is full column rank, i.e., the model is identified.

Third, the test of joint significance of endogenous regressors is implemented. The Anderson-Rubin (1949) test and the Stock-Wright (2000) S statistic can be implemented for this purpose. They are robust to the presence of week instruments. The null hypothesis for both tests is that the coefficients of the endogenous regressors in the structural equation are jointly equal to zero. Under "ivreg2", the Anderson-Rubin statistic is a Wald test and the Stock-Wright S statistic is a GMM-distance test. Both test statistics distributed as chi-squared with L1 degrees of freedom where L1 is the number of excluded instruments. The traditional F-stat version of the Anderson-Rubin test is also reported.

The relevance and validity of the main regression model

The main regression model is the model estimated from Equation (9). Four separated tests will be performed.

First, to conclude whether there is multicollinearity problem in our model, we assess the degree of correlation between variables used in the multivariate regression model.

Second, Hansen test (i.e. can also be known as Hansen J-statistic) is a robust Sargan test that is available for two-step GMM estimator to check whether weak instrumental variables exist (Baum, 2006). This test examines the lack of correlation between the instruments and the error term. The null hypothesis is that the instruments are valid instruments and uncorrelated with the error term, and that the excluded instruments are excluded from the model correctly. The test statistic is distributed as chi-squared in the number of overidentifying restrictions. Until now, there has been no mathematical evidence to confirm the ideal range of p-value of Hansen test. However, Roodman (2009) suggested that we should avoid the critically nonsense p-values of either 1.0 or less than 0.25. He also suggests that the number of instruments should not exceed the number of observations.

Third, Difference-in-Hansen test is employed to check the validity of a subset of instruments (Roodman, 2009). This is done by computing the increase in J when the given subset is

added to the estimation set-up. Under the same null of joint validity of all instruments, the change in J is χ_2, with degrees of freedom equal to the number of added instruments (Roodman, 2009, p.142).

Fourth, the test for autocorrelation in the disturbance term is performed. The system GMM assumes that the twice-lagged residuals are not autocorrelated; therefore, it is of great importance to test the autocorrelation in the error terms. As stated by Arrelano and Bond (1991), the GMM estimator requires that there is first-order serial correlation but that there is no second-order serial correlation in the error terms. The AR(1) and AR(2) statistics measure the first and second serial correlation, respectively. Their null hypotheses are that there is no first-order and second-order serial correlation.

4.2.3. Variables selection

This part summarizes the chosen variables used in the regression model. Chosen variables include a dependent variable (i.e. accounting performance measures) and a set of independent variables (i.e. potential bank profitability determinants which can be classified into three categories: bank-specify, industry-specify and macroeconomics determinants).

Accounting performance measures

The two main indicators for bank accounting performance (i.e. bank profitability) are return on assets (ROA) and return on equity (ROE). This study uses ROA as a measure of Vietnamese bank profitability (for recent examples, see Kosmidou, 2008; Olson and Zoubi, 2011; Tan and Floros, 2012; and Jabba, 2014). The reason is that according to Kosmidou et al. (2007) and Van Horen (2007), ROA is the most important performance measure over time as assets affect directly both income and expenses. Also, IMF (2002) suggests that ROA is a much better profitability indicator than returns on equity (ROE) since an analysis of the latter disregards the greater risks associated with high leverage.

Bank-specific determinants

The internal factors of individual banks include:

- *Capital adequacy (EQASS):* reflect the bank risk along with international prudential regulation. It is measured by the ratio of average equity to average assets. A high level of capital to asset signifies a low level of risk. EQASS can have a positive (see

Goddard et al., 2004; Kosmidou et al., 2007) or negative relationship (see Berger, 1995b) with bank profitability.

- *Liquidity risk (LODEP):* following Pasiouras and Kosmidou (2007) and Kosmidou (2008), liquidity risk is defined as the proportion of loans financed by deposits and short-term fundings. High level of this ratio means low level of liquidity. Holding liquid assets helps banks dealing with problems relating to insolvency (see Freixas, 2005), but they are usually associated with lower rates of return (see Rhoades, 1985). Thus, LODEP is expected to have either positive or negative impacts on ROE.

- *Credit risk (LORES):* reflect bank's loan quality. LORES is calculated by reserves for impaired loans over gross loans. The higher reserves for impaired loans, the poorer the bank's asset quality, and then the higher the credit risk. On one hand, the risk-return hypothesis implies a positive relationship between risk and profits . (see Dietrich and Wanzenried, 2011). On the other hand, poor asset quality can negatively affect ROE (see Kosmidou, 2008). Thus, LORES is expected to have a negative or positive relationship with bank profitability.

- *Market share (MS):* reflect the market power of individual banks and it is computed by the share of individual bank's assets as a percentage of total assets of the whole Vietnamese banking system. Basing on relative market power (RMP) hypothesis, technical efficiency is expected to have a positive relationship with ROE. Empirical findings that support RMP hypothesis are Smirlock (1985) and Berger (1995a), to name for a few.

- *Technical efficiency (TE):* X-efficiency measure is derived from the translog distance function as described in the first stage. According to relative X-efficiency (ESX) hypothesis, X-efficiency is expected to be positively related to bank profitability. Indeed, many studies found a positive relationship between technical efficiency and banks' profitability (see Maudos, 1998 and Timme and Yang, 1991).

Industry-specific determinants

Only concentration ratio is used to capture the effect of banking industry structure on bank performance. The concentration ratio (CR4) measures the competitiveness among bank

sector, which is calculated by bank loans held by four largest banks to total loans of the whole system. According to structure-conduct-performance (SCP) hypothesis, banks in highly concentrated markets tend to collude and thus earn monopoly profit (see Short, 1979; Molyneux et al., 1996). However, Boone and Weigand (2000) argue that a higher bank concentration might be the result of a tougher competition in the banking industry, which would suggest a negative relationship between performance and market concentration. In addition, in case increased market concentration is a result of the fact that more efficient banks gaining more market share, there would be no relationship between concentration and profitability.

Macroeconomic determinants

This paper aims to assess the correlation between bank profitability and the business cycle. Following Bikker and Hu (2002), this study employs these variables representing business cycle as follows.

- *GDP Annual Growth Rate (% change) (GDPGR)* is the most direct measure of macroeconomic developments. It is considered as a direct determinants of bank profits, since the GDP growth is an indicator of the demand for banking services. Economic booms are associated with both extension of loans and the supply of deposits, which lead to an increase in bank performance (Bikker and Hu, 2002). Therefore, GDP growth is expected to positively correlate with bank profitability.

- *Unemployment annual rate (%)* is a measure of the current phase in the business cycle. While short-term unemployment reflects business cycle, long-term unemployment primarily represents structural disequilibrium in the economy and adverse macroeconomic conditions, which create negative impacts on bank profits (Bikker and Hu, 2002). Hence, we expect a negative relationship between unemployment and profitability. Besides GDP growth and unemployment rate, inflation is supposed to be considered. Tan and Floros (2013) use inflation as a key macroeconomic variable to explain bank profitability. However, in this study employs only GDP growth and unemployment variables and inflation is excluded to avoid the multicollinearity problem between GDP growth and inflation.

The summary of variables selection and hypotheses are presented as follows:

Table 4.4 Variables selection and hypotheses

	Variables	Explanation	Calculation	Hypothesized sign with ROA
	ROA	Return on assets	$\frac{\text{Net income}}{\text{Total assets}}$	
Bank-specific determinants	EQASS	The ratio of average equity to average assets	$\frac{\text{Average Equity}}{\text{Average Assets}}$	+/-
	LODEP	The ratio of bank's loans to funding	$\frac{\text{Loans}}{\text{Deposits \& Short term funding}}$	+/-
	LORES	The ratio of loan loss reserves to gross loan	$\frac{\text{Reserves for Impaired Loans}}{\text{Gross Loans}}$	+/-
	MS	Market share of individual banks	$\frac{\text{Assets of individual bank}}{\text{Total assets of banking industry}}$	+
	TE	Techinical efficiency	From the translog distance function	+
Industry-specific determinant	CR4	The concentration ratio	$\frac{\text{The loans of the 4 largest banks}}{\text{The loans of all banks}}$	+/-
Macroeconomic determinants	GDPGR	The gross domestic product growth	The annual change of the GDP	+
	UNEMP	Unemployment rate	The annual unemployment rate	-

4.3. Data

This study uses individual commercial banks' accounting data, Vietnamese market data and banking industry information to estimate technical efficiency and also analyse the determinants of bank profitability.

Firstly, in terms of banks' financial data, the basic data source is Bankscope – Fitch's International Bank Database. Whenever Bankscope does not provide enough information, the data is collected from other official sources, such as annual audited financial reports published in banks' official websites, and newspaper releases on the performance and financial information of the banks in tracing missing data values. It is noted that to be included into the sample, banks should meet the following conditions: (i) They must have a positive amount of total assets, loans, fixed assets, equity, and (ii) they must have gross interest and dividend income, interest expenses, personnel expenses, loan loss provision, common equity, average loans, average equity, other earning assets and total funding[16] . As a result, our sample is an unbalanced panel which includes financial data of 45 Vietnamese commercial banks during the period of 2006-2013, totalling 196 samples. For details of 45 banks used in this study, please refer to Appendix 3. Among 45 Vietnamese commercial banks:

(i) 5 state-owned banks[17] (SOCBs) (includes Big Four banks in Vietnamese banking system) which account for around 45% of the total assets of the Vietnamese banking industry throughout period 2006-2013.

(ii) 33 joint stock commercial banks (JSCBs).

(iii) 4 joint venture commercial banks (JVCBs), namely Indovina Bank, VID Public Bank, Vietnam-Russia Joint Venture Bank and Vinasiam Bank.

(iv) 3 wholly-owned foreign banks, namely ANZ Bank Vietnam Limited, Hong Leong Bank Vietnam and Shinhan Bank Vietnam Limited, which are considered as small-sized banks because their average assets are less than VND40 Billion.

Bank size is defined based on total assets of the bank at year t, and the bank is a small bank if its assets are less than or equal to VND40 Billion, medium bank if the banks' assets are

[16] Total funding consist three components: deposits, short-term funding, and other interest bearing expenses.
[17] State-owned banks are defined as those banks whose state-owned enterprises ownership is greater than 50% of total ownership.

greater than VND40 Billion but less than or equal to VND100 Billion, large bank if the bank's assets are greater than VND100 Billion.

Table 4.5 presents the descriptive statistics of the variables used in distance function.

Table 4.5 Descriptive statistics of (i) inputs and outputs for technical efficiency estimation and (ii) variables for model examining determinants of bank profitability

	Obs.	Mean	Std. error	Minimum	Maximum
STAGE 1: Technical Efficiency Estimation Model					
Inputs					
Borrowed funds (X1)	196	6,122,264	8,720,610	10	50,500,000
Labour (X2)	196	879,059	1,580,486	2	10,300,000
Physical capital (X3)	196	836,963	1,170,248	2	6,426,900
Outputs					
Gross loans (Y1)	196	59,600,000	94,700,000	108	503,000,000
Other earning assets (Y2)	196	31,800,000	35,900,000	39	160,000,000
Non-interest operating income (Y3)	196	719,355	1,093,137	-1,181,200	5,332,400
Note: All values are presented in Million VND					
STAGE 2: Bank Profitability's Determinants Model					
Dependent variable					
ROA	196	0.010851	0.008404	-0.055118	0.057260
Independent variables					
EQASS	196	0.086918	0.043774	0.009428	0.293103
LODEP	196	0.672356	0.412933	0.185195	5.057954
LORES	196	0.007408	0.037870	0.000000	0.522245
MS	196	0.020528	0.049714	0.000000	0.303811
TE	196	0.643367	0.147146	0.344426	0.918772
CR4	196	63.920010	4.536944	56.897610	72.708260
GDPGR	196	5.993090	0.654674	5.247367	7.129504
UNEMP	196	2.176531	0.175295	1.900000	2.400000

CHAPTER 5: EMPIRICAL RESULTS

5.1. Stage 1: Banking efficiency scores

Using SFA (parametric methods), efficiency scores are estimated from a regression model with certain intervals and deviations. Details of regression model estimates are presented in Appendix 4. Efficiency levels of individual banks throughout period from 2006 to 2013 are presented in Table 5.1 as follows.

Table 5.1 Technical efficiency scores estimated from distance function (%).

Gamma in our model equals to 0.23, which falls in the acceptable range of 0.2 - 0.7.

No	Bank	2006	2007	2008	2009	2010	2011	2012	2013	Mean
1	An Binh Commercial Joint Stock Bank					62.88133	88.09345	72.81515	59.68117	70.86778
2	ANZ Bank (Vietnam) Limited						89.68309			89.68309
3	Asia Commercial Joint-stock Bank	41.95124	41.17872	79.43813	57.34864	63.00099	86.96688	71.80299	63.62056	63.16352
4	Bank for Investment and Development of Vietnam	42.86553	43.8812	72.65636	56.32106	61.58147	84.45226	71.61545	59.90241	61.65947
5	Bao Viet Commercial Joint Stock Bank					58.99901	86.44603	72.95226		72.7991
6	DongA Commercial Joint Stock Bank		40.19011	70.51011	54.00635	60.93753	84.21298	71.53925	63.28434	63.52581
7	Global Petro Commercial Joint Stock Bank		40.55467							40.55467
8	Ho Chi Minh City Development Joint Stock Commercial Bank								58.88622	58.88622
9	Hong Leong Bank Vietnam Limited					60.80781	87.69916	80.7688		76.42526
10	Housing Bank of Mekong Delta-MHB		43.8526	77.64413	61.50577	63.89707				61.72489
11	Indovina Bank Ltd.	40.56967							58.51005	49.53986
12	Joint Stock Commercial Bank for Foreign Trade of Vietnam	40.03111	40.13292	70.07161	54.42542	59.24031	83.70214	68.92819	57.24509	59.2221
13	Lien Viet Post Joint Stock Commercial Bank				57.03326	61.06085	86.77462	74.55403	64.57184	68.79892
14	Mekong Development Joint Stock Commercial Bank					55.69216	88.23434	86.84558		76.92403
15	Military Commercial Joint Stock Bank		39.22676	70.16366	53.16147	60.43646	83.69766	70.47627	59.15274	62.33072
16	Nam A Commercial Joint Stock Bank						88.36853	79.25583	58.82896	75.48444
17	Nam Viet Commercial Joint Stock Bank		39.44116		55.38955	62.43094	85.95913			60.8052
18	Bac A Comercial Joint Stock Bank							75.14318		75.14318
19	North Asia Bank			73.45141	55.05966					64.25554
20	Ocean Commercial Joint Stock Bank		34.44258	75.41793	53.89212	61.10158	84.98868	70.9511		63.46567
21	Orient Commercial Joint Stock Bank	43.28723	41.87358	72.67543	56.51805	61.21601	85.90668	72.37004		61.97815
22	Petrolimex Group Commercial Joint Stock Bank			73.33595	57.05767	61.93963	87.97046	75.62359	61.64828	69.59593
23	Saigon - Hanoi Commercial Joint Stock Bank		37.1794	74.62528	55.11759	61.05884	87.0935	71.92313	59.98414	63.85455
24	Saigon Bank for Industry and Trade		40.97183	73.17793	57.55948					57.23641

25	Saigon Commercial Bank-Saigonbank	39.71048	39.49315	72.57054	56.76269	66.58481		74.17923		58.21682
26	Saigon Thuong Tin Commercial Joint-Stock Bank	43.57062	39.65795	78.39969	56.91734	62.37361	88.40187	77.70411	65.68682	64.089
27	Shinhan Bank Vietnam					56.6777	74.4015	69.22297	61.18549	65.37192
28	Southeast Asia Commercial Joint Stock Bank				51.20152	57.40387	87.17948	78.65512		68.61
29	Southern Bank-Phuong Nam Commercial Joint Stock Bank							77.3046		77.3046
30	Southern Commercial Joint Stock Bank	45.25048								45.25048
31	Tien Phong Commercial Joint Stock Bank				53.3587	62.01459	87.92292	73.55707	57.86834	66.94432
32	VID Public Bank	43.12888	41.1153	71.5519	55.64374	60.24607	82.71637	68.76082	59.09183	60.28186
33	Viet Capital Commercial Joint Stock Bank					60.50083				60.50083
34	Viet Nam Thuong tín Joint Stock Commercial Bank					59.99245				59.99245
35	Vietnam Asia Commercial Joint-Stock Bank	43.38886	41.2453	75.73187	53.13466	60.22246				54.74463
36	Vietnam Bank for Agriculture and Rural Development	44.18308	43.14808	75.04312	59.26853	63.62091	85.49765	71.95173		63.24473
37	Vietnam Development Bank	37.50491	36.29638							36.90065
38	Vietnam Export Import Commercial Joint Stock Bank		39.67571	72.1696	54.97475	56.213	84.80646	72.64682	59.93692	62.91761
39	VietNam International Commercial Joint Stock Bank					61.48884	86.68731	79.83025	62.98429	72.74767
40	Vietnam Joint-Stock Commercial Bank for Industry and Trade		43.35959	75.59764	55.87719	62.89917	86.69222	72.14872	60.16054	65.24787
41	Vietnam Maritime Commercial Stock Bank				55.14035	65.29113	91.87716	80.24868	65.57462	71.62639
42	Vietnam Prosperity Joint Stock Commercial Bank		43.07812	77.97363	58.58557	59.41615	89.08721	76.40598	65.93126	67.21113
43	Vietnam Technological and Commercial Joint-Stock Bank			75.61039	58.17496	64.94946	90.20473	77.03505		73.19492
44	Vietnam-Russia Joint Venture Bank		44.33253	69.89583						57.11418
45	VinaSiam Bank				57.21027		89.00934			
	Average	42.12017	40.65126	73.98692	55.94987	61.13053	86.49113	74.57387	61.13028	64.0781
	Minimum	37.50491	34.44258	69.89583	51.20152	55.69216	74.4015	68.76082	57.24509	36.90065
	Maximum	45.25048	44.33253	79.43813	61.50577	66.58481	91.87716	86.84558	65.93126	89.68309

5.1.1. Overall result of technical efficiency

According to Table 5.1, the overall efficiency is 64.08%, that is, a typical Vietnamese bank in period 2006 – 2013 wasted around 46% of its resources relative to best-practice banks on the frontier. To some extent, this result is relatively equal to the prior evidence (76.7%) estimated from the study of Nguyen (2012) who calculated efficiency of 20 Vietnamese commercial banks over the period 2007 – 2010 by DEA approach. Vietnam banking industry experienced slight inefficiencies in 2006, 2007 and 2009 (i.e. efficiency less than 50%) compared to remaining years in studied period (i.e. efficiency levels in 2008, 2010-2013 greater than 60%).

An interesting finding is that those banks which are the least efficient are not restricted to any specific types of bank. Particularly, in 2006, 2007, 2009 and 2010, that were JSCBs: Vietnam Development Bank, Ocean Commercial Joint Stock Bank, Southeast Asia Commercial Joint Stock Bank, Mekong Development Joint Stock Commercial Bank respectively. In 2008 and 2012, that were JVCBs: Vietnam-Russia Joint Venture Bank and VID Public Bank. A wholly foreign-owned bank (i.e. Shinhan Bank Vietnam) and a state-owned bank (i.e. Joint Stock Commercial Bank for Foreign Trade of Vietnam- VIETCOMBANK) were recorded as the least efficient in year 2011 and 2013 respectively. There was a consistency across years as to the best-performing banks category over the studied period 2006 – 2013. Except for only 2009 in which a SOCB bank (i.e. Housing Bank of Mekong Delta MHB) is considered as the most efficient Vietnamese bank, remaining years witnessed that the most efficient banks belong to either JSCBs or JVCBs group. The majority of best-practice banks were JSCBs that have head offices in Ho Chi Minh City. For example, in 2006, this was Southern Commercial Joint Stock Bank (45.25%); in 2008, this was Asia Commercial Joint-stock Bank; in 2010, this was Saigon Commercial Bank; and in 2013, this was Saigon Thuong Tin Commercial Joint-Stock Bank. In 2007, Vietnam-Russia Joint Venture bank was the bank having the best performance, with efficiency scores being recorded at 44.23%.

5.1.2. Time-series properties of technical efficiency

The changes of technical efficiency over the period 2006 – 2013 are shown in Figure 5.1. Overall, technical efficiency level of Vietnamese banks experienced an upward trend, with the efficiency reaching its two peaks of 74% and 86.5% in 2008 and 2011, respectively. The relative high level of efficiency was witnessed in 2008 (the first peak over the studied period 2006-2013), that is, to some extent, is in line with the result of Ngo (2010). He concluded that the average scores of all banks in 2008 is close to optimal score (i.e. greater than 90%).

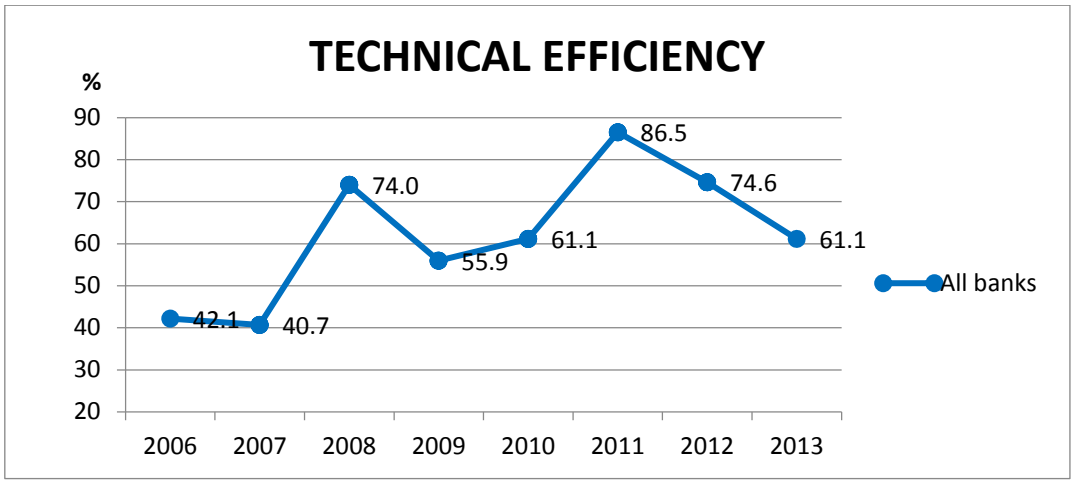
The lowest scores of efficiency were witnessed in the years 2006 and 2007 – the period before Vietnam officially became a member of WTO – at around 42% and 40% respectively. This fact could be explained by the "boom and burst" of Vietnamese securities market and real estate in 2006 (Ngo, 2012). After 5 years since launching, Vietnam's stock market saw the exploding of a biggest boom in 2006-2007, reached the peak of Vietnam stock market index, namely VN-Index, at 1,171 points in March 2007 (Dinh, 2009). Therefore, during two years 2006-2007, Vietnamese enterprises were likely to rely much on financial resources from securities markets than those from financial institutions. Moreover, even though VN-Index increased by 145% in 2006 due to the herding behavior of Vietnamese investors, the true value of securities could be only a half of the market price (Nguyen, 2007). Therefore, in August 2007, when VN-Index dropped to 887 points, overpriced assets as collateral for bank loans cannot cover the debts. That caused negative impact on Vietnamese commercial banks when investors could not pay back their loans.

The efficiency levels were closely consistent to the economic cycle that happened pre, during and post Global Financial Crisis 2008 (GFC). To be more specific, average efficiency score was about 74% in 2008, before dropping dramatically to 56% in 2009 due to lagged effect of GFC, and then increasing again from 2009 to 2011 thanks to immediate reaction of policy makers to the whole economy in general and the banking industry in particular.

For the last two years 2012 and 2013, due to the effect of increased non-performing loans levels, average efficiency level decreased from 74.6% in 2012 to 61% in 2013.

Figure 5.1 The trend of cost efficiency scores over time

Efficiency scores are calculated as average efficiency scores of all banks in each year



Compared to 2006, the efficiency level of Vietnamese commercial banks decreased from 42.1% to 40.7% in 2007, but with very marginal amount. This slight reduction can be explained by following reasons suggested by SBV (2007). First, even though 2007 witnessed a drastic growth rate 46.12% of total liquidity (2006: 33.59%) and a growth rate 47.64% of bank credit services (2006: 36.53%; 2005: 32.08%)[18], Vietnamese commercial banks suffered from liquidity surplus during the whole year. As a result, VND mobilizing annual interest rates decreased by about 0.1%-0.2%, that was likely decrease bank profits. Moreover, the surge in price of such necessities imported from foreign countries as crude oil, food, steel resulted in a sharp increase of inflation since July 2007[19]. Therefore, under the high pressure of keeping inflation rate stable and withdrawing money, SBV was forced to increase reserve requirement ratios by 1.5-2 times. In deed, VND deposit with term less than 12 months was required to have reserve ratio of 10% (the original ratio is 5%), except for Agribank. Reserve requirement ratio applicable to Agribank rose from 4% to 8%. That of VND deposit with term from 12 months to under 24 months increased from 2% to 4%. The SBV adjustment of reserve requirement ratio might pick up fund mobilization cost of financial institutions.

As reported by SBV (2008), although the global economic downturn stemmed from the U.S. in 2008 left many economies in recession and their massive banking system under negative impacts, Vietnam banking system still remained stable and witnessed a relative growth

[18] SBV (2007) reported a five-fold increase in foreign investment in 2006, which lead to unprecedented monetary movement in 2007 that followed by a considerable increase in credits amount as well as appreciation of VND.

[19] CPI in 2007 grew by 12.63% much higher than the rate of 6.6% in 2006.

thanks to timely and appropriate management policy of the SBV. The main banking services including accepting deposits and making business loans continued to grow at more than 12% compared to the last year 2007. Moreover, 2008 was considered as a peak time of merger and acquisition (M&A) activities with foreign investors in Vietnamese commercial banks[20] (VPBank Securities, 2014). The involvement of foreign partners in domestic banks brought a change for Vietnamese banks to approach better policy management as well as updated technology. Indeed, Vietnamese banking system experienced a significant changes in banking technology, such as the enlargement of automatic teller machine (ATM), the application of high-tech banking services and the expansion of computerized transactions, which likely increase technical efficiency of Vietnamese banks (Nahm and Vu, 2013). Thanks to above two-mentioned explanations, despite of global financial crisis, average efficiency level improved in 2008 from 40.7% in 2007 to 74% in 2008.

Illustratively, in year 2009, a year after the Global Financial Crisis (GFC), the average technical efficiency for all banks declined and stood at 55.9%. The reduction in efficiency level of Vietnamese banking system can be explained by the lagged effect of GFC, that is, GFC only hit Vietnamese economy since early 2009. This fact is likely to be consistent with study of Sufian (2009) who found a high degree of inefficiency of Malaysian banking sector only since a year after the East Financial Crisis (i.e.1999) due to the under utilization of inputs resources. In deed, since early 2009, Vietnam's economy witnessed a downturn due to a decrease in demand for exports, foreign direct investment (FDI), and remittances. The inflow of FDI declined substantially from $64 billion of registered capital in 2008 to only around $10.4 billion in 2009. The financial crisis pushed three million people below the $2-a-day poverty line (Thurlow et al., 2011). The GDP growth rate in 2009 decreased to 5.39%, which is considered as the second lowest GDP growth in the last decade.

A slight recovery of efficiency was seen in the period 2009-2010, before efficiency level reached the highest peak at 86.5% in 2011. The slight increase of efficiency from 55.9% in 2009 to 61.1% in 2010 is consistent with the result of study Ngo (2012) who considered Vietnamese banking efficiency from 1990-2010. However, the efficiency levels in the year 2010 estimated by this study (61.1%) are slightly higher than those estimated by DEA in Ngo

[20] During 2005-2012, there were 16 M&A transactions with foreign investors. More than half were conducted in 2007 and 2008.

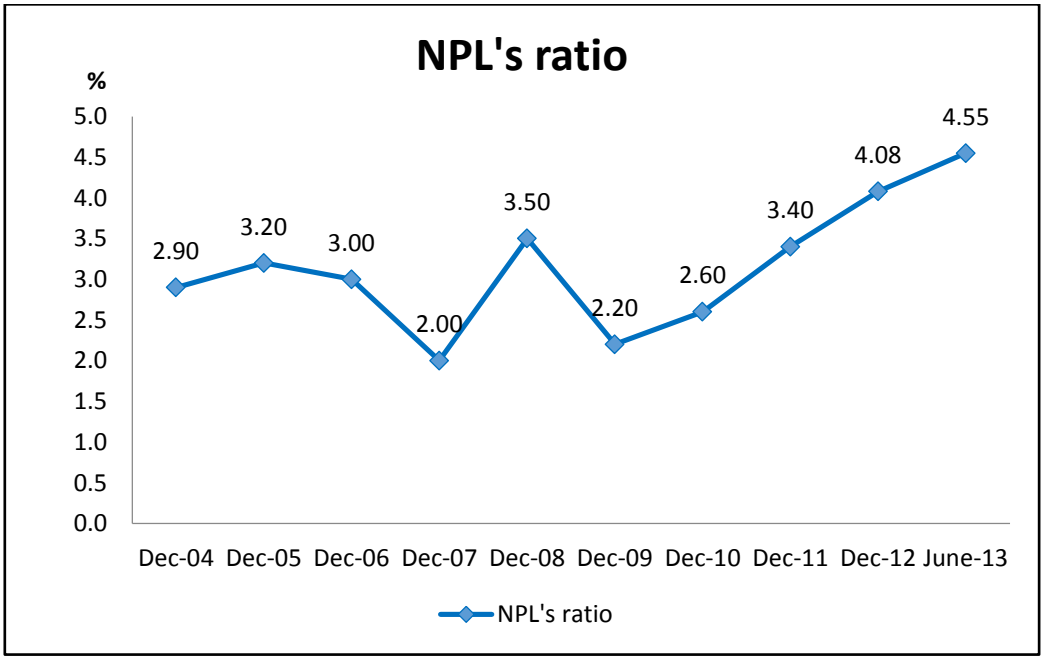
(2012) (under 60%). This finding is in line with prior evidence in the literature on efficiency and different techniques used, that is, the efficiency scores estimated by DEA are generally slightly lower than those estimated by SFA (Ariff and Can, 2008).

2010 – 2011 was considered as a period that witnesses the most significant results from Vietnamese banking system's reforms under the Restructuring Financial Institutions 2011-2015 Program. First, in terms of chartered capital, changes in regulation that requires all banks to have minimum capital requirement of VND3 Trillion by 31 December 2011 became both a motivation as well as a pressure for small banks with poor performance (i.e. poor lending practices, insolvency, illiquidity) to be merged by other strong banks or proactively sought outside capitals via share issuance or stock markets. By the end of 2011, only two banks had charter capital less than VND3 Trillion: PG Bank and Bao Viet Bank. This fact was likely to enhance internal capital strength of Vietnamese banking system, which results in a considerable improvement of capital adequacy ratio of commercial banks (SBV, 2011). The proportion of short-term fundings used to finance medium and long-term loans decreased in the whole banking system (SBV, 2011). Moreover, since 2010, as mentioned before in Section 2.1 (p.12), the capital adequacy ratio (CAR) rose from 8% to 9% and loan-to-deposit ratio was required to be no more than 85%, that is, banks were exposed to a lower level of financial risks, especially liquidity risk. Second, in respect of equitization, 2011 marked an initial completion of all SOCBs' initial public offering, except for Agribank, and also the increasing involvement of foreign partners in domestic banks (VPBank Securities, 2014). As a result, thanks to comprehensive banking reforms, commercial banks reached the peak of efficiency scores in 2011.

Over the last two years 2012 – 2013, efficiency experienced a considerable decrease from 86.5% in 2011 to 61.1% in 2013. This could be explained by the increase of non-performing loans (NPL) level in the whole Vietnamese banking system. As reported by commercial banks, banking system NPL's ratio continued to increase to 4.55% by June 2013 and did not see any signs of decreasing in the future (see Figure 5.2). Moreover, SBV noticed that the rate of bad debts in the whole banking system was understated, with the actual rate doubling the number stated. Even worse, NPL ratio for the first nine month of 2013 might reach 12.7%, while Fitch Ratings estimated this amount ranging from 15% to 20% (VP Bank Securities, 2014). Compared to JSCBs or FOBs, SOCBs were defined as a group having the

highest level of non-performing loans, with their NPL accounted for 70% of total NPLs as of September, 2012 (SBV, 2012). A large proportion of NPLs was from SOEs which experienced weak financial conditions or bankruptcy situations due to the adverse effects of European sovereign debt crisis. Also, the increase in banks' credit risks could be explained by the plunge in collateral property assets of bad debts (SBV, 2012). Therefore, commercial banks had to continuously increase their financial risk provision to write off their bad debts, which eventually lead to an increase in operating expenses and a reduction in bank profits (SBV, 2012). The considerable increase of non-performing loans in the Vietnamese banking system became the motivation for the establishment of Vietnam Asset Management Company (VAMC) – a specialized company solving NPL problems as mentioned before. According to Decision 53, Circular 19 and 20, VAMC's responsibility is to buy bad debts of all Vietnamese commercial banks and clean up NPLs from their balance sheet.

Figure 5.2 Vietnamese banking system NPL's ratio in 2004 - 2013



Source: SBV

5.1.3. Technical efficiency across different bank groups

It is also interesting to test whether there are any significant differences in efficiency across sub-groups divided by ownership status and the scale of size. Hence, average efficiency scores in each year of the full observations, different asset size groups and ownership status groups will be illustrated in Table 5.2. The outstanding point emerged from Table 5.2 is that

there is no evidence of considerable differences in efficiency between sub-groups. In deed, with regard to the comparison of three asset groups, large banks seem not to have any additional advantages in terms of technical efficiency over medium-size banks or small banks, which is in line with result found by Pi and Timme (1993). This result contrasts with the significant differences which are often found in the banking literature, that are, efficiency increases with bank size (see Berger and Mester, 2003) or larger banks tend to be less efficient (see Kwan, 2002). A possible explanation for this case is that the additional cost from managing more complex banks could offset the reduced costs that large banks gain from expanding their branch networks/ their scale.

Table 5.2 Vietnamese banking system – distance function efficiency scores

Year	Asset Groups			Ownership Groups			All banks
	Large banks	Medium-sized banks	Small banks	SOCBs	JSCBs	FOBs	
2006	41.68442	39.71048	43.12502	42.35991	42.09483	41.84928	42.12017
2007	40.72859	38.87667	41.67337	42.87488	39.63369	42.72392	40.65126
2008	74.35002	74.21950	73.43306	74.20257	74.35010	70.72387	73.98692
2009	56.16097	55.22844	56.24376	57.47959	55.51972	56.42701	55.94987
2010	61.96065	61.32598	60.35667	62.24779	61.13361	59.24386	61.13053
2011	86.62990	86.76465	86.19313	85.08607	87.18477	84.70189	86.49113
2012	73.45580	74.81578	75.45001	71.16102	75.38345	72.91753	74.57387
2013	61.40996	62.18904	59.52216	59.10268	61.84270	59.59579	61.13028
Mean	62.04754	61.64132	61.99965	61.81431	62.14286	61.02289	62.00425

Large banks include banks with total assets greater than VND100,000 Billion. Medium-sized banks between VND40,000 Billion and VND100,000 Billion. Small banks include banks with total assets less than VND40,000 Billion. SOCBs and JSCs denote state-owned commercial banks, joint-stock commercial banks, respectively. FOBs include both wholly-owned foreign banks and joint venture commercial banks

With regard to bank ownership type and efficiency, on average, foreign banks (i.e. joint-venture banks and 100% foreign capital banks) are approximately equally efficient to private domestic banks and state-owned banks. The most significant difference between these ownership bank groups was seen in the year 2008; but with very a very marginal variation. To illustrate, the mean efficiency for the group FOBs was 70.7%, while the corresponding scores for the Group SOCBs and JSCBs were 74.2% and 74.4%, respectively. Our finding is not in line with major findings of emerging markets in which FOBs are generally efficient than SOCBs and JSCBs (see Hasan and Marton, 2000; Isik and Hassan, 2002; Berger, 2009).

Possible reasons are as follows. Compared to other counterparts in banking system, although FOBs could have a better risk management processes, greater lending practices, more updated banking technology; the operation of FOBs are still restricted to only one or two branch offices in either of the two biggest cities including Hanoi and Ho Chi Minh city (Nahm and Vu, 2013). They, thus, have limited customer base, small amount of market share, and only focus on wholesale services rather than both wholesale and retail banking services. Also, acting as a foreign banks, theoretically, they faced a number of difficulties such as differences in language, culture, currency, country-specific market features and bias against foreign institutions (Nahm and Vu, 2013).

In addition, there was no difference in efficiency between SOCBs and JSCBs. That finding constrasts with the common findings in previous studies of Nguyen (2012) who found that JSCBs had greater average efficiency than SOCBs (i.e. 78.3% compared to 63%) and Nahm and Vu (2013) who found that SOCBs were more efficient than JSCBs in terms of both technical and allocative efficiency. Our finding could be explained by the competitive advantages and disadvantages of each sub-groups. Particularly, SOCBs have several advantages over JSCBs such as: (i) with a longer history, SOCBs have a wider nationwide network of branches and transaction offices, wider customer networks and a greater reputation with domestic depositors, which could lead to a benefit in mobilizing fund (VPBank Securities, 2014); (ii) currently, SOCBs are the first banking choice for state-owned enterprises which are large and pivotal enterprises in Vietnam such as electricity, gas and petroleum, coal, airline services, and telecom services enterprises) (Nahm and Vu, 2013); and (iii) SOCBs can have explicit support from the government, as they are 'too big too fail' banks of Vietnam. In contrast, JSCBs has their own competitive advantages over SOCBs such as: (i) JSCBs have greater practices and procedures of risk management, which was evidenced by the lower percentage of NPLs (VPBank Securities, 2014); and (ii) JSCBs are less affected by global financial crisis (Nguyen, 2012).

5.2. Stage 2: Determinants of bank profitability

5.2.1. The validity and relevance of model

As mentioned above, Equation (9) was estimated using system GMM estimator developed by Blundell and Bond (1998). In order to capture the dynamic nature of the models and also eliminate the unobserved bank specific effects, the model includes one lagged dependent variables. Also, system GMM estimator is of great benefit when it comes to the potential endogeneity issues because researchers can include instrumental variables for independent endogenous variables. Particularly, considering technical efficiency (TE) as an endogeous variable, this study instrumentalized it by including two variables: NIIA and NIM.

Endogeneity test of technical efficiency

Result of endogeneity test of regressor – TE – was presented in Table 5.3. According to the Table 5.3, the null hypothesis that TE can be treated as exogenous is rejected at 7.8% critical level. This is a border line result between 5% and 10% critical values, therefore, this study decided to treat various technical efficiency levels as endogenous in a system GMM estimation.

Table 5.3 Result of endogeneity test of endogenous regressor – TE

ROA	Coef.	Robust Std. Err.	z	P>|z|
TE	0.0952	0.0471	2.02	0.043
ROA L1.	0.2541	0.1164	2.18	0.029
GDPGR	0.0046	0.0024	1.89	0.058
UNEMP	0.0582	0.0308	1.89	0.059
CR4	-0.0031	0.0016	-1.98	0.047
EQASS	0.1556	0.0646	2.41	0.016
LORES	0.5218	0.2861	1.82	0.068
LODEP	0.0048	0.0039	1.22	0.221
MS	0.0563	0.0481	1.17	0.242
cons	-0.0316	0.0203	-1.56	0.119

Regressors tested: TE

Endogeneity test of endogenous regressors: 3.105

Chi-sq(1) P-val = 0.0780

Instrumented: TE

Included instruments: L.ROA GDPGR UNEMP CR4 EQASS LORES LODEP MS

Excluded instruments: NIIA NIM

The relevance and validity of instruments of technical efficiency

Technical efficiencies (TE) were instrumentalized by net interest income/total assets (NIIA) and net interest margin (NIM) measured by net interest income divided by average earning assets. Thus, the first-stage regression that is a reduced form regression of the endogenous variable (TE) on the full set of instruments was performed. The result of first-stage regression is illutrated in Table 5.4. As suggested by Baum et al., (2003), it is important for us to test the relevance and validity of these instruments. They confirmed that to be considered as "good instruments", variables must meet two following requirements: have correlation with endogenous variable, and orthogonal to the error process[21]. As a result, we examined the approprianess of selected instruments by using the code "ivreg2" in Stata to investigate a set of tests as follows.

[21] Baum et al. (2003) suggest that for model with one edogenous variable, the validity and relevance of instrumental variables can be tested by investigating either R^2 of the first-stage regression with the included instruments "partialled-out'' or the F test of the joint significance of the instruments in the first-stage regression.

Table 5.4 First-stage regression in which TE is treated as a dependent variable

TE	Coef.	Robust Std. Err.	T	P>|t|
ROA L1.	-0.4939	0.4095	-1.21	0.230
GDPGR	-0.0178	0.0162	-1.09	0.276
UNEMP	-0.5151	0.0499	-10.32	0.000
CR4	0.0301	0.0017	17.32	0.000
EQASS	-1.1406	0.2545	-4.48	0.000
LORES	-4.3866	1.2817	-3.42	0.001
LODEP	-0.0623	0.0157	-3.95	0.000
MS	-0.7127	0.2259	-3.15	0.002
NIIA	4.2522	1.1943	3.56	0.001
NIM	-1.6631	1.2164	-1.37	0.174
Cons	0.0908	0.1084	0.84	0.404

Included instruments: L.ROA GDPGR UNEMP CR4 EQASS LORES LODEP MS NIIA NIM

Weak identification test

Ho: equation is weakly identified

Cragg-Donald Wald F statistic: 14.08

Kleibergen-Paap Wald rk F statistic: 20.45

Angrist-Pischke multivariate F test of excluded instruments:

F(2, 136) = 20.45

Prob > F = 0.0000

Stock-Yogo weak ID test critical values for single endogenous regressor:

10% maximal IV size	19.93
15% maximal IV size	11.59
20% maximal IV size	8.75
25% maximal IV size	7.25

Underidentification test

Ho: matrix of reduced form coefficients has rank=K1-1 (underidentified)

Ha: matrix has rank=K1 (identified)

Kleibergen-Paap rk LM statistic Chi-sq(2)=17.85 P-val=0.0001

Weak-instrument-robust inference

Tests of joint significance of endogenous regressors B1 in main equation

Ho: B1=0 and orthogonality conditions are valid

Anderson-Rubin Wald test	F(2,136)= 7.25	P-val=0.0010
Anderson-Rubin Wald test	Chi-sq(2)= 15.67	P-val=0.0004
Stock-Wright LM S statistic	Chi-sq(2)= 8.97	P-val=0.0113

Number of observations	N = 147
Number of regressors	K = 10
Number of endogenous regressors	K1 = 1
Number of instruments	L = 11
Number of excluded instruments	L1 = 2

First, the Angrist-Pischke (AP) multivariate F test of excluded instruments is the F form of a test of weak identification of individual endogenous regressors (i.e. the null hypothesis is that the particular endogenous regressor in question is weakly identified). In our case, the F-test value (F (2,136) = 20.45) is greater than Stock-Yogo weak ID test critical values for single engogenous regressor at 10% maximal IV size (19.93). That means the bias in selected instruments in the model is less than 10%, hence endogenous regressor (TE) is strongly identified. Second, the underidentification test is performed. It is an LM test under the null hypothesis (Ho): the equation is underidentified. In our case, underidentification test (Kleibergen-Paap rk LM statistic) rejected the null hypotheses with p-value less than 5% (i.e. 0.0001), suggesting that the model is identified. Third, for the test of joint significance of endogenous regressors, in our case, Anderson-Rubin Wald test (Chi-square form) and Stock-Wright LM S statistic both rejected the null hypotheses with p-value less than 5% (i.e. 0.0004 and 0.0113, respectively). This means the coefficients of the endogenous regressors in the structural model are not jointly equal to zero. Based on the above tests, it can be concluded that instrumental variables NIIA and NIM are appropriate to represent the endogenous dependent variable TE.

The relevance and validity of the main regression model.

The result of our main regression model estimated by two-step Arrellano-Bover/Blundell-Bond dynamic GMM system is presented in Table 5.5. As mentioned before, this study treats return on assets (ROA) as the dependent variables.

Table 5.5 Determinants of profitability (ROA) of Vietnamese commercial banks.

Model: System GMM two-step.

ROA	Coef.	Corrected Std. Err.	z	P>|z|
ROA L1.	0.7126**	0.3517	2.03	0.04
EQASS	0.1951*	0.1149	1.70	0.09
LODEP	0.0137**	0.0069	1.99	0.05
LORES	0.6157	0.4275	1.44	0.15
MS	0.1639	0.1257	1.30	0.19
TE	0.0534*	0.0290	1.84	0.07
CR4	-0.0024*	0.0014	-1.73	0.08
GDPGR	0.0070***	0.0024	2.88	0.00
UNEMP	0.0193	0.0122	1.59	0.11
Cons	0.0079	0.0260	0.30	0.76
Number of observations			147	
Number of groups			35	
Number of instruments			25	
Hansen			0.81	
Difference –in-Hansen			0.39	
AR(1)			0.21	
AR(2)			0.21	

Notes: Hansen is the p-value of the Hansen test statistic of over-identifying restrictions, while difference-in-Hansen is the p-value of the difference-in-Hansen test of exogeneity of instrument subsets. AR(1) is the p-value of the first-order autocorrelation test statistic, while AR(2) is the p-value of the second-order autocorrelation test statistic.

*, ** and *** denote 10, 5 and 1% significance levels, respectively.

The validity of the obtained results in system GMM model depends on the statistical diagnostics. Therefore, first, model diagnostics will be interpreted. With regard to multicollinearity problem, we assess the degree of correlation between variables used in the multivariate regression model. Result is presented in Appendix 5. Following the matrix,

overall, the correlation between independent variables is not strong (less than 0.8 – the border of correlation suggests a multicollinearity problem, proposed by Kennedy, 2008), thus it is concluded that multicollinearity problems are nonexistent in our case.

Following Baum et al., (2003), Hansen test of over-identifying restrictions and also autocorrelation tests are conducted to ensure the validity of instrumental variables and that of our specified model, respectively (see previous example: Liu and Wilson, 2012). With regard to Hansen test, in this study, it is failed to reject the null hypothesis of Hansen test (0.81) and the p-value did not fall in the suspicious ranges. Therefore, it could be confirmed that (i) instruments are valid and (ii) there is no correlation between the instruments used and the error term in the models. In addition, regarding to the number of instruments used, in this study, 25 instruments were used, that does not exceed the number of observations (147) and number of groups (35). This fact can be considered as a positive sign of an appropriate model that does not have the instrument proliferation problem, following Roodman (2009) who suggested that the number of instruments should less than that of observations and groups to avoid the serious possibilities of false-positive results in system GMM[22]. Moreover, Difference-in-Hansen test is employed to check the validity of a subset of instruments (Roodman, 2009). Similar to result of Hansen test, we failed to reject the null hypothesis that instrument subsets are exogenous.

With regard to autocorrelation test, it should be acknowledged that AR (1) test under the null hypothesis: there is no first-order serial correlation in residuals (see Table 5.5) is failed to reject the null hypothesis at 5% significance level. That means there is no first - order serial correlation in residuals which contrasts to the suggestion of Arrelano and Bond (1991). However, the requirement that there is no second-order serial correlation in the residuals is met in this study's model. Indeed, this requirement can be checked through AR(2) test which have the null hypothesis: *There is no second-order serial correlation in residuals.* According to Table 5.5, this studied case supports the validity of the model

[22] Roodman (2009) suggested two alternative techniques to reduce the number of instruments in cases of over- number of instruments generated in system GMM: (1) use only certain lags rather than all available lags for instruments; and (2) combine instruments through addition into smaller sets

specification because we failed to reject second-order serial correlation tests' null hypothesis at 5% significance level.

Considering above statistical tests, we might conclude that there is enough evidence to confirm the validity of our system GMM model, as statistical tests meet the requirements of system GMM's assumptions. Thus, now, we will move on to economic interpretation of the results reported in Table 5.5.

5.2.2. Economic interpretation of model

In general, the last year ROA (ROA.L1), the level of capital to assets ratio (EQASS), the liquidity ratio (LODEP), technical effciency (TE) and GDP Growth (GDPGR) have positive impacts on accounting bank performance (ROA); while concentration ratio (CR4) is negatively related to ROA. Remaining variables, namely impaired loan reserve to gross loan ratio (LOSRES), market share of individual banks (MS) and unemployment rate (UNEMP) are found to have no effects on bank profitability.

Bank-Specific Determinants

The estimated coefficient of lagged dependent variable (ROA.L1) is significant, positive, and quite close to 1 (0.7), indicating that Vietnamese commercial banks have an ability to sustain profits from year to year. This finding can also be considered as an evidence of not much competitive banking industry. Indeed, currently, four largest SOCBs have accounted for a large percentage of deposit and market share, have received government support and have had a strong customers' network, especially large SOEs in Vietnam. Therefore, they could enjoy some benefits relative to other counterparts.

Risk management is an important topic in commercial banks. Therefore, we first examine whether the profitability of banks is affected by whether or not their capitalization level are growing. In general, the level of capital to assets ratio (EQASS) seems to have positive impact on bank performances. This is consistent with previous empirical findings (see Demirguc-Kunt and Huizinga, 1999; Kosmidou et al., 2007; Olson and Zoubi, 2011). Well-capitalized banks tend to follow a prudent business policy with low financial leverage, which reduce their risks of going bankrupt, gain more customers' trust and eventually could reduces their costs of funding (Kosmidou, 2008). The positive result between EQASS and

ROA confirms the appropriateness of Vietnamese banking regulation which adopted Basel I on capital adequacy since 2005 and are in process of adopting Basel II framework.

Regarding to liquidity risk, the liquidity ratio is significantly positively related to bank profitability, which is consistent with prior literature (see Bourke, 1989). This indicates that high loans-to-customers plus short-term funding ratio (LODEP), that is lower level of liquidity, could bring more profits to Vietnamese commercial banks (i.e. more loans, more profits). A bank with relatively less liquid assets could be more profitable compared to asset liquidity management in which a large proportion of liquid assets must be stored all times (Rose and Hudgins, 2012).

This study also examines whether credit risk have an impact on Vietnamese bank performance. As mentioned before, credit risk of a commercial bank is measured by the ratio of gross loans divided by reserves for impaired loans (LORES). The coefficient of LORES is positive but insignificant, implying that banks' credit risk conditions do not affect bank profitability. This finding contrasts with the majority of previous findings which found a significant relationship between credit risk and bank profitability (e.g. Kosmidou et al., 2007; Liu and Wilson, 2010). However, our result is in line with Dinh (2013) who found loan loss provision to total aset ratio is not related to profit before tax when examining 51 banks during 2000 – 2012. To understand this study's insignificant finding, it should be acknowledged that Vietnamese commercial banks' loan loss provisions are likely underestimated because non-performing loans are much below the true level (VPBank Securities, 2014). Also, Vietnamese accounting standard (IAS 39) restricted the loan loss provision, as IAS 39 requires an objective evidence on impaired loans before loan loss provision can be made.

Industry-specific Determinant

To understand the relationship between banking concentration level and bank profitability, we will examine sets of variables: individual bank market share (MS), technical efficiency (TE) and concentration ratio (CR4) instead of analysing only CR4 variable. Table 5.5 shows a significantly positive sign on the TE coefficient. The coefficient of MS is insignificant, while the CR4 coefficient is significant but negative signed. These results imply preliminary

support for the relative technical efficiency hypothesis. In other words, banks with higher level of technical efficiency would have a greater level of profitability. This result is in line with Berger (1995a). As the efficiency analysis in the first stage (Section 5.1) indicates that a typical Vietnamese bank, on average, wastes about 46% of its resources relative to best-practice banks on the frontier, the finding of positive relationship between TE and ROE will give banks a suggestion to improve their usage of inputs in producing outputs to increase their profitability.

The insignificant relationship between market share and profitability indicates that banks with a higher market share are not likely to exercise more market power and earn higher profits. The negative relationship between market concentration and bank profitability suggests two facts. First, there is no market power advantage in Vietnamese banking system[23]. That is, commercial banks might not exercise market power in setting prices of both inputs and outputs in Vietnamese banking industry. Even worse, higher market concentration causes higher competition in banking industry, which can lead to a decrease in ROE (see Boone and Weigand, 2000). The fact of no market power advantage in Vietnamese banking system could be explained by the reason that, currently, SBV still has the power to set price of banking products and it is not completely free for commercial banks to set their banking services' price. In adverse cases when prices of banking products (loans or deposits) fell beside expected range of SBV, SBV immediately using their regulatory power to adjust the price of commercial banks' products. To exemplify, in 2008, when commercial banks' lending interest rate was quite high (18.5-19% in March 2008), SBV issued Decision No.16/2008/QD-NHNN on the management of the base interest rate in VND (SBV, 2008). Accordingly, SBV specified the mobilization cap of 12% for the period from February 2008, and lending interest rate must be less than 150% of the base interest rate set by SBV.

[23] The negative relationship between bank concentration and profitability has also been found by Berger (1995b) and Crowley (2007)

Macroeconomic Determinants

With regard to the hypothesis in the relationship between business cycle and bank profitability literature, this study first analyse whether bank profitability is positively or negatively related to GDP growth (GDPGR). It is found that there is a significant positive relationship between GDP growth and profitability, which is consistent with traditional theory. Theoretically, when an economy witnesses a growth of personal consumption, investment, net exports of goods and services, there will be more demand for bank loans, which can lead to an increase in bank profits. In terms of empirical findings, this result is in line with results of Dinh (2013)'s study on 51 Vietnamese commercial banks from 2000 to 2012. She argues that (i) commercial banks (except for foreign banks) took advantages of high GDP growth rate to offer more loans and (ii) during positive economic periods, lenders easily afford and repay their debts. Indeed, World Bank (2014b) records that during the period from 2006 to 2013, GDP growth rate remained relatively high, starting at 6.98% and reaching a peak of 7.13% in 2007, before slightly decreasing to 5.24% in 2012 and then increasing to 5.46% in 2013.

With respect to the second macroeconomic variable – the unemployment rate (UNEMP), it is insignificant, that is, Vietnam bank profitability do not have relationship with unemployment rate. This result is the opposite of that found in Bikker and Hu (2002). The result implies that employment rate may not be a true proxy for loan demand (Beatty and Liao, 2011). In other words, loan growth is not decreased, when unemployment rate increases. This potential explanation is counter to a traditional hypothesis, that is, higher employment rate indicating a downward slope of economy, less people would have demand for bank loan. Moreover, as banks would place more strict requirements and credit assessment criteria, there would be less applicants who can receive credit services from commercial banks. Such traditional argument may be not appropriate in Vietnam case where banks tend to be stringent in granting individual loans. Specifically, only those with good credit rating and stable income are offered loans. Therefore, the impact of unemployment on the volume of loans is minimal, which lead to the insignificant relationship between unemployment rate and bank profitability.

5.3. Policy discussion

This part suggests policies for bank managers, supervisors and regulators to improve both accounting and economic performance of Vietnamese commercial banks. First, with regard to bank efficiency, even though efficiency scores experienced an overall increase during period 2006-2013, Vietnamese banks are operating much below the frontier of best-practice banks. Therefore, in the future, individual banks still need to invest in research and development function, more actively adopt updated banking technology in their operations, and reduce their costs by exploiting competitive advantages of each bank ownership group as mentioned in Section 5.1.3. For example, SOCBs should reduce their non-performing loans ratio, improve risk management practices; while JSCBs should expand their branches network, invest in marketing and promotion programs to gain more trust from customers. Another suggestion for FOBs is that these banks should utilize benefits of diversification instead of focusing only on wholesale banking services and open more branches, representative offices in other big cities rather than Hanoi and Ho Chi Minh city to widen their network customers. The equal efficiency level of all banking size groups might be an indicator of the nonexistence of economics of scale in Vietnamese banking industry. However, in order to have a more exact answer about the differences in production technology between large-sized banks and small or medium-sized banks, this study should measure efficiency by other techniques and compare the findings with our current findings.

In terms of accounting performance - Vietnamese banks' profitability, the first observation is related to the analytical results of effects of capitalization on ROE. In the process of restructuring commercial banks, SBV expected that bank performance could be improved by an enhancement of capital. SBV required all commercial banks to hold at least VND3 Trillion charter capital by December 2011 and increased the regulatory capital level from 8% to 9% in 2010. According to this study's findings, high level of capitalization could bring more profits to banks. Also, among significant determinants, equity-to-assets ratio (EQASS) exerted the greatest impact on banking profitability. Therefore, the current policy regarding to capitalization is basically appropriate. In the future, due to the important role of capital level in improving bank profitability, SBV still need to follow their previous bank-capital-related-philosophy, gradually give a guidance to help commercial banks to strengthen their

capital level, and eventually meet requirements of the most updated internal standard such as Basel III in terms of capital adequacy.

Another suggestion for banks managers to boost their banks accounting performance is to have attention into managing liquidity risk. This study's finding confirms a positive relationship between loans-to-deposits ratio (LODEP) and bank profitability. Therefore, Vietnamese banks should pay much attention to a flexible assets liabilities management rather than assets liquidity management. In other words, instead of holding a large percentage of liquid assets, especially deposits, commercial banks should make more loans and transfer more capital resources to outsiders (either businesses or individuals). However, it is noted that maintaining a high ratio of loans over deposits, banks could be exposed to high degree of liquidity risk. Thus, to implement the policy of having a high ratio of loans over deposits, banks need to establish a better liquidity management practices such as: (i) estimate and update liquidity needs derived from deposit withdrawal and loans demand on a continuing basis to avoid excess or deficit liquidity positions, (ii) have back-up plans in adverse circumstances to reduce the probabilities of bankruptcy (Rose and Hudgins, 2012).

In addition, regarding to banking industry characteristics, it is concluded that the process of banking liberation which has been carried out since 1990s is appropriate. The study's finding supports the nonexistence of market power in banking industry, which is a positive sign of competitive banking industry in Vietnam. This fact can be contributed by the effort of both government and SBV in creating a level playing field for all banks types from SOCBs, JSCBs to FOBs. Having no power in setting banking products' price, commercial banks still can improve their profitability by another way: enhancing their technical efficiency. Through having better management and/or better technology, Vietnamese commercial banks could have lower costs, higher profits, and bigger market shares. This fact, once again, is a proof of the appropriateness of policies issued by regulators. Since 2000s, SBV and Vietnamese government have performed vigorous reforms in the banking sector in the direction of market opening, gradually loose operational restrictions for foreign banks, and motivate foreign investors to invest in Vietnam. Vietnamese government realized that the increasing involvement of foreign investors in banking operations may enhance the professionalism as well as the technology of domestic banks, which could speed up the efficiency and profitability of Vietnamese commercial banks.

Last but not least, with respect to macroeconomic conditions, the significant positive result of GDP Growth and Vietnamese bank profitability give a suggestion to macroeconomic policy-makers. Accordingly, the government should lay a large attention to maintain a high economic growth rate to push commercial banks to develop in terms of both operational scale and quality, thereby improving their profitability.

CONCLUSION

Over the last two decades, Vietnamese banking system has substantially changed thanks to a series of reforms that aim to (i) transform the banking system from central planning to market-based system, and (ii) modernize the banking sector as well as improve financial capacity of individual commercial banks. This study examines performance of 45 commercial banks during the period 2006-2013 by conducting two separated research phases. We first estimate bank-specific efficiency levels – economics performance – for a panel of 196 banks over an 8-year period under the stochastic frontier approach (SFA) method applying translog input distance function. To take into account impact of environmental factors z on efficiency scores, instead of using two-step procedure, this study utilizes one-step model in which (i) z variables are incorporated directly into the frontier production function and (ii) the effects of z variables on efficiency levels are estimated by maximum likelihood technique. The second research phase is an assessment of determinants of bank profitability measured by accounting performance proxy – returns on assets (ROA). Three different groups of determinants, namely bank-specific (including technical efficiency estimated from the first stage), industry-specific and macroeconomic factors, are examined by using system generalized method of moments (GMM).

Regarding to technical efficiency, during the period 2006-2013, the performance of Vietnamese banking system was on an increasing trend in general. The average efficiency score of Vietnamese commercial banks was 64.08%, which suggest a typical Vietnamese bank in period 2006 – 2013 wasted around 46% of its resources relative to best-practice banks on the frontier. The highest levels of efficiency were witnessed in 2008 (74%) and 2011 (86.5%); while the lowest efficiency scores happened in the years 2006 and 2007 due to the “boom and burst” of the Vietnamese security market in 2006. There were two major drops of banking efficiency level during 2006-2013. First, the 2009 drop can be primarily attributed to the instability of the Vietnam’s economy caused by the global financial crisis’s lagged effect. Second, the increase of non-performing loans led to a reduction of efficiency in 2012 and 2013.

With respect to efficiency scores across different bank groups, first, large banks seem not have any additional advantages in terms of technical efficiency over medium-size banks or small banks, which is in line with result found by Pi and Timme (1993). A possible

explanation for this case is that the additional cost from managing more complex banks could offset the reduced costs that large banks gain from expanding their branch networks/ their scale. Second, on average, there was no difference in efficiency between state-owned banks, joint-stock commercial banks, and foreign banks. This may be due to the fact that each group has their own distinctive advantages and also possesses disadavantages compared to its counterparts. In comparison with JSCBs and FOBs, SOCBs have a wider network of branches and transaction offices, a wider customer networks, a greater reputation with domestic depositors and enterprises, more support from the government. However, they have a weaker management policy and greater level of non-performing loans. FOBs could have a better risk management processes, greater lending practices, more updated banking technology. However, their activities are still focused on only branches in biggest cities such as Hanoi and Ho Chi Minh city, and FOBs encountered difficulties in language, culture, currency, country-specific market features and bias against foreign institutions.

In terms of determinants of bank profitability, bank-specific (including technical efficiency), industry-specific and macroeconomic factors are considered. For bank-specific variables, the capital to asset ratio (EQASS) has a positive and significant impact on profitability, which shows that equity decisions of bank management are instrumental in influencing bank performance. Additionally, the loan-to-deposit (LODEP) ratios are also positively related to the profitability of Vietnamese banks. This suggests that lower level of liquidity could bring more profits to Vietnamese banks. The insignificant relationship between the impair loan loss reserves to gross loan ratio (LOSRES) and bank profitability contrasts with the majority of previous findings which found a significant relationship between credit risk and bank profitability (see Kosmidou et al., 2007; Liu and Wilson, 2010). However, this result is in line with Dinh (2013)'s result. This relationship should have a deeper analysis because of the fact that currently, the loan-loss-provisions stated by commercial banks seem to be much below the true level. Technical efficiency (TE) is found to be positively correlated with Vietnamese bank profitability, which is a preliminary support for efficient structure hypothesis in which increased efficiency can lead to higher profit. The market share (MS) also has no impacts on bank accounting performance, which implies that banks with a higher market share are not likely to exercise more market power and earn higher profits.

In terms of industry-specific factor, market concentration (CR4) is found to be negatively related to bank profitability, which is in line with results of Berger (1995b) and Crowley (2007). This relationship implies that increasing market concentration does not bring any additional advantages to commercial banks. Even worse, higher bank concentration causes a tougher competition in the banking industry (Boone and Weigand, 2000). With respect to macroeconomic factors, GDP growth (GDPGR) has positive impact on bank profitability. This means the government should lay a large attention to maintaining a high economic growth rate to boost the operational activities of banking industry. Additionally, unemployment rate (UNEMP) is insignificant in explaining bank profitability. A posible reason for this case is that Vietnamese banks applied a strict individual lending policy, that is, only those with good credit rating are offered loans.

Due to the limitation of time and data, our research only examines efficiency under SFA method and the impact of chosen determinants on ROE. Therefore, the current study can be extended by measuring profit efficiency, using other method such as DEA (Data Envelopment Analysis), and also testing the relationship between the determinants on other profitability measures such as return on asset or net income.

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Appendix 1 Vietnamese Banking Sector

State-Owned Commercial Banks

Bank	Year of Establishment	State's Ownerships as at 31 Dec 2013	Details of IPO
Bank for Investment and Development of Vietnam (BIDV)	1957	95.8%	IPO in December 2011, sold 3.68% stake First SOCB bank successfully had IPO
Joint Stock Commercial Bank for Foreign Trade of Vietnam (Vietcombank)	1963	77.1%	IPO in December 2007, sold 6.5% stake
Vietnam Joint-Stock Commercial Bank for Industry and Trade (Vietinbank)	1988	60.3%	IPO in December 2008, sold 4% stake
Vietnam Bank for Agriculture and Rural Development (Agribank)	1988	100%	
Mekong Housing Bank (MHB)	1997	91.0%	IPO in July 2011, sold 9% stake

Joint-Stock Commercial Banks (JSCBs)

34 banks, including **9 large-sized banks** (assets as at 31 December 2013 greater than VND100 Trillion): (1) Asia Commercial Joint-stock Bank, (2) Military Commercial Joint Stock Bank, (3) Saigon - Hanoi Commercial Joint Stock Bank, (4) Saigon Commercial Bank, (5) Saigon Thuong Tin Commercial Joint-Stock Bank, (6) Vietnam Export Import Commercial Joint Stock Bank, (7) Vietnam Maritime Commercial Stock Bank, (8) Vietnam Technological and Commercial Joint-Stock Bank, (9) Vietnam Prosperity Joint Stock Commercial Bank.

7 medium-sized banks (assets as at 31 December 2013 less than VND100 Trillion and greater than VND50 Trillion: (1) An Binh Commercial Joint Stock Bank, (2) DongA Commercial Joint Stock Bank, (3) Lien Viet Post Joint Stock Commercial Bank, (4) Ocean Commercial Joint Stock Bank, (5) Southeast Asia Commercial Joint Stock Bank, (6) Southern Commercial Joint Stock Bank, (7) VietNam International Commercial Joint Stock Bank.

18 small-sized banks (assets as at 31 December 2013 less than VND50 Trillion)

Foreign-Owned Banks (FOBs)

Joint-Venture Banks in Vietnam

Bank	Year of Establishment	Local Partner	Foreign Partner
Indovina Bank	1990	Vietinbank (50%)	Cathay United Bank in Taiwan (50%)
VID Public Bank	1991	BIDV (50%)	Public Bank Berhad, Malaysia (50%)
Vinasiam Bank	1995	Agribank (50%)	Siam Commercial Bank, Thailand (33%) & Charoen Pokphand Group, Thailand (33%)
Vietnam Russia Bank	2006	BIDV (50%)	VTB, Russia (50%)

100% Foreign Capital Banks

Bank	Year of Establishment	Foreign Investor
Shinhan Bank Vietnam	1994	Shinhan Bank, Korea
ANZ Bank (Vietnam) Limited	2008	Australia and Newzealand Banking Group
Hong Leong Bank (Vietnam) Limited	2008	Hong Leong Bank Berhad, Malaysia
HSBC (Vietnam) Limited	2008	HSBC Group
Standard Chartered (Vietnam) Limited	2008	Standard Chartered Group

Note: Initially, Shinhan Bank is a joint-venture bank, and then became 100% foreign owned bank since 2011

Source: VPBank Securities (2014) and author's summary

Appendix 2 M&A Transactions with foreign investors in Vietnamese banking industry 2005-2012

Source: VPBank Securities (2014)

Target	Date	Foreign investors	Purchased stake
ACB	7/1/2005	Standard Chartered bank	8.80%
TCB	12/1/2005	HSBC	10%
VPB	9/1/2006	OCBC Singapore	10%
TCB	1/1/2007	HSBC	10%
Ocean Bank	1/1/2007	BNP Parisbas	15%
Eximbank	7/1/2007	Sumitomo Mitsui Bank	15%
Habubank	10/1/2007	Deutsche bank	10%
An Binh Bank	3/1/2008	Maybank	15%
ACB	7/1/2008	Standard Chartered bank	6.16%
Southern Bank	7/1/2008	United Overseas Bank	20%
VPB	8/1/2008	OCBC Singapore	5%
Seabank	8/1/2008	France Societe Generale Bank	15%
VIB	9/1/2008	Common Wealth of Australia	15%
Vietinbank	1/1/2011	International Finance Corporation	10%
VCB	9/1/2011	Mizuho Bank	15%
Vietinbank	12/1/2012	Bank of Tokyo Mitsubishi UFJ	19.73%

Note: Target banks are denoted by code. Details of code are presented in Appendix 3

Appendix 3 Lists of commercial banks used in the study from 2006-2013 *(Alphabetically ordered)*

ID	Category	Code	BANK NAME	AVERAGE ASSETS (VND Million)
1		An Binh Bank	An Binh Commercial Joint Stock Bank	45,799,775
2	FOBs	ANZ	ANZ Bank (Vietnam) Limited	33,964,300
3		ACB	Asia Commercial Joint-stock Bank	154,032,225
4	SOCBs	BIDV	Bank for Investment and Development of Vietnam	339,234,988
5			Bao Viet Commercial Joint Stock Bank	13,409,700
6			DongA Commercial Joint Stock Bank	52,774,120
7			Global Petro Commercial Joint Stock Bank	7,214,810
8			Ho Chi Minh City Development Joint Stock Commercial Bank	86,226,641
9	FOBs		Hong Leong Bank Vietnam Limited	4,088,977
10	SOCBs	MHB	Housing Bank of Mekong Delta	38,533,519
11	FOBs		Indovina Bank Ltd.	708
12	SOCBs	Vietcombank	Joint Stock Commercial Bank for Foreign Trade of Vietnam	299,987,825
13			Lien Viet Post Joint Stock Commercial Bank	50,898,185
14			Mekong Development Joint Stock Commercial Bank	12,034,978
15		MBB	Military Commercial Joint Stock Bank	106,774,812
16			Nam A Commercial Joint Stock Bank	21,226,767
17			Nam Viet Commercial Joint Stock Bank	17,776,365
18			Bac A Comercial Joint Stock Bank	33,738,283
19			North Asia Bank	10,931,450
20		Ocean Bank	Ocean Commercial Joint Stock Bank	40,632,783
21			Orient Commercial Joint Stock Bank	16,216,386
22			Petrolimex Group Commercial Joint Stock Bank	15,782,398
23		SHB	Saigon - Hanoi Commercial Joint Stock Bank	62,343,394
24			Saigon Bank for Industry and Trade	11,088,633
25			Saigon Commercial Bank-Saigonbank	56,558,351
26			Saigon Thuong Tin Commercial Joint-Stock Bank	108,644,813
27	FOBs		Shinhan Bank Vietnam	20,180,850
28			Southeast Asia Commercial Joint Stock Bank	65,499,467
29			Southern Bank-Phuong Nam Commercial Joint Stock Bank	75,269,552
30			Southern Commercial Joint Stock Bank	9,115,671
31			Tien Phong Commercial Joint Stock Bank	20,742,289
32	FOBs		VID Public Bank	6,163,938
33			Viet Capital Commercial Joint Stock Bank	8,225,404
34			Viet Nam Thuong tín Joint Stock Commercial Bank	16,900,200
35			Vietnam Asia Commercial Joint-Stock Bank	12,772,866
36	SOCBs	Agribank	Vietnam Bank for Agriculture and Rural Development	447,743,014
37			Vietnam Development Bank	125,137,925
38		Eximbank	Vietnam Export Import Commercial Joint Stock Bank	114,582,286
39		VIB	VietNam International Commercial Joint Stock Bank	83,16,625
40	SOCBs	Vietinbank	Vietnam Joint-Stock Commercial Bank for Industry and Trade	358,791,129
41			Vietnam Maritime Commercial Stock Bank	102,126,260
42		VPB	Vietnam Prosperity Joint Stock Commercial Bank	61,555,786
43		TCB	Vietnam Technological and Commercial Joint-Stock Bank	132,186,261
44	FOBs		Vietnam-Russia Joint Venture Bank	4,777,978
45	FOBs		VinaSiam Bank	212

Appendix 4 Parameter estimates of regression model using maximum likelihood method to estimate technical efficiency

Independent variables	NEGLX1	Description	Coef.	Std. Err.	P-value
Frontier					
	LX21	Ln (X2/X1)	1.50457	2.08814	0.47100
	LX31	Ln (X3/X1)	5.59130	2.32026	0.01600
	LX21LX21	Ln (X2/X1) * Ln (X2/X1)/2	-0.18277	0.18859	0.33200
	LX31LX31	Ln (X3/X1) * Ln (X3/X1)/2	0.01022	0.23056	0.96500
	LX21LX31	Ln (X2/X1) * Ln (X3/X1)	0.35529	0.15744	0.02400
	LY1	Ln (Y1)	-0.97379	0.82440	0.23800
	LY2	Ln (Y2)	-1.26547	0.93614	0.17600
	LY3	Ln (Y3)	-2.17458	1.01365	0.03200
	LY1LY1	Ln (Y1) * Ln (Y1)/2	-0.19777	0.04701	0.00000
	LY2LY2	Ln (Y2) * Ln (Y2)/2	-0.17191	0.04305	0.00000
	LY3LY3	Ln (Y3) * Ln (Y3)/2	-0.03993	0.02604	0.12500
	LY1LY2	Ln (Y1) * Ln (Y2)	0.18800	0.04245	0.00000
	LY1LY3	Ln (Y1) * Ln (Y3)	0.05824	0.06748	0.38800
	LY2LY3	Ln (Y2) * Ln (Y3)	0.03908	0.07331	0.59400
	LY1LX21	Ln (Y1) * Ln (X2/X1)	-0.05227	0.07695	0.49700
	LY1LX31	Ln (Y1) * Ln (X3/X1)	0.21532	0.08491	0.01100
	LY2LX21	Ln (Y2) * Ln (X2/X1)	-0.00548	0.07498	0.94200
	LY2LX31	Ln (Y2) * Ln (X3/X1)	-0.09229	0.07944	0.24500
	LY3LX21	Ln (Y3) * Ln (X2/X1)	0.00150	0.19086	0.99400
	LY3LX31	Ln (Y3) * Ln (X3/X1)	-0.49136	0.20825	0.01800
	_cons	Constant	34.61824	13.31084	0.00900
Mu					
	GDPCAP	Annual GDP per capita growth rate	-0.05368	0.04909	0.27400
	MSG	Annual broad money growth rate	0.01497	0.00376	0.00000
	ASSGDP	Total assets of banking industry/GDP	-0.00296	0.00107	0.00600
	CAPASS	Total equity/ Total assets of banking industry	-0.14836	0.04129	0.00000
	CR4	Concentration ratio of four largest banks	-0.02530	0.00817	0.00200
	_cons	Constant	3.39893	0.81922	0.00000
Usigma					
	_cons	Constant	-4.45611	1.51021	0.00300
Vsigma					
	_cons	Constant	-3.25517	0.45079	0.00000
	sigma_u	Random variables associated with TE	0.10774	0.08135	0.18500
	sigma_v	Random variables associated with SN	0.19640	0.04427	0.00000
	lambda		0.54855	0.12437	0.00000

Note: Ln denotes logarithm |X1 = interest expenses. X2 = personnel expenses. X3 = other operating expenses.
Y1 = gross loans. Y2 = Other earning assets. Y3 = non -interest operating income.
TE = technical efficiency. SN = Statiscal noise. Gamma = 0.23 – falls in the acceptable range 0.2 – 0.7.

Appendix 5 Cross Correlation Matrix

	ROA	EQASS	LODEP	LORES	MS	TE	CR4	GDPGR	UNEMP
ROA	1								
EQASS	0.2430	1							
LODEP	0.0069	-0.0281	1						
LORES	0.0018	-0.0008	0.0563	1					
MS	-0.0428	-0.2170	0.2282	0.1235	1				
TE	-0.0636	-0.2639	-0.2236	0.0540	-0.3039	1			
CR4	0.1469	0.3496	0.1420	0.0982	0.4199	-0.1314	1		
GDPGR	0.0899	-0.0386	0.1481	0.0311	0.1838	-0.4603	0.2560	1	
UNEMP	0.1451	0.3292	0.1289	0.0175	0.3461	-0.4838	0.7417	0.3813	1