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BANK STRUCTURE, EFFICIENCY AND RISK MANAGEMENT IN VIETNAM

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Contents

List of Tables

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

List of Figures

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Abstract

The purpose of this thesis is to examine the feature of the Vietnamese banking system in terms of bank structure, bank efficiency and risk management. We extend the structural, non-structural and efficiency models to make them applicable to Vietnam. Findings from these models explain the performance and level of efficiency of the whole banking system, state owned commercial banks (SOCBs) and non-state owned commercial banks (non-SOCBs).

At the theoretical level, this thesis investigates the development of Vietnamese banking in four stages: (1) the period prior to 1986; (2) 1986–1995; (3) 1996–2005; (4) 2006 until now. We also put an emphasis on the Vietnamese crises in 1997 and 2008. Through such investigations, we are able to incorporate a number of financial fundamentals to the bank structure and efficiency models that capture the features of the Vietnamese banking system. Moreover, we construct a large data set of 48 Vietnamese commercial banks in the period from 1999 to 2009. This time span covers both the post 1997 Asian and 2008 Global crises, which allows us to estimate the impacts of financial crises on the banking system. At the empirical level, this thesis provides, for the first time, a comprehensive application of the extended structural (Structure-Conduct-Performance (SCP) and Efficiency Hypothesis (EH)) and non-structural (Panzar-Rosse) models. In the non-structural model, we employ models using current and lagged input prices, both with and without assets. Moreover, both equilibrium and disequilibrium approaches are used to examine the bank structure. This is the first time the semi-parametric model is applied through the two-stage procedure for the Vietnamese banking system. In addition, it is also the first study that carries out a survey of risk management using a questionnaire.

Our empirical results suggest that large commercial banks still dominate the whole banking system based on the concentration ratio and Herfindahl-Hirschman Index. The structural model does not support either the traditional or efficiency hypothesis. The non-structural model (disequilibrium approach with lagged input prices and without assets) indicates the environment of monopoly. There are decreasing trends of efficiency scores between 2001 and 2002, and between 2007 and 2008. Results from our survey indicate that there is a difference between efficient banks in terms of risk area identification, risk monitoring methods and credit risk analysis.

Abbreviations

ADB	Asian Development Bank
ALCO	Asset and Liability Committee
ANZ	Australia and New Zealand Banking Group Limited
APEC	Asia Pacific Economic Cooperation
AR(2)	Arellano and Bond Test for Second-Order Autocorrelation
ASEAN	Association of South East Asian Nations
BCC	Variable Returns to Scale
BFBs	Branch of Foreign Banks
CAR	Capital Adequacy Ratio
CCR	Constant Returns to Scale
CI	Confidence Interval
CIC	Customer Information Centre
CPI	Consumer Price Index
CR	Concentration Ratio
CSM	Credit Scoring Model
DEA	Data Envelopment Analysis
DFA	Distribution-Free Approach
DGP	Data Generating Process
DMU	Decision Making Unit
DNB	De Nederlandsche Bank
E1	Average Efficiency Scores Using A 0.59 Cut-off Point
E2	Average Efficiency Scores Using A 0.89 Cut-off Point
EH	Efficiency Hypothesis
EU	European Union
FDI	Foreign Direct Investment
FE	Fixed-Effects
FIs	Financial Institutions
FOREX	Foreign Exchange Transactions Centres
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
GSM	General-to-Specific Methodology
HHI	Herfindahl-Hirschman Index
HSBC	Hong Kong and Shanghai Banking Corporation
IFC	International Finance Company
IMF	International Monetary Funds
IPO	Initial Public Offering
IT	Internet Technologies
JSCBs	Joint Stock Commercial Banks

JVCBs	Joint Venture Commercial Banks
MS	Market Share
Non-SOCBs	Non-State Owned Commercial Bank
NPLs	Non-Performing Loans
OECD	Organisation of Economic Cooperation Development
OLS	Ordinary Least Squares
PASW	Predictive Analytics Software
PEs	Private Enterprises
SBV	State Bank of Vietnam
SCB	Standard Chartered Bank
SCP	Structure-Conduct-Performance
SFA	Stochastic Frontier Analysis
SIDA	Swedish International Development Cooperation Agency
SOBs	State Owned Banks
SOCBs	State Owned Commercial Banks
SOEs	State Owned Enterprises
SCCI	State Committee for Co-operation and Investment
SPSS	Statistical Package for the Social Sciences
TFA	Thick-Frontier Approach
TFP	Total Factor Productivity
UAE	United Arab Emirates
UK	United Kingdom
UNDP	United Nations Development Programme
US	United States of America
USAID	United States Agency for International Development
USD	United State Dollars
VCSC	Viet Capital Securities Company
VND	Vietnamese Dong
WB	World Bank
WTO	World Trade Organisation
2SLS	Two-stage Least Squares

Chapter 1 Introduction

1.1. Background

Vietnam has become one of Asia's economic success stories in recent years, averaging growth of 7.8% a year. The government will continue to pursue its aims of gradually modernizing and turning Vietnam into an industrialised country by 2020. During previous years, the banking system provided a great capital source for the economy, making up approximately 16% to 18% of GDP annually and was almost equivalent to 50% of total investment capital of the whole country from the transition in 1986. It turned out that the banking system had developed strongly and efficiently and played a crucial role as the connection between production, consumption, and savings. The most striking feature of the financial system is that foreign banks are now starting to enter this potential market. It is widely agreed that the domestic banking system still suffers from lack of capital, inadequate provisions for possible loan losses, low profitability, inexperience of the capital markets, low pace of institutional reform (Dinh TTH and Kleimeier, 2007: 478) and high dependence on governmental policies compared to foreign banks.

Generally, there are certain challenges for the banking system in Vietnam. Firstly, as a new industry, compared to other banking systems in the region and the world, Vietnamese banks are influenced by movements in the economy and governmental policies. We believe, accordingly, that the banking system will be the first to suffer when the economy declines and will also be the first to recover and provide necessary condition for economic recovery and stability. Since the early months of 2008, inflation and trade deficit have become more serious. The government priority is to restrain inflation by tightening monetary policy to reduce money supply circulation – the main reason for high inflation. The banking system, the bridge for economic capital, has been directly influenced by this policy since 2008. Secondly, to guarantee the competitive ability of domestic banks after joining the World Trade Organisation (WTO), the government issued Decree No. 141/2006/CP to define legal capital for commercial banks as 1,000 billion VND and 3,000 billion VND in 2008 and 2010 respectively.[1] This is a disadvantage for small commercial banks. Moreover, after joining the WTO, foreign banks with advanced technology, products and professional management seem to be the greatest obstacles to the domestic banking system in the coming years. Lastly, many banks have not regarded risk management as one of the important targets. The faster the banking system develops, the more important the role of risk management becomes. The biggest banks in the US and the UK might be in difficulties if they could not control emerging risks.

1.2. Objectives

To the best of our knowledge, the existing literature on the Vietnamese banking system often examines the following particular aspects of Vietnamese banking: banking system and business, competition in the integration, risk management, capital management, credit, structure, efficiency, financial crisis, and economic and financial transformation. Most studies, however, have concentrated on banking history and solutions with applications for a small sample of banks. A few empirical analyses have applied Structure-Conduct-Performance (SCP) and Panzar-Rosse models to a broad set of countries. However, the problem of data collection made it difficult for researchers to investigate the issue through parametric models. Kousted *et al.*'s study (2005) used the structural method and was based on the data of deposits before 2000 when the Vietnamese financial sector had just overcome "the Asian flu". Barth *et al.* (2001, 2004) used data covering aspects of banking in 107 countries, such as entry requirements, ownership restrictions, capital requirements, characteristics of deposit insurance schemes, loan classification and provisioning requirements, accounting and disclosure requirements, troubled bank resolution actions, and the quality of supervisory personnel and their actions. They analysed how banks were regulated and supervised, but could not inform on some countries including Vietnam. Another issue of the existing literature on bank structure is that not all studies regarded SOCBs as dominant in the banking system. Bikker *et al.* (2006a, 2006b) and Bikker and Spierdijk (2009) applied a non-structural model to 101 countries from 1986 to 2004, using the Panzar-Rosse model. Nevertheless, the authors only

[1] Equivalent to 47,607,712USD and 142,823,137USD respectively (Exchange rate: 21,005VND/USD on 04th November 2011).

investigated banking structure in Vietnam for the data of 24 banks from 1991 to 2004 (the number of observations was only 135) and employed variables that did not demonstrate the real businesses of banking sector in Vietnam where SOCBs still dominate the market.

We extend current research of Vietnamese bank structure in several ways. Firstly, we incorporate into three factors of customer deposits, total assets and customer loans in either 3-bank or 5-bank ratios that reflect features of the Vietnamese banking system but have not been employed by previous studies of Barth *et al.*, (2001, 2004). Secondly, we model and estimate revenue over total assets and interest income over total assets as the dependent variables for the Panzar-Rosse model. Both Bikker *et al.* (2006a, 2006b) and Bikker and Spierdijk (2009) used interest income as the dependent variable of the model. Other environmental factors such as capital/assets, loans/deposits and number of branches are included in the model to account for risks, cost and size. Moreover, in the non-structural model, we employ models using current and lagged input prices both with and without assets as Bikker *et al.* (2006a) and Goddard and Wilson (2009). Both the equilibrium approach (fixed-effect estimator) and disequilibrium approach (Arellano and Bond (1991) estimator) are used to examine bank structure. No previous study has explicitly modelled both the equilibrium and disequilibrium methods in a single formulation or used such range of estimation methods in Vietnam. Findings from the structural and non-structural models will explain the performance of the whole banking system, SOCBs and non-SOCBs. We will try to show, using the structural models, how the profitability measure is affected by market concentration (Structure-Conduct-Performance) or market share (Efficiency Hypothesis). As the non-structural models, the Vietnamese banking system is best characterised by monopoly, monopolistic competition or perfect competition.

Another limitation of the existing literature regarding bank efficiency arises from the fact that almost all studies used a small number of banks and covered only a short period of time in the system. Vietnam's economy in general and the banking system in particular faced difficult times in 1997 (Asian crisis) and 2008 (Global crisis). By restricting time spans, previous studies could not provide a comparative analysis of the efficiency between pre- and post-crises. Furthermore, previous studies only focused on the efficiency scores and did not consider the impacts of environmental variables on the inputs and outputs. The research of Nguyen V (2007) measured efficiency by employing data envelopment analysis (DEA). His research has been applied to a sample of only thirteen banks in Vietnam for the period from 2001 to 2003. His inputs are labour, capital and deposits. Outputs are interest and non-interest income. He argued that the average cost efficiency of the sampled banks was about 60.6%, and the average annual growth of the Malmquist index was negative 2.2% over the study period. Conversely, total factor productivity (TFP) increased by 5.7% in 2003 relative to 2001, and the TFP of 2003 was 15.1% higher than that of 2002. This TFP improvement was achieved primarily by greater technical efficiency and, to some extent, by technological advancement. He also argued that there was a decline in technical efficiency in the Vietnamese banking system from 0.912 down to 0.895 in 2001 and 2002, respectively. Another interesting research by Nguyen XQ and De Borger (2008) considered single bootstrap efficiency and the Malmquist Index for fifteen banks in the period from 2003 to 2006. They used labour, fixed asset, operating expenses and deposits as inputs; and loan and advance and investment as outputs. It was found that the productivity of Vietnamese banks tended to decrease over the short sample period, except for the year 2005. However, the bootstrapping results indicate that the productivity change between 2004 and 2005 was not significant.

This is the first time that the semi-parametric model of Simar and Wilson (2007) will be applied through the two-stage procedure for the Vietnamese banking system. In the first stage, we use data envelopment analysis (DEA) to estimate the relative efficiency scores in the sample constant returns to scale (Charnes *et al.*, 1978) and variable returns to scale (Banker *et al.*, 1984). In the second stage, we apply the Simar and Wilson (2007) procedure to bootstrap the DEA scores with a truncated bootstrapped regression. Explanatory variables (assets, non-performing loans, branch networks, the number of years since establishment and city banks) will also be included in the second stage for estimation. Efficiency scores will be investigated using asset size (small, medium, large and very large banks) and bank type (being SOCBs, JSCBs and JVCBs). Results from bank efficiency will be helpful to estimate the level of efficiency.

There has been rather limited research on risk management in Vietnam. Dinh TTH and Kleimeier (2007) proposed a credit scoring model (CSM) for retail loans in Vietnam. To develop this CSM they used database analysis of all retail loans signed between 1992 and 2005 by one Vietnamese commercial bank. This loan population contains still outstanding as well as repaid mortgages, consumer loans, credit loans or business loans to borrowers from all over Vietnam. Tran B (2008) highlighted the importance of "corporate governance" as part of the management function in the Vietnamese banking sector. His research methods included a survey of listed companies, expert interviews, case studies investigating "corporate governance" in the banking sector. He tried to address the issue of corporate governance in banking (with data from twelve banks) and mentioned that the risk management process still has a room for improvement. He also suggested a lack of bank risk management in the banking system.

This study will examine what type of risk methods banks employ; which risk management procedures they use and how they relate risk management to efficiency and other control variables. These control variables are type of bank in terms of form (SOCBs and non-SOCBs), type of bank in terms of asset size, type of bank in terms of shareholders (banks with and without foreign shareholders) and the number of years since establishment. Thus, to be able to carry out a comparative analysis and provide policy recommendation in risk management, we will carry out a survey of Vietnamese commercial banks using a questionnaire. The Kruskall-Wallis and Pearson chi-square tests will be employed to examine the relationship between bank risk management with efficiency and other control variables.

Previous studies provided little information for policy-makers. This thesis provides a comprehensive analysis by investigating not only the development of the Vietnamese banking system, but also the empirical results for performance and efficiency. Therefore, the final objective of this thesis is to provide recommendations for policy-makers to outline a further strategy of how to consolidate the system, to improve competitiveness, efficiency and risk management of the Vietnamese banking system.

1.3. Structure of the thesis

In Chapter 1, we introduced our research and showed that the Vietnamese banking system has developed strongly and efficiently and played a crucial role in the connection between production, consumption, and savings. There are, however, challenges for the banking system, which led to the objectives of my research.

In Chapter 2, we investigate the Vietnamese economy and banking system, especially from 1986, when the Vietnamese government started the transition procedure. The developments of Vietnam's banking system are divided into four stages: (1) the period prior to 1986; (2) 1986–1995; (3) 1996–2005; (4) 2006 until now. In each stage, macroeconomic and microeconomic aspects of the role of the bank in developments such as regulation, interest rate, exchange rate, non-performing loans, positions of SOCBs, etc. are included in the analyses. Besides, we also mention the main characteristics of the current banking system including the State Bank of Vietnam (SBV), SOCBs, joint stock commercial banks (JSCBs), joint venture commercial banks (JVCBs) and branch of foreign banks (BFBs).

In Chapter 3, we examine the structural model (SCP and EH). The findings showed that there are no significant studies in Vietnam that focused on bank structure. Several researches had problems with data collection (Barth *et al.*, 2001, 2004 and Kousted *et al.*, 2005). In this research, we employ the concentration ratio (CR), Herfindahl-Hirschman Index (HHI) and extend the structural model (Smirlock, 1985 and Lloyd-Williams *et al.*, 1994) to investigate a large number of banks over a long period of time. We also capture other control variables (being capital, loans, deposits, assets and branch networks) and investigate the full sample (1999–2009) and sub-samples (1999–2003; 2004–2009; five SOCBs and 43 non-SOCBs).

Chapter 4 is concerned with the non-structural model using the equilibrium approach (Panzar-Rosse model). Researchers did not regard SOCBs as dominant in the banking system (Bikker *et al.*, 2006a, 2006b and Bikker and Spierdijk, 2009). Hence, we employ H-statistics to examine the performance of the full sample and sub-samples based on the models with and without assets. Further, we also carry out E-statistics to test long-run equilibrium conditions. The Hausman test and the models using lagged input prices are employed to test the evidence of endogeneity of input prices.

In Chapter 5, we estimate the non-structural model using the disequilibrium approach (Arellano and Bond (1991) estimator). This is the first time that the Arellano and Bond (1991) estimator is applied to the Vietnamese banking system. We examine the "system" and "difference" estimators in both "one-step" and "two-step" specifications. The time dummy variables from D1999 to D2009 are added to incorporate period fixed-effects in addition to cross-sectional fixed-effects in the models. Similar to Chapter 4, we also employ models using current and lagged input prices both with and without assets.

In Chapter 6, bank efficiency will be explored. The recently developed semi-parametric model (Simar and Wilson, 2007) is applied through two-stage procedure. In the first stage, we use DEA to estimate banks' technical efficiency in the sample in order to decide which of them are most efficient. In the second stage, we apply the Simar and Wilson (2007) procedure to bootstrap the DEA scores with a truncated bootstrapped regression. This will be the first application of the Simar and Wilson (2007) model to the Vietnamese banking system.

Chapter 7 deals with risks management. We will design the questionnaire, carry out the survey and analyse the results to estimate how banks evaluate risk and incorporate risk management into structure and efficiency framework. The forms of questionnaire are matrix (five point Likert scale from "strongly agree" to "strongly disagree"), multiple choice, choice by rank, close-ended and open ended questions. Seventeen questions are used which are divided into four parts, including risk identification, risk monitoring system, credit risk analysis and efficiency improvement suggestions. The Kruskall-Wallis and Pearson chi-square tests will be applied to examine relations between bank risk management, efficiency and other variables.

Chapter 8 draws overall conclusions and findings from the analysis conducted during the thesis. Further, we also suggest policy implications and point up some avenues for future research.

Chapter 2 Vietnam's economy and banking system

2.1. Introduction

In this Chapter, we will investigate Vietnam's economy and banking system, especially the period from 1986 when the Vietnamese government started the transition procedure. In 1986, *Doimoi* or Transition was not a pure and definite socialist doctrine but it was a case of any port in a storm. The development of Vietnam's banking system will be divided into four stages: (1) the period prior to 1986; (2) 1986–1995; (3) 1996–2005; (4) 2006 until now. In each stage, macroeconomic and microeconomic aspects of the role of banks in developments such as regulation, interest rate, exchange rate, non-performing loans, positions of SOCBs, inter alia, will be included in the analyses. We also put emphasis on the crises that occurred in 1997 and 2008. Lastly, the current banking system, including the SBV, SOCBs, JSCBs, JVCBs, and branches of foreign bank (BFBs) will also be discussed.

This Chapter is organised as follows: section 2.1 is the introduction; sections 2.2 and 2.3 depict Vietnam's economy and banking system, respectively; and section 2.4 sets out the conclusion.

2.2. Vietnam's economy

There were several countries in Asia that succeeded in developing their economies after war. After World War II came to an end in 1945, Japan had a surprising "Japanese Miracle" period in the 1960s with economic growth of 10% and has now become the second largest economy in the world. South Korea is another example. After being almost destroyed by the Civil War (1950–1953), South Korea recovered and developed dramatically in the 1970s with the "Miracle on the Han River" and is now ranked thirteenth in the world in terms of the size of its economy. Both countries underwent dramatic transformations in the 15 years after conflict. Similarly, in Vietnam, the war finished in 1975 but economic reform only took place from

1986. Hence, the country was hoping for a "Miracle of Vietnam" in the 1990s, that is, 15 years after the war ended, to help the country develop by the end of twentieth century.

A decade after the war in Vietnam, it was still a difficult time in the search for a suitable transition model. There was a five-year plan (1976–1980) to merge the southern region, which is characterised by predominantly light industry and privately owned enterprises, and the northern, centrally planned industrial complex, biased to promote heavy industrial development. The plan failed in its objective due to several reasons, as discussed by Le DD and McCarty (1996: 100); Fforde and De Vylder (1996b: 345) and Van Donge *et al.* (1999: 5). For example, infrastructural links were so weak that internal trade barriers strangled domestic trade; the resistance to collectivisation in the south saw a decrease in agricultural output; the decline in foreign assistance after 1978, especially the US embargo, prevented lending by the International Monetary Funds (IMF) and World Bank. In addition, there are other reasons contributing to the failure of the five-year plan. One being that the Cambodian-Vietnamese war (1978) in the south and a brief war (1979) with China in the north bore down strongly on the country with an increase in military spending, plus extensive human and material losses. The second reason was the famine that seriously threatened some areas in the country. Relative scarcities appeared and a ration book system became more prevalent than ever before.

There was a substantial rise in official prices in the 1980s to reduce the increasingly evident disparity between official and free market prices. In general, free market prices tended to be much higher than official prices.[2] This adjustment precipitated a degree of "officially sanctioned inflation" with the context of a classically "repressed" financial system – with hyperinflation peaking at 95.1% in 1982 (Table 2.1).

Table 2.1 The general, official and free market prices indices (%) from 1981 to 1989[3]

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989
General price	69.6	**95.1**	49.5	64.9	91.6	**487.2**	301.3	308.2	76
Official price	102	**141.8**	42.8	55.8	110.9	**457.4**	289.9	313.2	--
Free market price	47.4	**65**	57.5	76.3	54.7	**582.3**	337.5	294.8	--

Source: McCarty et al. (1992).

[2] The official price of rice, for example, was 50VND per kilo in June 1988, whereas the free market price was 450 (see Fforde and De Vylder, 1996a: 294).

[3] With price reforms in 1989, there is no longer any distinction between official and free price indices.

Under pressure caused by the serious economic crisis, the Communist Party of Vietnam had no alternative but to implement reforms. Economic changes were introduced by the Sixth Congress, held in December 1986. Systemic transformation was not of course unique to Vietnam – there are 27 others "transition economies". In Vietnam, the transition started with the rise of the "reformer". The tendency to identify certain politicians as "reformers" gained ground in the second half of the 1980s, notably with the election of Nguyen Van Linh as Party General Secretary in 1986. Coming in the wake of the rise of Mikhail Gorbachev in the Soviet Union, it was a time when the West was receptive to the idea of change in the Communist bloc. Linh captured the imagination of foreign scholars and journalists with his call for transition. This period was called *Doimoi,* and described as "shock therapy" in other countries (Gainsborough, 2002: 354; Griffin, 1998: ix; Fforde and De Vylder, 1996a: 13 and Riedel and Comer, 1997: 200). *Doimoi* has transformed Vietnam from one of the poorest countries in the 1980s to become one of the world's fastest growing market economies.

Although Vietnam is governed by the Communist Party, the absence of democratic freedom is currently not a major issue, when political stability and economic prosperity are the preferred options. As Lavigne (2000) noted China and Vietnam are countries in transition, but unlike the eastern European and Russian transition paths, Vietnam and China have managed to go through macroeconomic stabilisation without experiencing a "transformational recession", and have until recently maintained a high and steady rate of growth.

In order to make fundamental changes to its economic management system, from 1989, Vietnam adopted a radical and comprehensive reform package aimed at stabilizing and opening the economy and enhancing freedom of choice for economic units and competition. The government concentrated on reforming state owned enterprises (SOEs), rather than privatising them. Tax reform was gradually carried out. Reducing public expenditure was one of the government's priority targets. Wage increases for civil servants were restrained below the inflation rate, and about a half million soldiers were demobilised (Riedel and Comer, 1997: 198 and Dollar and Litvack, 1998: 8). Moreover, liberalisation of the investment climate resulted in rapid growth in foreign investment between 1993 and 1997. After the implementation of the Law on Foreign Investment in Vietnam (introduced in 1987) by Decree 28 in 1990; the lifting of the US embargo in 1994; and Vietnam's accession to the

Association of South East Asian Nations (ASEAN) in 1996 and the Asia Pacific Economic Cooperation (APEC) in 1998, aid and trade have surged and the country has attracted foreign investment from some 60 countries (Brahm, 1992: 12; Griffin: x, 1998; Van Donge *et al.*, 1999: 7; Dufhues, 2003: 29 and Vo T, 2009: 187). Before the 1980s, Vietnam could not produce enough rice to feed its own people but has now become the second-largest rice exporter in the world. Poverty has reduced by half and businesses have boomed. Oil revenues poured in (Bui D *et al.*, 2005: 4 and Alpert and Sanders, 2005: 34).

According to Table 2.2, Gross Domestic Product (GDP) plummeted by 3.357% in 1986, rose by 5.809% in 1991, and remained roughly more than 8% for 6 years. Then, the country was partly influenced by the Asian financial crisis from 1998 to 1999, causing a sharp drop in GDP growth (under 6%). Since 2001 the economy has been hurt by the global economic slowdown after the 11th September 2001 terror attacks on the US, bringing GDP down to 6.895%. Incredibly, economic growth still reached 7.8% after 2000 with 2007 being a successful one for Vietnam when its GDP growth rate rocketed up to 8.48%, the highest since 1997. Thanks to this transformation, inflation spectacularly decreased from 453.538% in 1986 to 5.593% in 1996. In 2001 it was -0.31%, if relatively high in the following year and reached 7.503% in 2006. There was a fall in the current account balance from 1981 to 1991, and then it jumped from -1.746% to -8.181%, showing Vietnam's strategy of export-led investment and growth. After fluctuating in the 10 years from 1981 to 1991, exports and imports leaped to 48.4 and 60.8 billion USD respectively. These were the highest amounts ever recorded, making the current account balance -9.83% in 2007.

Table 2.2 Vietnam macroeconomic data (From 1981 to 2006 in 5-year-period and 2007, 2008 and 2009)

Subject Descriptor	1981	1986	1991	1996	2001	2006	2007	2008	2009
GDP (%)	5.797	**3.357**	**5.809**	**9.34**	**6.895**	8.229	**8.48**	**6.152**	**5.3**
Inflation (%)	69.6	**453.538**	81.817	**5.593**	**-0.31**	**7.503**	**8.349**	**23.115**	**6**
Current account balance (% of GDP)	-5.329	-4.369	**-1.746**	**-8.181**	2.097	-0.269	**-9.83**	-9.384	-4.84

Sources: IMF (2011) and WB (1998, 2011).

In January 2007, Vietnam joined the World Trade Organisation (WTO) following a decade of long negotiations. WTO membership has provided Vietnam with an anchor in the global market and reinforced the domestic economic reform process. Remarkably, after 20 years of *Doimoi,* and for the first time in its history, Vietnam has been elected to the United Nations

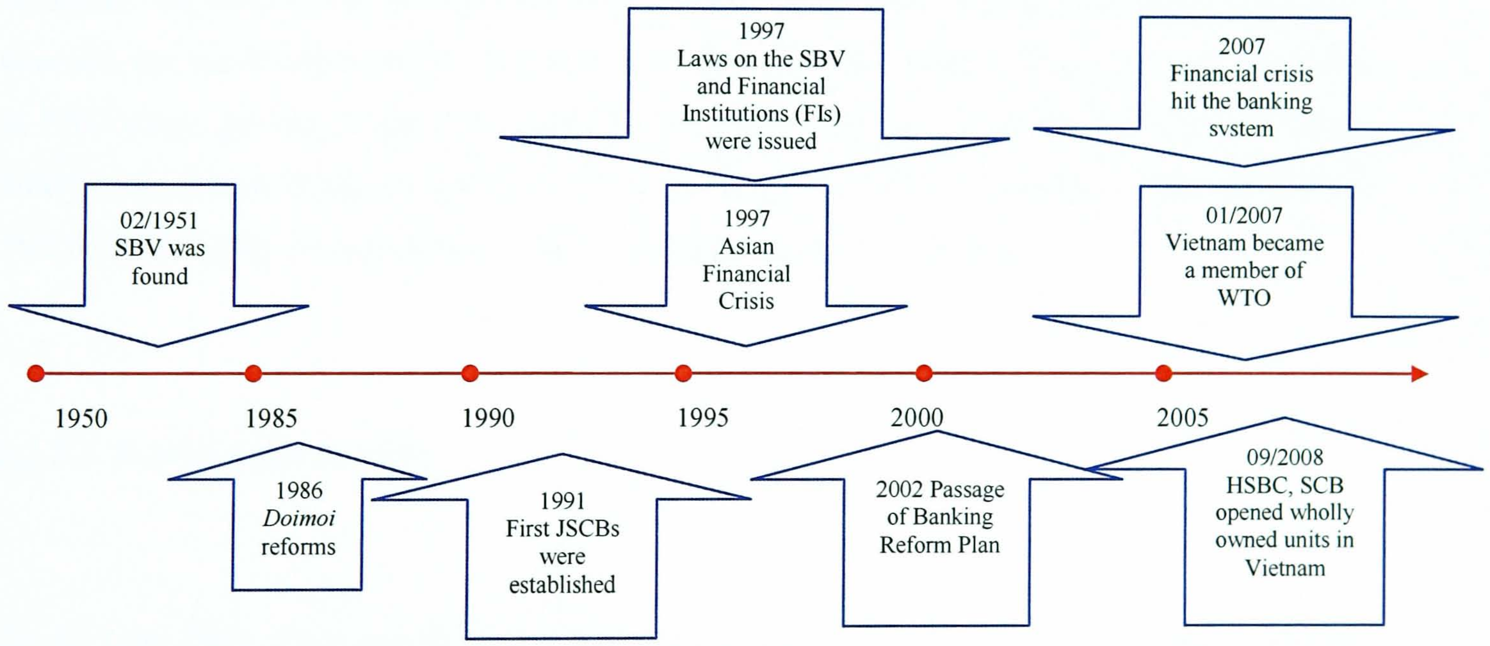
Security Council.[4] This membership is confirmation not only of Vietnam's improved relations with its neighbours but also its integration into the international community. However, in 2008, with internal economic difficulties caused by excessively rapid growth and unfavourable changes in the world's economy, Vietnam's economy was facing several difficulties. The inflation rate significantly peaked at 23.115% in 2008 and then dropped to 6% in 2009. The GDP growth rates were only 6.152% and 5.3% in 2008 and 2009, respectively.

2.3. Vietnam's banking system[5]

2.3.1. Banking developments in Vietnam

In this section, we will investigate the history of the Vietnamese banking system in the periods prior to 1986, 1986–1995, 1996–2005 and 2006 until now (Figure 2.1). In each period, we will deal with regulation, interest rates, exchange rates, debts and non-performing loans, banking staff, informal credit and SOCBs.

Figure 2.1 Milestones in the development of the Vietnamese banking system



[4] Vietnam was the only candidate endorsed by the Association of Southeast Asian Nations (ASEAN) and easily achieved the required two-thirds majority from other United Nations member states.

[5] A bank is a financial intermediary whose core activity is to provide loans to borrowers and to collect deposits from savers. In other words, they act as intermediaries between borrowers and savers. By carrying out the intermediation function banks collect surplus funds from savers and allocate them to those (both people and companies) with a deficit of funds (borrowers) (Casu *et al.*, 2006: 4).

Table 2.3 The number of commercial banks from 1990 to 2009[6]

Type of banks	1990	1995	2000	2005	2009
State owned commercial banks (SOCBs)	4	4	5	5	**5**
Joint stock commercial banks (JSCBs)	0	36	39	37	**37**
Branches of foreign banks (BFBs)	0	18	26	31	**48**
Joint venture commercial banks (JVCBs)	0	**4**	5	5	**6**
Foreign commercial banks (FCBs)	0	0	0	0	5
Total	4	62	75	78	101

Sources: Dufhues (2003:32); SBV (2005, 2008, 2009) and VCSC (2008).

Table 2.3 shows the number of Vietnamese commercial banks from 1990 to 2009. Since the addition of the fifth bank[7], the number of SOCBs remained unchanged. With extended networks in almost all provinces and larger cities, SOCBs have a competitive edge in providing banking services. Although JSCBs increased their numbers right after their appearance in 1990 (in 2009 it was 37 banks), the leading positions in the market still belong to SOCBs. The rising numbers of BFBs (from eighteen banks in 1995 to 48 banks in 2009) explained the demand for foreign companies on banking services. However, each BFB normally has one branch in either Hanoi or Ho Chi Minh City. Hence, the assets, loans and deposits are small compared to SOCBs and JSCBs. Despite Foreign Direct Investment (FDI) in USD terms growing eight times from 1990 to 2005, foreign companies are still hesitant as whether to choose domestic banks or not when they enter this new market. The number of JVCBs has slightly increased from four to six banks from 1995 to 2009.

2.3.1.1. Period prior to 1986

On 6th May 1951, President Ho Chi Minh signed Decree No. 15/SL setting up the National Bank of Vietnam, the current State Bank of Vietnam (SBV) – the first people's democratic

[6] Beside these commercial banks, there are also the Social Policy Bank and Vietnam Development Bank which are operating as non-profit institutions.

[7] Mekong Housing Bank is the fifth SOCB established in 1997.

state in South-East Asia. The primary purposes of the bank as prescribed in this statement are (Oborn and Nguyen TKO, 1997):

- ✓ To manage the issue of Vietnamese bank notes and coins and their uses in the economy.
- ✓ To collect savings and allocate them.
- ✓ To manage the exchange of gold and silver.
- ✓ To manage foreign currencies.
- ✓ To regulate and supervise banking operations.
- ✓ To maintain the stability of the value of the money in the interests of the national economic progress.

After the foundation of the SBV, the country entered into a 30-year war against France and America. In order to receive aid donated by friendly nations, SBV conducted flexible overseas banking to break through America's monetary and economic blockade. Additionally, SBV also set up special payments to finance the conflict. The efforts of the SBV contributed to the victory over America in the south in Spring 1975.

After reunification, SBV built up a new unified banking system under the new government. The basic organisational characteristic of SBV, in this period, was the mono-type banking system. SBV functioned both as a unique issuing bank and a commercial bank, domestically and internationally. There were a number of specialising banks, operating as functional departments of the SBV. They were founded in 1977 as Ordinate No. 163/CP including the Industrial Bank, Trade Bank, Agricultural Bank, Foreign Trade Bank and Socialist Saving Trust Bank. These banks were entrusted with their roles and functions by the general director of SBV and had only a central body, but not an independent branch network.

This was a painful time due to the decline in foreign assistance. The plan to rebuild the country after the long conflict had completely failed, creating an economic crisis. This crisis put pressure on the government to initiate a reform programme, making central planning less rigid. In the financial sector, the demand for capital rose higher and higher. Therefore, in the 1980s, the Chairman of the Council of Ministers issued the Decision No. 172/HDBT on the money, credit and payment operations of the SBV. SBV also set out on the urgent task of stabilizing monetary operations based on credit policy, which efficiently allocated credit structure resources for capital construction. Due to the famine in the country, the agriculture sectors such as food grains, foodstuffs, consumer goods, export and agricultural industries became priority areas for funding.

Nevertheless, the banking system was mainly satisfying government planned credits. The limitation of the mono-banking system became serious. Cash became the predominant means of payment. Individuals were not allowed to open business accounts. Interest rates remained far below inflation rates, especially in the escalation period of inflation (1980–1988). The deposit and lending rates varied according to the purposes and borrowers, with the lowest rates applying to state enterprises and the highest to the private sector. Deposits in banks lost value as inflation outpaced interest earned on deposits, resulting in an environment of non-savings. Households ceased to deposit their savings in state banks and changed their savings into real assets, such as real estate, gold and US Dollars. Transactions in gold were the monopoly of the state and neither the import nor export of gold was allowed (Oborn and Nguyen TKO, 1997).

On the other hand, to encourage investments in state owned enterprises (SOEs) the authorities set lending rates at low levels to reduce the cost of borrowing capital. Enterprises, even those with excess capital, would borrow to take advantage of the difference between official and market rates. As a result, artificial credit demand increased while the supply of credit fell sharply. Moreover, heavy industries were the priority sector in the economy and had surplus credit, while light industries, trade and service sectors were hungry for credit (Nguyen T, 2001: 8).

Generally, this phenomenon was not an accurate reflection on the demand and supply of credit. The banking activities were very complicated and difficult. After the serious errors in policy and currency swap execution in 1985, the financial situation became worse than ever before. Kousted *et al.* (2005: 9) mentioned that the regime of directed and subsidised credit resulted in negative real interest rates, and interest rates on deposits were higher than interest rates on loans. In parallel with the *Doimoi* implemented by the Sixth Congress of the Communist Party of Vietnam from December 1986, the banking system was steadily transformed from mono into two-tier.

2.3.1.2. 1986-1995

This stage could be described as the transformation from a mono to two-tier banking system. The two-tier banking system has the SBV as the central bank (tier 1) and four specialised state owned banks (SOBs) (tier 2). These SOBs were the Foreign Trade Bank, Construction and Investment Bank, Agricultural Bank, Industrial and Commercial Bank.

Regulation: Order No. 218/CT dated 23rd July 1987 was the first decision on the SBV operation mechanism and organisation apparatus, turning the SBV's branches into public commercial banks. After that, the Council of Ministers promulgated the Decision No. 53/HDBT on 26th March 1988. The first round of the reform had been completed with the launching of new business accounting mechanisms. This reform linked banking change to inflation control. The state management of money, credit and banking services was clearly detached. SBV was only in charge of state management functions and all other banking institutes doing business. The function of the SBV involved monetary, credit and banking operation of the entire country, so as to stabilise the value of the currency and promote the economic growth. SOBs became more independent and, in principle, bore responsibility for their profits and losses that were not transferred to the SBV as before (Nguyen DT and Pham DT, 1994: 18 and Kousted *et al.*, 2005: 12).

Then, on 1st October 1990, the Decree-Laws on the State Bank and Decree-Laws on Banks, Credit Operatives and Finance Companies came into force. The banking system was reorganised to meet the requirements of the duties in the two-tier banking system. The already existing two state-owned banks (SOBs): the Investment and Development Banks (1958) and Bank for Foreign Trade (1963) were transformed into state-owned commercial banks (SOCBs). Then two other SOCBs were created in 1991, the Industrial and Commercial Bank and Bank for Agriculture and Rural Development.

Following this turning point, one division of the SBV's staff was replaced and transferred to the SOCBs. The remainder were placed in departments of the SBV for managerial tasks. Besides, the Decree-Laws on Banks, Credit Operatives and Finance Companies made the second round of reform, with the first appearance of JSCBs, JVCBs, representative offices and BFBs[8].

The environment had room for the domestic sector and foreign firms. There would be no difference between state and private enterprises. This stimulated the private sector to become involved in the development of the economy. The branches of foreign banks have provided positive conditions for foreign investors in Vietnam, raising foreign investment. In 1990, however, hundreds of Vietnamese credit co-operatives went bankrupt. The foreign banks were afraid that the legal system could not be used to protect them.

Regarding interest rates, since 1991, the SBV has started to fix a ceiling for its lending to commercial banks, introducing bank reserve requirement of 10% of total deposits, and decreasing the state's earlier unlimited granting of credit. Realistic interest rates were set up, and for the first time a positive real interest rate level appeared. Since 1992, the SBV had not committed money to offset the government budget deficit. Savings were contributing a large amount to the bank's sources of funds. For example, in 1993 total deposits accounted for approximately 30% of the total liabilities of the banking system. Vietnamese people started saving in bank accounts instead of gold and US Dollars. A vast amount of liquidity was absorbed, helping to fight inflation (Oborn and Nguyen TKO, 1995; Fforde and De Vylder, 1996a: 296 and Dang D, 1995: 40).

Moving on to exchange rates, two foreign exchange transactions centres (FOREX centres) were established in Hanoi and Ho Chi Minh City in 1991. These centres were set up to control and monitor foreign currency transactions in the banking system and make it easier for the enterprises to balance their funds for foreign exchange (Nguyen D, 1995). The exchange rate was a combination of pegged and limited flexibility regimes. In 1994, the inter-bank foreign exchange market was established to assist the development of the economy. And in the late 1990s, inflation was reduced to single-digits, reflecting primarily trends in the real effective exchange rate.

[8] The first fully private Vietnamese commercial banks were approved in this period, including the Housing Bank, Saigon Bank for Industry and Trade, Export-Import Bank and Dainam Joint Stock Commercial Bank.

In terms of non-performing loans, domestic banks would have to charge high interest rates to compensate for their non-performing loans while new banks and foreign banks could offer low rates, attracting better customers over time. The collapse of credit co-operatives in the 1990s also limited the trust in informal financial institutions. This distrust drove people to withdraw or abstain from channelling their funds into the banks, and to buy gold and US Dollars instead. Moreover, the mobilisation of long-term funds was quite slow. Most banks preferred saving deposits for less than six months because there was an uncertainty of the minimum deposit rate set up by SBV. Thus, individuals were still afraid of depositing their money in the bank for a longer period of time, for there was no deposit insurance system.

In this period, banking staff had limited expertise and experience in modern banking operations, which was one of the reasons for the bankruptcy of the credit co-operatives in the 1990s. Staff needed to be retrained, especially in banking operations, customer services and English language skills. This training was supported by foreign organisations such as World Bank, Asian Development Bank (ADB), IMF, Swedish International Development Co-operation Agency (SIDA) and United States Agency for International Development (USAID) (Nguyen VD *et al.*, 1998 and Van Donge *et al.*, 1999).

As regards to informal credit, the microfinance system was rudimentary and the population relied mostly on moneylenders, distributors' credit, rotating savings, credit associations, relatives and friends (Nguyen X, 2005: 210). Due to the development of the banking network and the bitter experiences from the above arrangements, the informal market had been narrowed down and only accounted for a small share of the financial market of the country (Vo D, 1996: 50).

The SOCBs were still subject to the SBV and continued receiving financial resources from SBV to cover their needs. The specialised banks had little need to compete with each other because they had been “granted” steady clientele. The existence of the "soft budget constraints", which had not been completely abolished, discouraged competition. This lack of competition was one of the main reasons for the slow improvement of effectiveness and flexibility of the financial system. As a consequence, domestic banks were put in a disadvantageous position in competition with the foreign banks operating in the country (Nguyen D, 1995).

In general, the outcome of this transformation period was not clear. Table 2.4 illustrates the general financial indices after the transition. Accordingly, the portion of domestic savings in GDP rose slowly and occupied only about two fifths of total invested funds. Despite an important amount of foreign direct investment, (which grew from 1.8 to 3.92 billion USD from 1992 to 1994), the total invested capital was still far from the demand. In the past, Soviet bloc aided 50% of national budget deficit. In the absence of Soviet aid and budgetary support, the government borrowed from the SBV to finance the deficit and all expenditures (Brahm, 1992 and Nguyen D, 1995). It can be seen that since 1992 the growth of the financial sector sharply increased and reached 22.8% in 1994. To cover the budget deficit, the government rapidly issued short-term Treasury bills and Central Bank Certificates of Deposits to borrow money from the population. This number hit a peak in 1994 at 305.44 million USD but accounted for a very inconsiderable portion of the budget revenue. The unusual phenomenon here was that cash still the dominant form of payment. Cash outside the banking system was 55.9%, 58.9% and 57.9% in 1992, 1993 and 1994, respectively. The use of cheque accounts was widespread only in the large centres. Others preferred highly unstable credit co-operatives, or held gold and hard currency at home.

Table 2.4 Financial indices after the transition

	1992	1993	1994
Growth of GDP (%)	8.6	8.1	8.5
Proportion of the financial sector in GDP (%)	1.5	1.6	1.8
Growth in financial sector (%)	10.7	16.5	**22.8**
Deposits of foreign currencies inside the banking system (USD million)	776.6	725.9	876.8
Domestic savings (USD billion)	1.38	1.84	2.58
Domestic savings in GDP (%)	13.2	14.6	15.3
Total of investments (USD billion)	**1.8**	3.1	**3.92**
Total investment in GDP (%)	17.2	23.5	23.4
Budget deficit vs. GDP (%)	2.4	5	3.6
Government borrowing (USD million)	78.09	153.63	**305.44**
Cash out banks in M2 (%)	**55.9**	**58.9**	**57.9**
Ratio of government's borrowing to budget revenue (%)	4.1	5.2	7.7
Bonds' repayment (USD million)	9.82	12.32	332.73

Source: Nguyen D (1995).

2.3.1.3. 1996-2005

The Vietnamese banking system was not affected by the 1997 crisis as drastically as other countries. The door for free international capital mobility was narrow. Foreign exchange transactions were maintained under control. All movements of capital into (mainly FDI) and out of the country have to be authorised. International trade, which was observed in the form of trade licences and other regulations, meant that evasion of capital controls was more difficult in Vietnam than elsewhere. Many Asia-Pacific countries liberalised their domestic financial sectors in the 1980s, making apparent the large interest differential between domestic and world interest rates; this provided an incentive to evade capital controls. In Vietnam, nevertheless, domestic interest rate ceilings supported stringent controls over foreign borrowings, enabling the SBV to regulate flows of short-term capital more efficiently (Leung and Le DD, 1998: 125). Another explanation for the minor effect on the country was that the weakly-developed financial market did not attract much foreign capital in the first place (Kokko, 1999: 84).

The Law of State Bank in October 1998[9] represented a fundamental step towards separating the SBV from the political system, and establishing the former as an autonomous entity as well as the executive, legislative and judicial branches of government. In addition, the Law also authorised the SBV to perform a number of central bank functions, including the printing and issuing of money, refinancing, executing monetary market and open-market functions, controlling international monetary storage, managing foreign exchange and organizing payment storage (Kousted el al, 2005: 37). This is the beginning of changes in the banking sector, contributing to the growth of the whole economy in this period.

In the first quarter of 1997, the target exchange rate was 11,175 VND/USD, with a narrow fluctuation band of only +/- 1%. The band was widened to 5% in March 1997, and further to 10% in October 1997. Since the market rate immediately moved to the upper end of the band, these adjustments constituted de facto devaluations of the VND. During 1998, the target rate was changed twice, to 11,815 VND/USD in February and then 12,998 in August. Altogether, the VND depreciated by about 20% during this period, and the USD was traded at 13,907 VND in September (Kokko, 1999: 88 and IMF, 2009: 56).

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[9] This is different from the Degree-Laws on the State Bank in 1991.

From 1999, the SBV has used the managed-floating exchange rate regime. The official rate (the rate between VND and USD) was now set daily at the average of inter-bank exchange rates. It was based on the previous transaction day and the daily trading band, within which the rate was allowed to fluctuate by a very narrow band of ±0.1%. This trading band was gradually widened to ±0.25% in July 2002; and to ±0.5% in January 2007. This helped the commercial banks to be more proactive in FOREX trading. The SBV monitored the daily rate and intervened in the foreign exchange market through purchasing and selling foreign currency or foreign exchange swaps to achieve the targeted exchange rate. Furthermore, from 2004, forward, swap and option transactions could be carried out between financial institutions, economic entities and individual investors (Nguyen AN and Sarantis, 2008: 9-10).

From June 2000 to May 2002, the SBV set "basic rate" and bandwidth. The basic interest rate was determined by the central bank and was based on the real situation or targets of the national monetary policy. This basic rate and bandwidth were set by the SBV subjectively, and not in line with the actual conditions of money-supply and demand. From June 2002, the interest rate has been freely negotiable by the new policy of the SBV, in which banks can fix their own interest rate on loans based on market capital supply-demand and the creditability of borrowers. The SBV no longer controls the interest rate directly, but is starting to use many indirect tools, including a required reserve ratio, basic rate, refinancing, discount rate and open market operation (Pham TD *et al.*, 2006: 8-9).

Non-performing loans to outstanding loans (NPLs/TLs) increased from 9.3% in 1996 to 13% at the end of 1998, and decreased in the next seven years to 2.85% in 2004. Non-performing loans plunged sharply to a very low proportion of 3.17% in 2005 (see Table 2.5).

Table 2.5 Non-performing loans (per cent of total outstanding loans) from 1996 to 2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
NPLs/TLs (%)	**9.3**	12.3	**13**	12.11	9.7	8.5	7.06	4.74	**2.85**	**3.17**

Sources: Kousted et al. (2005:43); VCSC (2007:5) and SBV (2009).

Even until the 2000s, the best employees could be attracted by foreign banks with higher salaries and foreign experience. This would definitely not help the state banking sector's efforts to reform and increase quality. The banking techniques were considerably upgraded by several banks, such as the Asia Commercial Bank and the Bank for Foreign Trade in the 2000s.

Because of limited experience with market-based financial transactions, SOCBs were vulnerable to the kind of moral hazard problems that have plagued other Asian countries. In 1996, lending restrictions were liberalised and SOCBs were allowed to start issuing letters of credit to finance international trade transactions of SOEs. In practice, this was equivalent to increasing the short-term lending of foreign currencies, instead of using the credit for trading and financing. A number of SOEs channelled the funds into real estate investments and other speculative uses. Many of these investments failed and an estimated 40% of the guaranteed letters of credit had become bad loans in early 1997. Several commercial banks defaulted on their letters of credit, which eventually required a costly SBV rescue operation. This operation reduced the country's international reserves significantly. Another consequence was a down-grading of Vietnam's sovereign credit rating, from BA3 to C. By September 1997, before any real impact of the regional crisis had yet been felt, the overdue debts of Vietnamese banks grew to 12.7% of their total lending, corresponding to over 100% of their capital and reserves. The Vietnamese authorities responded by introducing various controls to avoid similar credit expansions in the future. It is likely that the banking system was in a worse condition than was indicated in its financial statements (Kokko, 1999: 84).

2.3.1.4. 2006 until now

There were still economic difficulties due to excessively rapid growth (7.8% a year in the past five years) and unfavourable changes in the world's economy. These induced the government to concentrate on the regulatory environment.

In parallel with the speed of the country's economic development, the loan growth rate grew dramatically. One of the reasons was that many banks had greatly increased their credit growth through real estate loans, due to over-heating of the real estate market. Meanwhile, increases in loans also helped banks to shift the proportion of outstanding loans for securities investment, from the beginning of the year, to 3% on total outstanding loans on 31st December

2007 (according to Instruction No. 03 of SBV). Another reason for the loan growth rate is that the financial investment of banks also accounts for a significant proportion of approximately 13.59% of investment, which resulted from the booming stock market in 2007. Banks' investment portfolios have concentrated on a large number of stocks and bonds, especially bonds with an average maturity of three years.

The main sources of funds used by commercial banks in Vietnam are (1) deposits; (2) loans from the inter-bank market; (3) loans from the SBV through the pledge of valuable documents. As Viet Capital Securities Company (VCSC) in 2007, total long-term deposits accounted for 35.12% of the total source of funds, whereas banks' medium and long-term loans and financial investments, mainly investing in bonds, comprised 47.09%. Therefore, the difference between total source of funds and total long-term deposits was 11.97%, which together with 44.4% in short term loans, had to be financed by short term deposits (VCSC, 2008: 7).

On the other hand, deposit growth increased from 35.5% to 46.5% in 2006, while the loan growth rate jumped twice from 25.9% to 54.4%. This indicates that commercial banks used sources such as the inter-bank market, where the interest rate was lower than 7% per year, to meet borrowing demands (see Table 2.6).

Table 2.6 Balance sheet growth of commercial banks (year-on-year per cent)

Balance sheet growth	2006	2007	September 2008	October 2008
Loan	**25.9**	**54.4**	38.9	31.9
Deposit	**35.5**	**46.5**	25.4	22.7

Source: IMF (2009: 28).

Nonetheless, loans from the inter-bank market were stipulated to be used only in the case of solving difficulties for short-term liquidity. Therefore, the misuse of this capital resource caused a serious imbalance in the capital structure and implicated high liquidity risk in the banking system. Most banks were pursuing their profit targets through the use of capital from the inter-bank market for long-term lending. As a result, the credit growth rate of the banking system increased greatly and reached 37.8% in 2007, then peaked at an alarming 63% in the first quarter of 2008 (WB, 2008: 3). This has been the highest growth rate within the past decade.

When the inflation rate and deficit in trade balance had become more serious, the government applied a traditional tightening of monetary policy in order to reduce money supply circulation – the main reason for high inflation. As in early 2008, SBV sold compulsory bills to further absorb VND liquidity in the banking system, while simultaneously introducing a cap on deposit interest rates (WB, 2008: 4). This strongly damaged the banking system. There was an increasing compulsory reserve proportion, from 10% to 11% on 1st Feb 2008 (Table 2.7).

Table 2.7 Compulsory reserve over time for SOCBs, JSCBs, BFBs and JVCBs

	August 2003	July 2004	Jun 2007	February 2008
VND deposits under 12 months (%)	2	5	**10**	**11**
Foreign currencies deposits under 12 months (%)	4	8	**10**	**11**
VND and foreign currencies deposits over 12 months and under 24 months (%)	1	2	4	5

Sources: SBV (2006: 89; 2007: 71 and 2008).

Commercial banks were required to buy VND 20,300 billion of Treasury bills with a fixed coupon rate of 7.8% and one year maturity before 17th March 2008 and were not allowed to use this amount of money in capital replenishment transactions in the inter-bank market (the Treasury bill's coupon rate was increased to 13% from 1st July 2008).

In 2007, the SBV maintained interest rates including a basic rate of 8.25%/year, a refinancing rate of 6.5%/year, and a discount rate of 4.5%/year. Since 1st January 2007, the SBV removed the ceiling rate for USD deposits of legal entities, banks were authorised to determine these deposits on a negotiation basis (SBV, 2007: 36). Due to the crisis in 2008, the SBV continuously adjusted the prime interest rate, the capital replenishment interest rate and discount rate. Within the first six months of 2008, the prime interest rate increased from 8.25% to 8.75% (in February), to 12% (in May) and to 14% (in June) (VCSC, 2008: 9).

Exchange rate was managed in a flexible manner in line with signals and the interest rates policy through adjusting exchange rate. The SBV intervened in the supply and demand for foreign currencies in the market in an appropriate manner to enhance liquidity, to supply the import of necessary goods as well as production and business activities with foreign currencies, and enhanced supervision of foreign currency trading by licensed credit institutions. Besides, the SBV required credit institutions to buy and sell foreign currencies in accordance with laws and regulations and co-ordinated with other ministries and agencies in implementing measures to counter illegal trade of foreign currencies in the black market (SBV, 2009).

In the past, four SOCBs had their own strengths, based on their distinct purposes, which led to the segmentation of the market. Today, all seem to have a similar business strategy: (1) to participate in the financing of investments of the SOEs; (2) to mobilise more savings dominated in USD; and (3) to build higher currency and maturity mismatches in their balance sheets. They became universal banks that serve all segments of the economy and weaken one another through competition, while exposing themselves to very similar credit and currency risks.

Non-performing loans over total loans were quite low in this period. With the high development of the economy, non-performing loans decreased from 2.6% in 2006 to 1.5% in 2007. Due to the financial crisis in 2008, non-performing loan went up to 2.13% in 2008 and reduced slightly to 1.99% in 2009.

Table 2.8 Non-performing loans (per cent of total outstanding loans) from 2006 to 2009

Year	2006	2007	2008	2009
NPLs/TLs (%)	**2.6**	**1.5**	**2.13**	**1.99**

Source: SBV (2009).

Moving to regulation, the aim is to create a banking supervision development from 2010 onwards. Meanwhile, the coverage, measures and procedures of banking supervision and monitoring will be reformed in accordance with the development of internet technologies (IT) and banking technology. This will be done by applying key principles of international standards on banking supervision (Basel I and Basel II). The old capital adequacy ratio (CAR) in Basel I and Basel II standards for banks are 8 and 12%, respectively. CAR for Vietnamese commercial banks would be adjusted to 9% (as Circular No. 13/TT-NHNN dated 20th May 2010 of the SBV).

In short, the banking system encountered many difficulties, resulting from loss of balance in the source and use of funds, and the rapid increase in credit growth. On this basis, many banks were affected by the tightening monetary policy. Compulsory measures were necessary for banks to reorganise and strengthen their organisations.

2.3.2. State Bank of Vietnam (SBV) and banks

SBV

We have had discussions about the history of the Vietnamese banking system, SBV included, in section 2.3.1. In brief, SBV is a ministerial agency of the government, which performs the state management of monetary and banking activities. At the moment, with 27 tasks and powers, SBV can support both government and financial institutions.

State-owned commercial banks (SOCBs)

Three out of five SOCBs accounted for 45% of customer deposits, 41% of total assets and 51% of customer loans of the banking system in 2009. They still dominate the domestic banking sector. SOCBs were originally sector departments under SBV, with specified lending programmes to SOEs and based on government policies. Most of these banks have suffered from inadequate risk management and poor asset quality, which created risks for the Vietnamese banking system and overall economy. Compounding these weaknesses has been the existence of poor disclosure and weak accounting standards.

Five SOCBs originally specialised in particular areas of finance: (1) the Bank for Foreign Trade was formerly the export and trade department of the SBV with the function of financing external trade. It was transformed to state owned bank and then commercial bank; (2) the Bank for Industry and Trade was formerly the industrial department of the SBV with the function of fund industrial development; (3) the Bank for Investment and Development was formerly the infrastructure department of the SBV, with the function of facilitating infrastructure projects. It became a state-owned bank before becoming a commercial bank; (4) the Bank for Agriculture and Rural Development was formerly the agriculture department of the SBV with the function of providing rural finance and supporting to commodities markets; and (5) the Mekong Housing Bank was a relative newcomer, specializing in finance for housing projects.

SOCBs' performance has greatly been improved. Fitch ratings recently upgraded the four largest SOCBs to D/E from E. There was a big improvement in the banks' shift to private-sector lending and overall profitability. The government planned to equitise all of the banks, with the exception of the Bank for Agriculture and Rural Development. The Bank for Foreign Trade was the pilot bank under the equitisation programme. In December 2007, the Initial Public Offering (IPO) of the Bank for Foreign Trade was launched and in April 2008, this fully state-owned bank transformed into a joint-stock commercial bank in which the government still holds the majority share. On 25th December, 2008, the Bank for Industry and Trade's IPO was also launched (SBV, 2008: 52). Banks had also embarked upon programmes to reduce non-performing loans and to raise capital adequacy ratios to Basel I standards.

Joint stock commercial banks (JSCBs)

The banking decrees in 1990 allowed JSCBs to be progressively established. Their shareholders are private entities, SOEs, SOCBs and foreign banks. One third of them were transformed from rural commercial banks. Unlike the SOCBs, a number of the JSCBs are making profit for good performance. JSCBs have achieved average returns on equity between 15 and 30%, and NPLs are estimated to be substantially lower than those of the SOCBs. At less than 15 years old the JSCBs are relatively young, and can be divided into three groups: (1) the top five large urban banks; (2) a smaller group of banks that are either growing rapidly or have established a niche; and (3) twelve small rural JSCBs. The top five urban banks are the Techcombank, Sacombank, VIBBank, Asia Commercial Bank, and East Asia Commercial Bank. The smaller urban JSB group consists of banks such as the HabuBank, Viet A Bank, and Saigon Bank. Small rural commercial banks were all transformed into city commercial banks at the end of 2010. Some of them are the An Binh Bank, Saigon-Hanoi Bank, Petrolimex Group Bank, Dai A Bank, etc. They developed throughout the country, not just in rural areas. With help from big business and foreign investors they also performed well in the 2000s.

Most of the top five JSCBs have large international strategic investors, such as the HSBC, Australia and New Zealand Banking Group Limited (ANZ), and Standard Chartered Bank. These investors recognise the large growth potential and profitability of the JSCBs, and also assist JSCBs in CAR requirements. Table 2.9 indicates the investment of foreign investors into domestic banks until 2008.

Table 2.9 Foreign investments in the Vietnamese banking system

Banks	Assets (million USD)	Foreign investor	Investment (million USD)	% Ownership (02/2008)
Asia Commercial Bank	2,901	Standard Chartered Bank	22	9
		International Finance Company (IFC)	3	7
		Jardine Matheson	2	7
		Dragon Capital	2	7
Sacombank	1,609	ANZ	27	10
		IFC	3	8
		Dragon Capital	3	7
Techcombank	1,126	HSBC	17	10
Habubank	985	Deutsche Bank	n/a	10
East Asia Bank	864	Citigroup	35	10
Sourthern Bank	663	United Overseas Bank Limited	n/a	10
VPBank	660	Oversea-Chinese Banking Corporation	16	10
Oricombank	419	Banque Nationale de Paris Paribas	n/a	10

Sources: ACB (2007) and author's findings.

Branches of foreign banks (BFBs)

A "foreign bank" is a bank incorporated under the laws of another country that has a branch in Vietnam. The foreign bank is the actual office of the foreign bank that has been granted a licence by the SBV to operate in Vietnam. BFBs (and JVCBs) may be approved by the SBV and the State Committee for Co-operation and Investment in accordance with Decree No. 189-HDBT on the Regulation on BFBs and JVCBs operating in Vietnam. In the case of discontinuation of operations, BFBs and JVCBs are required to give priority to the payment of debts to Vietnamese creditors (Brahm, 1992: 35).

These types of banks focus their services on serving foreign investment companies, large state-owned corporations, and foreign individuals. Some (Citibank, ANZ, and HSBC) also target wealthy Vietnamese clients. Foreign banks have been instrumental in introducing new products to the Vietnamese market (e.g., mortgage services (ANZ) and medium-term certificates of deposit (HSBC)). At the same time, they have also penetrated the retail market through automobile and housing loans, and international credit card services. Only since the

2000s have foreign banks ventured into correspondent banking services, cash management, project development services, longer-term financing, and international payment and foreign exchange services. Intense competition with domestic banks in the short-term trade financing market and capital left over from high start-up capital requirements have forced foreign banks to enter the term-finance market[10] (Nguyen X, 2005: 211).

In 2005, they still were not allowed to mobilise deposits in VND and might purchase only up to 30% of equity in existing domestic banks. Thirty-one foreign banks mostly provide services to multinational corporations, rather than compete with local banks in serving domestic companies. However, 2008 was a turning point for the BFBs when the Hong Kong and Shanghai Banking Corp (HSBC) and the Standard Chartered Bank (SCB), both of which are from the UK, were given licences to establish 100% foreign-owned subsidiaries in Vietnam.

Joint venture commercial banks (JVCBs)

The Commercial Banking Decree allows foreign banks to enter the Vietnamese market. It permits them to enter into joint ventures with local Vietnamese banks, and to open branches within Vietnam. The JVCBs focus on the financing of foreign trade activities. There are currently six JVCBs in Vietnam.

Table 2.10 JVCBs in 2009

Name of bank	Established	Joint Venture partners		Charter Capital (mil. USD)
		Vietnamese bank	Foreign bank	
Indovina Bank	21/11/1990	Bank for Industry and Trade	Cathay United Bank, Taiwan	70
Shinhavina Bank	04/01/1993	Bank for Foreign Trade	First Bank, Korea	30
VID Public Bank	25/03/1992	Bank for Investment and Development	Public Bank Berhad, Malaysia	41
Vinasiam Bank	20/04/1995	Bank for Agricultural and Rural Development	Siam Commercial Bank, Thailand	20
Lao-Viet Bank	22/06/2009	Bank for Investment and Development	Bank for Commerce and Trade, Laos	2.5
Vietnam-Russia Bank	30/10/2006	Bank for Investment and Development	SJC Vneshtorgbank, Russia	62.5

Source: SBV (2009).

[10] A minimum capital requirement for US bank to open a branch in Vietnam is 15 million USD, joint venture VN-US is 10 million USD.

2.4. Conclusion

We have reviewed Vietnam's economy and banking system from the transition period. The main findings are: (1) the economy in general and the banking system in particular faced tough times in 1986 (transition); 1997 (Asian crisis) and 2008 (Global crisis); (2) SOCBs still play important roles in the economy despite certain new policies from the government and SBV; (3) foreign banks with advance technology, products and professional management seem to be the greatest obstacles to the domestic banking system in the coming years. The number of branches of foreign banks reached 48 in 2009 and the emergence of foreign banks (the HSBC, SCB, Hongleong, ANZ and Shinhan banks) that had licences to set up wholly foreign-owned banks from 2008; (4) the demand for an evaluation of the banking system in the structural and non-structural models, which has not been done before is really necessary to provide policies for the whole financial system in the future. After more than 20 years of transition, Vietnamese finance is experiencing a somewhat ambivalent period in choosing its way forward, due to the step-by-step opening of the market.

Chapter 3 Bank structure: Structural model (SCP and EH)

3.1. Introduction

In this Chapter, we will investigate the Vietnamese banking system as the structural model that analyses the impact of market structure on bank conduct or bank performance. The measurement of market structure, using market measures such as concentration ratio or competition index, could indirectly show us the economic conditions of business. To investigate features of corporate behaviour in market characterised by imperfect competition, such as an oligopoly, it is useful to measure the degree of market competition. Two kinds of measures, the structural and non-structural models, are often employed, and this Chapter focuses on the former. Vietnam has the characteristics of an emerging and developing country, in which social and business activities are in the process of growth and industrialisation. Hence, we will, for the sake of simplicity, evaluate the Vietnamese banking system in terms of the following: (1) market structure; (2) bank structure; (3) bank structure in emerging and developing countries; and (4) bank structure in Vietnam.

The structural model consists of the Structure-Conduct-Performance (SCP) and Efficiency Hypothesis (EH) approaches. The SCP approach is the model that can examine whether a highly concentrated market causes collusive behaviour among large banks and whether it improves market performance. In contrast, the EH approach is used to determine whether the efficient behaviour of large banks leads to an improvement in market performance. We will employ the concentration ratio (CR), Herfindahl-Hirschman Index (HHI) and concentration-profitability model in SCP-EH estimates to examine Vietnamese banking system in the full sample (1999–2009) and the sub-samples (1999–2003; 2004–2009; five SOCBs and 43 non-SOCBs). Control variables, such as capital, loans, deposits, assets and number of branches are included to analyse the Vietnamese banking system.

This Chapter is organised as follows: section 3.1 contains the introduction; section 3.2 contains the literature review; section 3.3 deals with methodology; section 3.4 provides empirical results; and section 3.5 sets out the conclusion.

3.2. Literature review

3.2.1. Market Structure

Market structure can be defined as a market with perfect competition, monopolistic competition, oligopoly or monopoly. We could imagine what that structure is, how it is made; its movements and reactions to endogenous and exogenous conditions. One may deduce that the relationship between prices and the number of market participants were explored by theorists while conducting analysis of industrial structure. Scholars such as Cournot (1927), nevertheless put forward a view on structure; however, it was limited in a theoretical sense. The more economics developed, the more academics sought progressive change. Economists kept seeking to define sets of attributes or variables that influenced economic performance. They built theories to detail the links between those attributes and end performance (Scherer and Ross, 1990:4). In the first half of the twentieth century, a series of researchers introduced the Structure-Conduct-Performance (SCP) method, which was the nodal point in the scientific field of "structure". These works belonged to Mason (1939, 1949) and Bain (1951, 1956 and 1959), and partly touched on Chamberlin's study (1962). We can, by summarizing these papers, conceive, as we argue at length later, that SCP is a chain of mutual affection between concentration and performance that is measured by profitability. Then, we will also take a look at the challenges of SCP that were put forward by Stigler (1968) and Demsetz (1974).

The Structure-Conduct-Performance model (SCP)

Before we go further, let us pause to inquire what and how Bain and Mason defined Structure, Conduct and Performance. Then we will draw an SCP diagram based on their illustration.

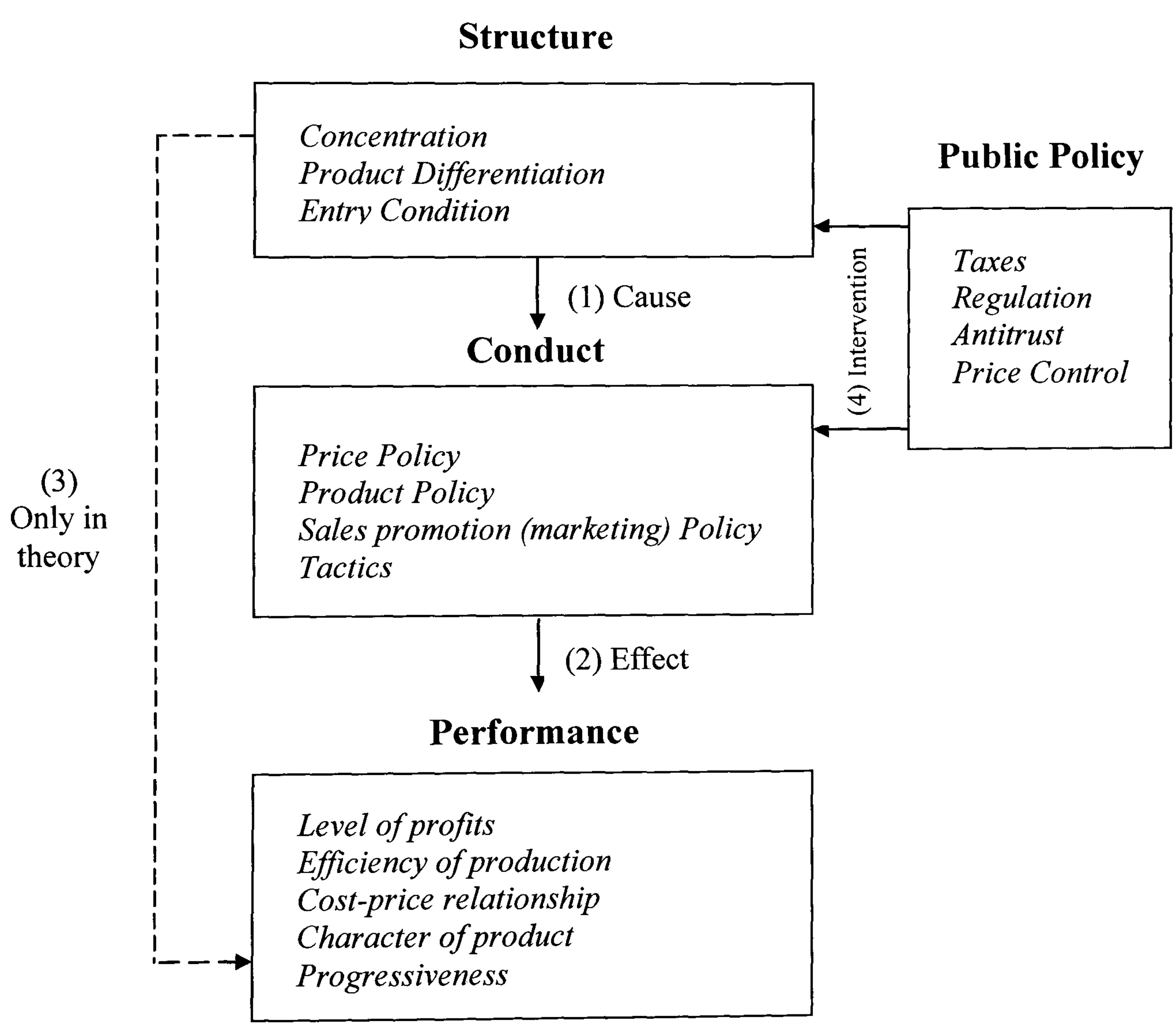
a) SCP definitions (Market structure – Market conduct – Market performance)

Market structure involves the organisational characteristics of a market; and for practical purposes we clarify those characteristics that determine the relations of sellers in the market to each other, of buyers in the market to each other, of sellers to buyers, and of the sellers established in the market to other actual or potential suppliers of goods (including potential new firms that might enter the market). In other words, market structure for practical purposes means those characteristics of the organisation of a market that seem to influence strategically the nature of competition and pricing within the market (Bain, 1959: 7). The characteristics of market structure are concentration, product differentiation and entry condition. First of all, concentration (Mason, 1949 and Bain, 1959: 85-143) is used to refer mainly to the ownership or control of a large proportion of some aggregate of economic resources or activity either by a small proportion of the units that own or control the aggregate, or by a small absolute number of such units. With regard to product differentiation (Chamberlin, 1962; Bain, 1956: 114 and Bain, 1959: 210-215), it is outputs of the various sellers, which are viewed as non-identical by buyers in quality, design, packaging and reputation. Buyers may have a preference, transitory or permanent, for some or all established products as compared to new-entrant products. Lastly, the condition of entry (Bain, 1956 and Bain, 1959: 237-262) as a structural characteristic of an industry refers to the advantage that sellers have already established in the industry and possess over potential additional sellers who may wish to enter it. It is the measure of the extent of barriers to new competition in the industry – of the "fence" that protects established sellers and which added sellers must surmount before they can enter into competition in the field.

Market conduct refers to the patterns of behaviour that enterprises follow in adapting or adjusting to the markets in which they sell (or buy). If the enterprises are referred to sellers they have price, product, sales promotion policies and tactics. Firstly, price policy (Mason, 1939 and Bain, 1959: 286-287) is the method of calculating or determining price. There are four alternatives: (1) the seller or group of sellers calculates the prices to be charged and output to be produced by using "marginal" techniques, in which each possible price adjustment, and corresponding adjustment of output sold, is evaluated from the standpoint of its effects in marginally changing total sales revenues of the firm or group, and in marginally changing aggregate costs of production; (2) the seller or group of sellers may make prices by adding an established and inflexible percentage rate of profit to the costs of production per unit of output as calculated in some way – most commonly calculated as what unit cost would be at some "standard" or average expected rate of output; (3) the sellers may follow a cost-plus-margin formula for pricing, but vary the size of the margin in response to changing market conditions; and (4) the sellers may arrive at a price by imitating the prices of competitors. Secondly, product policy (Mason, 1939 and Bain, 1959: 316) can alter product design in numerous dimensions (an automobile can be made lighter or heavier, shorter or longer, higher or lower, et cetera ad infinitum), it can alter product quality over a wide range, and it faces multiple choices as to the rate and frequency of product change over time. Thirdly, sales promotion (marketing) policy (Bain, 1959: 316) includes the complex design of promotional campaigns (involving, for examples, choice of advertising media to be used, or the emphasis of the promotional "message") as well as a determination of how much to spend. Fourthly, in tactics (Bain, 1959: 324), one dimension of market conduct deserves mention: the "acts, practices, and policies" of sellers aimed either at gaining advantage over, weakening, controlling, or eliminating competitors, or at discouraging or preventing the entry of new competitors to the market. The outcomes of conduct are conveniently labelled – drawing upon the language of the law under the antitrust statutes – as "predatory and exclusionary" (and also "coercive").

Market performance considers the composite of end results in the dimensions of price, output, production cost, selling cost, product design, and so forth, which enterprises arrive at in any market as the consequence of pursuing whatever lines of conduct they espouse (Bain, 1959: 11). It includes level of profits, efficiency of production, cost-price relationship, character of product, progressiveness. At first, level of profits (Bain, 1951; Bain 1959: 364 and Mason, 1949: 1282) are profits continually and substantially higher than in other industries exhibiting similar trends in sales, costs, innovations, etc. Profits, variously designed as "economic", "pure", or "excess" profits. They are simply defined as the residual excess of the sales revenue of the enterprise over and above all costs incurred to earn the revenue. Efficiency of production (Bain, 1959: 342-363) is influenced by scale or size of plants and firms (relative to the most efficient), and by the extent, if any, of excess capacity. It is measured by how closely firms in the industry approximate the lowest attainable costs for the outputs they produce and distribute. Both attained and attainable costs, for this purpose, should refer basically to real costs in terms of human and physical resources used, or to the money value of such resources valued at constant prices. This is the cost measure of efficiency and is not influenced by "strictly pecuniary" considerations revolving around possible variations in the money prices that firms may pay for given real resources. Turning to the cost-price relationship (Mason, 1949: 1281 and Bain, 1959: 363-378), it is the reduction in cost, whether due to falling wages or material prices, technical improvements, discovery of new sources of supply, that are passed on promptly to buyers in the form of price reductions. It is described as sales revenue or value of owners' investment in the enterprise. In the case of product character (Bain, 1959: 397-401), it is how well the firms engaged in the design of, determine the quality of, vary, differentiate, and progressively improve their product. With regard to progressiveness (Mason, 1949: 1281 and Bain, 1959: 394-397), production techniques in any sector or industry of the economy are continually or intermittently improving or progressing, with the general result of lowering the real costs of producing various goods and services.

Figure 3.1 SCP paradigm



Sources: Scherer and Ross (1990:5); Goddard et al. (2001:35) and Bikker (2004:16).

It appears that structure is not simple concentration. It is now also product differentiation and entry conditions. The connection between market structure and market performance is only in theory. As to the role of the government in the SCP paradigm, Bain (1959: 472) argued that with respect to the propagation of greater efficiency and of better conservation, moreover, our analysis suggests that direct and positive governmental intervention in market structures may be required to secure more desirable performance in the usual cases. Hence, as the analyser, once unsatisfactory performance has been identified, needs to employ public interference to secure more satisfactory performance (see Figure 3.1).

b) Arguments for and against Bain's idea

Brozen's (1971a, 1971b) critique of Bain's work is the first study to raise, if only indirectly, the question of the inter-temporal pattern of profitability and its relationship to market structure characteristics. Qualls (1974) responded to Brozen's attack on Bain by pointing out that high concentration was a necessary but not sufficient condition for persistently above normal profits. Where entry barriers are slow, high profits attract new entrants, which in turn drive profit rates down. Thus Qualls commented that one should expect a stable concentration-profits relationship only in industries with high entry barriers (Mueller, 1990: 5). Brozen (1971a) was also selected for special criticism by Leonard Weiss. He contended that it was improper for Brozen to classify a few industries as concentrated. Weiss (1974) also listed 46 concentration-profit studies.

In terms of government intervention on the SCP paradigm, as we mentioned before, regards markets as imperfect, and needing intervention from government. Harold Demsetz (1974), disputes this finding of Bain. He contradicted that "I do not suggest that we abandon the search for privacy conspiracy, but I do think that it is time to pay much less attention to the structure of industry and virtually no attention to the notion of nongovernmental barriers to entry. The present trend in antitrust laws makes it difficult to refrain from asking whether present practices encourage more competition than they inhibit. The answer cannot be given yet with any certainty but there are numerous instances where cartelisation seems to have taken place. Given these uncertainties, it would seem wise to redirect our efforts to the task of reducing governmentally protected monopolies" (Demsetz, 1974: 184).[11]

The Efficiency Hypothesis (EH)

The difference between SCP and EH is not in the relationship between market structure, conduct and performance, but rather the connection between concentration and profit under public intervention to reach a competitive goal. The main idea of the EH is that an industry will become more concentrated under competitive conditions if some firms expand output. Such expansion will increase the degree of concentration at the same time that it increases the rate of return. The result may be better products that satisfy demand at a lower cost. We can understand that efficient firms tend to achieve bigger market share, leading to concentration of the industry. To gain superiority depends on the firm's owner. The success of firms will be reflected in higher returns and stock prices, not higher input prices (Demsetz, 1973: 1-2).

Superior ability may also be interpreted as a competitive basis for acquiring a measure of monopoly power. To destroy such power when it arises may remove the incentive for progress. This is in contrast to a situation in which a high rate of return is obtained through a successful collusion to restrict output. It seems that after a degree of concentration, monopoly is the highest form of concentration. Concentration and monopoly that are characterised by high profits are not related to the collusion among firms to reduce output. To substantiate his point, he collected internal revenue data partitioned by size of firm and industry concentration for 95 three digit industries for interpretation. [12] Accordingly, he confirmed that decentralisation or anti-merger policies can reduce efficiency by impairing the survival of large firms in concentrated industries. Peltzman (1977: 261-263) implemented another survey

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[11] Demsetz is one among the people from the Chicago School (Stigler, 1968; Posner, 1979; Reder, 1982) that queried a challenge to Professor Joe Bain that used another explanation about structure, called the Efficiency Hypothesis (EH).

[12] C63 designates the four firm concentration ratio measured on industry sales; R1, R2, R3 and R4, respectively, measure rates of return (profit plus interest)/total assets, for firms with asset value less than USD500,000; USD500,000 to 5,000,000; USD 5,000,000 to 50,000,000 and over USD50,000,000. For instance, industries with C63>50% of concentration seem to have earned higher profit than less concentrated industries.

about industrial concentration that supported Demsetz's views[13]. He claimed that since this concentrated sector currently accounts for around one-fourth, or 250 billion USD of manufacturing sales, any existence of a de-concentration programme would risk imposing losses that are many times greater than the typical estimates of the benefits that such a policy might have been thought to produce.

After Demsetz, there were also a number of researchers swayed by the EH involving McGee (1974), Smirklock (1985), Jovanovic (1982), Carter (1978), Brozen (1970), Phillips (1976) and others. Some economists were undecided with regard to the two methods. These included Schamalensee (1985) and Eckard (1995). Altogether, EH is a criticism of SCP on concentration. It still based on the SCP paradigm to explain a structure. We can, for this reason, call SCP (collusion hypothesis) and EH (efficiency hypothesis) structural methods for determining market structure.

3.2.2. Bank structure

Banking researchers seem to have useful tools to implement the research on banking structure. The structural method (SCP), defines our bank structures as perfect competition, monopolistic competition, oligopoly or monopoly. Banking researchers might access three characters of market structure (see Figure 3.2): concentration, product differentiation and entry barriers. It is widely accepted that the measurement of bank performance and the measurement of market structure are different but parallel to each other.

The application of the SCP to the banking literature has been criticised by various authors, for instance by Gilbert (1984), Reid (1987) and Vesala (1995) (see Bikker, 2004:64). Their criticism is directed at the form of the model, rather than at the specification of the variables used.

[13] In his data, the average ratio of the industries that have a four firm concentration ratio (CR) greater than 5 is around 7. By a divestiture action, the CR for such an industry is reduced by 5, raising unit costs in the order of 20%, which in turn would raise prices by 10 to 15%. Resource costs would increase by around 12.7% per USD of output, so producers would lose 3.6 cents per USD, and the total loss would be just over 13 cents.

Table 3.1 The measures of bank performance and market structure in the US banking industry from 1961 to 1991

Structure in banking industry				
Performance characters	*Number of times used*	*Structure characters*		*Number of times used*
Loan interest rates	30	*Concentration ratios*		**95**
Deposit interest rates	25		Firm deposits (CR1, 2, 3, 5)	51
Service charges	22		Herfindahl index (H)	17
Profitability	**38**		Number of firms in the market	16
Other measures	18		Other concentration ratios	11
		Product differentiation		N/A
		Entry barriers		N/A

Source: Molyneux et al. (1996: 98 and 102).

We are discussing bank structure and later we will choose one of the above characters of performance and structure for the case of Vietnam. In bank performance, in Table 3.1 above, some of the evidence showed that ***profitability*** (measured as return on assets and return on capital) is the preferred performance measure with 38 times out of 133 cases that are considered. Profitability measures succeed in finding a significant relationship between market structure and industry performance. For market structure, ***concentration*** is commonly used (with 95 times) due to its easy quantification. Typical profitability-concentration studies include Weiss (1974), Smirlock (1985), Rhoades (1985), Berger and Hannan (1989), Lloyd-Williams *et al.* (1994) and Molyneux and Forbes (1995).

As we stated previously, SCP (collusion hypothesis) and EH (efficiency hypothesis) are different in terms of the concentration relationship in the market structure. In the banking sector, according to the SCP hypothesis, all banks respond similarly to an increase in market concentration, by strengthening their collusive behaviour. As a result they all benefit equally from such a change. Furthermore, increased market concentration was found to be associated with higher prices and greater than normal profits. Antitrust or regulatory policy should be aimed at changing market structure in order to increase competition or the quality of bank performance. The EH suggests that market concentration does not reduce competition between banks. It postulates that the most efficient banks gain market share at the cost of less efficient banks. Hence, increasing concentration in banking markets should not be restricted by antitrust or regulatory measures (Bikker *et al.*, 2007: 4 and Molyneux and Forbes, 1995: 156).

Before the survey of research on bank structure by Molyneux *et al.* (1996), there were surveys of Rhoades (1977) for 39 studies from 1961 to 1977 and Gilbert (1984) for 56 studies from

1964 to 1983. From 1991 to 2002, there were approximately another 20 studies of bank performance and market structures summarised by Goddard *et al.* (2001) and Shaffer (2004).

Smirlock (1985) and Evanoff and Fortier (1988) found evidence of a positive relationship between market share and profitability. However, these results cannot distinguish between the two competing hypotheses (SCP and EH) because of observational equivalence. Lloyd-Williams *et al.* (1994) found that market share was either negatively related to profit or insignificant when included within the three-bank concentration ratio, which was positively related to profit, in their study of Spanish banks in 1980s. They came down in favour of the SCP hypothesis, but in fact even their study can be interpreted as observationally equivalent to the EH model. The survey by Gilbert (1984) on an earlier generation of SCP studies in banking concluded that the empirical results suffered from inconsistencies and methodological flaws in being unable to distinguish between two competing hypotheses. In the survey, it was noted that nearly 50% rejected the SCP hypothesis. Later studies of Molyneux and others, while attempting to distinguish between the two hypotheses, still fall to produce identifying restrictions that could reject one hypothesis against another. The effect of barriers to entry and restrictions on interstate banking in the US was examined by Frame and Kamerschen (1997) in their 1994 study of banks in rural Georgia. They included an independent estimate of inefficiency, using the cost function approach to estimate relative inefficiency. If the inclusion of an efficiency measure makes market share insignificant, then market share is a proxy for efficiency and the SCP model is rejected. If, on the other hand, the inclusion of efficiency does not affect the statistical significance of market share, then the EH hypothesis is rejected. Fame and Kamerschen (1997) rejected the EH model but concluded that the relative market power was created by legal and positive market barriers to entry, given restrictions in interstate banking. As noted by Gilbert (1984), the policy implications of the SCP model against the EH model were starkly different. According to the SCP hypothesis, dominant banks in the market should be broken up by competition legislation, whereas the EH model suggests that the banking market should be left alone (Mathews and Thompson, 2008: 175).

3.2.3. Structural model in emerging and developing countries

Barth *et al.* (2001) used the concentration ratio of banks in 107 countries, including emerging and developing nations. Table 3.2 indicates that bank concentration is the highest in sub-Saharan countries (82.77%) and the lowest in the EU (59.19%). Foreign bank ownership is 42.2% in East Asia and the Pacific, reflecting the excellent environment for investors in this area. South Asia has the largest percentages number of government owned banks with 59.98%. America opened the largest percentage of banks in the surveyed time with 60.50 % on the total banks in emerging countries. South Asia and Europe and Central Asia follow with 21.4% and 18.24% on the total banks, respectively. The Organisation for Economic and Co-operation and Development (OECD) has a similar percentage of new banks as America with 67.68% while the EU only has 22.14%.

Table 3.2 Bank structure in averages by region including emerging and developing countries from 1998 to 2001 (%)

	American	East Asia & Pacific	Europe & Central Asia	Middle East & North Africa	South Asia	Sub-Saharan Africa	OECD	EU
Bank concentration	62.47	66.8	65.42	72.04	65.45	**82.77**	59.78	**59.19**
Foreign bank ownership	32.27	**42.2**	28.7	24.56	17.29	**35.89**	22.97	**16.29**
Government Owned banks	12.2	13.2	19.33	13.76	**59.98**	24.1	14.03	9.98
Number of new banks	**60.5**	8.23	**18.24**	2.56	**21.4**	5.1	**67.68**	**22.14**
New domestic banks	54.84	7.31	101	0.7	14.4	3	53.25	17.47
New foreign banks	2.47	6.23	8.86	1.7	5.83	1.82	11.45	11.15

Source: Barth et al (2001:45).

3.2.4. Structural model in Vietnam

Bank structure in Vietnam is not analysed for a large number of banks and long period of time using parametric or non-parametric methods. Researchers analysed the Vietnamese banking structure using concentration data (bank sizes) from the reports of the SBV. Le T (2006) considered the structure of the Vietnamese banking industry and the possible solutions to the obstacles in the process of joining the WTO. She argued that market share of the SOCBs will be reduced from 75% in 2004 to 50% in 2010, while JSCBs and BFBs' market share will become 25-35% and 20% in 2010 from 12.5% and 11.5% in 2004, respectively. Trinh Q (2004) and Le D (2005) discussed the potential for competition and the integration of Vietnamese commercial banks by 2010. Lam T (2006) examined the methods that could develop the Vietnamese banking system in the light of the process of internationalisation.

These investigations examined the structure from a macroeconomic perspective and have not applied any methodology of structure. However, there are some researches that discuss banking structure in Vietnam, including Barth *et al.* (2001, 2004) and Kousted *et al.* (2005).

Barth *et al.* (2001) is a valuable report about regulation and supervision of banks around the world. Disappointingly, most of the indices are limited for Vietnam. Building on this work and other sources, Kousted *et al.* (2005) explained market structure for Vietnam using concentration ratio.

Table 3.3 Bank structure in Vietnam compared to developing and developed countries

Countries	Bank concentration (5-banks deposits)	Share of deposits of the five largest banks held by foreign banks	Share of deposits of the five largest banks held by governments owned banks	Entry into banking requirement (0-8)
Vietnam	65	**0**	**80**	**8**
Developed countries	61	25	36	**7.19**
Developing Countries	71	10	22	**7.38**

Note: (0): None of the foreign banks are among the five largest in Vietnam; Sources: Kousted et al. (2005:61, 62) and Barth et al. (2001: 38-39).

From Table 3.3 it is apparent that the Vietnamese banking sector is less concentrated than that of average developing countries. The degree of government ownership in the Vietnamese banking sector is very high compared to both other countries in the region and to the average level in developing countries.

Barth *et al.* (2004) indicated that a higher degree of state ownership tends to be associated with lower bank efficiency, less saving and borrowing, lower productivity and slower growth. The share of deposits of the five largest banks held by government-owned banks was 80% before 2001 (when they accounted for only 10% of the total of banks at that time). Barth *et al.* (2004) also found that tighter entry restrictions tend to increase overhead costs; the likelihood of a major banking crisis is positively associated with greater limitations on foreign bank participation. He divided the level of entries from zero to eight (from low to high entries). Entry into banking requirement is eight in Vietnam. Developed and developing countries are 7.19 and 7.38 respectively (see Table 3.3). This shows that before 2001, Vietnam protected the domestic banks. Tight restrictions on entry into the banking sector can create monopolies/duopolies that are associated with high interest margins and high overhead expenditures.

The Vietnamese banking sector is characterised by so little inter-bank competition that any indirect regulation with the objective of making SOCBs stay within the areas assigned to them during the period of central planning is likely to make the eventual entry of foreign banks resemble shock therapy. Any attempt to introduce new entrants and a higher level of competitiveness in the sector should, of course, be gradual so that the franchise value of local banks does not erode quickly, causing instability and increased risk of financial crises. As a consequence, any liberalisation of the entry process must be managed over time and be transparent. Prior to opening the sector to new and, most likely, more sophisticated entrants, the government must strengthen the capacity and autonomy of the regulatory framework (Kousted *et al.*, 2005: 75-76).

3.3. Methodology

Concentration-profitability in the SCP model will be employed to look into the banking structure of Vietnam. The motivation of this section is to answer the question of whether the Vietnamese banking market is collusive or efficient. An important contribution we make to the structural method is that we incorporate three factors of customer loans, total assets and customer deposits in either 3-bank or 5-bank ratios. These factors have not been incorporated by the previous studies of Barth *et al.* (2001, 2004). Other environmental factors such as capital/assets, loans/deposits, number of branches are included into the model to evaluate the impacts of them on the dependent variables. Another contribution is the construction of a data set of 48 Vietnamese commercial banks from 1999 to 2009 for economic fundamentals and environmental covariates, which allow us to carry out an econometric investigation. HHI and CR will also be applied, in order to investigate the Vietnamese banking system.

3.3.1. Herfindahl-Hirschman Index (HHI)

HHI is one of the most common measures of concentration and the one used by financial regulators. It is defined as the sum of the squared market shares of the banks in the market.

$$HHI = \sum_{i=1}^{n} MS_i^2 \tag{3.1}$$

Where, MS is the market share of bank i. This will be estimated using data on the customer loans, total assets and customer deposits of bank i divided by total banking sector customer loans, total assets and customer deposits, respectively, in year t. HHI-CL is the HHI index when market share is measured using customer loans. HHI-TA gives the HHI index when market share is measured using total assets. HHI-CD is concerned with the HHI index when market share is measured using customer deposits. This index has the values from 1/n (1/48=0.02) to 1. When HHI approaches the minimum value (0.02), all banks have the same size in the market (low concentration). On the other hand, HHI would be 1 when there is a monopoly (high concentration).

3.3.2. Concentration ratio (CR)

The k-bank concentration ratio (defined in equation **(3.2)**) is employed to indicate the relative size of banks in relation to their banking industry as a whole. Popular measures in studies of banking markets have been the three-bank and five-bank CR, which are also applied in this study. The hypothesis is that, the larger the CR, the greater will be the potential for anticompetitive behaviour. A number of studies have employed the CR to examine the effect of concentration on the profit of banks, for example Lloyd-Williams *et al.* (1994) and Molyneux and Forbes (1995).

$$CR_k = \sum_{i=1}^{k} MS_i \tag{3.2}$$

- ✓ CR-CL3 (5): Concentration ratio of three (five) banks when market share is measured using customer loans.
- ✓ CR-TA3 (5): Concentration ratio of three (five) banks when market share is measured using total assets.
- ✓ CR-CD3 (5): Concentration ratio of three (five) banks when market share is measured using customer deposits.

Where, CR_k is the k-bank concentration index; MS_i is the market share of bank i. This index uses the k leading banks to measure concentration and the other banks in the system are neglected. The concentration index is considered as one point on the concentration curve, and is a first-order measure that takes values between zero and one. When there is an infinitively large number of banks with equal size (low concentration), the index value is zero. On the other hand, it approaches one when a small number of banks constitute a large percentage share of the market (high concentration).

3.3.3. Structural model: Concentration-profitability

Following Weiss (1974); Smirlock (1985); Lloyd-Williams *et al.* (1994) and Molyneux and Forbes (1995) we will test the performance of the Vietnamese banking system by estimating the profit equation:

$$\pi_i = a_0 + a_1 MS_i + a_2 CR_i + \sum_{j=3}^{n} a_j Z_{ij} \qquad \textbf{(3.3)}$$

Where π_i is a profit measure; MS_i is a measure of market share; CR_i denotes market concentration; and Z_{ij} is a vector of control variables which are included to account for firm-specific and market-specific characteristics.

From equation **(3.3)**, if:

- ✓ $a_1 > 0$ and $a_2 = 0$: Banks with high market share are more efficient than their rivals and earn rents because of this efficiency while also indicating that increased market concentration does not result in banks earning any monopoly rents. This supports the efficiency hypothesis.
- ✓ $a_1 = 0$ and $a_2 > 0$: Market share does not affect bank rents and rents reflected in higher profitability are monopoly rents that result from market concentration. This supports the traditional hypothesis (Smirlock, 1985: 74).

For testing purposes, we cast model **(3.3)** in empirical form, as follows:

$$LN(ROA_{i,t}) = a_0 + a_1 MS_{i,t} + a_2 CR_{i,t} + a_3 \frac{TC_{i,t}}{TA_{i,t}} + a_4 \frac{CL_{i,t}}{CD_{i,t}} + a_5 LN(TA_{i,t}) + a_6 LN(BR_{i,t}) \qquad \mathbf{(3.4)}$$

Where:

$Ln(ROA_{i,t})$[14]: bank i's profits measured as the natural logarithm of revenue divided by total assets LN(REV/TA); interest income divided by total assets LN(INT/TA) and profit before tax divided by total assets LN(1+PBT/TA)[15].

$MS_{i,t}$: market share is measured as the percentage of industry sales of a particular company or product. This captures bank efficiency (Smirlock, 1985:75; Molyneux and Forbes, 1995:156). We will define MS using the following measures:

- ✓ MS-CL: the total loans of bank i divided by total banking sector loans in year t.
- ✓ MS-TA: the total assets of bank i divided by total banking sector assets in year t.
- ✓ MS-CD: the total deposits of bank i divided by total banking sector deposits in year t.

CR_t: the concentration ratio indicates the relative size of firms in relation to their industry as a whole. To measure market concentration we use the three-bank and five-bank loans, assets and deposits concentration in year t.

Control variables are included to account for other risk, cost, size and ownership characteristics. Since the performance measure, ROA, is not risk adjusted, we will employ the two following variables to account for firm-specific risk, **$TC_{i,t}/TA_{i,t}$** (capital to total asset ratio) and **$CL_{i,t}/CD_{i,t}$** (customer loans to customer deposits ratio) (Lloyd-Williams *et al.*, 1994: 439; Molyneux and Forbes, 1995: 156). **$LN(TA_{i,t})$** is the natural logarithm of asset size of a bank

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[14] Many SCP studies employing manufacturing firm data have used the rate of return on equity (R_E) as the profit rate measure. Weiss (1974) pointed out that (R_E) is more appropriate than alternative measures since this corresponds most closely to what owners seek to maximise. Banking studies have chosen to emphasize two other profit rate measures, the rate of return on total capital (R_C) and (particularly) the rate of return on total assets (R_A). Heggestad (1979) suggested that it is (R_A) that has provided the strongest evidence on the concentration-profitability relationship in banking.

[15] Because PBT/TA can take on (small) negative values, we compute the dependent variable as ROA'=(1+PBT/TA) (see Claessens and Laeven, 2004).

included as a control variable to account for cost and capital ratio differences related to bank size and to control for the possibility that large banks are likely to have greater products and loan diversifications. This increased diversification implies less risk and hence a lower required rate of return (Smirlock, 1985). **$LN(BR_{i,t})$** is the natural logarithm of the number of branches. E-views econometric software will be used to estimate these structural models (Startz, 2007)[16].

3.4. Data[17]

In this research, annual individual balance sheets and income statements of 48 Vietnamese commercial banks from 1999 to 2009 have been collected from the SBV, Orbis (Bloomberg), National Library of Vietnam and individual banks. In addition, interviews have been carried out to provide the necessary data and information for the research. Financial statements of some banks are still not reported on their web sites, especially branches of foreign banks. Almost all researchers have difficulties obtaining estimates for their models because they do not have full data on the banking system.[18] We have travelled to Vietnam three times, in August 2008, December 2009 and August 2010, to seek data from banks. Direct meetings have been implemented with bank managers. Some attempts have met with great success, especially in obtaining financial statements from 2004. However, there has been a lack of success in obtaining information from branches of foreign banks. In our data, information has been collected on 48 banks out of more than 100. Although the number of banks for which there is data is only half of the total they account for more than 90% of total customer loans, total customer deposits and total assets. Five of the 48 banks are SOCBs, five are JVCBs, one is an FCB and the remaining 37 are JSCBs. Several banks established in 2008 and 2009 are included in the data. We could not collect data for more than 40 branches of foreign banks.

The available sample of data contains financial and bank characteristics from 48 banks that have been members of the banking system for at least one year over the period from 1999 to

[16] Eviews will also be employed for the estimation of the non-structural models (equilibrium approach).

[17] This data is also applied to Chapter 4: Bank structure: Non-structural model (Equilibrium approach); Chapter 5: Bank structure: Non-structural model (Disequilibrium approach) and Chapter 6: Bank efficiency.

[18] As information is still not publicly available in Vietnam, SBV issued Decision No. 16/2007/QD-NHNN on 18th April, 2007, regarding the issuance of financial statements applicable to credit institutions.

2009, and have records of sufficient quality to be included in at least one year. The number of records ranged from a low of 17 banks in 1999 to a high of 46 in 2009. Banks also have differing frequencies of years in the data. There are sixteen banks with full data; twelve banks with 4–8 years of data; fourteen banks with 5–7 years of data and five banks with 2–4 years of data (of which three banks were established in 2008 and one bank was founded in 2006). Only one bank (which was transformed from a branch of foreign bank to a foreign commercial bank in 2008) has one year of data. Appendix I is the explanation of the data while Appendix 2 gives the data on loans, assets, deposits and capital of 46 Vietnamese commercial banks in 2009.

3.5. Empirical results

3.5.1. HHI and CR

Applying the equations **(3.1)** and **(3.2)** to the data on 48 banks in Vietnam from 1999 to 2009, the results for CR and HHI are presented in Table 3.4. Columns 1 and 2 of Table 3.4 are years and number of banks, respectively. CR is presented in columns 3 to 8 while HHI is presented in columns 9, 10 and 11. The values of these indices, based on customer loans, total assets and customer deposits show that the rankings of the five biggest banks throughout the decade are as follows:

1. Bank for Agriculture and Rural Development (SOCB).
2. Bank for Investment and Development (SOCB).
3. Bank for Industry and Trade (SOCB).
4. Bank for Foreign Trade (SOCB).
5. Asia Commercial Bank (JSCB).

Only the Asia Commercial Bank is a non-SOCB while the other ones are SOCBs. The highest CR is for customer deposits involving five banks (CR-CD5) in 1999, being 92.70%, and this suggests that these five banks almost dominated the banking industry in 1999. By 2009 CR-CD5 had fallen to 60.73%. Meanwhile, CR of three banks for customer deposits was 72.68%

and 45.55% in 1999 and 2009, respectively. Turning to total assets, the five biggest banks accounted for 91.75% in 1999 and 57.23% in 2009. The three biggest banks represented 69.16% of the total assets in 1999. After 10 years, this value plummeted to only 40.89% which was the lowest CR in the table. The corresponding values for customer loans of the five banks are 92.56% and 64.59%. On the other hand, CR measured by customer loans of three banks in the system has reduced by 30 percentage points (from 80.21% to 50.66%) in 10 years. The HHI provides the same inferences. They gradually reduced from 1999 to 2009 and medium banks increased their customer loans, total assets and customer deposits in the system. In 1999, HHI-CL, HHI-TA and HHI-CD were 0.2270, 0.2052 and 0.2127, respectively. After 10 years, these indices reduced to only 0.1141, 0.0824 and 0.0972, respectively.

On the whole, the overall trend of ratios and indices indicates a reduction from 1999 to 2009, which suggests the Vietnamese banking industry has become less concentrated. However, large commercial banks still dominate the whole banking system. The change is approximately 10% a year. There are changes regarding non-SOCBs and SOCBs, in terms of customer loans, total assets and customer deposits. Non-SOCBs start to expand their total assets and offer customers both low-rate loans and high-rate deposits. On the other hand, SOCBs start to transform into non-SOCBs. The increase in the number of banks and decreased market concentration may suggest that banking service choice is increasing. Indeed, the growth in branch networks in many banks appears to affect this trend. In addition, the growth of non-traditional banking services, such as through the stock exchange, derivative products, internet banking, phone banking, credit cards, ATM and so on also indicate that overall choice is growing in this period.

Table 3.4 CR (3 and 5 banks) and HHI for the Vietnamese banking system from 1999 to 2009[19]

		Concentration ratios						Herfindahl-Hirschman indices		
Year	No. of banks	CR-CL3	CR-CL5	CR-TA3	CR-TA5	CR-CD3	CR-CD5	HHI-CL	HHI-TA	HHI-CD
1999	17	**0.8021**	**0.9256**	**0.6916**	**0.9175**	**0.7268**	**0.9270**	**0.2270**	**0.2052**	**0.2127**
2000	22	0.7703	0.9036	0.6856	0.9069	0.6975	0.9107	0.2157	0.1990	0.2006
2001	25	0.7839	0.8963	0.6782	0.8976	0.7023	0.8910	0.2179	0.1942	0.1988
2002	28	0.7542	0.8921	0.5316	0.6944	0.6415	0.8587	0.2134	0.1895	0.1739
2003	29	0.7347	0.8788	0.6772	0.8703	0.6493	0.8583	0.2198	0.1895	0.1767
2004	40	0.7001	0.8522	0.6582	0.8395	0.6422	0.8435	0.2059	0.1780	0.1705
2005	41	0.6741	0.8221	0.6185	0.8076	0.6327	0.8310	0.1886	0.1617	0.1643
2006	41	0.6283	0.7733	0.5770	0.7577	0.5864	0.7940	0.1683	0.1391	0.1480
2007	44	0.5411	0.6891	0.4770	0.6416	0.5278	0.7024	0.1314	0.1019	0.1215
2008	46	0.5427	0.6819	0.4741	0.6372	0.5220	0.6784	0.1302	0.1016	0.1194
2009	46	**0.5066**	**0.6459**	**0.4089**	**0.5723**	**0.4555**	**0.6073**	**0.1141**	**0.0824**	**0.0972**

Note: CR range from 0 to 1; HHI range from 0.02 to 1; Sources: Financial statements of 48 Vietnamese commercial banks.

3.5.2. SCP-EH estimations for the full sample

Tables 3.5, 3.6 and 3.7 report the estimated revenue and profit equations using the various concentration ratio (CR) and market share (MS) measures for the Vietnamese banking system. 'LN(REV/TA)', 'LN(INT/TA)' and 'LN(1+PBT/TA)' are the dependent variables in these equations. Each of these dependent variables is modelled using, in turn, customer loans, total assets and customer deposits measures of both CR and MS. The left hand side of the tables give the models using 3-bank-ratio while the right hand side gives the results of the models based upon 5-bank-ratio. The top of the columns in the tables are labelled 'Normal' and '1-

[19] The actual number of banks from 1999 to 2003 are nearly 40 banks per year (see Table 2.3) but we only report the number as in column 2 of Table 3.4. The data of other banks regarding deposits, assets and loans are very small over this period.

way-FE', and refer to the estimation method used. 'Normal' is pooled Ordinary Least Squares (OLS) and '1-way-FE' is the cross-sectional fixed-effects estimator[20]. H_0^1 refers to the F-test of the null hypotheses that cross-sectional fixed-effects are redundant. All of the F-tests reject the exclusion of cross-sectional fixed-effects and so the '1-way-FE' model is favoured and used for inference. In addition to the CR and MS covariates are the control variables. The control variables included are total capital over total assets (TC/TA), customer loans over customer deposits (CL/CD), total assets (LNTA) and number of branch networks (LNBR). The R^2 and Adjusted R^2 are reported below the control variables. The F-statistic (F-sta.) testing the original explanatory power of the model and number of observations (Obs.) are at the bottom of the table.

The coefficients on CR are always negative and generally significantly different from zero, and those on MS are insignificant. The results regarding CR and MS are broadly the same regardless of whether OLS or FE. These results do not support either the traditional or efficiency hypotheses. MS does not affect banks' revenue, interest income or profit before tax. On the other hand, CR generally has an unexpected negative effect on bank's revenue and profit before tax. As banks expand their customer loans, total assets and customer deposits this does not lead to a growth in revenue and profit. Our data suggests that when banks' revenue and profit increase, market concentration declines from 1999 to 2009. This is consistent with the results of CR and HHI and indicates that the negative coefficients of CR come from the fact that small and medium banks became more competitive in terms of revenue, interest income and profit before tax over this period. It could be that business strategies of banks are raising capital, loans, assets, deposits, branch networks and reducing non-performing loans. Thus, revenue, interest income and profit are not the most propriety missions of banks.

Regarding the other variables, TC/TA is always positive and statistically significant. This implies that capital/asset ratio has a positive relation with revenue, interest income and profit before tax. In reality, all the banks increased their capital as the Decree No. 141/2006/CP of the government. CL/CD is insignificant in all the models. LN(TA) is negative and significant when LN(REVTA) and LN(INT/TA) are the dependent variables; and the CRs are measured using customer deposits and customer loans. In contrast, LN(TA) is insignificant when CRs

[20] We cannot apply '2-way-FE' with both cross-sectional and period fixed effects as the CR variable is perfectly collinear with the period fixed effects.

are measured with total assets and when LN(1+PBT/TA) is the dependent variable. LN(BR) is always positive and sometimes statistically significant. Hence, there is some evidence that revenue and profit also grow when banks increase their network branches.

Table 3.5 SCP-EH estimations of customer loans for the full sample

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-1.15422***	-0.00876	-0.65135	0.227958	0.040766*	0.110649**	-0.93081**	0.736445	-0.40328	0.766863	0.040779*	0.091746*
	(-2.69109)	(-0.01109)	(-1.40795)	(0.264148)	(1.924153)	(2.49542)	(-1.97843)	(0.854233)	(-0.79397)	(0.81058)	(1.747445)	(1.871657)
MSCL	**-0.00663**	**-2.27129***	**0.619569**	**-1.52172**	**-0.01234**	**0.070922**	**0.064513**	**-2.02182**	**0.645526**	**-1.45793**	**-0.01699**	**0.048213**
	(-0.01423)	**(-1.81348)**	**(1.232054)**	**(-1.11167)**	**(-0.536)**	**(1.008386)**	**(0.138494)**	**(-1.63068)**	**(1.283639)**	**(-1.07153)**	**(-0.73523)**	**(0.683905)**
CRCL	**-0.63058****	**-1.47917*****	**-1.10139*****	**-1.85599*****	**-0.03519*****	**-0.07293*****	**-0.72758*****	**-1.81084*****	**-1.17384*****	**-2.03773*****	**-0.03211****	**-0.05635****
	(-2.41378)	**(-3.3178)**	**(-3.90871)**	**(-3.80902)**	**(-2.72682)**	**(-2.91306)**	**(-2.66955)**	**(-3.92338)**	**(-3.98946)**	**(-4.02317)**	**(-2.37492)**	**(-2.14733)**
TC/TA	0.500035***	0.486087***	0.433798***	0.474113***	0.047366***	0.04038***	0.490321***	0.460158***	0.428208***	0.458515***	0.047821***	0.04148***
	(5.42947)	(4.450462)	(4.366973)	(3.971696)	(10.41173)	(6.583556)	(5.319506)	(4.218321)	(4.303183)	(3.830262)	(10.45963)	(6.687754)
CL/CD	0.005223	0.004168	0.011432	0.010173	-0.00048	-0.00074	0.004212	0.002035	0.010714	0.008691	-0.00044	-0.00067
	(0.407071)	(0.345918)	(0.826028)	(0.772382)	(-0.74906)	(-1.08687)	(0.328176)	(0.169411)	(0.773245)	(0.659231)	(-0.6902)	(-0.98481)
LN(TA)	-0.08971***	-0.11897***	-0.11259***	-0.1281***	-0.0006	-0.00378*	-0.09326***	-0.13555***	-0.11492***	-0.13649***	-0.00046	-0.00285
	(-4.17111)	(-2.98007)	(-4.85318)	(-2.93588)	(-0.56146)	(-1.68516)	(-4.31005)	(-3.38191)	(-4.91946)	(-3.10319)	(-0.4246)	(-1.25138)
LN(BR)	0.105693***	0.083725*	0.104262***	0.076386	0.000301	0.001156	0.104868***	0.077752	0.104551***	0.075649	0.000407	0.001811
	(4.3368)	(1.699973)	(3.966267)	(1.419072)	(0.250374)	(0.418068)	(4.316359)	(1.593906)	(3.986069)	(1.413176)	(0.33772)	(0.652937)
R2	0.220657	0.512551	0.220451	0.499378	0.338431	0.465232	0.223351	0.512551	0.221742	0.501861	0.335261	0.458888
Adj. R2	0.207985	0.432319	0.207775	0.416978	0.327674	0.377211	0.210723	0.432319	0.209088	0.419869	0.324452	0.369823
H_0^1	—	4.102543***	—	3.817154***	—	1.624488***	—	4.208418***	—	3.852561***	—	1.565254**
		Reject		Reject		Reject		Reject		Reject		Reject
F-sta.	17.41266	6.388336	17.39175	6.060381	31.46081	5.28548	17.68639	6.55246	17.52269	6.120869	31.01746	5.152277
Obs.	376	376	376	376	376	376	376	376	376	376	376	376

*Coefficients and t-statistics (in brackets) are reported in the table; *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Sources: Financial statements of 48 Vietnamese commercial banks.*

Table 3.6 SCP-EH estimations of total assets for the full sample

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-1.47186***	-1.65102***	-1.34821***	-2.33356***	0.030995	0.03952	-1.4663***	-1.65692***	-1.29562***	-2.26849***	0.037093*	0.051258
	(-3.4718)	(-2.7175)	(-2.91879)	(-3.48936)	(1.480317)	(1.175122)	(-3.38587)	(-2.68334)	(-2.74752)	(-3.33969)	(1.737962)	(1.503601)
MSTA	**-0.27277**	**-1.57601**	**0.07882**	**-1.26957**	**-0.01583**	**-0.00116**	**-0.28427**	**-1.58309**	**0.098664**	**-1.22971**	**-0.01204**	**0.006226**
	(-0.55439)	**(-1.40174)**	**(0.147034)**	**(-1.02582)**	**(-0.6514)**	**(-0.01861)**	**(-0.57771)**	**(-1.40541)**	**(0.184142)**	**(-0.99242)**	**(-0.49658)**	**(0.100114)**
CRTA	**-0.45324***	**-0.60241***	**-0.63461****	**-0.36224**	**-0.03143****	**-0.02964***	**-0.37085***	**-0.48961***	**-0.54714****	**-0.33187**	**-0.02928*****	**-0.03066****
	(-1.74934)	**(-1.8943)**	**(-2.24805)**	**(-1.03481)**	**(-2.45644)**	**(-1.68398)**	**(-1.70833)**	**(-1.8338)**	**(-2.31465)**	**(-1.12998)**	**(-2.73632)**	**(-2.07998)**
TC/TA	0.530642***	0.573109***	0.500084***	0.601891***	0.048507***	0.043582***	0.533413***	0.578231***	0.500425***	0.602083***	0.048248***	0.043328***
	(5.80955)	(5.247869)	(5.025057)	(5.006929)	(10.75296)	(7.20953)	(5.857349)	(5.312729)	(5.046534)	(5.02886)	(10.75036)	(7.210775)
CL/CD	0.00766	0.007309	0.01732	0.016223	-0.00041	-0.00051	0.007808	0.007481	0.017221	0.016169	-0.00044	-0.00052
	(0.599876)	(0.599899)	(1.244852)	(1.209669)	(-0.65525)	(-0.74861)	(0.61158)	(0.614099)	(1.238785)	(1.206552)	(-0.70242)	(-0.7791)
LN(TA)	-0.07959***	-0.05701	-0.09297***	-0.03535	-0.00028	-0.00141	-0.07859***	-0.05491	-0.09305***	-0.0366	-0.0004	-0.00175
	(-3.52533)	(-1.50241)	(-3.7793)	(-0.8463)	(-0.24693)	(-0.67276)	(-3.50488)	(-1.4566)	(-3.81127)	(-0.88263)	(-0.35839)	(-0.84113)
LN(BR)	0.108567***	0.092115*	0.11575***	0.104564*	0.000201	0.002791	0.10837***	0.091437*	0.115197***	0.103469*	0.000152	0.002637
	(4.799779)	(1.888787)	(4.696783)	(1.947792)	(0.179898)	(1.03392)	(4.786997)	(1.872354)	(4.67317)	(1.926077)	(0.136239)	(0.978185)
R2	0.21562	0.489937	0.19943	0.468632	0.334398	0.456293	0.21532	0.489583	0.20008	0.468971	0.336968	0.458777
Adj. R2	0.202865	0.405982	0.186413	0.381171	0.323576	0.366801	0.202561	0.405571	0.187073	0.381566	0.326187	0.369693
H_0^1	—	3.684576*** Reject	—	3.470895*** Reject	—	1.535956** Reject	—	3.681292*** Reject	—	3.469094*** Reject	—	1.541916** Reject
F-sta.	16.90583	5.835745	15.32028	5.358178	30.89761	5.098699	16.87594	5.827494	15.38269	5.365469	31.25568	5.149972
Obs.	376	376	376	376	376	376	376	376	376	376	376	376

See notes to Table 3.5.

Table 3.7 SCP-EH estimations of customer deposits for the full sample

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-1.28125***	-0.65301	-0.80763	-0.84286	0.043639	0.070327	-1.0205**	0.276912	-0.54255	0.051229	0.03708	0.041071
	(-2.63943)	(-0.80502)	(-1.53575)	(-0.94872)	(1.821115)	(1.564452)	(-2.05435)	(0.337812)	(-1.00916)	(0.056954)	(1.503364)	(0.890419)
MSCD	**-0.1243**	**-0.79959**	**0.438104**	**-0.37716**	**-0.00688***	**-0.00179**	**0.047633**	**-0.33625**	**0.596179**	**0.061599**	**-0.01329**	**-0.02044**
	(-0.24365)	**(-0.65617)**	**(0.792717)**	**(-0.2826)**	**(-0.27318)**	**(-0.02652)**	**(0.093735)**	**(-0.28004)**	**(1.084006)**	**(0.046753)**	**(-0.52653)**	**(-0.3025)**
CRCD	**-0.62945***	**-1.34714****	**-1.11533*****	**-1.4553****	**-0.04334**	**-0.05449**	**-0.65612****	**-1.59015*****	**-1.03746*****	**-1.65446*****	**-0.0296****	**-0.02597**
	(-1.87168)	**(-2.56093)**	**(-3.06132)**	**(-2.52601)**	**(-2.61051)**	**(-1.8692)**	**(-2.42308)**	**(-3.7907)**	**(-3.54014)**	**(-3.59429)**	**(-2.20163)**	**(-1.10031)**
TC/TA	0.520671***	0.540598***	0.463617***	0.547763***	0.047842***	0.042774***	0.502851***	0.509278***	0.446863***	0.518012***	0.04846***	0.043978***
	(5.630046)	(4.910592)	(4.627443)	(4.543071)	(10.47945)	(7.011166)	(5.45106)	(4.685357)	(4.475889)	(4.34314)	(10.58006)	(7.190282)
CL/CD	0.006655	0.005236	0.014427	0.013002	-0.00048	-0.00057	0.005033	0.002668	0.012784	0.010484	-0.00044	-0.00052
	(0.520292)	(0.429257)	(1.041168)	(0.973282)	(-0.7562)	(-0.83748)	(0.394197)	(0.220821)	(0.925144)	(0.790754)	(-0.68759)	(-0.75783)
LN(TA)	-0.08401***	-0.09078**	-0.10759***	-0.08627*	-0.00056	-0.00226	-0.0916***	-0.11992***	-0.11487***	-0.11408**	-0.00031	-0.00122
	(-3.61379)	(-2.21662)	(-4.27198)	(-1.9234)	(-0.48724)	(-0.99619)	(-3.93659)	(-2.96281)	(-4.56142)	(-2.56863)	(-0.27206)	(-0.53494)
LN(BR)	0.1067***	0.08308*	0.112241***	0.087907	9.11E-05	0.002235	0.10545***	0.070939	0.111232***	0.076266	0.000155	0.002636
	(4.694016)	(1.692808)	(4.557898)	(1.635438)	(0.081164)	(0.821693)	(4.655976)	(1.461514)	(4.537908)	(1.431937)	(0.137882)	(0.965075)
R2	0.215974	0.492568	0.208864	0.476676	0.335314	0.457847	0.220927	0.504351	0.215418	0.486892	0.331816	0.454017
Adj. R2	0.203226	0.409047	0.196	0.390539	0.324506	0.36861	0.208259	0.422769	0.202661	0.402437	0.320951	0.36415
H_0^1	—	3.734417*** Reject	—	3.506048*** Reject	—	1.548419** Reject	—	3.917612*** Reject	—	3.624747*** Reject	—	1.533396** Reject
F-sta.	16.94128	5.897504	16.2363	5.533919	31.02489	5.130719	17.43995	6.182145	16.88571	5.765065	30.54048	5.052111
Obs.	376	376	376	376	376	376	376	376	376	376	376	376

See notes to Table 3.5.

3.5.3. SCP-EH estimations for the sub-sample 1999-2003

Tables 3.8 to 3.10 report the estimated revenue and profit equations with the various measures of concentration ratio (CR) and market share (MS) for the Vietnamese banking system between 1999 and 2003. This 5-year-period has only 119 observations. The data for several banks in this sub-period is small and some banks are established after this period. The number of banks in our sample in 1999 and 2003 is 17 and 39, respectively. The '1-way-FE' specification is still favoured for inference as H_0^1 is rejected except for the models using customer loans with LN(1+PBT/TA) as the dependent variable. MS is negative and statistically significant (in the models using customer loans). In contrast, MS is insignificant in all the models based upon total assets and customer deposits. CR is generally insignificant being negative and significant only in the model using customer loans for the '5-bank-ratio' specification. Hence, bank revenue and profits are generally not correlated with either market shares or market concentrations. In other words, an increase or decrease in MS and CR does not affect revenue and profit. Revenue and profit might not come from loans but different sources such as derivative products, international settlements and other services. This contrasts with the full sample results where CR is negatively related with revenue and profit. TC/TA is positive and statistically significant and indicates that capital/asset ratio has a positive relation with revenue, interest income and profit before tax from 1999 to 2003. All other variables are insignificant. Thus there is no relation between the dependent variables and customer loans, total assets and number of branches.

Table 3.8 SCP-EH estimations of customer loans for the sub-sample 1999-2003

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-0.0783	-0.66065	1.279293	0.000861	0.080269	0.058237	1.647676	6.77968	3.897101	7.253468	0.049922	-0.30107
	(-0.05886)	(-0.22281)	(0.809004)	(0.000245)	(1.069635)	(0.260011)	(0.723152)	(1.523169)	(1.438273)	(1.367249)	(0.384705)	(-0.86818)
MSCL	**0.358287**	**-5.16535****	**1.973612***	**-5.48968****	**-0.05388**	**0.088262**	**0.465219**	**-4.42322****	**2.063749****	**-4.81846***	**-0.06362**	**0.041063**
	(0.423154)	**(-2.36463)**	**(1.960737)**	**(-2.12271)**	**(-1.12788)**	**(0.534879)**	**(0.548653)**	**(-2.05886)**	**(2.046631)**	**(-1.88174)**	**(-1.31728)**	**(0.245322)**
CRCL	**-1.30373**	**-1.69238**	**-3.1416***	**-2.74368**	**-0.10407**	**-0.15641**	**-2.99613**	**-7.4866****	**-5.56432***	**-8.47223****	**-0.05859**	**0.105875**
	(-0.86623)	**(-0.87272)**	**(-1.75584)**	**(-1.19507)**	**(-1.22561)**	**(-1.06775)**	**(-1.25615)**	**(-2.28111)**	**(-1.96171)**	**(-2.16582)**	**(-0.43127)**	**(0.414053)**
TC/TA	1.15073***	2.032314***	1.493279***	2.135701***	0.060109***	0.111208***	1.166177***	1.805955***	1.508026***	1.951167***	0.05889***	0.130001***
	(3.938662)	(4.309175)	(4.29939)	(3.824948)	(3.646806)	(3.121481)	(4.001283)	(3.927427)	(4.350965)	(3.56007)	(3.547782)	(3.628671)
CL/CD	0.00849	0.01031	0.010581	0.007534	9.44E-05	-0.00013	0.00682	0.005345	0.008017	0.002037	0.00012	-2.87E-05
	(0.587874)	(0.747967)	(0.61629)	(0.461691)	(0.115837)	(-0.12028)	(0.470386)	(0.39218)	(0.464935)	(0.125394)	(0.145686)	(-0.02706)
LN(TA)	-0.13399***	-0.0638	-0.14183***	-0.06405	-0.00026	0.004144	-0.13627***	-0.19222	-0.14388***	-0.1758	-6.41E-05	0.013269
	(-3.69868)	(-0.54832)	(-3.29331)	(-0.46496)	(-0.12578)	(0.471498)	(-3.76962)	(-1.59865)	(-3.34701)	(-1.2267)	(-0.03114)	(1.416426)
LN(BR)	0.110007**	0.098618	0.059521	0.082993	0.002991	-0.0023	0.107018**	0.05376	0.0574	0.044972	0.003306	0.001104
	(2.51498)	(0.935502)	(1.144658)	(0.664987)	(1.211981)	(-0.2893)	(2.453927)	(0.520074)	(1.106781)	(0.365012)	(1.331201)	(0.137105)
R2	0.283996	0.735839	0.277811	0.735745	0.145069	0.434491	0.289213	0.748846	0.282582	0.745358	0.135039	0.428059
Adj. R2	0.245639	0.633282	0.239122	0.633152	0.099269	0.21494	0.251135	0.65134	0.244149	0.646497	0.088702	0.206012
H_0^1	—	5.384842*** Reject	—	5.455512*** Reject	—	1.61119* Accept	—	5.761394*** Reject	—	5.721308*** Reject	—	1.612878* Accept
F-sta.	7.403949	7.174937	7.180668	7.171492	3.167451	1.979	7.595303	7.679953	7.352564	7.539443	2.914269	1.927781
Obs.	119	119	119	119	119	119	119	119	119	119	119	119

See notes to Table 3.5.

Table 3.9 SCP-EH estimations of total assets for the sub-sample 1999-2003

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-0.66889	-3.53756***	-0.70862	-4.82932***	0.029054	-0.11225	-0.61693	-3.54804**	-0.59873	-4.90732***	0.033219	-0.09684
	(-0.97472)	(-2.70683)	(-0.87063)	(-3.14185)	(0.742026)	(-1.17866)	(-0.89495)	(-2.6292)	(-0.73187)	(-3.08919)	(0.846748)	(-0.9874)
MSTA	**1.2387**	**-2.66753**	**2.639219*** **	**-2.62406**	**-0.03439**	**0.074241**	**1.247619**	**-2.67257**	**2.655*** **	**-2.65095**	**-0.03112**	**0.078729**
	(1.487077)	**(-1.00367)**	**(2.671407)**	**(-0.83946)**	**(-0.7236)**	**(0.383317)**	**(1.492333)**	**(-1.0045)**	**(2.67598)**	**(-0.84642)**	**(-0.65406)**	**(0.407152)**
CRTA	**0.105758**	**0.214355**	**0.284144**	**0.57643**	**-0.04174**	**-0.03489**	**0.023094**	**0.143634**	**0.093075**	**0.410799**	**-0.03487**	**-0.03014**
	(0.205171)	**(0.544045)**	**(0.464771)**	**(1.243908)**	**(-1.4191)**	**(-1.21529)**	**(0.060314)**	**(0.473674)**	**(0.204828)**	**(1.150838)**	**(-1.60015)**	**(-1.36743)**
TC/TA	1.08176***	2.202675***	1.403511***	2.42995***	0.056914***	0.121682***	1.083717***	2.207033***	1.407316***	2.445625***	0.057346***	0.119885***
	(3.765492)	(4.815396)	(4.119114)	(4.51669)	(3.472159)	(3.650413)	(3.769334)	(4.809205)	(4.124537)	(4.52708)	(3.504774)	(3.594408)
CL/CD	0.003405	0.00917	0.00682	0.006344	-4.16E-05	-6.34E-05	0.003356	0.00919	0.006734	0.006384	-5.87E-05	-6.27E-05
	(0.238404)	(0.642497)	(0.402679)	(0.377927)	(-0.05107)	(-0.06098)	(0.234882)	(0.64367)	(0.39711)	(0.379849)	(-0.07222)	(-0.06044)
LN(TA)	-0.16685***	0.025462	-0.18881***	0.081129	-0.00013	0.008513	-0.16707***	0.027115	-0.18917***	0.087472	-0.00024	0.007722
	(-3.98666)	(0.272762)	(-3.80378)	(0.738949)	(-0.0539)	(1.251511)	(-3.98567)	(0.286329)	(-3.80269)	(0.784658)	(-0.10074)	(1.12203)
LN(BR)	0.104871***	0.09856	0.087909**	0.103678	0.001691	0.000603	0.104762***	0.099495	0.087714**	0.106571	0.001652	0.000346
	(2.947778)	(0.900832)	(2.08337)	(0.805695)	(0.833039)	(0.075586)	(2.943408)	(0.908363)	(2.076589)	(0.82654)	(0.815634)	(0.043438)
R2	0.293611	0.717196	0.290804	0.720797	0.137273	0.43658	0.293368	0.716959	0.289702	0.720077	0.141389	0.439129
Adj. R2	0.255769	0.607402	0.252811	0.612401	0.091055	0.217841	0.255513	0.607072	0.251651	0.6114	0.095392	0.221379
H_0^1	—	4.715319*** Reject	—	4.848391*** Reject	—	1.6724** Reject	—	4.711414*** Reject	—	4.840189*** Reject	—	3.036901** Reject
F-sta.	7.758807	6.532177	7.654216	6.649651	2.970149	1.995891	7.749737	6.52453	7.61339	6.625893	3.073884	2.016664
Obs.	119	119	119	119	119	119	119	119	119	119	119	119

See notes to Table 3.5.

Table 3.10 SCP-EH estimations of customer deposits for the sub-sample 1999-2003

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-0.01914	-1.82691	0.634992	-3.26424	0.076132	0.070501	0.697602	1.350274	1.641487	-0.99053	0.098843	0.120447
	(-0.01918)	(-0.7904)	(0.536575)	(-1.19236)	(1.344139)	(0.421576)	(0.505552)	(0.427244)	(1.003677)	(-0.26271)	(1.254671)	(0.518455)
MSCD	**1.243819**	**-1.68784**	**2.760802*** **	**-2.06453**	**-0.02768**	**-0.01308**	**1.332752**	**-1.42482**	**2.857156*** **	**-1.87153**	**-0.02936**	**-0.01232**
	(1.440117)	**(-0.78127)**	**(2.696668)**	**(-0.80684)**	**(-0.56481)**	**(-0.08368)**	**(1.534805)**	**(-0.66478)**	**(2.77611)**	**(-0.73191)**	**(-0.59216)**	**(-0.07819)**
CRCD	**-0.90842**	**-0.75884**	**-1.74572**	**-0.34915**	**-0.10291***	**-0.14899**	**-1.45699**	**-2.65283**	**-2.41922**	**-1.71613**	**-0.10502**	**-0.17058**
	(-0.857)	**(-0.59197)**	**(-1.38937)**	**(-0.22996)**	**(-1.71127)**	**(-1.60638)**	**(-1.12882)**	**(-1.48408)**	**(-1.58139)**	**(-0.80472)**	**(-1.42519)**	**(-1.29819)**
TC/TA	1.125786***	2.063333***	1.487974***	2.299789*	0.059112***	0.106568***	1.137683***	1.888147***	1.500301***	2.17***	0.058799***	0.106938***
	(3.902739)	(4.278367)	(4.351716)	(4.026164)	(3.612083)	(3.054129)	(3.949099)	(3.874925)	(4.393936)	(3.73279)	(3.574952)	(2.985515)
CL/CD	0.003932	0.009308	0.00736	0.006622	-8.90E-05	-0.00013	0.002802	0.007112	0.005744	0.005175	-0.00013	-0.00026
	(0.276578)	(0.651643)	(0.436736)	(0.39143)	(-0.11034)	(-0.12874)	(0.196489)	(0.500256)	(0.339838)	(0.3051)	(-0.15893)	(-0.24428)
LN(TA)	-0.16452***	-0.05038	-0.1871***	0.012539	-0.00045	0.002508	-0.1676***	-0.13421	-0.19064***	-0.04935	-0.00042	0.002529
	(-3.97367)	(-0.44748)	(-3.81256)	(0.094026)	(-0.19065)	(0.30788)	(-4.03903)	(-1.10362)	(-3.87634)	(-0.34012)	(-0.1776)	(0.282924)
LN(BR)	0.10302***	0.112478	0.082256*	0.121714	0.001667	-0.003	0.102085***	0.07838	0.081411*	0.09675	0.001712	-0.00314
	(2.848107)	(1.041751)	(1.918475)	(0.95177)	(0.812541)	(-0.3843)	(2.828495)	(0.719915)	(1.903169)	(0.744861)	(0.830635)	(-0.39245)
R2	0.293559	0.716564	0.291581	0.71622	0.146984	0.443372	0.296925	0.722584	0.29511	0.71819	0.140271	0.437624
Adj. R2	0.255714	0.606524	0.25363	0.606046	0.101286	0.227269	0.25926	0.614881	0.257348	0.608781	0.094214	0.21929
H_0^1	—	4.698354*** Reject	—	4.710774*** Reject	—	1.676298** Reject	—	4.830419*** Reject	—	4.726297*** Reject	—	1.664562** Reject
F-sta.	7.756853	6.511855	7.683084	6.500829	3.216459	2.051672	7.88337	6.709053	7.815016	6.564293	3.045611	2.004376
Obs.	119	119	119	119	119	119	119	119	119	119	119	119

See notes to Table 3.5.

3.5.4. SCP-EH estimations for the sub-sample 2004-2009

Tables 3.11 to 3.13 report the estimated revenue and profit equations for the various measures of the concentration ratio (CR) and market share (MS) for the Vietnamese banking system from 2004 to 2009. This 6-year-period has 257 observations. We use the '1-way-FE' specification for inference as H_0^1 is rejected in all the models. MS is insignificant in all the models. CR is negative and significant, except for the models using 3-bank customer deposits, 3-bank total assets and when the dependent variable is LN(1+PBT/TA). Hence, there is some evidences that as CR declines profitability increases. Thus the banking system becomes more competitive.

TC/TA is positive and statistically significant in virtually all cases while LN(TA) has a significant negative relation with revenue and profit for most models. These results are similar to those for the full sample and sub-sample 1999-2003 when capital/asset ratio has a positive relation with revenue, interest income and profit before tax. CL/CD is negative and statistically significant when the dependent variables are LN(REV/TA) and LN(INT/TA). This indicates that banks earn revenue from other banking products and services instead of loans. LN(BR) is generally positive and significant in the models where LN(REV/TA) and LN(INT/TA) are the dependent variables. This is also consistent with our expectation. The more banks open branches the more revenue and interest income will increase.

Table 3.11 SCP-EH estimations of customer loans for the sub-sample 2004-2009

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-0.77215	1.199857	-0.57498	1.372304	0.048392*	0.128571**	-0.58905	1.75543	-0.37083	1.974476	0.048862*	0.123297**
	(-1.32175)	(1.226767)	(-0.97468)	(1.386562)	(1.758453)	(2.4786)	(-0.95224)	(1.679926)	(-0.59387)	(1.868245)	(1.672661)	(2.208807)
MSCL	**0.603025**	**0.065756**	**0.595683**	**-0.81331**	**0.007986**	**0.097968**	**0.652163**	**0.517947**	**0.655599**	**-0.2919**	**0.006428**	**0.085861**
	(1.014159)	**(0.02601)**	**(0.992074)**	**(-0.31793)**	**(0.2851)**	**(0.730686)**	**(1.096775)**	**(0.204963)**	**(1.092244)**	**(-0.11421)**	**(0.228906)**	**(0.636042)**
CRCL	**-0.90063****	**-1.69238*****	**-0.91158****	**-1.54806****	**-0.03271***	**-0.05543***	**-0.91758****	**-1.85523*****	**-0.94227****	**-1.75759*****	**-0.02888***	**-0.04563**
	(-2.32799)	**(-2.78115)**	**(-2.33337)**	**(-2.51404)**	**(-1.79492)**	**(-1.71738)**	**(-2.49216)**	**(-3.14899)**	**(-2.53528)**	**(-2.94961)**	**(-1.6611)**	**(-1.44999)**
TC/TA	0.448619***	0.324739***	0.329003***	0.229208*	0.046846***	0.032266***	0.442628***	0.312427**	0.321716***	0.214898*	0.04703***	0.032623***
	(4.524787)	(2.641676)	(3.286078)	(1.842601)	(10.02996)	(4.94899)	(4.467064)	(2.551361)	(3.21644)	(1.735132)	(10.05072)	(4.987153)
CL/CD	-0.08453**	-0.15588***	-0.04942	-0.11982**	-0.00342*	-0.0018	-0.08547**	-0.15832***	-0.05067	-0.12288***	-0.00336*	-0.00167
	(-2.00672)	(-3.4125)	(-1.16191)	(-2.59214)	(-1.72494)	(-0.74115)	(-2.03362)	(-3.48594)	(-1.19438)	(-2.67519)	(-1.69291)	(-0.6871)
LN(TA)	-0.09876***	-0.21193***	-0.12537***	-0.25154***	-0.00074	-0.00663**	-0.10116***	-0.22118***	-0.12833***	-0.26256***	-0.00066	-0.0063**
	(-3.4655)	(-4.12908)	(-4.35671)	(-4.84323)	(-0.55357)	(-2.43656)	(-3.55295)	(-4.32461)	(-4.46529)	(-5.07576)	(-0.48797)	(-2.30529)
LN(BR)	0.109133***	0.224267***	0.133707***	0.29244***	-0.00072	0.006384	0.10883***	0.210361***	0.13337***	0.27692***	-0.00073	0.006628
	(3.654004)	(2.963716)	(4.433288)	(3.819132)	(-0.51449)	(1.590695)	(3.649253)	(2.774544)	(4.430307)	(3.611237)	(-0.51466)	(1.636389)
R2	0.240535	0.555783	0.226592	0.545747	0.414439	0.56587	0.242881	0.560334	0.229557	0.550853	0.413368	0.564078
Adj. R2	0.222308	0.439805	0.20803	0.427148	0.400385	0.452526	0.22471	0.445545	0.211066	0.433588	0.399288	0.450266
H_0^1	—	3.065177***	—	3.034598***	—	1.50659**	—	3.11857***	—	3.089694***	—	1.493249**
		Reject		Reject		Reject		Reject		Reject		Reject
F-sta.	13.19653	4.792152	12.20744	4.601644	29.49015	4.992496	13.3665	4.881403	12.41476	4.697509	29.3602	4.956216
Obs.	257	257	257	257	257	257	257	257	257	257	257	257

See notes to Table 3.5.

Table 3.12 SCP-EH estimations of total assets for the sub-sample 2004-2009

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-1.21369**	0.291822	-1.02453	0.552022	0.041837	0.096136*	-1.11089*	0.556122	-0.92015	0.810188	0.044599	0.099885*
	(-2.14444)	(0.316212)	(-1.79302)	(0.59224)	(1.573131)	(1.968728)	(-1.87679)	(0.577299)	(-1.53978)	(0.832583)	(1.602505)	(1.955818)
MSTA	**0.094761**	**-1.43191**	**0.057952**	**-1.91141**	**0.0123**	**0.023951**	**0.130784**	**-1.26369**	**0.094582**	**-1.74219**	**0.012401**	**0.024606**
	(0.13129)	**(-0.69202)**	**(0.079528)**	**(-0.91461)**	**(0.362674)**	**(0.218757)**	**(0.181464)**	**(-0.61256)**	**(0.129987)**	**(-0.83602)**	**(0.365957)**	**(0.224979)**
CRTA	**-0.54837***	**-0.98555***	**-0.55616***	**-0.91949***	**-0.02517**	**-0.02923**	**-0.52407***	**-0.97949****	**-0.53159***	**-0.92036****	**-0.02282**	**-0.02675**
	(-1.65527)	**(-1.92134)**	**(-1.66282)**	**(-1.77483)**	**(-1.61686)**	**(-1.07681)**	**(-1.75688)**	**(-2.13006)**	**(-1.76516)**	**(-1.98135)**	**(-1.6273)**	**(-1.09708)**
TC/TA	0.47012***	0.355533***	0.350808***	0.258422**	0.047024***	0.033218***	0.467185***	0.351029***	0.347822***	0.253806**	0.047032***	0.03323***
	(4.691931)	(2.871206)	(3.467889)	(2.066312)	(9.987595)	(5.069835)	(4.671207)	(2.844852)	(3.444722)	(2.036244)	(10.00153)	(5.079838)
CL/CD	-0.07539*	-0.14846***	-0.04014	-0.11439**	-0.00334*	-0.00139	-0.07601*	-0.14936***	-0.04077	-0.11532**	-0.00334**	-0.00139
	(-1.79617)	(-3.25988)	(-0.94719)	(-2.48706)	(-1.69326)	(-0.57653)	(-1.81266)	(-3.28815)	(-0.96298)	(-2.5133)	(-1.69309)	(-0.57541)
LN(TA)	-0.08833***	-0.18737***	-0.11466***	-0.22872***	-0.00071	-0.00583**	-0.08987***	-0.19273***	-0.11622***	-0.2341***	-0.00072	-0.00585**
	(-2.968)	(-3.57041)	(-3.81606)	(-4.31538)	(-0.51022)	(-2.09775)	(-3.02462)	(-3.68042)	(-3.87446)	(-4.42547)	(-0.51357)	(-2.10809)
LN(BR)	0.117571***	0.240518***	0.142586***	0.304086***	-0.00079	0.007323	0.117502***	0.236202***	0.142516***	0.299711***	-0.00079	0.007318*
	(3.986861)	(3.182409)	(4.78919)	(3.983699)	(-0.57115)	(1.831211)	(3.987316)	(3.136668)	(4.790227)	(3.940031)	(-0.57077)	(1.832991)
R2	0.234719	0.549951	0.221014	0.541529	0.412899	0.562206	0.235767	0.551785	0.222094	0.543248	0.412978	0.5623
Adj. R2	0.216352	0.43245	0.202318	0.42183	0.398809	0.447905	0.217425	0.434763	0.203424	0.423997	0.398889	0.448024
H_0^1	---	3.025305*** Reject	---	3.019496*** Reject	---	1.473015** Reject	---	3.045251*** Reject	---	1.671199*** Reject	---	1.47349** Reject
F-sta.	12.77953	4.680413	11.82168	4.524077	29.3602	4.918643	12.85422	4.715232	11.89592	4.555513	29.31303	4.920532
Obs.	25	257	257	257	257	257	257	257	257	257	257	257

See notes to Table 3.5.

Table 3.13 SCP-EH estimations of customer deposits for the sub-sample 2004-2009

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-1.32585**	-0.33772	-1.1445*	-0.01748	0.040181	0.07271	-1.06609*	0.454293	-0.84269	0.903324	0.036743	0.058032
	(-2.17418)	(-0.34892)	(-1.85883)	(-0.01788)	(1.403652)	(1.43165)	(-1.76614)	(0.479927)	(-1.38346)	(0.94587)	(1.291651)	(1.158927)
MSCD	**-0.00098**	**-1.16956**	**-0.04802**	**-1.36205**	**0.010292**	**0.020027**	**0.177295**	**-0.48513**	**0.158915**	**-0.56847**	**0.008014**	**0.007776**
	(-0.00146)	**(-0.56011)**	**(-0.07079)**	**(-0.64575)**	**(0.326338)**	**(0.182789)**	**(0.265252)**	**(-0.23427)**	**(0.235609)**	**(-0.27209)**	**(0.254408)**	**(0.070987)**
CRCD	**-0.52684**	**-0.65591**	**-0.52985**	**-0.62388**	**-0.0272**	**-0.01584**	**-0.57856***	**-0.99262****	**-0.60912***	**-1.04637****	**-0.01854**	**-0.00334**
	(-1.2122)	**(-1.01911)**	**(-1.20743)**	**(-0.95963)**	**(-1.33299)**	**(-0.46912)**	**(-1.76016)**	**(-2.0437)**	**(-1.83643)**	**(-2.13535)**	**(-1.1971)**	**(-0.12993)**
TC/TA	0.487333***	0.387877***	0.368723***	0.288412**	0.047564***	0.034228***	0.471131***	0.368066***	0.349736***	0.264652**	0.047846***	0.034742***
	(4.869967)	(3.113236)	(3.649406)	(2.291677)	(10.12559)	(5.235796)	(4.742266)	(2.995904)	(3.488598)	(2.13514)	(10.21959)	(5.345745)
CL/CD	-0.07133*	-0.14337***	-0.03602	-0.11033**	-0.00318	-0.00109	-0.07351*	-0.14479***	-0.03863	-0.11212**	-0.00312	-0.00104
	(-1.70854)	(-3.1234)	(-0.85459)	(-2.37951)	(-1.62076)	(-0.45311)	(-1.76892)	(-3.18091)	(-0.92129)	(-2.44127)	(-1.59073)	(-0.43147)
LN(TA)	-0.0812***	-0.16382***	-0.10721***	-0.20769***	-0.0005	-0.00499*	-0.089***	-0.18565***	-0.11631***	-0.2333***	-0.00038	-0.00454*
	(-2.74894)	(-3.13706)	(-3.59454)	(-3.93729)	(-0.36006)	(-1.8222)	(-3.04475)	(-3.63269)	(-3.94327)	(-4.52488)	(-0.27364)	(-1.67988)
LN(BR)	0.116665***	0.263909***	0.141766***	0.325149***	-0.00084	0.008223**	0.116076***	0.238076***	0.141766***	0.325149***	-0.00085	0.008594**
	(3.972627)	(3.502031)	(4.781112)	(4.271412)	(-0.60692)	(2.079647)	(3.964876)	(3.158417)	(4.781112)	(4.271412)	(-0.61444)	(2.155146)
R2	0.230108	0.540072	0.216204	0.531337	0.410562	0.560039	0.235063	0.547039	0.216204	0.531337	0.409756	0.559598
Adj. R2	0.211631	0.419993	0.197393	0.408977	0.396416	0.445172	0.216704	0.428778	0.197393	0.408977	0.395591	0.444617
H_0^1	—	2.910847*** Reject	—	2.904236*** Reject	—	1.467426** Reject	—	2.974802*** Reject	—	2.977577*** Reject	—	1.469545** Reject
F-sta.	12.45351	4.497615	11.49343	4.342403	29.0222	4.875553	12.80405	4.625697	11.89819	4.488237	28.92567	4.866849
Obs.	257	257	257	257	257	257	257	257	257	257	257	257

See notes to Table 3.5.

3.5.5. SCP-EH estimations for the non-SOCBs

Tables from 3.14 to 3.16 refer to the estimated revenue and profit equations using the various measures of the concentration ratio (CR) and market share (MS) for the 43 non-SOCBs between 1999 and 2009. All the F-tests for the exclusion of cross-sectional effects H_0^1 are rejected and so the '1-way-FE' specification is employed for inference except for the models where LN(1+PBT/TA) is the dependent variable. MS is generally insignificant in all of the favoured models while CR is negative and significant only in the models based on customer loans and 5-bank customer deposits (otherwise it is insignificant). While the non-SOCBs' revenue and profit are often negatively related with CR, their revenue and profit are unrelated to MS.

Regarding the other variables, TC/TA is broadly positive and statistically significant in all the models. Capital/asset ratio has a positive relation with revenue, interest income and profit before tax. CL/CD is insignificant in all reported equations. LN(TA) is negative and significant in most cases while LN(BR) has positive and significant relation with revenue and interest income but not with profit before tax. The non-SOCBs increase their revenue and interest income, not profit, when there is a rise of network branches.

Table 3.14 SCP-EH estimations of customer loans for the non-SOCBs

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-0.04866	0.588477	0.482135	1.126458	0.091091***	0.123032**	0.279842	1.194993	0.781259	1.44381	0.090347***	0.10053*
	(-0.07962)	(0.671573)	(0.734659)	(1.188199)	(2.924765)	(2.401989)	(0.419248)	(1.237402)	(1.087201)	(1.375076)	(2.640872)	(1.764025)
MSCL	**12.29962****	**5.368444**	**9.853968***	**5.619908**	**0.583004****	**0.139524**	**12.78756*****	**5.148022**	**9.741321***	**5.507668**	**0.532996***	**0.148029**
	(2.548308)	**(0.94258)**	**(1.901221)**	**(0.912031)**	**(2.370232)**	**(0.419089)**	**(2.656594)**	**(0.907132)**	**(1.879808)**	**(0.892624)**	**(2.16041)**	**(0.442017)**
CRCL	**-1.0645*****	**-1.37305*****	**-1.61694*****	**-1.88471*****	**-0.05446*****	**-0.07224****	**-1.18181*****	**-1.65008*****	**-1.67775*****	**-1.94183*****	**-0.05015****	**-0.05268***
	(-3.18862)	**(-2.67995)**	**(-4.51038)**	**(-3.40015)**	**(-3.2008)**	**(-2.41204)**	**(-3.39515)**	**(-3.06471)**	**(-4.4771)**	**(-3.31718)**	**(-2.81097)**	**(-1.65808)**
TC/TA	0.397962***	0.301339**	0.307081***	0.253983*	0.044276***	0.03627***	0.387442***	0.285899**	0.304631***	0.251568*	0.044926***	0.037441***
	(4.002685)	(2.494369)	(2.876232)	(1.943213)	(8.738532)	(5.136114)	(3.892749)	(2.368973)	(2.843033)	(1.917229)	(8.806892)	(5.25719)
CL/CD	-0.0009	0.009591	0.005484	0.017144	-0.00073	-0.00069	-0.00227	0.007603	0.004714	0.015921	-0.00068	-0.00064
	(-0.0669)	(0.755199)	(0.379159)	(1.247761)	(-1.06119)	(-0.92837)	(-0.16785)	(0.597671)	(0.324544)	(1.151123)	(-0.9889)	(-0.84558)
LN(TA)	-0.14635***	-0.19308***	-0.16736***	-0.21999***	-0.00328**	-0.0049*	-0.15189***	-0.20415***	-0.16898***	-0.2202***	-0.00297*	-0.0039
	(-4.80001)	(-4.20511)	(-5.11145)	(-4.42847)	(-2.11351)	(-1.8262)	(-4.94194)	(-4.43033)	(-5.10698)	(-4.39521)	(-1.8863)	(-1.43472)
LN(BR)	0.092399***	0.201511***	0.096108***	0.215134***	0.000154	0.002967	0.091366***	0.193764***	0.097143***	0.214744***	0.00033	0.003642
	(3.168895)	(3.329808)	(3.069481)	(3.285791)	(0.103595)	(0.838867)	(3.144657)	(3.206961)	(3.105696)	(3.268972)	(0.221397)	(1.021394)
R2	0.22438	0.513608	0.227924	0.508528	0.325131	0.4432	0.22762	0.517429	0.227233	0.50756	0.320218	0.436981
Adj. R2	0.209559	0.427775	0.213171	0.421798	0.312235	0.344941	0.212861	0.432269	0.212466	0.420659	0.307228	0.337625
H_0^1	—	3.851009*** Reject	—	3.697556*** Reject	—	1.373273* Accept	—	3.889292*** Reject	—	3.686651*** Reject	—	1.343087* Accept
F-sta.	15.13956	5.983753	15.44928	5.863322	25.21258	4.510539	15.42258	6.075991	15.38864	5.840659	24.65209	4.398126
Obs.	321	321	321	321	321	321	321	321	321	321	321	321

See notes to Table 3.5.

Table 3.15 SCP-EH estimations of total assets for the non-SOCBs

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-1.13381**	-0.89316	-1.20979**	-1.56712**	0.053892**	0.050783	-1.08816**	-0.82445	-1.08991*	-1.39863*	0.061811**	0.06329
	(-2.10691)	(-1.34312)	(-2.07277)	(-2.1558)	(1.974276)	(1.313262)	(-1.9813)	(-1.22026)	(-1.83155)	(-1.89364)	(2.223045)	(1.614059)
MSTA	**1.874669**	**2.459174**	**-1.06057**	**2.859339**	**0.207137**	**-0.11878**	**1.964036**	**2.48913**	**-0.74922**	**2.870062**	**0.228621**	**-0.11644**
	(0.536539)	**(0.540633)**	**(-0.27987)**	**(0.575044)**	**(1.168733)**	**(-0.44907)**	**(0.561485)**	**(0.547478)**	**(-0.19768)**	**(0.577456)**	**(1.291015)**	**(-0.44128)**
CRTA	**-0.53556***	**-0.43955**	**-0.68947****	**-0.09655**	**-0.03699****	**-0.03137**	**-0.46206***	**-0.39854**	**-0.62965****	**-0.18051**	**-0.03463*****	**-0.03305***
	(-1.76163)	**(-1.22427)**	**(-2.09104)**	**(-0.24601)**	**(-2.39893)**	**(-1.50268)**	**(-1.80963)**	**(-1.32627)**	**(-2.27595)**	**(-0.5495)**	**(-2.67908)**	**(-1.89525)**
TC/TA	0.460632***	0.363322***	0.424015***	0.362315***	0.046624***	0.039457***	0.460774***	0.363687***	0.41998***	0.35755***	0.046305***	0.039243***
	(4.716599)	(3.032775)	(4.003067)	(2.766667)	(9.411734)	(5.663988)	(4.733628)	(3.042843)	(3.982022)	(2.736506)	(9.396455)	(5.657307)
CL/CD	0.006555	0.014702	0.017053	0.025816*	-0.00045	-0.00043	0.006549	0.014734	0.016667	0.025416	-0.00048	-0.00044
	(0.488579)	(1.158206)	(1.171968)	(1.860421)	(-0.66491)	(-0.57694)	(0.488834)	(1.162584)	(1.148237)	(1.83455)	(-0.71115)	(-0.60335)
LN(TA)	-0.10124***	-0.14393***	-0.10132***	-0.13119***	-0.00183	-0.00227	-0.10141***	-0.14504***	-0.10377***	-0.1363***	-0.00202	-0.00259
	(-3.45902)	(-3.33584)	(-3.19182)	(-2.78146)	(-1.23343)	(-0.90632)	(-3.48913)	(-3.37466)	(-3.29531)	(-2.90105)	(-1.371)	(-1.04004)
LN(BR)	0.117011***	0.237935***	0.12607***	0.278606***	0.001087	0.004654	0.116499***	0.236801***	0.124743***	0.275061***	0.001	0.00441
	(4.116696)	(3.992737)	(4.089525)	(4.276849)	(0.754222)	(1.342987)	(4.095942)	(3.975076)	(4.047759)	(4.223758)	(0.694393)	(1.275424)
R2	0.20465	0.50198	0.192359	0.486268	0.314378	0.435793	0.20508	0.502454	0.194402	0.486724	0.317415	0.438524
Adj. R2	0.189453	0.414095	0.176926	0.39561	0.301277	0.336227	0.189891	0.414651	0.179009	0.396146	0.304372	0.33944
H_0^1	—	3.866445***	—	3.70507***	—	1.393646*	—	3.87069***	—	3.688324***	—	1.396896***
		Reject		Reject		Accept		Reject		Reject		Reject
F-sta.	13.46582	5.711733	12.46443	5.363733	23.99641	4.376928	13.50139	5.722557	12.62878	5.373521	24.33601	4.425778
Obs.	321	321	321	321	321	321	321	321	321	321	321	321

See notes to Table 3.5.

Table 3.16 SCP-EH estimations of customer deposits for the non-SOCBs

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-0.79525	-0.43837	-0.45847	-0.47859	0.083815***	0.087259*	-0.50073	0.346513	-0.18586	0.20003	0.074978**	0.052425
	(-1.31416)	(-0.50058)	(-0.70316)	(-0.50116)	(2.743598)	(1.712172)	(-0.80808)	(0.388314)	(-0.27845)	(0.205269)	(2.379824)	(0.999158)
MSCD	**3.377713**	**3.953076**	**0.708801**	**2.68458**	**0.386741****	**0.140949**	**4.130806**	**3.916702**	**1.340144**	**2.683394**	**0.354104****	**0.152835**
	(1.035989)	**(0.855152)**	**(0.201765)**	**(0.532542)**	**(2.349664)**	**(0.523924)**	**(1.26991)**	**(0.8533)**	**(0.382469)**	**(0.535338)**	**(2.141073)**	**(0.566289)**
CRCD	**-0.82065****	**-0.84323**	**-1.31557*****	**-1.00813**	**-0.06027*****	**-0.05729**	**-0.81582****	**-1.15413****	**-1.18821*****	**-1.21725****	**-0.04165****	**-0.02323**
	(-2.03291)	**(-1.39683)**	**(-3.02457)**	**(-1.53137)**	**(-2.95722)**	**(-1.63063)**	**(-2.51178)**	**(-2.36718)**	**(-3.39615)**	**(-2.28622)**	**(-2.52185)**	**(-0.81033)**
TC/TA	0.444213***	0.356417***	0.375821***	0.334005**	0.045316***	0.038529***	0.427196***	0.33953***	0.361846***	0.320629**	0.046097***	0.039694***
	(4.482793)	(2.967142)	(3.519884)	(2.549783)	(9.058552)	(5.511442)	(4.326032)	(2.853746)	(3.401669)	(2.467763)	(9.181211)	(5.674102)
CL/CD	0.0056	0.013749	0.013137	0.023332*	-0.00052	-0.00054	0.003845	0.011063	0.011445	0.020863	-0.00048	-0.00047
	(0.417805)	(1.083459)	(0.909626)	(1.685978)	(-0.77268)	(-0.73369)	(0.287092)	(0.873221)	(0.793356)	(1.508047)	(-0.70553)	(-0.63365)
LN(TA)	-0.11084***	-0.15479***	-0.12385***	-0.16138***	-0.00278*	-0.00354	-0.11989***	-0.17628***	-0.13171***	-0.17951***	-0.00243	-0.00243
	(-3.81157)	(-3.44659)	(-3.95273)	(-3.29515)	(-1.89484)	(-1.35468)	(-4.11467)	(-3.96182)	(-4.19615)	(-3.6943)	(-1.64002)	(-0.92935)
LN(BR)	0.111128***	0.221321***	0.118122***	0.250497***	0.000473	0.003659	0.108184***	0.202691***	0.115726***	0.233944***	0.000611	0.004335
	(3.856568)	(3.60556)	(3.804516)	(3.742161)	(0.325208)	(1.024382)	(3.767687)	(3.30187)	(3.741508)	(3.489794)	(0.418856)	(1.201034)
R2	0.207135	0.503776	0.205391	0.490585	0.323011	0.436925	0.212522	0.510305	0.211214	0.49588	0.31797	0.43279
Adj. R2	0.191985	0.416207	0.190207	0.400688	0.310075	0.337558	0.197475	0.423888	0.196142	0.406917	0.304938	0.332694
H_0^1	—	3.871442*** Reject	—	3.625666*** Reject	—	1.31017 Accept	—	3.938157*** Reject	—	3.656962*** Reject	—	1.310962 Accept
F-sta.	13.67201	5.752904	13.52713	5.457196	24.96977	4.397113	14.12355	5.905154	14.01338	5.57404	24.39842	4.323746
Obs.	321	321	321	321	321	321	321	321	321	321	321	321

See notes to Table 3.5.

3.5.6. SCP-EH estimations for the SOCBs

Tables 3.17 to 3.19 report the estimated revenue and profit equations for the various measures of the concentration ratio (CR) and market share (MS) for the five SOCBs from 1999 to 2009. All of the F-tests, H_0^1, reject the exclusion of cross-sectional effects and so the '1-way-FE' specification is used for inference. MS is negative and significant when the dependent variables are LN(REV/TA) and LN(INT/TA), however, MS is only negative and significant in the profit equations when using total assets measures. CR is insignificant in all except one equation. This is different from all the previous estimations when CR is generally negative and significant and MS is generally insignificant. Hence, for the SOCBs, MS decreases while revenue and interest income increase. This suggests that banks with high MS are less efficient than their rivals. When there are more banks entering the market, the SOCBs reduce their shares of customer loans, total assets and customer deposits but they also increase revenue and interest income. This is consistent with CR measure, HHI and our expectation (three SOCBs represent 3-bank-ratio and four out of five SOCBs are in 5-bank-ratio).

TC/TA is positive and statistically significant in all cases. CL/CD is insignificant when the dependent variables are LN(REV/TA) and LN(INT/TA); and positive and significant when LN(1+PBT/TA) is the regressand. Revenue or interest income of the SOCBs is not affected by the growth of loans. However, profit actually increases when the SOCBs offer more loans to the public. LN(TA) is insignificant when the dependent variables are LN(REV/TA) and LN(INT/TA) except when using customer deposits measures. LN(BR) is generally negative and significant when the regressands are LN(REV/TA) and LN(INT/TA). In contrast, it is positive and significant when the dependent variable is LN(1+PBT/TA). These suggest that when the SOCBs open more branches, revenue decreases and profit increases. In the previous estimations, LN(BR) has no relation with revenue in the full sample and sub-sample 1999-2003 while it generally has positive relation with revenue and profit in the sub-sample 2004-2009. In brief, when banks have more loans and branch networks, the SOCBs earn profits while the non-SOCBs grow revenue and interest income. SOCBs' revenue and profit are in opposite direction with MS. Non-SOCBs' revenue and profit before tax are sometimes in opposite direction with CR.

Table 3.17 SCP-EH estimations of customer loans for the SOCBs

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-0.07184	-2.38288	0.804626	-2.06514	-0.18405***	-0.14294**	0.361664	-0.98372	1.357171	-0.39088	-0.18114***	-0.13116**
	(-0.04427)	(-0.97619)	(0.434108)	(-0.71779)	(-4.91344)	(-2.37239)	(0.235031)	(-0.44191)	(0.773435)	(-0.14905)	(-4.97621)	(-2.33641)
MSCL	**0.816658**	**-2.92735*** **	**1.069413**	**-2.78101** **	**-0.04888*** **	**0.020607**	**0.866947**	**-2.71488*** **	**1.154015**	**-2.52643** **	**-0.04551*** **	**0.02332**
	(1.069519)	**(-3.28075)**	**(1.226333)**	**(-2.64434)**	**(-2.77362)**	**(0.935658)**	**(1.257447)**	**(-3.22506)**	**(1.467836)**	**(-2.54749)**	**(-2.79013)**	**(1.098525)**
CRCL	**-1.91358*** **	**-0.62394**	**-2.12716** **	**-0.74004**	**0.033368** **	**0.012871**	**-2.0828*** **	**-1.11116**	**-2.34807*** **	**-1.32318**	**0.031461** **	**0.00845**
	(-2.6857)	**(-0.75828)**	**(-2.61413)**	**(-0.76306)**	**(2.029132)**	**(0.633727)**	**(-3.15051)**	**(-1.526)**	**(-3.11468)**	**(-1.54245)**	**(2.0117)**	**(0.460205)**
TC/TA	1.772164***	1.465834***	1.672163***	1.333955**	0.106805***	0.11551***	1.739656***	1.285763***	1.625359***	1.118327**	0.105792***	0.11357***
	(4.502861)	(3.378916)	(3.720303)	(2.60885)	(11.75823)	(10.78747)	(4.667605)	(3.276582)	(3.824274)	(2.419051)	(11.99886)	(11.47684)
CL/CD	-0.06338	-0.08218	-0.08262	-0.11879	0.006516***	0.007228**	-0.04777	-0.04689	-0.06719	-0.07666	0.00596**	0.007275**
	(-0.6048)	(-0.74383)	(-0.69039)	(-0.91224)	(2.694029)	(2.650491)	(-0.49097)	(-0.42309)	(-0.60556)	(-0.58708)	(2.58911)	(2.60292)
LN(TA)	-0.09216	0.063869	-0.13947*	0.059806	0.009341***	0.005936**	-0.09381	0.013025	-0.14355**	-0.00107	0.009035***	0.005409**
	(-1.45191)	(0.591444)	(-1.92381)	(0.46988)	(6.376074)	(2.227147)	(-1.64404)	(0.135266)	(-2.20627)	(-0.00943)	(6.693795)	(2.227729)
LN(BR)	0.053737	-0.07771	0.055049	-0.12138*	-0.00092	0.002977**	0.049718	-0.08802	0.049632	-0.13374**	-0.00099	0.002827*
	(1.302747)	(-1.31687)	(1.168575)	(-1.74507)	(-0.96428)	(2.043566)	(1.25504)	(-1.56333)	(1.098678)	(-2.01619)	(-1.05506)	(1.991095)
R2	0.663276	0.831541	0.63049	0.8031	0.823632	0.899085	0.679045	0.837918	0.648853	0.810729	0.823393	0.898651
Adj. R2	0.621185	0.793255	0.584301	0.75835	0.801586	0.876149	0.638925	0.801081	0.60496	0.767712	0.801317	0.875618
H_0^1	—	10.98736*** Reject	—	9.643022*** Reject	—	8.224537*** Reject	—	10.7822*** Reject	—	9.407804*** Reject	—	8.168258*** Reject
F-sta.	15.75831	21.71913	13.65029	17.94637	37.35964	39.2009	16.9256	22.74672	14.7825	18.84704	37.29833	39.0145
Obs.	55	55	55	55	55	55	55	55	55	55	55	55

See notes to Table 3.5.

Table 3.18 SCP-EH estimations of total assets for the SOCBs

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-3.17251***	-5.93058***	-2.39164*	-5.56948***	-0.1429***	-0.11946***	-3.53126***	-6.31638***	-2.79676*	-5.99368***	-0.14362***	-0.12507***
	(-2.59936)	(-4.8149)	(-1.73283)	(-3.905)	(-5.13567)	(-4.3122)	(-2.70254)	(-4.97618)	(-1.88939)	(-4.06676)	(-4.84343)	(-4.34613)
MSTA	**-0.57296**	**-3.5528*** **	**-0.36331**	**-3.5053*** **	**-0.02695***	**0.052522** **	**-0.76548**	**-3.69491*** **	**-0.58691**	**-3.67645*** **	**-0.02647**	**0.04995** **
	(-0.83739)	**(-3.55834)**	**(-0.46954)**	**(-3.03192)**	**(-1.72744)**	**(2.338801)**	**(-1.09627)**	**(-3.74722)**	**(-0.74196)**	**(-3.21115)**	**(-1.67032)**	**(2.234446)**
CRTA	**-0.53627**	**0.471918**	**-0.72505**	**0.352907**	**0.015608**	**0.00119**	**-0.27397**	**0.523328**	**-0.4038**	**0.44339**	**0.012637**	**0.003095**
	(-0.97489)	**(1.091839)**	**(-1.16557)**	**(0.705129)**	**(1.244591)**	**(0.122376)**	**(-0.57623)**	**(1.42976)**	**(-0.74969)**	**(1.043282)**	**(1.171207)**	**(0.373024)**
TC/TA	2.197586***	1.480494***	2.134126***	1.346451***	0.097301***	0.120382***	2.243766***	1.505904***	2.188306***	1.373834***	0.09711***	0.120732***
	(6.246035)	(4.201476)	(5.363817)	(3.299908)	(12.13057)	(15.18914)	(6.337027)	(4.302733)	(5.455559)	(3.380705)	(12.08541)	(15.21604)
CL/CD	0.017323	-0.13851	0.008172	-0.17265	0.00444*	0.006768***	0.018615	-0.12541	0.008212	-0.16104	0.004641*	0.006863***
	(0.166585)	(-1.26939)	(0.069497)	(-1.3665)	(1.872967)	(2.757561)	(0.175167)	(-1.15319)	(0.068216)	(-1.27536)	(1.924408)	(2.783448)
LN(TA)	0.024195	0.278286***	-0.02271	0.270569***	0.008288***	0.004162***	0.039819	0.294251***	-0.00484	0.288899***	0.008289***	0.00442***
	(0.418281)	(4.225576)	(-0.34717)	(3.548051)	(6.285194)	(2.809584)	(0.66105)	(4.458007)	(-0.07094)	(3.769589)	(6.063282)	(2.953795)
LN(BR)	0.079046**	-0.23654***	0.089596**	-0.27517***	-0.0027***	0.005106***	0.079001**	-0.24062***	0.089747**	-0.2804***	-0.00273***	0.005022***
	(2.4822)	(-3.40025)	(2.487963)	(-3.41599)	(-3.71614)	(3.263555)	(2.458306)	(-3.50126)	(2.465168)	(-3.51387)	(-3.73794)	(3.223084)
R2	0.619418	0.816538	0.590514	0.793036	0.805503	0.908742	0.614549	0.819933	0.583797	0.795749	0.804805	0.908998
Adj. R2	0.571845	0.774842	0.539328	0.745998	0.781191	0.888001	0.566367	0.779009	0.531772	0.749329	0.780406	0.888316
H_0^1	—	11.81893*** Reject	—	10.76387*** Reject	—	12.44401*** Reject	—	12.54663*** Reject	—	11.41476*** Reject	—	12.59457*** Reject
F-sta.	13.02044	19.58319	11.53668	16.85969	33.13181	43.81473	12.7549	20.0354	11.22141	17.14217	32.98464	43.95075
Obs.	55	55	55	55	55	55	55	55	55	55	55	55

See notes to Table 3.5.

Table 3.19 SCP-EH estimations of customer deposits for the SOCBs

	3-bank-ratio						5-bank-ratio					
	LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)		LN(REV/TA)		LN(INT/TA)		LN(1+PBT/TA)	
	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE	Normal	1-way-FE
Int.	-1.84099	-9.0664***	-1.3579	-8.90804***	-0.20112***	-0.20923***	-0.67079	-7.25123***	0.004558	-6.79934**	-0.2022***	-0.18232***
	(-1.03464)	(-4.12149)	(-0.67293)	(-3.5843)	(-5.17423)	(-3.85004)	(-0.38997)	(-3.2065)	(0.002334)	(-2.6684)	(-5.2515)	(-3.27947)
MSCD	**-0.0719**	**-4.43832*** **	**-0.07834**	**-4.90018*** **	**-0.06783*** **	**-0.0221**	**0.574088**	**-3.96834*** **	**0.671393**	**-4.33982*** **	**-0.06909*** **	**-0.01677**
	(-0.07022)	**(-4.59366)**	**(-0.06746)**	**(-4.48906)**	**(-3.03265)**	**(-0.92605)**	**(0.573198)**	**(-3.84569)**	**(0.590384)**	**(-3.73251)**	**(-3.08155)**	**(-0.66107)**
CRCD	**-1.29332**	**1.770632***	**-1.33223**	**1.825977***	**0.048937** **	**0.052472** **	**-1.57493** **	**0.782202**	**-1.69333** **	**0.721006**	**0.040058** **	**0.032904***
	(-1.38821)	**(1.91472)**	**(-1.26094)**	**(1.747731)**	**(2.404605)**	**(2.296822)**	**(-2.16486)**	**(1.012737)**	**(-2.04994)**	**(0.828478)**	**(2.459886)**	**(1.732881)**
TC/TA	2.074518***	1.984801***	2.040174***	1.813114***	0.103467***	0.121332***	1.933173***	1.782794***	1.876856***	1.579618***	0.103941***	0.118204***
	(5.56081)	(5.463192)	(4.822293)	(4.417298)	(12.69643)	(13.51854)	(5.286942)	(4.809553)	(4.520601)	(3.781982)	(12.69931)	(12.97126)
CL/CD	-0.01833	-0.48974***	-0.03005	-0.54316***	0.001292	0.006597**	0.021952	-0.46273***	0.014426	-0.50714***	0.000589	0.006469**
	(-0.15674)	(-4.43571)	(-0.22663)	(-4.3544)	(0.505721)	(2.41851)	(0.188528)	(-3.73458)	(0.109112)	(-3.63247)	(0.225878)	(2.123768)
LN(TA)	-0.02612	0.408441***	-0.05969	0.41497***	0.010664***	0.008621***	-0.0694	0.328857***	-0.11042	0.322618***	0.010612***	0.00743***
	(-0.34032)	(4.04448)	(-0.68585)	(3.63707)	(6.361109)	(3.455672)	(-0.95385)	(3.179028)	(-1.33658)	(2.767836)	(6.516236)	(2.92159)
LN(BR)	0.082984**	-0.15854***	0.09435**	-0.20748***	-0.00206***	0.003209**	0.074934**	-0.16032***	0.085358**	-0.20941***	-0.00195**	0.003168**
	(2.493899)	(-2.90297)	(2.50028)	(-3.36263)	(-2.82977)	(2.378644)	(2.287393)	(-2.85362)	(2.294758)	(-3.30808)	(-2.6519)	(2.293564)
R2	0.63154	0.842874	0.601304	0.831258	0.827117	0.905709	0.650838	0.83366	0.621256	0.822315	0.827978	0.90115
Adj. R2	0.585482	0.807164	0.551467	0.792907	0.805507	0.884279	0.607193	0.795855	0.573913	0.781932	0.806475	0.878684
H_0^1	—	14.79505*** Reject	—	14.99022*** Reject	—	9.168391*** Reject	—	12.08993*** Reject	—	12.44704*** Reject	—	8.142539*** Reject
F-sta.	13.71198	23.60308	12.06542	21.67524	38.2742	42.26381	14.912	22.05182	13.12242	20.36291	38.50557	40.11174
Obs.	55	55	55	55	55	55	55	55	55	55	55	55

See notes to Table 3.5.

3.5.7. Summary of results from the structural model: SCP-EH estimations

The most striking feature of the structural models is that the results do not support either the traditional (SCP) or efficiency hypothesis (EH). As can be seen from Table 3.20 which summarises the findings, the results for the full sample are similar to the sub-sample for 2004-2009 and for 43 non-SOCBs. In these cases, there is generally no relation between MS and revenue, interest income and profit before tax while there is a negative relation between CR and all the three dependent variables (although the evidence is more ambiguous) except for the sub-sample 2004-2009. Revenue, interest income and profit before tax of Vietnamese banks increase, when CR decreases for the period of 1999-2009; 2004-2009 and for the non-SOCBs sub-sample. This suggests that non-SOCBs become more competitive in terms of customer loans, total assets and customer deposits, especially between 2004 and 2009. Over the period 1999 to 2003, both CR and MS are generally insignificant with the models using total assets and customer deposits. CR and MS are often negative and significant with the models based upon customer loans measures. Generally, banks' revenue, interest income and profit are not from loans but other sources such as derivative products, international settlements, credit cards and other services. When banks expand their loans from 2004 to 2009, revenue and interest income decrease. This might be due to non-performing loans. There is almost no relation between CR and revenue, interest income and profit before tax for the five SOCBs. On the other hand, MS has negative relation with revenue and interest income but not profit before tax of customer deposits and loans. When there are more banks entering the market, the five SOCBs reduce their MS in terms of customer loans, total assets and customer deposits but they also increase their revenue and interest income.

Table 3.20 Summary of the results from the structural model

	Majority	Minority		Majority	Minority
			Full sample		
			CR	(-)	
			MS	(0)	
1999-2003			2004-2009		
CR	(0)	(-) CRCL5 and LN(1+PBT/TA)	CR	(-)	(0) CRCD3; LN(1+PBT/TA)
MS	(0)	(-) CRCL with LN(REV/TA) and LN(INT/TA)	MS	(0)	
SOCBs			Non-SOCBs		
CR	(0)	CRCD3	CR	(-)	(0) CRTA; CRCD3 with LN(REV/TA) and LN(INT/TA)
MS	(-)	(0) CRCD and CRCL with LN(1+PBT/TA)	MS	(0)	

Note: (0) Insignificant; (-) negative and significant.

3.6. Conclusion

This study has examined the SCP and EH models in order to analyse the Vietnamese banking system. The SCP hypothesis is the approach through which the influence of market structure on firms' performance is examined (Goddard *et al.*, 2001). If the banking industry is nearing a monopolistic situation the degree of competition would decline and collusive behaviour would be taken by those banks. Consequently, a reinforcement of regulation on the part of the government would be likely in order to prevent abuses of market power by a small number of firms. In contrast, a method developed by members of the Chicago school, such as Demsetz (1973), is the EH. According to the Chicago school the positive relationship between concentration and profitability does not necessarily reflect collusive behaviour by several firms: it shows merely that large firms come to earn high profits by performing efficiently. According to this concept the profitability measure is affected not by market concentration but by market share, because the efficient firms could increase their market share and earn high profits even in a competitive and low-concentration market. This idea implies that the governmental regulation and intervention are inappropriate policies since they might impose penalties on efficient firms and discourage the proper functioning of the market mechanism. We also found that there were no substantial studies using SCP and EH estimations for the Vietnamese banking system.

Our empirical results showed that the Vietnamese banking industry became substantially less concentrated over the period 1999-2009 as the CR and HHI fell. However, large commercial banks still dominate the whole banking system. The SCP and EH estimations do not support either traditional or efficiency hypotheses. The results of the full sample, sub-sample 2004-2009 and 43 non-SOCBs are similar in that MS is generally insignificant and CR is broadly negative and significant. There is generally no relation between MS and CR and the dependent variables for the sub-sample 1999-2003. For the five SOCBs, CR is insignificant and MS is negative and significant when revenue and interest income are the dependent variables. Regarding the control variables, TC/TA is positive and significant, which indicates that capital/asset ratio has a positive impact on revenue, interest income and profit before tax. CL/CD and LN(TA) are generally insignificant or negative and significant. The effect of LN(BR) differs depending on the samples.

Chapter 4 Bank structure: Non-structural model (Equilibrium approach)

4.1. Introduction

In this Chapter, we will provide a detailed analysis of market competition in the Vietnamese banking system using the non-structural approach (Panzar-Rosse approach). This is different from the structural approach discussed in Chapter 3. This model suggests that the markets become a monopoly if the service offered by a particular bank is independent and originate. In contrast, the market is competitive and the level of competition increases if the bank services are similar in the market. We would like, under this procedure, to consider whether the Vietnamese banking market is best characterised by monopoly, perfect competition or the intermediate case of monopolistic competition.

We employ the equilibrium approach to examine the Vietnamese banking system in this chapter. The disequilibrium approach will be discussed in Chapter 5. We use fixed-effects estimations to find the valid H-statistics of the models with and without assets using the full sample (1999-2009) and the sub-samples (1999–2003; 2004–2009; five SOCBs and 43 non-SOCBs). Further, E-statistics are applied to test for long-run equilibrium conditions. The Wu-Hausman test and a comparison of models using current and lagged input prices are employed to test for evidence of endogeneity of input prices.

This Chapter is organised as follows: section 4.1 is the introduction; section 4.2 is concerned with the literature review while section 4.3 examines methodology; section 4.4 contains empirical results; and section 4.5 sets out the conclusion.

4.2. Literature review

4.2.1. Non-structural model

We have seen, after a long procedure, how economists inferred theory from Cournot's study to investigate economic and social realities in Chapter 3. In contrast to the SCP approach, empirical studies that seek to establish the extent of contestability in banking markets are concerned with drawing inferences about market structure indirectly from observing conduct. This is because contestability, which depends on the extent of potential competition, is not observable directly (Goddard *et al.*, 2001). These models can be regarded as the shortcomings of the SCP and EH approaches, which assess the strength of market power by examining deviations between observed and marginal cost pricing, without explicitly using any market structure indicator (Matthews and Thompson, 2008: 176). The remarkable models that should be mentioned here are Iwata (1974), Lau (1982), Bresnahan (1982) and Panzar and Rosse (1987). These models were developed in reaction to the theoretical and empirical deficiencies of the structural models. These New Empirical Industrial Organisation approaches test competition and the use of market power, and stress the analysis of banks' competitive conduct in the absence of structural measures (Bikker, 2004: 63).

The Iwata (1974) model is known to have been applied to the banking industry once. It allows the estimation of conjectural variation value for individual banks supplying a homogenous product in an oligopolistic market. The method involves the estimation of a market demand function and cost functions of individual banks to obtain a numerical value of the conjectural variation for each bank. Bresnahan (1982) and Lau (1982) used historical data to estimate a market demand and cost equation indicating the banks' price setting equation and their implicit mark up over marginal cost (Mkrtchyan, 2005: 69). Empirical applications of the Bresnahan model are rather scarce.

Panzar and Rosse (1987) formulated simple models for monopolistic, oligopolistic and perfectly competitive markets, and develop a test to discriminate between these market structures. Bikker and Bos (2008) clearly explained this model. It is based on the properties of a reduced-form revenue equation at the firm or bank level and uses the H-statistic, which, under certain assumptions, can serve as a measure of how competitive banks are. The test is from a general banking model, which determines equilibrium output and the equilibrium number of banks by maximizing profits at both the bank level and the industry level. This implies, first, that bank i maximises its profits, where marginal revenue equals marginal cost. The profit maximising condition is:

$$R'_i(Y_i, n, Z_i) - C'_i(Y_i, n, T_i) = 0 \tag{4.1}$$

R_i refers to revenue, C_i to cost, Y_i to output, w_i to a vector of m factor input prices, and Z_i and T_i to vectors of exogenous variables that shift the bank's revenue and cost functions, respectively. The sub index i refers to bank i; n is the number of banks; and prime denotes a first derivative with respect to output. Second, at the market level, it means that, in equilibrium, the zero profit constraint holds:

$$R^*_i(Y^*, n^*, Z_i) - C^*(Y^*, w_i, T_i) = 0 \tag{4.2}$$

Variables marked with an asterisk (*) represent equilibrium values. Market power is measured by the extent to which a change in factor input prices ($dw_{k,i}$) for k = 1,..., m is reflected changes in equilibrium revenue (dR^*_i), earned by bank i. Panzar and Rosse (1987) defined a measure of competition H as the sum of the elasticities of the reduced-form revenue with respect to factor prices:

$$H = \sum_{k=1}^{m} \left(\frac{\partial R_i^*}{\partial w_{k,i}}\right)\left(\frac{w_{k,i}}{R_i^*}\right) \tag{4.3}$$

The first market model of Panzar and Rosse investigates monopoly. In their analysis, monopoly includes the case of price-taking competitive banks, as long as the prices they face are truly exogenous, that is, as long as their equilibrium values are unaffected by changes in the other exogenous variables in the model. The empirical refutation of "monopoly" constitutes a rejection or the assumption that the revenue of the banks in question is independent of the decisions made by their actual or potential rivals. Panzar and Rosse model demonstrates that under monopoly, an increase in input prices will increase marginal costs, reduce equilibrium output and subsequently reduce revenue; hence H will be zero or negative.

- ✓ $H < 0$: indicates a collusive oligopoly or a monopoly, in which an increase in costs causes output to fall and prices to increase. Because the profit-maximizing firm must be operating on the price-elastic portion of its demand function, revenue will fall.

- ✓ 0< H < 1: indicates the intermediate case of monopolistic competition, in which an increase in cost causes revenue to increase at a rate slower than the rate of increase in costs.
- ✓ H = 1: indicates a perfectly competitive industry, in which an increase in costs causes some firms to exit, price to increase, and the revenue of the survivors to increase at the same rate as the increase in cost. This ensures that the surviving firm earns normal profits.

Research using the non-structural model

Shaffer (1982) obtained 0<H<1 for a sample of unit banks in the New York banking sector, suggesting monopolistic competition. Although the New York banking sector is highly concentrated, entry and exit conditions are relatively free. As the effect of loan losses is not considered in Shaffer's regression, Nathan and Neaven (1989) included these impacts in the estimation of the H statistics since the loan losses would be an important factor in bank profits. They assumed that it is better to deduct the loan losses from revenue. However, they did not find that the loan losses had an important impact on the H statistics. They tested for contestability for a group of Canadian banks, trust companies and mortgage companies with data for the period from 1982 to1984. The result indicated 0<H<1. As a further development, Shaffer (1982) defined physical capital per unit, including other properties, such as rentals and leases, as the proportion of non-personal expenses to the aggregate balance sheet amount of premises. However, as the owners of the bank rented quarters often associated with the capital corporation, the actions of rental contracts for the properties are sometimes decided administratively not as market prices but as transfer prices. To offset these effects, therefore, Nathan and Neave (1989) used the total non-personal expenses of individual banks divided by the number of domestic branches. In other words, the estimate of average non-personal cost per branch is represented as the proxy of the property price per unit.

DeBandt and Davis (2000) provided a significant improvement on the specification of variables employed in the model and its functional form. They emphasised that the banking industry is not a general industry, like manufacturing but instead an industry with individual characteristics, which is in line with the argument of Panzar and Rosse (1987). The estimation by Panzar and Rosse (1987) about the H-statistics requires an assumption that banks are treated as single product firms. It is assumed that the nature and level of competition in the loan market is completely independent from those in the deposit market. In each case the inputs are (a) financial capital which is proxied by several kinds of bank debts, (b) labour, measured by the total number of staff, (c) the other inputs. In terms of each input, DeBandt and Davis (2000) considered that there are bank-specific input prices in which banks do not necessarily play the role as the price-taker in the factoring market or local factor market. Moreover, they argued that it is better to use total income as the dependent variable in modern empirical approaches, although only gross interest income is used in the traditional approach. The reason is that there are some banks in which the discrimination between interest income and non-interest income is not relative, due to competition being too intense. On the other hand, it is also asserted that there is an important cross-subsidisation between loans and other non-interest services which is not included in the traditional approaches –particularly under conditions of strong bank regulation. They obtained $0<H<1$ for France, Germany, Italy and the US. Competition appears to be most intense in the US while small banks are found to enjoy some monopoly power in the German and French markets.

In terms of the functional form of the model there is a variety of specific forms of equation in the general banking literature. Molyneux *et al.* (1994) and Bikker and Groeneveld (2000) in particular employed the ratio of interest revenue to total amount of balance sheet as an endogenous variable. On the other hand, Nathan and Neave (1989) used the logarithm of interest revenue. According to DeBandt and Davis (2000) the latter option is the most appropriate since the ratio of interest revenue to total assets might provide the price equation. There is an issue that the possibility of homogeneity might be induced even in the logarithmic specification. DeBandt and Davis (2000) insisted that in the empirical studies on banking competition, although cross-sectional results are generally employed, the implicit assumptions in this case are that all banks have access to the same factor market and only the scale of operations differs. They argued that the dimension of the time-series is crucial, and that irregular results might arise from estimating a cross-sectional regression of the equation with OLS in every year ($t=1, \dots T$). As a result they asserted that it is desirable to focus on the pooled sample regression.

There have been several studies of the non-structural models using dynamic Arellano and Bond (1991) estimator. Bikker *et al.* (2006b) used the Panzar-Rosse model to investigate more than 18,000 banks in 101 countries over 16 years. They found that the inclusion of scale variables as explanatory variables, which is common practice in the current literature, has a similar distorting effect. Moreover, monopoly cannot be rejected in 28% of the countries (against 0% under misspecification) and that perfect competition cannot be rejected in 38% of the cases (against 20-30% under misspecification). Georgiev and Burghof (2007) studied the cost efficiency and profitability effects of 132 bank mergers among the German savings banks over the period from 1993 to 2004. The application of the dynamic unobserved effects panel data model is preferred to a fixed-effects model since the inclusion of a lagged dependent variable as a regressor is found to significantly improve the model by capturing the full history of any determinants of the variable to be explained. Moreover, the dynamic model applied by the authors differs from similar models applied by other researchers in the way the merger dummies of interest are treated. The authors treated the three merger dummy variables as endogenous. Goddard and Wilson (2009) identified the implications for the H-statistic of misspecification bias in the revenue equation, arising when adjustment towards market equilibrium is partial and not instantaneous. In their simulations, fixed effects estimation produced a measured H-statistic that is severely biased towards zero. Empirical results for the banking sectors of the Group of Seven (G7) countries corroborated their principal finding, that a dynamic formulation of the revenue equation was required for accurate identification of the H-statistic.

4.2.2. Non-structural model in emerging and developing countries

Table 4.1 summarises empirical studies of emerging and developing countries, using the Panzar-Rosse model.

Table 4.1 Studies using Panzar-Rosse model in emerging and developing countries

	Studies	Periods	Countries	Results
1	Gelos and Roldos (2004)	1994-1999	Central and Eastern Europe and Latin America	Monopolistic competition.
2	Belaisch (2003)	1997-2000	49 Brazilian banks	Oligopolistic.
3	Yeyati *et al.* (2003)	1996 and 2002	Latin America	foreign penetration weakened banking competition.
4	Drakos and Konstantinou (2005)	1992-2000	Central and Eastern European countries	Perfect competition and monopoly; except Latvia is monopoly.
5	Yeyati and Micco (2003)	1994 and 2001	Latin American countries	Monopolistic competition.
6	Claessens and Laeven (2004)	1994-2001	50 countries	Systems with greater foreign bank entry and fewer entry and activity restrictions are more competitive.
7	Buchs and Mathisen (2005)	1998-2003	Ghana	Non-competition.
8	Mamatzakis *et al.* (2005)	1998-2002	South Eastern European countries	Monopolistic competition.
9	Wong *et al.* (2006)	1991 Q1-2005 Q4	Hong Kong	Monopolistic competition.
10	Yildirim and Philippatos (2003)	1993-2000	Central and Eastern Europe transition countries	Perfect competition or monopoly except Macedonia and Slovakia.
11	Bikker *et al.* (2007)	1995-2004	76 countries	Different results for countries.
12	Goddard and Wilson (2009)	1994-2001	19 developed and developing countries	Monopolistic competition.
13	Bikker and Spierdijk (2009)	1986-2004	120 countries	Different results for countries.

Sources: Mamatzakis et al. (2005:194); Bikker and Bos (2008:32-33); Bikker and Spierdijk (2009:3-4); Matthews and Thompson (2008:180) and author's findings.

4.2.3. Non-structural model in Vietnam

Three previous studies applied the Panzar-Rosse model to the Vietnamese banking system. Bikker *et al.* (2006a, 2006b) and Bikker and Spierdijk (2009) analysed bank structure in the world (with 101 countries including Vietnam) from 1986-2004 using Panzar-Rosse. Due to the lack of data, they only investigated banking structure in Vietnam from 1991 to 2004 for the data of 24 banks (the number of observations is 135). The H-statistic for the Vietnamese banking system is 0.74. However, they applied one model for all 101 countries, including Vietnam. In some cases, it is not applicable as some countries have specific conditions. Further, they could not observe the three input prices directly. Therefore, they used the ratio of annual personal expenses to total assets as an approximation to the price of personal expenses, and the ratio of other non-interest expenses to fixed assets as proxy for the price of capital expenditure. While Bikker *et al.* (2006a, 2006b) and Bikker and Spierdijk (2009) preferred interest income as the dependent variable, other researchers and especially the bankers, liked using revenue for the Panzar-Rosse model.

4.3. Methodology

The Panzar-Rosse model will be employed to look into the banking structure of Vietnam. The motivation of this section is to consider whether the Vietnamese banking market is best characterised by monopoly, perfect competition or the intermediate case of monopolistic competition. There are two methods for estimating the non-structural models, namely equilibrium and disequilibrium, and both approaches will be applied. Each approach will be analysed in detail, regarding method, equation, criteria and conditions for use. This Chapter is concerned with equilibrium approach. The disequilibrium approach will be examined in Chapter 5.

With the non-structural method, we estimate models for revenue over total assets and interest income over total assets as the dependent variables in the Panzar-Rosse framework. Similar to the structural model, other environmental factors such as capital/assets, loans/deposits and branch networks are included into the model to evaluate their impacts on the dependent variables. Both Bikker *et al.* (2006a, 2006b) and Bikker and Spierdijk (2009) preferred interest income as the dependent variable. In this research, we will use two measures for the dependent variables, being revenue over total assets LN(REV/TA) and interest income over total assets LN(INT/TA). Based on the Panzar-Rosse model, the empirical form that we employ is as follows:

$$LN(ROA_{i,t}) = \delta_0 + \delta_1 LN(\frac{PE_{i,t}}{TE_{i,t}}) + \delta_2 LN(\frac{IE_{i,t}}{FF_{i,t}}) + \delta_3 LN(\frac{CE_{i,t}}{FA_{i,t}}) + \delta_4 \frac{TC_{i,t}}{TA_{i,t}} + \delta_5 \frac{CL_{i,t}}{CD_{i,t}}$$
$$+ \delta_6 LN(TA_{i,t}) + \delta_7 LN(BR_{i,t})$$

(4.4)

Where:

$LN(ROA_{i,t})$: bank i's revenue which is measured in two ways as the natural logarithm of revenue divided by total assets $LN(\frac{REV_{i,t}}{TA_{i,t}})$ and interest income divided by total assets $LN(\frac{INT_{i,t}}{TA_{i,t}})$.

$LN(\frac{PE_{i,t}}{TE_{i,t}})$: is the natural logarithm of the unit price of labour, $\frac{PersonalExpenses}{TotalEmployees}$

$LN(\frac{IE_{i,t}}{FF_{i,t}})$: is the natural logarithm of the unit cost of fund, $\frac{InterestExpenses}{FundableFunds}$

$LN(\frac{CE_{i,t}}{FA_{i,t}})$: is the natural logarithm of the unit cost of fixed assets, $\frac{CapitalExpenses}{FixedAssets}$

(Claessens and Laeven, 2003; Gelos and Roldos, 2004: 50 and Nathan and Neave, 2001: 580).

$\frac{TC_{i,t}}{TA_{i,t}}$: is the capital to assets ratio.

$\frac{CL_{i,t}}{CD_{i,t}}$: is the loans to deposits ratio.

$LN(TA_{i,t})$: is the natural logarithm of total assets.

$LN(BR_{Ri,t})$: is the natural logarithm of the number of branches.

The H-statistic is defined as $H = \delta_1 + \delta_2 + \delta_3$ **(4.5)**

From equation **(4.5)**, if:

- ✓ H < 0: The banking structure is a monopoly. An increase in input prices will increase marginal costs, reduce equilibrium output and subsequently reduce bank's revenue.
- ✓ 0 < H < 1: indicates monopolistic competition.
- ✓ H = 1: There is perfect competition. An increase in input prices will increase both marginal and average costs without altering the optimal output of any individual bank. This is also consistent with a natural monopoly in a perfectly contestable market or sales-maximizing bank subject to a break-even constraint.

Models without assets

Many previous empirical studies include among the controls the log of assets to measure size $LN(TA_{i,t})$, or some other similarly defined measure of bank size; and many studies also scale the revenue variable with total assets, using $LN(\frac{REV_{i,t}}{TA_{i,t}})$ and $LN(\frac{INT_{i,t}}{TA_{i,t}})$ as the dependent variables for the estimating equation. However, Bikker *et al.* (2006a) pointed out that it is incorrect to estimate a revenue elasticity using a specification that includes a quantity-type variable among the controls, or using a specification which, through rescaling, converts a revenue variable into a price-type variable. In fact, if $LN(TA_{i,t})$ appears among the controls, then it is immaterial whether the dependent variable is the unscaled $LN(REV_{i,t})$ and $LN(INT_{i,t})$ or scaled, $LN(\frac{REV_{i,t}}{TA_{i,t}})$ and $LN(\frac{REV_{i,t}}{TA_{i,t}})$. In either case, we should interpret the coefficients on the factor input prices $(\delta_1 + \delta_2 + \delta_3)$ as output price elasticities, and not as revenue elasticities. The model is misspecified if assets are included and inference regarding market structure is invalid. Hence, on the left hand side of the models, the dependent variables should be $LN(REV_{i,t})$ and $LN(INT_{i,t})$ instead of $LN(\frac{REV_{i,t}}{TA_{i,t}})$ and $LN(\frac{REV_{i,t}}{TA_{i,t}})$, respectively. On the right hand side of the models, $LN(TA_{i,t})$ should be removed. All other variables are still the same as the initial ones defined in equation **(4.4)** (Goddard and Wilson, 2009).[21]

$$LN(R_{i,t}) = \delta_0 + \delta_1 LN(\frac{PE_{i,t}}{TE_{i,t}}) + \delta_2 LN(\frac{IE_{i,t}}{FF_{i,t}}) + \delta_3 LN(\frac{CE_{i,t}}{FA_{i,t}}) + \delta_4 \frac{TC_{i,t}}{TA_{i,t}} + \delta_5 \frac{CL_{i,t}}{CD_{i,t}} + \delta_6 LN(BR_{i,t})$$

(4.6)

Where: $LN(R_{i,t})$ are $LN(REV_{i,t})$ and $LN(INT_{i,t})$

Equilibrium test

An important feature of the H-statistic is that the test must be undertaken on observations that are in long-run equilibrium. This suggests that competitive capital markets will equalise risk-adjusted rates of return across banks such that, in equilibrium, rates of returns should not be significantly correlated with input prices (Shaffer, 1982; Molyneux and Forbes, 1995; Lloyd-

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[21] In this study, we will estimate models that both include and exclude assets for comparison purposes.

Williams *et al.*, 1994; Classens and Laeven, 2004 and Matthews *et al.*, 2007). Thus, in the context of the theory of competitiveness and contestability set out in models **(4.4)** and **(4.6)**, we specify models for obtaining measures of the competitive banking environment by including a specification for equilibrium conditions. This is obtained by replacing bank revenue and interest income by profit before tax on assets (1+PBT/TA)[22] as the dependent variable calculating the E-statistic from the following equations:

With assets:

$$LN(1+\frac{PBT_{i,t}}{TA_{i,t}}) = \delta_0 + \delta_1 LN(\frac{PE_{i,t}}{TE_{i,t}}) + \delta_2 LN(\frac{IE_{i,t}}{FF_{i,t}}) + \delta_3 LN(\frac{CE_{i,t}}{FA_{i,t}}) + \delta_4 \frac{TC_{i,t}}{TA_{i,t}} + \delta_5 \frac{CL_{i,t}}{CD_{i,t}}$$
$$+ \delta_6 LN(TA_{i,t}) + \delta_7 LN(BR_{i,t})$$

(4.7)

Without assets:

$$LN(1+\frac{PBT_{i,t}}{TA_{i,t}}) = \delta_0 + \delta_1 LN(\frac{PE_{i,t}}{TE_{i,t}}) + \delta_2 LN(\frac{IE_{i,t}}{FF_{i,t}}) + \delta_3 LN(\frac{CE_{i,t}}{FA_{i,t}}) + \delta_4 \frac{TC_{i,t}}{TA_{i,t}} + \delta_5 \frac{CL_{i,t}}{CD_{i,t}}$$
$$+ \delta_6 LN(BR_{i,t})$$

(4.8)

The E-statistic is defined as $E = \delta_1 + \delta_2 + \delta_3$ **(4.9)**

We test whether E=0 using an F-test. If rejected, the market is assumed not to be in equilibrium (Claessens and Laeven, 2004). That is from equation **(4.9)**, if:

- ✓ E = 0: The market is in equilibrium.
- ✓ E $\neq$ 0: The market is in disequilibrium.

[22] Because profit before tax can take on small (negative) values, we compute the dependent variable as (1+PBT/TA)

Simultaneity

Simultaneity is a dual direction of causality in a system of equations which violates the assumption that the explanatory variables and equation's error term are uncorrelated. Variables in a regression can violate this assumption for several reasons, including omitted variable bias, measurement error and simultaneity/reverse causation. In our regression, the models including current values of input prices might suffer from simultaneity (endogeneity) bias between input prices and the dependent variables (revenue and interest income). We use two methods to determine whether or not one or more of the input prices (LN(IE/FF), LN(PE/TE) and LN(CE/FA)) suffers from endogeneity. They are: (1) Wu-Hausman test (for equilibrium approach) and (2) comparing regressions using current and lagged input prices (for both equilibrium and disequilibrium approaches) (Shaffer, 2004; Goddard and Wilson, 2009). The models using lagged input prices are as follows:

With assets and with lagged input prices:

$$LN(ROA_{i,t}) = \delta_0 + \delta_1 LN(\frac{PE_{i,t-1}}{TE_{i,t-1}}) + \delta_2 LN(\frac{IE_{i,t-1}}{FF_{i,t-1}}) + \delta_3 LN(\frac{CE_{i,t-1}}{FA_{i,t-1}}) + \delta_4 \frac{TC_{i,t}}{TA_{i,t}} + \delta_5 \frac{CL_{i,t}}{CD_{i,t}}$$
$$+ \delta_6 LN(TA_{i,t}) + \delta_7 LN(BR_{i,t})$$

(4.10)

Where: $LN(ROA_{i,t})$ are $LN(\frac{REV_{i,t}}{TA_{i,t}})$ and $LN(\frac{INT_{i,t}}{TA_{i,t}})$

Without assets and with lagged input prices:

$$LN(R_{i,t}) = \delta_0 + \delta_1 LN(\frac{PE_{i,t-1}}{TE_{i,t-1}}) + \delta_2 LN(\frac{IE_{i,t-1}}{FF_{i,t-1}}) + \delta_3 LN(\frac{CE_{i,t-1}}{FA_{i,t-1}}) + \delta_4 \frac{TC_{i,t}}{TA_{i,t}} + \delta_5 \frac{CL_{i,t}}{CD_{i,t}}$$
$$+ \delta_6 LN(BR_{i,t})$$

(4.11)

Where: $LN(R_{i,t})$ are $LN(REV_{i,t})$ and $LN(INT_{i,t})$. The remaining variables of the models are unchanged.

Equilibrium tests:

$$LN(1+\frac{PBT_{i,t}}{TA_{i,t}}) = \delta_0 + \delta_1 LN(\frac{PE_{i,t-1}}{TE_{i,t-1}}) + \delta_2 LN(\frac{IE_{i,t-1}}{FF_{i,t-1}}) + \delta_3 LN(\frac{CE_{i,t-1}}{FA_{i,t-1}}) + \delta_4 \frac{TC_{i,t}}{TA_{i,t}} + \delta_5 \frac{CL_{i,t}}{CD_{i,t}}$$
$$+ \delta_6 LN(TA_{i,t}) + \delta_7 LN(BR_{i,t})$$

(4.12)

$$LN(1+\frac{PBT_{i,t}}{TA_{i,t}}) = \delta_0 + \delta_1 LN(\frac{PE_{i,t-1}}{TE_{i,t-1}}) + \delta_2 LN(\frac{IE_{i,t-1}}{FF_{i,t-1}}) + \delta_3 LN(\frac{CE_{i,t-1}}{FA_{i,t-1}}) + \delta_4 \frac{TC_{i,t}}{TA_{i,t}} + \delta_5 \frac{CL_{i,t}}{CD_{i,t}}$$
$$+ \delta_6 LN(BR_{i,t})$$

(4.13)

4.4. Empirical results

4.4.1. Fixed-effects estimations (with assets) for the full sample

Table 4.2 reports the estimated revenue and profit equations (with assets) for the Vietnamese commercial banks from 1999 to 2009. In this case, total assets are included in the model. The estimated revenue equations and H-statistics are presented in first part of the table. Two dependent variables are employed. Columns 2 to 4 of the table show the results, using 'LN(REV/TA)' as the dependent variable. Columns 5 to 7 of the table give the results when 'LN(INT/TA)' is the dependent variable. The top of the columns of the tables are labelled 'Normal', '1-way-FE' and '2-way-FE'. These refer to the estimation method used: 1) 'Normal' is pooled Ordinary Least Squares (OLS); 2) '1-way-FE' includes the cross-sectional fixed-effects only; and 3) '2-way-FE' incorporates both cross-sectional and period fixed-effects. H_0^1 refers to the F-test of the null hypothesis that cross-sectional fixed-effects are redundant. H_0^2 refers to the F-test of the null hypothesis that both cross-sectional and period fixed-effects are redundant. They are located in the third section from bottom of the table. All of the F-tests reject the exclusion of cross-sectional and period fixed-effects. Therefore, the '2-way-FE' model is favoured for inference. There is also information on R^2, Adjust R^2, F-statistic and number of observations. The coefficients of input prices are all statistically significant in the '2-way-FE' model when the dependent variable is LN(REV/TA). They are also all significant at the 5% level, except for that on $LN(\frac{PE_{i,t}}{TE_{i,t}})$, in the '2-way-FE' model when LN(INT/TA) is the dependent variable. $LN(\frac{CE_{i,t}}{FA_{i,t}})$ is also insignificant at the 5% level when LN(INT/TA) is the regressand. The H-statistic is defined as the sum of the coefficients on $LN(\frac{PE_{i,t}}{TE_{i,t}})$, $LN(\frac{IE_{i,t}}{FF_{i,t}})$, and $LN(\frac{CE_{i,t}}{FA_{i,t}})$. They are reported in the row labelled H-statistics in the table. The H-statistics in the '2-way-FE' model are 0.59 (with LN(REV/TA)) and 0.62 (with LN(INT/TA)). The rows below the H-statistics show the result of t-tests on the null hypothesis, 'H statistics = 0' or 'H-statistics = 1'. The H-statistics are found to be significantly different from both zero and one. When the H-statistic is between zero and one, it indicates monopolistic competition. The degree of competitiveness is at an average competitive level. As for the three input prices, the logarithmic cost of fund has the largest value. Hence, interest expense per total fund has the most direct impact on revenue and interest income of the Vietnamese banking system. Personnel expense per person and capital expense per fixed-asset have the second and third greatest impacts on revenue and interest income, respectively. Regarding the other variables, TC/TA and LN(BR) are positively and significantly related to revenue and interest income. LN(TA) has a negative and significant coefficient. CL/CD is insignificant. This means there is no significant increase of revenue and interest income even if banks offer more loans to customers. This is consistent with the structural model results and our expectation.

The second part of the table shows the results of the profit equations and their E-statistics for Vietnamese commercial banks from 1999 to 2009 with total assets. The E-statistic is used to determine whether the long-term equilibrium condition of the market is met. This is calculated as sum of the coefficients on $LN(\frac{PE_{i,t}}{TE_{i,t}})$, $LN(\frac{IE_{i,t}}{FF_{i,t}})$, and $LN(\frac{CE_{i,t}}{FA_{i,t}})$ in the equation using

LN(1+PBT/TA) as the dependent variable. If the E-statistic is equal to zero, the market is in long-term equilibrium. If the E-statistic is not equal to zero, the market is not in the long-term equilibrium. If the market is not in equilibrium, that the value of the H-statistic (obtained from the corresponding revenue equation) is temporal and the degree of competitiveness is changing through time. In this case the models estimated using the equilibrium approach (reported in this chapter) are not valid for inference and it is appropriate to employ a dynamic model to determine the equilibrium value of the market. We use the '2-way-FE' specification for inference because the H_0^2 on the F-test of the null hypothesis is rejected. The E-statistic in the '2-way-FE' model is 0.00743 which does not reject the null hypothesis that the Vietnamese banking system is in equilibrium. Hence, the corresponding H-statistics, 0.59 and 0.62, are valid. This suggests that the Vietnamese banking system is in monopolistic competition. However, these results are not valid for inference because they include assets (Bikker *et al.*, 2006a and Goddard and Wilson, 2009). In the next section, we will discuss the results based upon valid models that exclude assets.

Table 4.2 Fixed-effects estimations (with assets) for the full sample

	H-statistics						E-statistics			
	LN(REV/TA)			LN(INT/TA)				LN(1+PBT/TA)		
	Normal	1-way-FE	2-way-FE	Normal	1-way-FE	2-way-FE		Normal	1-way-FE	2-way-FE
Intercept	-0.37962**	0.451095	0.733285	-0.16892	0.711477**	1.050945**	Intercept	0.003117	0.005489	0.035722
	(-1.63476)	(1.327259)	(1.557959)	(-0.74716)	(2.100496)	(2.207039)		(0.208847)	(0.22092)	(1.046801)
LN(PE/TE)	0.024785	0.150109***	0.130563**	0.03256	0.110363**	0.07147	LN(PE/TE)	0.003851*	0.006513*	0.005107
	(0.75032)	(3.183078)	(2.253397)	(1.012408)	(2.34821)	(1.219238)		(1.813864)	(1.889211)	(1.215762)
LN(IE/FF)	0.419901***	0.409174**	0.39471***	0.518282***	0.520494***	0.500256***	LN(IE/FF)	0.002041	-0.00017	0.000987
	(15.20912)	(13.8844)	(11.75899)	(19.28146)	(17.72182)	(14.73095)		(1.150394)	(-0.07796)	(0.405365)
LN(CE/FA)	-0.00429	0.062675***	0.064164***	-0.00887	0.04204*	0.04532*	LN(CE/FA)	-0.0017	0.000905	0.001336
	(-0.2177)	(2.477427)	(2.537291)	(-0.46252)	(1.667405)	(1.771392)		(-1.33967)	(0.489296)	(0.728692)
TC/TA	0.524411***	0.462685***	0.432035***	0.499559***	0.454545***	0.431849***	TC/TA	0.049875***	0.043552***	0.041361***
	(7.366121)	(5.563048)	(5.065356)	(7.207266)	(5.483745)	(5.004611)		(10.8993)	(7.163053)	(6.688494)
CL/CD	-0.01955**	-0.01076	-0.01342	-0.01479	-0.00697	-0.00889	CL/CD	-0.00036	-0.00047	-0.0005
	(-1.97649)	(-1.16083)	(-1.42996)	(-1.53556)	(-0.75396)	(-0.93642)		(-0.56205)	(-0.68719)	(-0.73725)
LN(TA)	-0.08454***	-0.18157***	-0.19549***	-0.09245***	-0.18142***	-0.19306***	LN(TA)	-0.00039	-0.00204	-0.00332
	(-4.54197)	(-6.25232)	(-6.27521)	(-5.10169)	(-6.2686)	(-6.12532)		(-0.32149)	(-0.95838)	(-1.47073)
LN(BR)	0.083713***	0.152376***	0.145194***	0.091439***	0.169692***	0.152247***	LN(BR)	0.000173	0.003285	0.003179
	(4.495936)	(4.171086)	(3.720896)	(5.043979)	(4.660868)	(3.856508)		(0.144374)	(1.229992)	(1.12373)
R2	0.531159	0.708711	0.725245	0.617898	0.751249	0.75821	R2	0.326118	0.45844	0.497537
Adj. R2	0.522241	0.659709	0.668704	0.61063	0.709404	0.708452	Adj. R2	0.3133	0.367336	0.394137
H_0^1	---	4.163032***	3.960733***	---	3.661344***	3.430044***	H_0^1	---	1.668748***	1.680463***
		Reject	Reject		Reject	Reject			Reject	Reject
H_0^2	---	----	3.854213***	---	---	3.16622***	H_0^2	---	---	1.861405***
			Reject			Reject				Reject
H-sta.	**0.440397**	**0.621957**	**0.589437**	**0.54197**	**0.672896**	**0.617046**	**E-statistic**	**0.004196**	**0.00725**	**0.00743**
H_0: H=0	114.6379***	145.0535***	77.59328***	183.157***	170.9424***	83.07647***	H_0: E=0	2.519051	3.688038*	2.345269
	Reject	Reject	Reject	Reject	Reject	Reject		**Accept**	**Accept**	**Accept**
H_0: H=1	185.0977***	53.59058***	37.64517***	130.8164***	40.39465***	31.99893***	---	---	---	---
	Reject	Reject	Reject	Reject	Reject	Reject				
F-statistic	59.55913	14.46294	12.82685	85.01341	17.95277	15.23812	F-statistic	25.4414	5.032069	4.81174
Obs.	376	376	376	376	376	376	Obs	376	376	376

See notes to Table 3.5.

4.4.2. Fixed-effects estimations (without assets) for the full sample

Table 4.3 presents the estimated revenue and profit equations (without total assets) and corresponding H-statistics and E-statistics for the Vietnamese commercial banks from 1999 to 2009. In the first part of the table, we produce two sets of results with dependent variables that exclude total assets, being 'LN(REV)' and 'LN(INT)'. LN(TA) is also removed from the control variables to ensure the H-statistics have the intended interpretation. The '2-way-FE' specification is favoured for inference as H_0^1 and H_0^2 are rejected. The H-statistics are 0.95 for the equation where LN(REV) is the dependent variable and 0.98 for the specification with LN(INT) as the regressand. They are both significantly different from zero and insignificantly different from one. Since the H-statistic=1 this indicates that the Vietnamese banking system is a competitive industry. An increase in costs causes some banks to exit, prices to increase, and the revenue of the survivors to rise at the same rate as the increase in costs. The Vietnamese Banking system is virtually in perfect competition between 1999 and 2009. Removing the downward bias by excluding total assets in the revenue equations has transformed our inference of the Vietnamese banking market from monopolistic competition to perfect competition which is consistent with the prediction of Bikker *et al.* (2006a) and Goddard and Wilson (2009).

The coefficients of input prices are all statistically significant at the 1% in the '2-way-FE', except for LN(CE/FA). The magnitudes of input prices are from smallest to largest, cost of fund, price of labour and cost of fixed-assets. Regarding the control variables, TC/TA has a negative relation and LN(BR) has a positive relation with revenue. The first implies that increasing the capital/asset ratio causes a reduction in revenue which is consistent with our expectations. The second means that revenue and interest income increase when banks open more branches. CL/CD is insignificant which means that there is no relation between customer loans and revenue.

The right hand side of the table presents the results of the profit equations and their associated E-statistics with assets excluded. As H_0^1 and H_0^2 are rejected we prefer to use the '2-way-FE' specification for inference. The E-statistic in the '2-way-FE' model is 0.005917 which is not significantly different from zero (see H_0: E=0). Hence, the Vietnamese banking system is in long-term equilibrium, and therefore the inference from the H-statistics is valid. That is, the results suggest that the Vietnamese banking industry is not significantly different from a market in perfect competition over the period from 1999 to 2009. We prefer to use these results for inference over those discussed in the previous section because they exclude assets and therefore have the appropriate interpretation.

Table 4.3 Fixed-effects estimations (without assets) for the full sample

	H-statistics					
	LN(REV)			LN(INT)		
	Normal	1-way-FE	2-way-FE	Normal	1-way-FE	2-way-FE
Intercept	7.580116***	8.455433***	10.55636***	7.722018***	8.717219***	10.90377***
	(16.5633)	(24.33831)	(21.51005)	(17.0605)	(25.11315)	(22.08992)
LN(PE/TE)	0.974453***	0.776625***	0.413203***	0.97402***	0.736989***	0.354966***
	(13.22968)	(10.03369)	(4.102046)	(13.37045)	(9.529688)	(3.503598)
LN(IE/FF)	0.298812***	0.499114***	0.480003***	0.39824***	0.61045***	0.585807***
	(3.954055)	(9.154161)	(8.1166460	(5.32818)	(11.20566)	(9.848678)
LN(CE/FA)	0.084173	0.051103	0.062575	0.078826	0.030465	0.043726
	(1.561048)	(1.085534)	(1.397685)	(1.478086)	(0.647703)	(0.971045)
TC/TA	-1.23065***	-0.61724***	-0.66226***	-1.24034***	-0.62557***	-0.66576***
	(-7.26921)	(-4.49292)	(-5.05363)	(-7.40766)	(-4.55742)	(-5.05106)
CL/CD	-0.08423***	-0.0025	-0.0209	-0.0789***	0.001297	-0.01639
	(-3.12593)	(-0.14498)	(-1.25865)	(-2.9609)	(0.075273)	(-0.98161)
LN(BR)	0.86065***	0.948117***	0.740557***	0.861661***	0.965572***	0.749412***
	(31.77344)	(21.97745)	(13.28667)	(32.16354)	(22.40107)	(13.36808)
R2	0.840704	0.954595	0.96124	0.846102	0.955231	0.961273
Adj. R2	0.838114	0.947121	0.953413	0.8436	0.947862	0.953453
H_0^1	---	17.1846***	19.28638***	---	16.70018***	18.67979***
		Reject	Reject		Reject	Reject
H_0^2	---	---	17.02186***	---	---	16.27823***
			Reject			Reject
H-statistic	**1.357439**	**1.326842**	**0.95578**	**1.451086**	**1.377905**	**0.984499**
H₀: H=0	181.5058***	249.0087***	68.15444***	212.0391***	268.9997***	71.48077***
	Reject	Reject	Reject	Reject	Reject	Reject
H₀: H=1	12.58499***	15.10955***	0.145884	20.49029***	20.23383***	0.017721
	Reject	Reject	Accept	Reject	Reject	Accept
F-statistic	324.5748	127.7302	122.8171	338.1154	129.6317	122.9265
Obs.	376	376	376	376	376	376

	E-statistics		
	LN(1+PBT/TA)		
	Normal	1-way-FE	2-way-FE
Intercept	-0.00023	-0.01441	-0.00484
	(-0.02124)	(-1.05605)	(-0.24029)
LN(PE/TE)	0.003452**	0.004955	0.00394
	(2.006398)	(1.630094)	(0.953369)
LN(IE/FF)	0.002092	-0.00039	0.000634
	(1.185221)	(-0.18284)	(0.261438)
LN(CE/FA)	-0.00173	0.000934	0.001343
	(-1.37644)	(0.504982)	(0.730912)
TC/TA	0.050613***	0.046237***	0.04588***
	(12.79771)	(8.569202)	(8.532962)
CL/CD	-0.00033	-0.00049	-0.00047
	(-0.5246)	(-0.71794)	(-0.69088)
LN(BR)	-0.00015	0.001307	0.000721
	(-0.24282)	(0.771156)	(0.315234)
R2	0.325929	0.45689	0.494043
Adj. R2	0.314968	0.367496	0.391878
H₀: α=0	---	1.65201***	1.629334***
		Reject	Reject
H₀: β=0	---	---	1.818732***
			Reject
E-statistic	**0.003811**	**0.005498**	**0.005917**
H₀: E=0	2.621434	2.771285**	1.551729
	Accept	**Reject**	**Accept**
---	---	---	---
F-statistic	29.73667	5.110977	4.835757
Obs.	376	376	376

See notes to Table 3.5.

4.4.3. Fixed-effects estimations (with assets and with lagged input prices) for the full sample

Table 4.4 shows the empirical results for Panzar-Rosse's revenue and profit equations for the Vietnamese commercial banks from 1999 to 2009 including total assets and using lagged input prices. In order to avoid possible simultaneity between input prices and revenue, which might arise if banks exercise monopsony power in their factor markets, Shaffer (2004) suggests using lagged input prices as covariates in the revenue equation. We use the '2-way-FE' specification for inference as H_0^1 and H_0^2 are rejected for all models. The coefficients of input prices in the revenue equations are insignificant, except for $LN(\frac{IE_{i,t-1}}{FF_{i,t-1}})$. The H-statistic is 0.16 when LN(REV/TA) is the dependent variable and 0.13 when LN(INT/TA) is the regressand. The null hypotheses that the H-statistic is zero or one are both rejected. This indicates industry is in the monopolistic competition, if close to monopoly.

As regards to the control variables, TC/TA is positive and significant, showing a positive relationship between both revenue and interest income with capital/asset ratio. LN(TA) is negative and significant. CL/CD is negative and significant when the dependent variable is LN(REV/TA) but is insignificant when the regressand is LN(INT/TA). When customer loans increase, revenue decrease while interest income is not significant changed. Lastly, LN(BR) is insignificant.

The H-statistics based on revenue equations (including assets) that include lagged input prices as regressors are notably smaller than the corresponding equations that use current input prices. That is, the H-statistics fall from 0.59-0.62 to 0.13-0.16. This dramatic change in inference could be due to simultaneity bias in the model including current dated variables and/or a difference in the sample used to estimate the different mode. Given that the sample size does not change substantially when using lagged rather than current input prices we consider the change in H-statistics is most likely due to simultaneity bias. We are therefore inclined to favour the results using lagged input prices.

In the test for equilibrium we use inference from the '2-way-FE' specification as H_0^2 is rejected. The test for E=0 cannot be rejected which suggests that the market is in equilibrium and the results of the H-statistics are valid. In other words, the Vietnamese banking system is in monopolistic competition, but close to monopoly when we use lagged input prices as regressors.

Table 4.4 Fixed-effects estimations (with assets and lagged input prices) for the full sample

H-statistics

	LN(REV/TA)			LN(INT/TA)		
	Normal	1-way-FE	2-way-FE	Normal	1-way-FE	2-way-FE
Intercept	-0.86277***	-1.49541***	0.680675	-0.99569***	-1.74897***	0.682813
	(-2.67647)	(-2.79416)	(1.033669)	(-2.85767)	(-2.92764)	(0.944973)
$LN(PE/TE)_{(t-1)}$	0.110642***	0.252523***	0.06657	0.112795**	0.216742***	-0.00373
	(2.713966)	(3.975811)	(0.913147)	(2.559717)	(3.057114)	(-0.04665)
$LN(IE/FF)_{(t-1)}$	0.154914***	0.019843	0.081654*	0.205964***	0.067912	0.136075***
	(4.517401)	(0.466997)	(1.932173)	(5.556604)	(1.431851)	(2.934431)
$LN(CE/FA)_{(t-1)}$	-0.04603*	0.028971	0.011959	-0.05652**	0.01463	-0.00226
	(-1.76594)	(0.819662)	(0.376167)	(-2.006)	(0.370822)	(-0.06468)
TC/TA	0.451598***	0.392848***	0.24037**	0.412768***	0.374683***	0.210259*
	(5.309947)	(3.391362)	(2.242414)	(4.490174)	(2.897722)	(1.787582)
CL/CD	-0.05164*	-0.04139	-0.07214**	-0.00981	-0.00413	-0.04083
	(-1.73266)	(-1.26384)	(-2.33329)	(-0.30462)	(-0.11293)	(-1.2034)
LN(TA)	-0.13904***	-0.15516***	-0.21713***	-0.13422***	-0.13452***	-0.19864***
	(-5.76853)	(-3.69594)	(-5.30411)	(-5.15179)	(-2.87066)	(-4.42196)
LN(BR)	0.149699***	0.155557***	0.079386	0.151099***	0.158675***	0.064661
	(6.333659)	(3.022809)	(1.593449)	(5.914476)	(2.762302)	(1.182792)
R2	0.342756	0.541526	0.649645	0.3349	0.505202	0.634611
Adj. R2	0.328334	0.454516	0.568997	0.320305	0.411299	0.550502
H_0^1	---	2.639808***	3.362863***	---	2.095709***	1.904406
		Reject	Reject		Reject	Accept
H_0^2	---	----	4.298568***	---	---	85.16071***
			Reject			Reject
H-statistic	**0.219528**	**0.301337**	**0.160184**	**0.262244**	**0.299285**	**0.130088**
H_0: H=0	17.52266***	17.88439***	3.476749*	21.4029***	14.15875***	1.904406
	Reject	Reject	Accept	Reject	Reject	Accept
H_0: H=1	221.4811***	96.14003***	95.56634***	169.3889***	77.61367***	85.16071***
	Reject	Reject	Reject	Reject	Reject	Reject
F-statistic	23.76575	6.223736	8.055327	22.94671	5.38003	7.545139
Obs.	327	327	327	327	327	327

E-statistics

	LN(1+PBT/TA)		
	Normal	1-way-FE	2-way-FE
Intercept	0.004229	-0.00569	0.029717
	(0.238078)	(-0.18372)	(0.711595)
$LN(PE/TE)_{(t-1)}$	0.00548***	0.009888***	0.009512
	(2.439145)	(2.692137)	(2.057433)
$LN(IE/FF)_{(t-1)}$	-0.00027	-0.0037	-0.00317
	(-0.14203)	(-1.50745)	(-1.18275)
$LN(CE/FA)_{(t-1)}$	-0.00216	-0.00044	-0.00115
	(-1.50299)	(-0.21584)	(-0.56975)
TC/TA	0.049593***	0.036223***	0.033188***
	(10.58159)	(5.407512)	(4.882017)
CL/CD	-0.00109	-0.00011	-0.00231
	(-0.6617)	(-0.0562)	(-1.1788)
LN(TA)	-0.00133	-0.00294	-0.00476*
	(-1.00313)	(-1.21083)	(-1.83266)
LN(BR)	0.000714	0.00385	0.003327
	(0.547931)	(1.29356)	(1.052936)
R2	0.357793	0.506674	0.546615
Adj. R2	0.343701	0.41305	0.442251
H_0^1	---	1.837561***	1.735822***
		Reject	Reject
H_0^2	---	---	2.043796***
			Reject
E-statistic	**0.003053**	**0.005743**	**0.00743**
H_0: E=0	1.115667	1.942426	0.908744
	Accept	**Accept**	**Accept**
---	---	---	---
F-statistic	25.38924	5.411794	5.23758
Obs	327	327	327

See notes to Table 3.5.

4.4.4. Fixed-effects estimations (without assets and with lagged input prices) for the full sample

Table 4.5 presents estimated revenue and profit equations (excluding assets) for the Vietnamese commercial banks from 1999 to 2009, using lagged not current input prices. We use the '2-way-FE' specification for inference as both H_0^1 and H_0^2 are rejected for all models. The coefficients on $LN(\frac{IE_{i,t-1}}{FF_{i,t-1}})$ are significant at the 1% level for both revenue and interest income while the other input prices are insignificant in all cases. The H-statistics are 0.45 for LN(REV) and 0.43 for LN(INT) which, as expected, are higher than for the corresponding equations with assets included. We reject the null hypotheses that H is zero or one. This indicates monopolistic competition.

The H-statistics based upon revenue equations (excluding assets) that include lagged input prices as regressors are notably smaller than the corresponding equations that use current input prices. That is, the H-statistics fall from 0.95-0.98 to 0.45-0.43. This difference could be due to simultaneity bias in the model including current dated variables and/or a difference in the sample used to estimate the different mode. Given that the sample size does not change substantially when using lagged rather than current input prices we consider the change in H-statistics is most likely due to simultaneity bias. Hence we favour the results using lagged input prices for inference.

The control variables TC/TA and CL/CD are both negative and insignificant. Capital/asset and loan/deposit have no significant relationship with revenue and interest income. However, the coefficient on LN(BR) is positive and significant. That is, branch networks have a positive impact on revenue and interest income. The E-statistics from the favoured '2-way-FE' specification is 0.00341 which is insignificantly different from zero. We can conclude that the H-statistics from Table 4.5 are valid and that the Vietnamese banking system is in monopolistic competition between 1999 and 2009.

Table 4.5 Fixed-effects estimations (without assets and lagged input prices) for the full sample

	H-statistics						E-statistics			
	LN(REV)			LN(INT)				LN(1+PBT/TA)		
	Normal	1-way-FE	2-way-FE	Normal	1-way-FE	2-way-FE		Normal	1-way-FE	2-way-FE
Intercept	7.700997***	7.853374***	11.23347***	7.616027***	7.828188***	11.48497***	Intercept	-0.00902	-0.03822**	-0.03442
	(16.0082)	(18.80789)	(20.30188)	(15.50439)	(17.64589)	(19.67044)		(-0.75993)	(-2.48465)	(-1.50365)
$LN(PE/TE)_{(t-1)}$	0.919411***	0.767839***	0.217644*	0.926092***	0.744646***	0.150912	$LN(PE/TE)_{(t-1)}$	0.004228**	0.008095**	0.008594*
	(12.14759)	(8.407197)	(1.950276)	(11.983)	(7.674139)	(1.281549)		(2.263134)	(2.406339)	(1.861617)
$LN(IE/FF)_{(t-1)}$	0.168421**	0.254987***	0.24519***	0.219547***	0.308801***	0.303476***	$LN(IE/FF)_{(t-1)}$	-0.00029	-0.00452*	-0.00416
	(2.200026)	(3.972247)	(3.847462)	(2.8086)	(4.527878)	(4.512916)		(-0.1531)	(-1.9126)	(-1.57942)
$LN(CE/FA)_{(t-1)}$	0.042667	0.001865	-0.0094	0.032677	-0.01314	-0.02412	$LN(CE/FA)_{(t-1)}$	-0.0023	-0.00035	-0.00102
	(0.736598)	(0.033601)	(-0.1922)	(0.552481)	(-0.22282)	(-0.46728)		(-1.60584)	(-0.16968)	(-0.50345)
TC/TA	-1.02913***	-0.80327***	-0.8926***	-1.07625***	-0.85065***	-0.94948***	TC/TA	0.051884***	0.040385***	0.040073***
	(-6.20752)	(-5.14156)	(-6.48884)	(-6.35758)	(-5.12489)	(-6.54123)		(12.67847)	(7.017951)	(7.042275)
CL/CD	-0.30171***	-0.03336	-0.12042**	-0.26129***	0.004101	-0.09024*	CL/CD	-0.0007	-0.00013	-0.00202
	(-4.66538)	(-0.64826)	(-2.53777)	(-3.95682)	(0.075021)	(-1.80237)		(-0.43831)	(-0.0709)	(-1.02807)
LN(BR)	0.877726***	0.972249***	0.624379***	0.883202***	0.995317***	0.622532***	LN(BR)	-0.00041	0.001008	1.46E-05
	(32.85085)	(19.55396)	(9.922553)	(32.37268)	(18.84157)	(9.375584)		(-0.62622)	(0.550338)	(0.005607)
R2	0.847128	0.947146	0.961207	0.843687	0.941493	0.95764	R2	0.355767	0.504034	0.540869
Adj. R2	0.844262	0.937344	0.952457	0.840756	0.930642	0.948085	Adj. R2	0.343688	0.412055	0.437305
H_0^1	---	11.56436***	16.31798***	---	10.21589***	14.78175***	H_0^1	---	1.826887***	1.68434***
		Reject	Reject		Reject	Reject			Reject	Reject
H_0^2	---	----	14.48581***	---	---	13.25124***	H_0^2	---	---	1.985917***
			Reject			Reject				Reject
H-statistic	**1.130499**	**1.024691**	**0.453431**	**1.178316**	**1.040309**	**0.430264**	**E-statistic**	**0.001643**	**0.003226**	**0.003411**
H_o: H=0	122.1123***	112.3479***	12.13582***	127.2345***	102.589***	9.813877***	H_o: E=0	0.423184	0.820762	0.401416
	Reject	Reject	Reject	Reject	Reject	Reject		**Accept**	**Accept**	**Accept**
H_o: H=1	1.627163	0.06523	17.63348***	2.913822*	0.15402	17.20751***	---	---	---	---
	Accept	Accept	Reject	Accept	Accept	Reject				
F-statistic	295.5424	96.62786	109.849	287.8628	86.77029	100.225	F-statistic	29.45249	5.479872	5.222586
Obs.	327	327	327	327	327	327	Obs	327	327	327

See notes to Table 3.5.

4.4.5. Summary of results from the Wu-Hausman test

The Wu-Hausman test tests for weak exogeneity. We use it to test whether the input price variables in our models may be treated as if they are exogenous for the purpose of estimation such that OLS produces valid estimates. Table 4.6 reports results from instruments of input prices. The instrument set is the same for the input price variables being instrumented. The results show that all F-tests for the significance of the explanatory power of the instrumented input price equations are significant at the 1% level except for LN(CE/FA) of the sub-sample SOCB (without assets) which is significant at the 5% level. Further, the F-statistic exceeds 10 in 20 of the 30 cases, suggesting appropriate instruments (Stock and Watson, 2012).

Table 4.7 reports the summary of results from the Wu-Hausman test for the models with and without assets. Full sample and sub-sample (SOCBs, non-SOCBs, 1999-2003 and 2004-2009) results are produced. The residuals of each instrument equation for input price (LN(IE/FF), LN(PE/TE) and LN(CE/FA)) are denoted as Res[LN(IE/FF)], Res[LN(PE/TE)] and Res[LN(CE/FA)] in the table. The coefficients and t-ratios (in parentheses) on these three variables when added (together) to the previously discussed models used to obtain H- and E-statistics are reported along with an F-test (with associated probability value in square parentheses) of the joint significance of these three variables. The results show that there is evidence of endogeneity of the revenue and interest income equations when assets are included in the models (except for the sub-samples SOCBs and 1999-2003 when LN(REV/TA) is the dependent variable). However, when assets are excluded from the revenue equations there is no endogeneity in the revenue equations (except for the sub-sample 1999-2003 for the interest income equation). Hence, these results suggest that we should employ current input prices for the revenue and interest income models (without assets) except for the interest income equation the sub-sample 1999-2003 (where inference should be drawn using lagged input prices). In contrast, these results also suggest that we should employ lagged input prices for the revenue and interest income models which include assets except for the sub-samples SOCBs and 1999-2003 (where inference should be drawn using current input prices). With the profit equations there is always evidence of endogeneity except for some of the samples split by period (1999-2003 and 2004-2009 with current input prices). Therefore, it would probably be safest to produce all E-statistics based on the profit equations using lagged input prices.

In general, the Wu-Hausman test suggests that there is general evidence of endogeneity in the models with assets and there is less evidence of endogeneity in the models without assets. Nevertheless, the large differences in coefficients in the estimated models both with and without assets suggest endogeneity in both cases. In order to secure valid inference we will use the models employing lagged input prices.

Table 4.6 Summary of results from the instruments of input prices

		With assets		Without assets	
		LN(REV/TA), LN(INT/TA), LN(1+PBT/TA)		LN(REV), LN(INT), LN(1+PBT/TA)	
		Adj. R^2	F-test	Adj. R^2	F-test
Full sample 1999-2009	LN(PE/TE)	0.902	47.141*** [0.000]	0.900	47.789*** [0.000]
	LN(IE/FF)	0.661	10.765*** [0.000]	0.618	9.360*** [0.000]
	LN(CE/FA)	0.723	14.105*** [0.000]	0.724	14.603*** [0.000]
non-SOCBs 1999-2009	LN(PE/TE)	0.906	45.258*** [0.000]	0.896	41.853*** [0.000]
	LN(IE/FF)	0.650	9.544*** [0.000]	0.610	8.458*** [0.000]
	LN(CE/FA)	0.742	14.205*** [0.000]	0.743	14.770*** [0.000]
SOCBs 1999-2009	LN(PE/TE)	0.960	50.451*** [0.000]	0.953	46.427*** [0.000]
	LN(IE/FF)	0.832	11.138*** [0.000]	0.833	12.157*** [0.000]
	LN(CE/FA)	0.477	2.861*** [0.006]	0.327	**2.082**** **[0.036]**
Sub-sample 1999-2003	LN(PE/TE)	0.930	30.849*** [0.000]	0.928	31.563*** [0.000]
	LN(IE/FF)	0.592	4.269***	0.600	4.546***
	LN(CE/FA)	0.914	24.822*** [0.000]	0.915	26.502*** [0.000]
Sub-sample 2004-2009	LN(PE/TE)	0.856	23.872*** [0.000]	0.856	24.739*** [0.000]
	LN(IE/FF)	0.697	9.866*** [0.000]	0.635	7.936*** [0.000]
	LN(CE/FA)	0.700	9.977*** [0.000]	0.702	10.404*** [0.000]

Note: The variables which are included as the regressors in the instrument equations. Presumably the instruments are the same for every single instrumented equation.

Table 4.7 Summary of results from the Wu-Hausman test

		With assets			Without assets		
		LN(REV/TA)	LN(INT/TA)	LN(1+PBT/TA)	LN(REV)	LN(INT)	LN(1+PBT/TA)
Full sample 1999-2009	Res[LN(PE/TE)]	-0.270**	-0.204	-0.025***	-0.213	-0.165	-0.019**
		(-2.180)	(-1.618)	(-2.643)	(-1.014)	(-0.773)	(-2.029)
	Res[LN(IE/FF)]	-0.290***	-0.185**	-0.006	-0.170	-0.174	0.033***
		(-3.165)	(-1.987)	(-0.783)	(-0.870)	(-0.880)	(3.853)
	Res[LN(CE/FA)]	0.112	0.108	0.013**	0.058	0.072	0.007
		(1.325)	(1.263)	(1.966)	(0.399)	(0.482)	(1.030)
	F-All inputs	4.707***	2.282*	3.212**	0.533	0.432	7.578***
		[0.003]	[0.080]	[0.024]	[0.660]	[0.731]	[0.000]
non-SOCBs 1999-2009	Res[LN(PE/TE)]	-0.464***	-0.352**	-0.039	-0.263	-0.191	-0.023*
		(-2.856)	(-2.167)	(-3.037)	(-1.139)	(-0.826)	(-1.959)
	Res[LN(IE/FF)]	-0.316***	-0.234**	-0.005	-0.116	-0.137	0.039***
		(-3.153)	(-2.329)	(-0.590)	(-0.579)	(-0.677)	(3.808)
	Res[LN(CE/FA)]	0.123	0.102	0.012	0.044	0.040	0.005
		(1.391)	(1.160)	(1.653)	(0.312)	(0.281)	(0.648)
	F-All inputs	6.107***	3.478**	3.702***	0.526	0.364	6.651***
		[0.001]	[0.017]	[0.013]	[0.665]	[0.779]	[0.000]
SOCBs 1999-2009	Res[LN(PE/TE)]	0.034	0.051	-0.003	0.123	0.305	0.025**
		(0.190)	(0.251)	(-0.473)	(0.373)	(0.864)	(2.428)
	Res[LN(IE/FF)]	-0.090	0.102	0.029***	0.179	0.543	0.058***
		(-0.411)	(0.415)	(3.906)	(0.443)	(1.253)	(4.666)
	Res[LN(CE/FA)]	0.042	-0.026	-0.008**	0.035	0.024	0.003
		(0.388)	(-0.211)	(-2.249)	(0.404)	(0.266)	(0.974)
	F-All inputs	**0.155**	**0.080**	8.403***	0.109	0.528	10.098***
		[0.926]	**[0.970]**	[0.001]	[0.954]	[0.667]	[0.000]
Sub-sample 1999-2003	Res[LN(PE/TE)]	0.413	1.340	0.027	1.147	1.977	0.024
		(0.308)	(1.169)	(0.202)	(0.658)	(1.242)	(0.166)
	Res[LN(IE/FF)]	0.154	0.575***	-0.004	0.323	0.660**	0.005
		(0.718)	(3.138)	(-0.167)	(1.129)	(2.528)	(0.213)
	Res[LN(CE/FA)]	0.806	1.581***	0.043	-0.177	0.698	0.001
		(1.314)	(3.014)	(0.702)	(-0.253)	(1.092)	(0.018)
	F-All inputs	**0.992**	7.556***	0.182	0.454	**2.816****	0.015
		[0.404]	[0.000]	[0.908]	[0.715]	**[0.048]**	[0.997]
Sub-sample 2004-2009	Res[LN(PE/TE)]	-0.325*	-0.361**	-0.030	-0.414	-0.463	-0.015
		(-1.776)	(-2.117)	(-2.102)	(-1.312)	(-1.527)	(-1.108)
	Res[LN(IE/FF)]	-0.425***	-0.399***	0.000	-0.172	-0.196	0.057***
		(-3.687)	(-3.717)	(-0.035)	(-0.620)	(-0.737)	(4.814)
	Res[LN(CE/FA)]	0.075	0.085	0.006	-0.025	-0.006	0.001
		(0.879)	(1.075)	(0.911)	(-0.170)	(-0.044)	(0.182)
	F-All inputs	5.457***	5.978***	1.543	0.716	0.923	8.843***
		[0.001]	[0.001]	[0.205]	[0.544]	[0.431]	[0.000]

See notes to Table 3.5.

4.4.6. Summary of results from the non-structural model: equilibrium approach

Table 4.8 gives a summary of the main results obtained from equilibrium approach. The results are for models using current and lagged input prices both with and without assets included. The procedure of finding valid H-statistics is also applied to the sub-samples (1999-2003; 2004-2009; five SOCBs and 43 non-SOCBs). All of the F-tests reject the exclusion of cross-sectional and period fixed-effects and so the '2-way-FE' model is favoured and used for inference. All the models are in equilibrium except the sub-sample 1999-2003 using lagged input prices for LN(REV/TA), LN(REV) and LN(INT). This may suggest that there rewards impact of the 1997 Asian financial crisis on the commercial banking industry. Therefore, it suggests that the degree of market competition indicated in the sub-sample 1999-2003 which is monopolistic may change in the future.

There are differences between the models using current and lagged input prices. The models based on current input prices suggest that the full sample and sub-samples are generally in monopolistic competition. The removal of total assets from the models transforms our inference to the market being perfect competition. This is consistent with the bias caused by including assets discussed by Bikker *et al.* (2006a) and Goddard and Wilson (2009). However, the models using lagged input prices including assets indicate that the full sample and sub-samples behave as if in monopoly except for the full sample when LN(REV/TA) is the dependent variable. When assets are excluded from the models, the full sample and non-SOCBs sub-sample indicate monopolistic competition while the other sub-samples suggest monopoly. The Wu-Hausman test indicates endogeneity in most of the models including assets if only a few excluding assets. However, the difference in the estimated coefficients of the models with and without assets suggests evidence of endogeneity in both. Therefore we prefer the models using lagged input prices for inference.

In the models using lagged input prices, the H-statistics are generally higher for models where revenue is the dependent variable than when it is interest income (except for the SOCBs sub-sample). Hence the market appears more competitive when based on revenue. Revenue includes interest income plus fee and commission income. Interest income accounts for most of revenue. In contrast, the models based upon current input prices generally show that the H-statistics are generally higher for the models when interest income is the dependent variable than when it is revenue except for the sub-sample 2004-2009 without assets.

Another finding relates to the exclusion of the natural logarithm of total assets from the model. This issue is raised by Bikker *et al.* (2006a) and Goddard and Wilson (2009). They asserted that it is incorrect to estimate a revenue elasticity using a specification that includes a quantity-type variable among the controls, or using a specification which, through rescaling, converts a revenue variable into a price-type variable. Further, if total assets appear among the controls, then it is immaterial whether the dependent variable is unscaled, or scaled. To examine the implications of this critique, we estimate all the models with and without assets. The removal of total assets from all the models transforms our inference regarding the market toward being more competitive as predicted by Bikker *et al.* (2006a) and Goddard and Wilson (2009). In the models using lagged input prices, the H-statistics for the full sample are between 0.16 and 0.13 when assets are included. The corresponding range is 0.45 to 0.43 when we exclude total assets from the models. On the other hand, the H-statistics of the models with current input prices are 0.59 and 0.61 with assets included and when we eliminate assets from the models the corresponding range is 0.95 and 0.98. Given that inference in the models including total assets is inappropriate and the models using lagged input prices are preferred for inference we would conclude from these results that the Vietnamese banking system and the non-SOCBs are in monopolistic competition over the whole period. Further, the Vietnamese banking system in the sub-periods 1999-2003 and 2004-2009 and the SOCBs operate in monopoly.

The empirical results of the models using lagged input prices and excluding assets show that non-state owned commercial banks (non-SOCBs) are more competitive than state owned commercial banks (SOCBs). The H-statistics for non-SOCBs are between 0.52 and 0.54 in the models that exclude assets. The corresponding range for SOCBs is -0.15 to -0.13. Therefore, non-SOCBs behave as if in monopolistic competition while SOCBs behave as if in a monopoly environment.

Regarding the time period there is another interesting finding. The results suggest that in the period 1999-2003 the market is slightly less competitive than during period 2004-2009. This is also consistent with our expectations about these two periods. Some banks are established in the period 2004-2009. As new banks they offered loans with good rates for customers. They are also not affected by non-performing loans (NPL) as the other existing banks. The average NPL in the sub-sample 1999-2003 is 8.422% while the average NPL decreased to 2.37% in the sub-period 2004-2009 (see section 2.3.1 in Chapter 2). The H-statistics are 0.03 and -0.05 in the sub-period 1999-2003. The corresponding results for the sub-period 2004-2009 are 0.05 and 0.03. Hence, whilst the degree of competition has increased through time it has only increased slightly.

These results are slightly different from researches of Bikker *et al.* (2006a, 2006b) and Bikker and Spierdijk (2009). They investigated banking structure in Vietnam the period of 1991-2004 for the data of 24 banks (the number of observations was 135) with current input prices but they could not observe the three input price directly. They provided an H-statistic of 0.74, using interest income as the dependent variable. This suggested that the Vietnamese banking system operates in monopolistic competition. Our H-statistic is 0.81 for LN(INT/TA) from 1999 to 2003 with assets and current input prices This indicates that the Vietnamese banking system is in monopolistic competition but also suggests that the industry is not different from perfect competition.

There is an apparent inconsistency in the results. The full sample results (1999-2009) clearly suggest that the market is in monopolistic competition. However, both sub-sample results (1999-2003 and 2004-2009) indicate that the industry is monopolistic. We are inclined to favour the full sample results that is based on more data (especially as equilibrium cannot be rejected) and infer that the market is characterised by monopolistic competition. The sub-sample results use less data and are regarded only as indicate of the degree competition possibly rising slightly through time.

Table 4.8 Summary of results from the equilibrium approach

		Current input prices				Lagged input prices			
		With assets		Without assets		With assets		Without assets	
		LN(REV/TA)	LN(INT/TA)	LN(REV)	LN(INT)	LN(REV/TA)	LN(INT/TA)	LN(REV)	LN(INT)
Full sample 1999-2009	H-sta.	**0.5894**	**0.6170**	**0.9558**	**0.9845**	**0.1602**	**0.1301**	**0.4534**	**0.4303**
	H=0	77.5933***	83.0765***	68.1544***	71.4808***	3.4767*	1.904	12.136***	9.814***
		Reject	Reject	Reject	Reject	Accept	Accept	Reject	Reject
	H=1	37.6452***	31.9989***	0.1459	0.0177	95.566***	85.1607***	17.633***	17.207***
		Reject	Reject	Accept	Accept	Reject	Reject	Reject	Reject
non-SOCBs 1999-2009	H-sta.	**0.6206**	**0.6519**	**1.1386**	**1.1648**	**0.1857**	**0.1590**	**0.5426**	**0.5197**
	H=0	60.6231***	36.1378***	91.7403***	97.335***	3.409*	2.1285	15.318***	12.808***
		Reject	Reject	Reject	Reject	Accept	Accept	Reject	Reject
	H=1	22.6558***	7.9148***	1.3586	1.9482	65.523***	59.506***	10.883***	10.941***
		Reject	Reject	Accept	Accept	Reject	Reject	Reject	Reject
SOCBs 1999-2009	H-sta.	**0.5674**	**0.6812**	**0.6364**	**0.7481**	**-0.1490**	**-0.1738**	**-0.1360**	**-0.1590**
	H=0	30.5662***	36.1378***	18.6345***	24.0660***	0.741	0.694	0.377	0.3804
		Reject	Reject	Reject	Reject	Accept	Accept	Accept	Accept
	H=1	17.7617***	7.9148***	6.0811***	2.7284**	44.061***	31.641***	26.234***	20.074***
		Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject
Sub-sample 1999-2003	H-sta.	**0.3644**	**0.8167**	**0.5623**	**1.0090**	**0.0533**	**0.2244** (OLS)	**0.0310**	**-0.0500**
	H=0	3.5107*	17.5072***	5.2342***	17.1553***	0.0177	2.510	0.0047	0.008
		Accept	Reject	Reject	Reject	Accept	Accept	Accept	Accept
	H=1	10.6834***	0.8818	3.1707*	0.0014	5.578**	30.242***	4.5459**	3.574*
		Reject	Accept	Accept	Accept	Reject	Reject	Reject	Accept
Sub-sample 2004-2009	H-sta.	**0.6187**	**0.6092**	**0.7517**	**0.7363**	**0.0030**	**-0.0160**	**0.049**	**0.0288**
	H=0	58.4683***	61.312***	26.7634***	27.985***	0.000	0.029	0.118	0.0425
		Reject	Reject	Reject	Reject	Accept	Accept	Accept	Accept
	H=1	22.1985***	25.2377***	2.9208*	3.5896*	105.54***	114.604***	43.291***	48.164***
		Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject

Note: All the models use 2-way-FE except the sub-sample 1999-2003 assuming lagged input prices for LN(INT/TA) which is pooled OLS. All are in equilibrium except the sub-sample 1999-2003 using lagged input prices for LN(REV/TA), LN(REV) and LN(INT).

4.4. Conclusion

In this chapter the Panzar-Rosse approach has been applied in order to investigate the degree of competition faced by the cooperative financial institutions in Vietnam. The approach is based on the comparative static properties of a reduced-form revenue function. The larger H-statistics ($H\geq1$) derived from this function imply more perfect, while lower statistics ($H\leq0$) indicate market conditions closer to monopoly. In addition, the range $0<H<1$ indicates monopolistic competition. This study extends the previous literature by considering new additional variables. Environmental factors such as total assets, capital/assets, loans/deposits and the number of branches that are incorporated in our models have not been employed in previous studies of Vietnam. In addition, to compare the outcome models, we examine dependent variables including revenue divided by total assets (REV/TA) and interest income divided by total assets (INT/TA). This is also the first study that excludes assets (and avoid the bias) in a study of the Vietnamese banking system.

The inclusion of total assets in all the models transforms our inference regarding the market toward being more competitive as predicted by Bikker *et al.* (2006a) and Goddard and Wilson (2009). Our favoured models for inference use lagged input prices (to avoid endogeneity) exclude assets (to avoid bias) and are based on '2-way-FE' specification. The E-statistic suggests the banking industry is in equilibrium and so inference from H-statistics is valid. Over the full sample the industry is characterised by monopolistic competition with non-SOCBs behaving more competitively than SOCBs (the latter being monopolistic). There is some tentative evidence that the Vietnamese banking system may have become slightly more competitive through time.

As for the three input prices, LN(IE/FF) is positive and significant in the full sample and sub-sample non-SOCBs while it is negative and significant in the sub-sample 2004-2009. These suggest that unit cost of fund has the most direct impact on revenue and interest income. LN(PE/TE) is positive and significant in the revenue models of the full sample, Non-SOCBs and sub-sample 2004-2009 and interest income model of non-SOCBs. LN(CE/FA) is negative and significant in all the models. Regarding the other variables, CL/CD is negative and significant in all the models except for the sub-samples SOCBs and 1999-2003 while TC/TA is generally negative and significant in the models that exclude assets[23]. LN(BR) is positive and significant in all the models except for the sub-sample SOCBs. This is consistent with structural models and our expectation. Banks opens more branches when they also grow their revenue and interest income except for SOCBs.

[23] As our experiments, TC/TA is positive and significant in all the models that include assets, which indicates capital/asset ratio has a positive relation with revenue, interest income and profit before tax

Chapter 5 Bank structure: Non-structural model (Disequilibrium approach)

5.1. Introduction

This Chapter will focus on the degree of market competition of bank using non-structural models within the disequilibrium approach. The Arellano and Bond (1991) estimator will be applied to find valid H-statistics for the models with and without assets using the full sample (1999-2009) and the sub-samples (1999-2003; 2004-2009; five SOCBs and 43 non-SOCBs). We also employ both current and lagged input prices to test for evidence of endogeneity of input prices. We will examine the 'system' and 'difference' generalised method of moments (GMM) estimators with both 'one-step' and 'two-step' specifications. The inclusion of time period dummy variables for all periods in addition to economic covariates appears to undermine the precision of coefficient estimates. Hence, the general-to-specific method (GSM) will be applied to remove redundant time period dummy variables in each model in an attempt to improve the efficiency of estimation and obtain meaningful H-statistics. Moreover, we also assess whether the H-statistics from the equilibrium or disequilibrium approaches should be used for inference.

This Chapter is organised as follows: section 5.1 is the introduction; section 5.2 deals with methodology; section 5.3 presents empirical results; and section 5.4 sets out the conclusion.

5.2. Methodology

Some econometric problems may arise from estimating the equations **(4.4, 4.6, 4.10** and **4.11)** from Chapter 4 (Roodman, 2006 and Stewart, 2011). These include:

- ✓ The process may be dynamic, with current realisations of the dependent variable influenced by past ones.
- ✓ Some regressors may be endogenous.
- ✓ The idiosyncratic disturbances (those apart from the fixed-effects) may have individual-specific patterns of heteroscedasticity and serial correlation. It is assumed that there are two orthogonal components to the residuals: the idiosyncratic component that varies across time and sections and fixed-effects.
- ✓ The idiosyncratic disturbances are uncorrelated across individuals.
- ✓ Some regressors may be predetermined but not strictly exogenous: even if independent of current disturbances, the still may be influenced by past ones. The lagged dependent variable is an example.

The difference and system GMM estimators can be applied using either the one-step method (with robust coefficient standard errors) or the two-step method (with Windmeijer small sample corrected coefficient standard errors). The efficient GMM estimator is equivalent to two-stage least squares (2SLS) when the residuals are homoscedastic (with no autocorrelation or cross-correlation). If the residuals do not satisfy these assumptions then using some initial consistent estimate of the residuals' variance-covariance matrix (allowing for heteroscedasticity, for example) in the GMM estimator yields the one-step GMM estimator. This coefficient estimator will be asymptotically efficient and consistent as long as the initial estimates of the coefficients are consistent (even when the number of time-series observation is small). Coefficient standard errors will not be robust to autocorrelation and heteroscedasticity but, by using the variance-covariance matrix based upon the one-step estimator's residuals in the appropriate standard error formula, will yield robust standard errors.

Using the residuals obtained from the one-step GMM estimator to construct a new variance-covariance matrix to be used with the GMM formula yields the two-step GMM estimator. The two-step coefficient estimator is asymptotically efficient and robust to whatever heteroscedasticity, autocorrelation and cross-correlation that is modelled by the new variance-covariance matrix. Hence, the two-step estimator should yield superior coefficient estimates relative to the one-step estimator.

In practice, researchers would report both the one-step GMM estimator (with robust coefficient standard errors) and the two-step GMM estimator because of a downward bias that afflicts the standard errors calculated by the two-step method[24]. However, using Windmeijer (2005) corrected standard errors with two-step GMM greatly reduces this problem with biased coefficient standard errors. A feasible approximation of Windmeijer's small sample correction for two-step GMM's coefficient standard errors has been shown to perform well in simulations (Roodman, 2006:10).

Consider the following properties of standard estimators applied to a dynamic model (incorporating a lagged dependent variable) that should include cross-sectional fixed-effects.

- ✓ The (pooled) OLS estimator (without fixed-effects) will suffer from dynamic panel bias and will be inconsistent for small T (the number of time periods) in the sense that increasing N (the number of cross-sectional units) will not make the estimator consistent. Because it is assumed that T is small in panels with small T and large N consistency typically refers to what happens when N tends to infinity. When T is large dynamic models retain their consistency property, as occurs when using time-series models. Indeed, when T is large the bias and inconsistency will decline and so dynamic panel (endogeneity) bias will not be a major issue. The coefficient on the lagged dependent variable will be biased upwards if pooled OLS is applied to a dynamic model without accounting for fixed-effects in finite samples.

- ✓ The fixed-effects estimator will also suffer from dynamic panel bias and inconsistency (as N tends to infinity) when T is small. As for pooled OLS, as T increases the bias and inconsistency of the fixed-effects estimator disappears. However, Roodman (2006:17-18) notes that even when T = 30 substantial bias (20%) can still remain in the estimator. In contrast to pooled OLS, the coefficient on the lagged dependent variable will be biased downwards if the fixed-effects estimator is applied to a dynamic model in finite samples.

[24] This arises when the number of instruments is large and can render the two-step estimator useless for inference. Thus, even though GMM will be more efficient than 2SLS asymptotically, when errors are non-spherical it may not be so in finite samples because reweighting the estimators using the estimated residual variance/covariance matrix may result in overfitting the sample (data mining) using GMM. That is, GMM may give too much weight to observations that fit the model and too little to observations that do not fit the model.

Interestingly the bias of the pooled OLS and fixed-effects estimators works in opposite directions. Thus, as a first step it is recommended to estimate the model using both estimators and use the estimated coefficient on the lagged dependent variable to provide a range within which one would normally expect the true coefficient to fall. We follow this recommendation in our analysis of panel data with small T where both OLS and fixed effect may be expected to be biased.

In the application of GMM Sargan and Hansen tests test whether the instruments are exogenous. If the residuals are homoscedastic and non-autocorrelated (spherical) the variance covariance matrix is essentially a scalar and the two tests are equivalent. However, if the residuals are not spherical the Sargan test is inconsistent and Hansen's J-statistic provides a superior test[25]. Both tests can be applied to subsets of instruments to determine whether a particular set of instruments are exogenous. Further, both tests become weaker, in the sense that inference is biased towards accepting the null that the instruments are exogenous, as the number of instruments increase. As a guide, if the number of instruments exceeds the number of cross-sections (N) in the panel then there are arguably *far* too many instruments (Roodman, 2006). Generally there should be fewer instruments than cross-sections, although there is no clear rule as to an appropriate (maximum) number of instruments. We report the number of instruments and ensure that this number does not exceed the number of cross-sectional units (banks).

In our application, we apply both difference and system GMM estimators using both the one-step (with robust standard errors) and two-step (with Windmeijer correction) procedures. By using robust standard errors we do not assume spherical disturbances and so the Hansen test is our favoured method for assessing the validity of instruments. The criteria that we require for a model to be valid are:

- ✓ The coefficient on the lagged dependent variable estimated by GMM (denoted L1) must fall in the range of the lagged dependent variable's coefficient estimated by Ordinary least squares (L1 OLS) and by the fixed-effects estimator (L1 period FE).

[25] Arellano and Bond (1991) showed that the one-step (two-step) Sargan test over- (under-) rejects the null of valid instruments in the presence of heteroscedasticity. Hence, if heteroscedasticity is present the Sargan test applied after the one-step (two-step) estimator may indicate the invalidity (validity) of instruments when the instruments are truly valid (invalid).

- ✓ There is no second-order autocorrelation, denoted AR(2), or evidence of invalid instruments, denoted Hansen (these tests' probability values are higher than 0.05).
- ✓ The number of instruments is smaller number of cross-sectional units.

If more than one model satisfies these criteria we choose our favoured specification for inference as follows:

- ✓ If the test of the null hypothesis that there are no period fixed-effects (H_0 period FE) is rejected at the 5% level we favour the model including period dummy variables. Otherwise we prefer the one without period dummies.
- ✓ We prefer the model with the smallest coefficient standard error on the lagged dependent variable.

Lastly, if the coefficient on the lagged dependent variable is insignificant (the t-statistic is less than two in magnitude) we prefer the equilibrium model results (discussed in Chapter 4). Otherwise, we favour the disequilibrium results (reported in this Chapter). The Stata econometric software is employed to estimate the non-structural models (disequilibrium approach) (Baum, 2006; Cameron and Trivedi, 2009).

5.3. Empirical results

5.3.1. Arellano and Bond (1991) GMM estimations (with assets) for the full sample

Table 5.1 reports the estimated revenue equations (with assets) and associated H-statistics for the Vietnamese banking system from 1999 to 2009. Columns 2 to 5 of the table show the results, using 'LN(REV/TA)' as the dependent variable. The next four columns of the table give the results when 'LN(INT/TA)' is the regressand. We examine the 'system' and 'difference' estimators[26] in both 'one-step' and 'two-step' specifications[27]. In the table, 1S

[26] Nolevel (or noleveleq) tells Stata to apply the difference GMM estimator. By default xtabond2 will apply the system GMM estimator, if you do not specify nolevel.

(2S) denotes the one (two) step system estimator and 1D (2D) indicates the one (two) step difference estimator. The time dummy variables from D1999 to D2009 are added to explicitly incorporate period fixed-effects in addition to accounting for (eliminating) cross-sectional fixed-effects in the model. The two dummies D1999 and D2009 are automatically dropped by Stata software due to collinearity. The rows labelled instruments and groups indicate the number of instruments and cross-sectional units respectively. The Arellano and Bond test for second-order autocorrelation (AR(2)) and Hansen's test for instrument validity (Hansen) are also presented in the table[28]. 'H_0 period FE' specification refers to the F-test of the null hypothesis that all period fixed-effects dummy variables are jointly redundant. The next row gives the coefficients on the first lagged dependent variable in the models estimated by Ordinary Least Square (L1 OLS) and fixed-effects (L1 FE) estimators. The H-statistics are also reported along with two t-tests of the hypotheses that the H-statistic is significantly different from both zero (H=0) and one (H=1), respectively[29]. We also report the Wald test of whether the model has significant explanatory power and the number of observations (Obs.) at the bottom of the table.

The models estimated using the two-step procedure with both the difference and system estimators are reported in columns 2 and 3 of Table 5.1. The coefficients on the lagged dependent variable using the 'two-step' estimator with LN(REV/TA) as the dependent variable [denoted L1 LN(REV/TA)] are 0.0811 (the 'difference' estimator) and 0.1293 (the 'system' estimator). These fall inside the range of the corresponding variable's coefficient estimated by OLS (0.2526) and FE (0.0799), as is desirable for a model to be valid. However, this criterion is not met for the corresponding models estimated using the 'one-step' estimator, presented in columns 4 and 5 of Table 5.1. The corresponding coefficients on the lagged

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[27] Two-step specifies that the two-step estimator is calculated instead of the default one-step. In two-step estimation, the standard covariance matrix is robust to panel-specific autocorrelation and heteroskedasticity, but the standard errors are downward biased. We use two-step robust to get the finite-sample corrected two-step covariance matrix used to produce the Windmeijer coefficient standard errors.

[28] The Sargan test has a null hypothesis of "the instruments as a group are exogenous". Therefore, the higher the p-value of the Sargan statistic provides the better the result is. In robust estimation Stata reports the Hansen statistic instead of the Sargan test and both tests have the same null hypothesis. The Arellano – Bond test for autocorrelation has a null hypothesis of no autocorrelation and is applied to the differenced residuals. The test for AR(2) in first differences is important because it will detect autocorrelation in levels. These models are valid when these tests p-values are higher than 0.05 (see Roodman, 2006; Stewart, 2011).

[29] To estimate t-statistics for the H-statistics to test when they are statistically different from to zero or one, we need to calculate the coefficients in static long-run equilibrium and standard errors. Firstly, coefficients of the three input prices and one lagged dependent variable in the initial model will be used to calculate the coefficients in static long-run equilibrium. Secondly, variance of the H-statistic, variance of the lagged dependent variable and covariance between the H-statistic and lagged dependent variable will be used to estimate the standard errors. These calculations are explained in Appendix IV.

dependent variable for the one-step system and one-step difference estimators are 0.0779 and 0.0654, respectively. The number of instruments is smaller than the number of cross-sectional units for all models, as is required for a model to be valid. Further, the AR(2) and Hansen tests indicate that there is no evidence of autocorrelation or instrument invalidity. All of the F-tests reject the exclusion of the period fixed-effects suggesting that period dummy variables should be kept in the models. Hence, the '2-way-FE' specifications that use the 'two-step' estimator are valid while those using the 'one-step' estimator are not when LN(REV/TA) is the dependent variable. We therefore use the models based on the 'two-step' estimator with LN(REV/TA) as the dependent variable for inference. The H-statistic is approximately 0.54 for both of the models based on the two-step estimator. The H-statistics for both specifications are significantly different from both zero and one. This implies that the Vietnamese banking system is in monopolistic competition over the period 1999-2009.

As for the coefficients on the three input prices, the logarithmic cost of fund (LN(IE/FF)) has the largest value, and is positive and significant in both models. Accordingly, interest expense per total fund has the greatest impact on revenue. The coefficients on personnel expense per person (LN(PE/TE)) and capital expense per fixed asset (LN(CE/FA)) are both insignificant in both models. Regarding the other variables, TC/TA and LN(BR) are positively and significantly related to revenue while CL/CD and LN(TA) have negative relations with revenue.

The models using LN(INT/TA) as the dependent variable are presented in columns 6 to 9 of Table 5.1. All of the coefficients on the first lagged dependent variables (0.0806, 0.1114, 0.0646 and 0.0756) are outside of the range of the corresponding variable's coefficients estimated by OLS and FE (0.1115). Further, the Hansen tests for both models based on the difference estimator indicate that the instruments are invalid. The invalidity of all of these models might be due to the inclusion of some time period dummy variables that could be excluded and are undermining the precision of coefficient estimates. Indeed, in the model based on the one-step system estimator the time dummy variables are jointly insignificant at the 5% level (although they are jointly significant at the 10% level).

The models based on the 'one-step' estimator for LN(REV/TA) are invalid as are all specifications using LN(INT/TA). We experiment to find valid specifications (and H-statistics) for these models by excluding time period dummy variables that are insignificant. Our procedure is loosely based upon the general-to-specific method (GSM) in that we consider the models by sequentially deleting dummies based upon their degree of statistical insignificance. For comparison purposes and consistency we also apply the GSM to specifications based upon the 'two-step' estimator with LN(REV/TA) as the dependent variable.[30]

[30] Appendix III explains the procedure of general-to-specific method (GSM).

Table 5.1 GMM estimations (with assets) for the full sample

	LN(REV/TA)				LN(INT/TA)			
	2S	2D	1S	1D	2S	2D	1S	1D
L1 LN(REV/TA)	0.0811 (0.9853) {0.0823}	0.1293 (1.273) {0.1016}	**0.0779** (0.8699)	**0.0654** (0.8603)				
L1 LN(INT/TA)					**0.0806** (0.9853)	**0.1114** (1.468)	**0.0646** (0.7239)	**0.0756** (0.9953)
LN(PE/TE)	0.0657 (1.031)	0.0059 (0.0392)	0.0751 (1.228)	0.0113 (0.0924)	0.0923 (1.262)	0.0468 (0.4081)	0.0696 (1.304)	-0.0028 (-0.035)
LN(IE/FF)	0.4291*** (5.396)	0.4249*** (5.088)	0.423*** (7.544)	0.3634*** (5.355)	0.5338*** (6.237)	0.4764*** (4.693)	0.5234*** (6.995)	0.4833*** (5.608)
LN(CE/FA)	0.0042 (0.1404)	0.0412 (0.9305)	-0.0229 (-0.7745)	0.0756* (1.715)	0.0034 (0.0958)	0.047 (0.8161)	-0.0261 (-0.8109)	0.0533 (1.066)
TC/TA	0.5255*** (4.394)	0.3665* (1.824)	0.5151*** (6.988)	0.2974** (1.958)	0.5515*** (5.47)	0.3612 (1.636)	0.5012*** (7.284)	0.2672 (1.515)
CL/CD	-0.091* (-1.741)	-0.1094** (-2.091)	-0.125*** (-2.682)	-0.1176*** (-3.004)	-0.0501 (-0.9048)	-0.0723 (-1.261)	-0.1126** (-2.207)	-0.1055** (-2.436)
LN(TA)	-0.0973** (-2.678)	-0.1947 (-1.533)	-0.1299*** (-2.857)	-0.3487** (-2.399)	-0.09** (-2.09)	-0.2415*** (-3.432)	-0.1295*** (-2.811)	-0.36** (-2.523)
LN(BR)	0.0916** (2.455)	0.0514 (0.6769)	0.1187*** (2.801)	0.1386 (1.467)	0.0933** (2.148)	0.1419* (1.8)	0.1204*** (2.858)	0.2016** (2.179)
D1999								
D2000	0.1066 (0.7367)	-0.4018 (-0.8581)	0.0772 (0.6725)	-0.8576* (-2.029)	0.2481* (1.796)	-0.2741 (-0.8975)	0.0801 (0.6496)	-0.7667* (-1.829)
D2001	0.1681 (1.285)	-0.2715 (-0.6133)	0.1743 (1.547)	-0.7081* (-1.763)	0.2563** (1.99)	-0.2162 (-0.7484)	0.1179 (1.018)	-0.6811* (-1.713)
D2002	0.1849 (1.47)	-0.2854 (-0.7359)	0.1423 (1.316)	-0.6869* (-1.931)	0.1883* (1.762)	-0.2611 (-1.017)	0.081 (0.7237)	-0.657* (-1.794)
D2003	0.1014 (1.022)	-0.2698 (-0.7631)	0.1124 (1.204)	-0.6273* (-1.902)	0.1828* (1.927)	-0.2362 (-1.06)	0.1198 (1.255)	-0.5334 (-1.593)
D2004	0.0711 (0.7777)	-0.2787 (-0.8969)	0.0438 (0.5633)	-0.6099* (-2.098)	0.1368* (1.686)	-0.2124 (-1.059)	0.0584 (0.7366)	-0.5221* (-1.79)
D2005	0.1022 (1.256)	-0.1729 (-0.6712)	0.0576 (0.6914)	-0.4626* (-1.855)	0.1605** (2.305)	-0.1328 (-0.8267)	0.0729 (0.875)	-0.38 (-1.513)
D2006	0.0342 (0.4927)	-0.1791 (-0.9957)	0.0193 (0.3552)	-0.3533* (-2.146)	0.0635 (1.064)	-0.1586 (-1.287)	0.0085 (0.1502)	-0.3127* (-1.853)
D2007	0.0727 (1.341)	-0.0714 (-0.6365)	0.094 (1.702)	-0.1164 (-1.428)	0.0628 (1.348)	-0.0411 (-0.4254)	0.0674 (1.292)	-0.1058 (-1.298)
D2008	0.1339 (2.348)	0.0863 (1.174)	0.1154 (2.326)	0.0373 (0.6366)	0.1247** (2.249)	0.0874 (1.708)	0.0891 (1.551)	0.0158 (0.2415)
D2009								
constant	-0.13 (-0.2366)		0.2393 (0.4901)		-0.2636 (-0.4716)		0.3763 (0.7143)	
Instruments	35	25	33	25	35	25	33	25
Groups	46	44	46	44	46	44	46	44
AR(2)	0.853 Valid	0.995 Valid	0.845 Valid	0.647 Valid	0.996 Valid	0.847 Valid	0.923 Valid	0.939 Valid
Hansen	0.383 Valid	0.250 Valid	0.383 Valid	0.250 Valid	0.262 Valid	**0.024** **Invalid**	0.262 Valid	**0.024** **Invalid**
H_0 period FE	32.67*** [0.0002] Reject	28.14*** [0.0009] Reject	32.88*** [0.0001] Reject	33.00*** [0.0001] Reject	20.79** [0.0136] Reject	18.45** [0.0303] Reject	**16.26*** **[0.0617]** **Accept**	26.00*** [0.0020] Reject
L1 OLS	0.2526	0.2526	0.2526	0.2526	0.2478	0.2478	0.2478	0.2478
L1 period FE	0.0799	0.0799	0.0799	0.0799	0.1115	0.1115	0.1115	0.1115
H-statistic	**0.5430**	**0.5421**						
H=0	3.7528*** Reject	2.4205*** Reject						
H=1	-3.1589*** Reject	-2.0445*** Reject						
Wald test	1134.82	509.95	1217.62	644.27	1145.96	540.46	1934.24	925.79
Obs.	327	280	327	280	327	280	327	280

*Coefficients, t-statistics (round brackets), standard errors (curly brackets) and probabilities (square brackets) are reported in the table; *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Sources: Financial statements of 48 Vietnamese commercial banks from 1999 to 2009; (2S): Two-step system estimator; (2D): Two-step difference estimator; (1S): One-step system estimator; (1D): One-step difference estimator.*

Tables 5.2, 5.3 and 5.4 report the estimated revenue equations (with assets) and corresponding H-statistics for the Vietnamese banking system from 1999 to 2009 using LN (REV/TA) as the dependent variable after applying the general-to-specific-type method to exclude redundant dummy variables from the model. The row denoted "H_0 redundant period dummies" reports the joint test for the exclusion of several time dummy variables from the models. We first remove dummy variables with t-statistics less than one in magnitude, being D2000, D2004 and D2006, and report the resulting model in the third column of Table 5.2. The coefficient on the lagged dependent variable (0.0845) lies outside the range of the corresponding variable in the same model estimated by OLS (0.2239) and FE (0.1102). So this model is not valid. Secondly, we additionally remove dummy variables with absolute t-ratios below 1.5 (being D2007 and D2009 and then D2003 as well). These models are reported in the fourth and fifth columns of Table 5.2. The coefficients on the lagged dependent variables are also outside of the range of this variables' coefficient estimated by OLS and FE. Thus, these models are also regarded as invalid. Lastly, D2002, D2005 and D2008 are also removed because their t-statistics are less than two in absolute value. This leaves only one time dummy variable in the model that has a t-statistic higher than two in magnitude, being D2001. This model is reported in column 6 of Table 5.2. In this model, the coefficient on the lagged dependent variable is also outside of desired range and so the equation and its H-statistic regarded as invalid for inference. Hence, none of the equations (and H-statistics) estimated using the two-step system estimator that exclude dummies (Table 5.2) are regarded as valid for inference because the estimated lagged dependent variable is not in the desired range.

There is a similar situation in Table 5.3 where the one-step system estimator results with LN(REV/TA) are reported. We first exclude D2000, D2004, D2005 and D2006 and then D2007 and D2009 are additionally discarded. These models are reported in columns 3 and 4 of Table 5.3. In all cases, the equations and H-statistics are considered invalid because the coefficients on the lagged dependent variables are outside of the required range. For the model reported in the column 4 of Table 5.3 we find that the remaining time dummy variables are jointly insignificant. Hence we report a model that excludes all time period fixed-effects in column 5. However, the equation is still invalid because the dependent variable's coefficient is outside of the desired range.

In Table 5.4, we report the models with dummy variables sequentially deleted that are estimated using the 'difference' estimator. In the specifications based on the two-step method we first remove time dummy variables with t-statistics below 0.8 in absolute value (being, D2001, D2002, D2003, D2005 and D2007) and second we additionally eliminate those with t-ratios below 1.5 in magnitude (D2009). These models are reported in the third and fourth columns of Table 5.4 and both are valid according to all of our criteria. They have approximately the same H-statistics (being 0.61) and the H-statistics are significantly different from both zero and one. This suggests that the Vietnamese banking system operates in an environment of monopolistic competition. In column 5 of Table 5.4 we report a model estimated with the two-step procedure with D2006 also discarded (which has t-statistic that is less than two in absolute value). However, the coefficient on the lagged dependent variable (0.0908) is outside of the range of the corresponding OLS (0.2215) and FE (0.0995) estimates. Hence, we consider that this model, and its H-statistic, is invalid.

The results of the models based on the one-step difference estimator are also reported in Table 5.4. There are three models with dummy variables deleted. The first removes D2001, D2002 D2003 and D2005 the second additionally eliminates D2007 while the third also excludes D2000. These specifications are reported in columns 7 to 9 of Table 5.4, respectively. All three models are valid for inference according to the various criteria that we employ. The H-statistics of the three models are similar, being 0.83, 0.85 and 0.86. All of these H-statistics are significantly different from zero but not significantly different from one. Hence, whilst all the models indicate an environment of monopolistic competition they also suggest that the environment is not significantly different from perfect competition.

In general, we favour the models based upon the one-step difference estimator because they exhibit the smallest coefficient standard error for the lagged dependent variable. In particular, we prefer to draw our inference from the model reported in column 7 of Table 5.4 which features the lowest standard error for the dependent variable of all the models, being 0.0652. The H-statistic is 0.83 which is not significantly different from one. This suggests that the Vietnamese banking system is in monopolistic competition, if relatively competitive such that the environment is not significantly different from perfect competition. As for the three input prices in this model, the logarithmic cost of fund (LN(IE/FF)) has the largest value and is positive and significant. Hence, interest expense per total fund has the greatest impact on revenue. Personnel expense per person (LN(PE/TE)) and capital expense per fixed asset (LN(CE/FA)) are insignificant. All other variables are significant. TC/TA and LN(BR) are positive and this indicates that capital and branch networks have positive relations with revenue. In contrast CL/CD and LN(TA) have negative coefficients which suggest that customer loans and total assets are inversely related to revenue.

Table 5.2 GMM estimations (with assets) for the full sample (LN(REV/TA), 2S)

	2S				
L1 LN(REV/TA)	0.0811	0.0845	0.0729	0.0546	0.0124
	(0.9853)	(0.7571)	(1.043)	(0.6086)	(0.2078)
	{0.0823}				
LN(PE/TE)	0.0657	0.0434	0.0258	0.0276	0.0836
	(1.031)	(0.7428)	(0.4326)	(0.3979)	(1.25)
LN(IE/FF)	0.4291***	0.4141***	0.3969***	0.4026***	0.4655***
	(5.396)	(5.617)	(5.853)	(5.885)	(6.445)
LN(CE/FA)	0.0042	-0.0088	-0.0128	-0.0101	-0.0197
	(0.1404)	(-0.2948)	(-0.3863)	(-0.2971)	(-0.6077)
TC/TA	0.5255***	0.4841***	0.4788***	0.4797***	0.5074***
	(4.394)	(3.784)	(3.54)	(3.124)	(4.91)
CL/CD	-0.091*	-0.1035**	-0.0921*	-0.0892*	-0.1242***
	(-1.741)	(-2.03)	(-1.796)	(-1.852)	(-2.825)
LN(TA)	-0.0973**	-0.1098**	-0.1101***	-0.1102***	-0.1418***
	(-2.678)	(-2.546)	(-2.853)	(-2.823)	(-3.14)
LN(BR)	0.0916**	0.1014**	0.1014**	0.1044**	0.1353***
	(2.455)	(2.16)	(2.487)	(2.438)	(2.879)
D2000	0.1066				
	(0.7367)				
D2001	0.1681	0.084**	0.0816**	0.083**	0.1078**
	(1.285)	(2.529)	(2.406)	(2.406)	(2.452)
D2002	0.1849	0.0948	0.0926	0.1129*	
	(1.47)	(1.593)	(1.538)	(1.777)	
D2003	0.1014	0.0403	0.0359		
	(1.022)	(0.9991)	(0.9729)		
D2004	0.0711				
	(0.7777)				
D2005	0.1022	0.0458*	0.0469*	0.0347	
	(1.256)	(1.823)	(1.678)	(1.098)	
D2006	0.0342				
	(0.4927)				
D2007	0.0727	0.0291			
	(1.341)	(0.6909)			
D2008	0.1339	0.0891	0.1074**	0.1011*	
	(2.348)	(1.377)	(2.112)	(1.742)	
D2009		-0.0379			
		(-0.4916)			
constant	-0.13	0.1494	0.1276	0.087	0.3687
	(-0.2366)	(0.2837)	(0.2595)	(0.1755)	(0.6726)
H_0 redundant period dummies		0.81	2.70	0.95	6.22
		[0.8460]	[0.2598]	[0.3306]	[0.1016]
	—	Accept	Accept	Accept	Accept
Instruments	35	33	31	30	27
Groups	46	46	46	46	46
AR(2)	0.853 Valid	0.874 Valid	0.668 Valid	0.658 Valid	0.355 Valid
Hansen	0.383 Valid	0.383 Valid	0.337 Valid	0.355 Valid	0.073* Valid
H_0 period FE	32.67***	33.78***	15.14***	10.79**	6.01**
	[0.0002]	[0.0000]	[0.0098]	[0.0290]	[0.0142]
	Reject	Reject	Reject	Reject	Reject
L1 OLS	0.2526	0.2239	0.2294	0.2253	0.2018
L1 period FE	0.0799	0.1102	0.0972	0.0959	0.0831
H-statistic	**0.5430**				
H=0	3.7528***				
	Reject				
H=1	-3.1589***				
	Reject				
Wald test	1134.82	1168.32	699.40	617.77	405.08
Obs.	327	327	327	327	327

See notes to Table 5.1.

Table 5.3 GMM estimations (with assets) for the full sample (LN(REV/TA), 1S)

	1S			
L1 LN(REV/TA)	**0.0779**	**0.0633**	**0.0538**	**0.0553**
	(0.8699)	(0.7701)	(0.8688)	(1.21)
LN(PE/TE)	0.0751	0.0656	0.0669	0.0626
	(1.228)	(1.249)	(1.203)	(1.131)
LN(IE/FF)	0.423***	0.4198	0.4179	0.4362
	(7.544)	(7.752)	(7.896)	(9.459)
LN(CE/FA)	-0.0229	-0.0242	-0.0225	-0.0158
	(-0.7745)	(-0.8242)	(-0.7541)	(-0.5011)
TC/TA	0.5151***	0.5087	0.4866	0.4959
	(6.988)	(6.504)	(6.345)	(6.847)
CL/CD	-0.125***	-0.1284	-0.126	-0.1269
	(-2.682)	(-2.861)	(-2.999)	(-3.334)
LN(TA)	-0.1299***	-0.1323	-0.1415	-0.1472
	(-2.857)	(-2.937)	(-3.011)	(-3.183)
LN(BR)	0.1187***	0.1198	0.1287	0.1312
	(2.801)	(2.8)	(2.718)	(2.829)
D1999				
D2000	0.0772			
	(0.6725)			
D2001	0.1743	0.1197	0.1147	
	(1.547)	(2.487)	(2.329)	
D2002	0.1423	0.0936	0.0849	
	(1.316)	(1.393)	(1.261)	
D2003	0.1124	0.0652	0.0579	
	(1.204)	(1.628)	(1.371)	
D2004	0.0438			
	(0.5633)			
D2005	0.0576			
	(0.6914)			
D2006	0.0193			
	(0.3552)			
D2007	0.094	0.0586		
	(1.702)	(0.7297)		
D2008	0.1154	0.0821	0.076	
	(2.326)	(1.582)	(1.547)	
D2009		-0.0294		
		(-0.4811)		
constant	0.2393	0.3091	0.3977	0.5914
	(0.4901)	(0.708)	(0.8978)	(1.319)
H_0 redundant period dummies	---	0.75 [0.9453] Accept	2.39 [0.3020] Accept	---
Instruments	33	32	30	26
Groups	46	46	46	46
AR(2)	0.845 Valid	0.729 Valid	0.625 Valid	0.474 Valid
Hansen	0.383 Valid	0.119Valid	0.058* Valid	0.059* Valid
H_0 period FE	32.88*** [0.0001] Reject	29.77*** [0.0000] Reject	**7.35** **[0.1183]** **Accept**	---
L1 OLS	0.2526	0.2470	0.2205	0.2022
L1 period FE	0.0799	0.0891	0.0970	0.0847
H-statistic				
H=0				
H=1				
Wald test	1217.62	820.94	661.49	464.64
Obs.	327	327	327	327

See notes to Table 5.1.

Table 5.4 GMM estimations (with assets) for the full sample (LN(REV/TA), difference estimator)

	2D				1D			
L1 LN(REV/TA)	0.1293 (1.273) {0.1016}	0.1856** (1.996) {0.093}	0.1031 (1.003) {0.1028}	**0.0908** (0.8893)	**0.0654** (0.8603)	0.1679** (2.573) {0.0652}	0.1313* (1.887) {0.0695}	0.1413* (1.816) {0.0778}
LN(PE/TE)	0.0059 (0.0392)	0.0552 (0.626)	0.0645 (0.7041)	0.0579 (0.571)	0.0113 (0.0924)	0.1909 (1.324)	0.2237* (1.717)	0.2256* (1.724)
LN(IE/FF)	0.4249*** (5.088)	0.4152*** (6.913)	0.4392*** (6.516)	0.4423*** (6.36)	0.3634*** (5.355)	0.4105*** (6.668)	0.4345*** (6.784)	0.4353*** (6.671)
LN(CE/FA)	0.0412 (0.9305)	0.0266 (0.5757)	0.0416 (0.9566)	0.0562 (1.287)	0.0756* (1.715)	0.0864 (1.444)	0.0786 (1.362)	0.0788 (1.354)
TC/TA	0.3665* (1.824)	0.4667* (1.835)	0.3683 (1.509)	0.4569* (1.753)	0.2974** (1.958)	0.5071*** (4.013)	0.439*** (3.811)	0.4358*** (3.757)
CL/CD	-0.1094** (-2.091)	-0.0918** (-2.409)	-0.0903** (-2.589)	-0.0951** (-2.404)	-0.1176*** (-3.004)	-0.0971*** (-2.63)	-0.0845** (-2.443)	-0.0816** (-2.396)
LN(TA)	-0.1947 (-1.533)	-0.1325** (-2.388)	-0.1344** (-2.023)	-0.1232 (-1.544)	-0.3487** (-2.399)	-0.2648** (-2.268)	-0.2836** (-2.443)	-0.2848** (-2.453)
LN(BR)	0.0514 (0.6769)	0.0824 (1.14)	0.083 (0.8388)	0.0885 (0.7945)	0.1386 (1.467)	0.2456* (1.673)	0.2841* (1.916)	0.29* (1.963)
D1999								
D2000	-0.4018 (-0.8581)	-0.1098** (-2.296)	-0.0949** (-2.183)	-0.0958** (-2.131)	-0.8576* (-2.029)	-0.0781* (-1.711)	-0.0597 (-1.4)	
D2001	-0.2715 (-0.6133)				-0.7081* (-1.763)			
D2002	-0.2854 (-0.7359)				-0.6869* (-1.931)			
D2003	-0.2698 (-0.7631)				-0.6273* (-1.902)			
D2004	-0.2787 (-0.8969)	-0.0709** (-2.561)	-0.0659** (-2.585)	-0.055** (-2.24)	-0.6099* (-2.098)	-0.0809** (-2.59)	-0.0922*** (-2.795)	-0.0874*** (-2.635)
D2005	-0.1729 (-0.6712)				-0.4626* (-1.855)			
D2006	-0.1791 (-0.9957)	-0.0542* (-1.837)	-0.0496* (-1.881)		-0.3533* (-2.146)	-0.0554* (-1.826)	-0.0711** (-2.329)	-0.0703** (-2.263)
D2007	-0.0714 (-0.6365)				-0.1164 (-1.428)	0.0668 (0.8261)		
D2008	0.0863 (1.174)	0.1468** (2.156)	0.1322*** (2.966)	0.1174*** (2.724)	0.0373 (0.6366)	-0.0571 (-0.8839)	-0.0728** (-2.3)	-0.0794** (-2.456)
D2009		-0.0131 (-0.2014)						
constant								
H_0 redundant period dummies	---	2.34 [0.8008] Accept	0.04 [0.8404] Accept	3.54* [0.06] Accept	---	5.04 [0.4105] Accept	0.68 [0.4088] Accept	1.96 [0.1615] Accept
Instruments	25	21	20	19	25	21	20	19
Groups	44	44	44	44	44	44	44	44
AR(2)	0.995 Valid	0.526 Valid	0.909 Valid	0.898 Valid	0.647 Valid	0.683 Valid	0.932 Valid	0.850 Valid
Hansen	0.250 Valid	0.530 Valid	0.542 Valid	0.345 Valid	0.250 Valid	0.530 Valid	0.129 Valid	0.161 Valid
H_0 period FE	28.14*** [0.0009] Reject	18.83*** [0.0021] Reject	13.72*** [0.0083] Reject	11.84*** [0.0079] Reject	33.00*** [0.0001] Reject	19.27*** [0.0017] Reject	16.00*** [0.0030] Reject	15.10*** [0.0017] Reject
L1 OLS	0.2526	0.2524	0.2192	0.2215	0.2526	0.2524	0.2490	0.2493
L1 period FE	0.0799	0.1029	0.0988	0.0995	0.0799	0.1029	0.1041	0.1048
H-statistic	**0.5421**	**0.6103**	**0.6080**			**0.8265**	**0.8481**	**0.8614**
H=0	2.4205*** Reject	3.9542*** Reject	7.2951*** Reject			4.1443*** Reject	6.6103*** Reject	6.8075*** Reject
H=1	-2.0445*** Reject	-2.5252*** Reject	-4.7038*** Reject			-0.8698 Accept	-1.1840 Accept	-1.0954 Accept
Wald test	509.95	541.89	455.71	334.76	644.27	442.98	384.20	395.26
Obs.	280	280	280	280	280	280	280	280

See notes to Table 5.1.

Tables 5.5 to 5.7 present the estimated revenue equations (with assets) and associated H-statistics for the Vietnamese banking system from 1999 to 2009 based on LN(INT/TA) after employing the GSM to discard time dummy variables that are insignificant. In Table 5.5 in the specifications using the two-step system estimator we exclude time dummy variables with t-ratios less than two in absolute value (being D2000, D2001, D2002, D2003, D2004, D2006 and D2007) and find that the remaining time dummy variables are jointly insignificant at the 10% level. Thus we report a model that excludes time period fixed-effects. These models are presented in the third and fourth columns of Table 5.5. Similarly, for models using the one-step system estimator we eliminate all time dummy variable as they are also jointly insignificant at the 10% level and report the resulting model in the column 6 of Table 5.5. All of the coefficients on the first lagged dependent variables (0.0252, 0.0007, 0.0646 and 0.0374) fall outside of the ranges of the corresponding variable's coefficients estimated by OLS and FE and so all of these models are regarded as invalid.

The models using the two-step difference estimator are reported in Table 5.6. We first discard dummy variables with t-statistics below one in magnitude (being D2000, D2001, D2005 and D2007 and then D2003 and D2008 as well). These models are presented in the third and fourth columns of Table 5.6. Only the model in column 3 of Table 5.6 is valid for inference according to all of our criteria. The H-statistic (being 0.81) is significantly different from zero but not significantly different from one. So, the Vietnamese banking system behaves as if monopolistic competition but is not significantly different from perfect competition. In the model reported in column 4 the remaining time dummy variables are jointly insignificant. Thus we report a model that excludes all time period fixed-effects in column 5. However, the equations given in columns 4 and 5 are invalid because the coefficients on the lagged dependent variables lie outside of the desired ranges.

Table 5.7 shows the models based on the one-step difference estimator for LN(INT/TA). Firstly, we remove time dummy variables with t-statistics lower than 1.6 in magnitude, being D2003, D2005 and D2007 and report the resulting model in column 3 of Table 5.7. However, there is evidence of invalid instruments as indicated by the Hansen test (0.024) and so this model is invalid. Secondly, D2008 is additionally eliminated. This model is valid for inference according to all of our criteria and is presented in the fourth column of Table 5.7. The H-statistic is 0.98 which is significantly different from zero but not significantly different from one. Thirdly, we discard D2001 and report the model in column 5 of Table 5.7. The coefficient on lagged dependent variable (0.1226) is outside the range of the corresponding variable in the same model estimated by OLS (0.2366) and FE (0.1284). Hence this model is considered invalid. Lastly, in column 6 of Table 5.7 we report a model which excludes D2000, D2002 and D2004 because their t-statistics are less than two in absolute value. This model is valid and its H-statistic is 0.94 which is significantly different from zero but not significantly different from one. The H-statistics from columns 4 and 6 of Table 5.7 suggest that the Vietnamese banking system is in an environment of monopolistic competition but they also indicate that the Vietnamese banking system is not significantly different from perfect competition.

The models using the one-step difference estimator with LN(INT/TA) (Table 5.7) are favoured for inference as they have the smallest coefficient standard errors for the lagged dependent variable. In particular, we prefer the model reported in column 6 of Table 5.7 which has the lowest standard error for the dependent variable of all the models with this dependent variable, being 0.0657. The H-statistic is 0.94 which is not significantly different from one. This suggests an environment of monopolistic competition, if highly competitive such that the environment is not significantly different from perfect competition. As for the coefficients on the three input prices, the logarithmic cost of fund has the largest value, and is positive and significant. Thus, interest expense per total fund has the greatest impact on interest income. Personnel expense per person is significantly different from zero at the 10% level. Capital expense per fixed asset is insignificant. All other variables are significant. TC/TA and LN(BR) are positive and this means that capital and branch networks have positive relations with total interest income. CL/CD and LN(TA) are negative which indicates that increases in customer loans and total assets reduce interest income.

As we mentioned earlier in the methodology, Arellano and Bond (1991) GMM estimator is preferred for inference if the coefficient on the lagged dependent variable is significantly different from zero (t-statistic is higher than two in magnitude). If this is not the case, we favour fixed effect estimator for inference. In our full sample, the H-statistic is 0.83 where LN(REV/TA) is the dependent variable and 0.94 for the model with LN(INT/TA). The coefficients on lagged dependent variables are both significantly different from zero and this indicates that we use the disequilibrium instead of equilibrium approach to evaluate the Vietnamese banking system. Thus we can conclude that the Vietnamese banking system is in monopolistic competition but the environment is not different from perfect competition over the period 1999 to 2009.

Table 5.5 GMM estimations (with assets) for the full sample (LN (INT/TA), system estimator)

	2S			1S	
L1 LN(INT/TA)	**0.0806**	**0.0525**	**0.0007**	**0.0646**	**0.0374**
	(0.9853)	(0.6935)	(0.0185)	(0.7239)	(0.905)
LN(PE/TE)	0.0923	0.0405	0.0567	0.0696	0.0614
	(1.262)	(0.609)	(0.9729)	(1.304)	(1.162)
LN(IE/FF)	0.5338***	0.5267***	0.5754***	0.5234***	0.5368***
	(6.237)	(6.744)	(8.609)	(6.995)	(8.737)
LN(CE/FA)	0.0034	-0.0158	-0.0074	-0.0261	-0.0218
	(0.0958)	(-0.425)	(-0.1666)	(-0.8109)	(-0.6548)
TC/TA	0.5515***	0.4828***	0.4557***	0.5012***	0.4805***
	(5.47)	(4.757)	(5.82)	(7.284)	(6.533)
CL/CD	-0.0501	-0.0892	-0.1031***	-0.1126**	-0.1103***
	(-0.9048)	(-1.421)	(-2.644)	(-2.207)	(-2.798)
LN(TA)	-0.09**	-0.1198**	-0.1468***	-0.1295***	-0.1463***
	(-2.09)	(-2.331)	(-2.967)	(-2.811)	(-3.176)
LN(BR)	0.0933**	0.1166*	0.1396***	0.1204***	0.133***
	(2.148)	(1.93)	(2.615)	(2.858)	(2.925)
D1999					
D2000	0.2481*			0.0801	
	(1.796)			(0.6496)	
D2001	0.2563**			0.1179	
	(1.99)			(1.018)	
D2002	0.1883*			0.081	
	(1.762)			(0.7237)	
D2003	0.1828*			0.1198	
	(1.927)			(1.255)	
D2004	0.1368*			0.0584	
	(1.686)			(0.7366)	
D2005	0.1605**	0.0505*		0.0729	
	(2.305)	(1.737)		(0.875)	
D2006	0.0635			0.0085	
	(1.064)			(0.1502)	
D2007	0.0628			0.0674	
	(1.348)			(1.292)	
D2008	0.1247**	0.0543		0.0891	
	(2.249)	(0.7224)		(1.551)	
D2009		-0.0442			
		(-0.8516)			
constant	-0.2636	0.3853	0.6921	0.3763	0.6662
	(-0.4716)	(0.7137)	(1.457)	(0.7143)	(1.43)
H_0 redundant period dummies	---	8.01 [0.3321] Accept	---	---	---
Instruments	35	29	26	33	26
Groups	46	46	46	46	46
AR(2)	0.996 Valid	0.861 Valid	0.533 Valid	0.923 Valid	0.594 Valid
Hansen	0.262 Valid	0.167 Valid	0.156 Valid	0.262 Valid	0.156 Valid
H_0 period FE	20.79** [0.0136] Reject	**6.61*** **[0.0855]** **Accept**	---	**16.26*** **[0.0617]** **Accept**	---
L1 OLS	0.2478	0.2384	0.1888	0.2478	0.1887
L1 period FE	0.1115	0.1348	0.1104	0.1115	0.1104
H-statistic					
H=0					
H=1					
Wald test	1145.96	817.36	719.87	1934.24	376.60
Obs.	327	327	327	327	327

See notes to Table 5.1.

Table 5.6 GMM estimations (with assets) for the full sample (LN(INT/TA), 2D)

	2D			
L1 LN(INT/TA)	0.1114 (1.468)	0.1975* (1.762) {0.1121}	**0.0176** (0.2665)	**-0.0129** (-0.1647)
LN(PE/TE)	0.0468 (0.4081)	0.1142 (1.208)	0.1236 (1.418)	0.1205 (1.298)
LN(IE/FF)	0.4764*** (4.693)	0.5022*** (5.174)	0.5964*** (7.231)	0.5988*** (7.525)
LN(CE/FA)	0.047 (0.8161)	0.0357 (0.6609)	0.0306 (0.5719)	0.0233 (0.3777)
TC/TA	0.3612 (1.636)	0.4101* (1.862)	0.3794** (2.143)	0.4306* (1.87)
CL/CD	-0.0723 (-1.261)	-0.0743 (-1.343)	-0.0967** (-2.029)	-0.1015** (-2.469)
LN(TA)	-0.2415*** (-3.432)	-0.2019*** (-2.804)	-0.2245*** (-3.833)	-0.2032*** (-2.834)
LN(BR)	0.1419* (1.8)	0.1482 (1.297)	0.243*** (2.733)	0.2322** (2.108)
D1999				
D2000	-0.2741 (-0.8975)			
D2001	-0.2162 (-0.7484)			
D2002	-0.2611 (-1.017)	-0.0601 (-1.199)	-0.0191 (-0.4161)	
D2003	-0.2362 (-1.06)	-0.0242 (-0.3754)		
D2004	-0.2124 (-1.059)	-0.0591 (-1.373)	-0.0382 (-1.008)	
D2005	-0.1328 (-0.8267)			
D2006	-0.1586 (-1.287)	-0.0699** (-2.469)	-0.0356 (-1.355)	
D2007	-0.0411 (-0.4254)			
D2008	0.0874 (1.708)	0.0993 (0.9427)		
D2009		-0.0406 (-0.4189)		
constant				
H_0 redundant period dummies	---	2.78 [0.5952] Accept	7.62* [0.0546] Accept	---
Instruments	25	22	19	16
Groups	44	44	44	44
AR(2)	0.847 Valid	0.389 Valid	0.600 Valid	0.583 Valid
Hansen	**0.024 Invalid**	0.129 Valid	0.104 Valid	0.139 Valid
H_0 period FE	18.45** [0.0303] Reject	13.38** [0.0374] Reject	**2.33** **[0.5067]** **Accept**	---
L1 OLS	0.2478	0.2433	0.1904	0.1888
L1 period FE	0.1115	0.1324	0.1149	0.1104
H-statistic		**0.8126**		
H=0		3.4781*** Reject		
H=1		-0.8023 Accept		
Wald test	540.46	544.08	560.09	292.38
Obs.	280	280	280	280

See notes to Table 5.1.

Table 5.7 GMM estimations (with assets) for the full sample (LN(INT/TA), 1D)

	1D				
L1 LN(INT/TA)	**0.0756**	0.2262***	0.2049***	0.1226**	0.1572**
	(0.9953)	(3.738)	(3.055)	(2.068)	(2.392)
			{0.0670}		{0.0657}
LN(PE/TE)	-0.0028	0.1454	0.1709	0.2088**	0.2074*
	(-0.035)	(1.136)	(1.535)	(2.028)	(1.961)
LN(IE/FF)	0.4833***	0.5383***	0.5501***	0.5221***	0.5355***
	(5.608)	(7.004)	(7.712)	(8.003)	(7.648)
LN(CE/FA)	0.0533	0.0605	0.0555	0.0545	0.0535
	(1.066)	(0.9619)	(0.8795)	(0.9064)	(0.8583)
TC/TA	0.2672	0.4488***	0.4142***	0.3874***	0.4083***
	(1.515)	(3.835)	(3.411)	(3.142)	(3.296)
CL/CD	-0.1055**	-0.0947**	-0.085**	-0.0728*	-0.078**
	(-2.436)	(-2.078)	(-2.036)	(-1.914)	(-2.093)
LN(TA)	-0.36**	-0.311***	-0.3206***	-0.3203***	-0.3167***
	(-2.523)	(-2.671)	(-2.825)	(-2.849)	(-2.843)
LN(BR)	0.2016**	0.3032**	0.3257**	0.3493**	0.3505**
	(2.179)	(2.026)	(2.304)	(2.388)	(2.396)
D1999					
D2000	-0.7667*	-0.1196	-0.1003	-0.0533	
	(-1.829)	(-1.363)	(-1.147)	(-1.066)	
D2001	-0.6811*	-0.0824	-0.0676		
	(-1.713)	(-1.13)	(-0.8929)		
D2002	-0.657*	-0.0996*	-0.0898	-0.0626	
	(-1.794)	(-1.73)	(-1.5)	(-1.465)	
D2003	-0.5334				
	(-1.593)				
D2004	-0.5221*	-0.0878**	-0.0888**	-0.0612*	
	(-1.79)	(-2.158)	(-2.174)	(-1.789)	
D2005	-0.38				
	(-1.513)				
D2006	-0.3127*	-0.0749***	-0.0816***	-0.0613**	-0.0567**
	(-1.853)	(-2.989)	(-3.204)	(-2.141)	(-2.123)
D2007	-0.1058				
	(-1.298)				
D2008	0.0158	0.0382			
	(0.2415)	(0.437)			
D2009		-0.0643	-0.0765**	-0.0703**	-0.0827**
		(-0.9803)	(-2.18)	(-2.131)	(-2.518)
constant					
H_0 redundant period dummies	---	2.82 [0.4207] Accept	0.19 [0.6621] Accept	0.8 [0.3719] Accept	5.92 [0.1156] Accept
Instruments	25	23	22	21	18
Groups	44	44	44	44	44
AR(2)	0.939 Valid	0.204 Valid	0.172 Valid	0.488 Valid	0.431 Valid
Hansen	**0.024 Invalid**	**0.014 Invalid**	0.055* Valid	0.217 Valid	0.270 Valid
H_0 period FE	26.00*** [0.0020] Reject	23.37*** [0.0015] Reject	21.78*** [0.0013] Reject	12.50** [0.0285] Reject	9.74*** [0.0074] Reject
L1 OLS	0.2478	0.2398	0.2362	0.2366	0.2351
L1 period FE	0.1115	0.1302	0.1287	0.1284	0.1281
H-statistic			**0.9766**		**0.9449**
H=0			7.2463*** Reject		6.8143*** Reject
H=1			-0.1736 Accept		-0.3972 Accept
Wald test	925.79	709.21	593.22	394.34	398.87
Obs.	280	280	280	280	280

See notes to Table 5.1.

5.3.2. Arellano and Bond (1991) GMM estimations (without assets) for the full sample

Table 5.8 reports the estimated revenue equations (without assets) and corresponding H-statistics for the Vietnamese banking system from 1999 to 2009. Columns 2 to 5 of Table 5.8 give the results of the models when LN(REV) is the regressand. The coefficients on the lagged dependent variables using the 'difference' estimator are 0.7674 (two-step difference estimator) and 0.8462 (one-step difference estimator) which are higher than corresponding variable's coefficient estimated by OLS (0.7608)[31]. Moreover, the Hansen test for both models based on 'difference' estimator indicates that the instruments are invalid. Hence, the models for LN(REV) based on the difference estimator are invalid. In contrast, the models using the 'system' estimator are valid for inference according to all of our criteria. The number of instruments is smaller than the number of cross-sectional units for both the 'two-step' and 'one-step' specifications, as is required for a model to be valid. Moreover, the AR(2) and Hansen tests indicate that there is no evidence of autocorrelation or instrument invalidity. All of the F-tests reject the exclusion of the period fixed-effects suggesting that period dummy variables should be kept in the models. Hence, the '2-way-FE' specifications that use the 'system' estimator are valid while those using the 'difference' estimator are not. We therefore use the models based on the 'system' estimator for inference. The H-statistic is 1.10 for the model using the two-step system estimator and 1.06 based upon the one-step system estimator. These H-statistics are significantly different from zero but not significantly different from one and so they suggest that the Vietnamese banking system is in perfect competition between 1999 and 2009. As for the coefficients on the three input prices, the logarithmic price of labour has the largest value, and is positive and significant at the 5% level in both models. Thus, personnel expense per person has the greatest impact on the revenue. Interest expense per total fund and CL/CD are significantly different from zero at the 10% level in the model based upon the one-step system estimator but are not significantly different from zero in the model using the two-step system estimator. All other variables are jointly insignificant. We will use GSM to seek for valid specifications and H-statistics based on the 'difference' estimator. We also employ GSM for the models using the 'system' estimator for comparison purposes and consistency.

[31] The coefficient on the lagged dependent variable estimated by OLS is always higher than that estimated by FE.

The models when LN(INT) is the dependent variable are reported in columns 6 to 9 of Table 5.8. All the Hansen tests show that the instruments are invalid. In addition, the coefficients on the lagged dependent variables of the models using the 'difference' estimator (0.867 and 0.8268) are outside of the range of the corresponding variable's coefficients estimated by OLS (0.7564) and FE (0.5468). The invalidity of these models might be due to the inclusion of several time dummy variables that could be removed. GSM will be applied to the time dummy variables in each model to find valid specifications and H-statistics.

Table 5.8 GMM estimations (without assets) for the full sample

	LN(REV)				LN(INT)			
	2S	2D	1S	1D	2S	2D	1S	1D
L1 LN(REV)	0.5879***	**0.7674*** **	0.6178***	**0.8462*** **				
	(8.931)	(5.459)	(9.421)	(6.181)				
	{0.0658}		{0.0655}					
L1 LN(INT)					0.6465***	**0.867*** **	0.6274***	**0.8268*** **
					(8.325)	(5.198)	(9.44)	(5.907)
LN(PE/TE)	0.3113**	0.0103	0.2454**	0.1045	0.2456*	0.1352	0.2522**	0.1816
	(2.411)	(0.0538)	(2.391)	(0.5829)	(1.862)	(1.031)	(2.587)	(1.401)
LN(IE/FF)	0.1192	0.1701	0.1301*	0.1669*	0.1931***	0.2815*	0.2087**	0.303**
	(1.371)	(1.286)	(1.829)	(1.787)	(2.585)	(1.891)	(2.464)	(2.545)
LN(CE/FA)	0.0234	0.0496	0.0311	0.0544	0.0352	0.093	0.0242	0.0289
	(0.5655)	(0.748)	(0.9688)	(1.013)	(0.7089)	(1.183)	(0.6733)	(0.4391)
TC/TA	-0.3145	-0.5231	-0.2382	-0.2988	-0.2059	-0.1166	-0.216	-0.2453
	(-1.21)	(-0.6745)	(-1.454)	(-0.708)	(-0.9818)	(-0.2579)	(-1.459)	(-0.6662)
CL/CD	-0.0803	-0.0132	-0.078*	5.80E-04	-0.0749	0.0261	-0.0757	-0.0013
	(-1.324)	(-0.1754)	(-1.693)	(0.0088)	(-1.341)	(0.3797)	(-1.623)	(-0.0187)
LN(TA)								
LN(BR)	0.3301***	0.1779	0.3174***	0.2412**	0.2787***	0.2596**	0.3121***	0.3511***
	(4.855)	(1.195)	(5.017)	(2.396)	(3.563)	(2.109)	(4.926)	(3.15)
D1999								
D2000	0.0742	0.0099	0.0941	0.5842	0.1616	0.8006	0.1728	0.9293*
	(0.3608)	(0.0187)	(0.7116)	(1.054)	(0.8339)	(1.385)	(1.338)	(1.867)
D2001	0.0321	-0.0346	0.0171	0.5017	-0.0312	0.605	0.0073	0.7241
	(0.1597)	(-0.0728)	(0.1322)	(0.9979)	(-0.1591)	(1.199)	(0.0597)	(1.626)
D2002	-0.0204	-0.0469	-0.0475	0.4202	-0.0061	0.5898	-0.0199	0.6754*
	(-0.1089)	(-0.1172)	(-0.4421)	(0.9744)	(-0.0324)	(1.252)	(-0.1806)	(1.655)
D2003	0.0702	0.0252	0.0426	0.5202	0.1433	0.7241	0.1488	0.8271**
	(0.5155)	(0.0576)	(0.4313)	(1.155)	(0.9653)	(1.585)	(1.374)	(2.075)
D2004	0.031	0.0263	0.0083	0.4206	0.0621	0.5924	0.0718	0.6488*
	(0.2537)	(0.0738)	(0.1025)	(1.1)	(0.5269)	(1.563)	(0.9369)	(1.919)
D2005	0.1059	0.1399	0.0793	0.4837	0.1528	0.6258*	0.1278*	0.6687**
	(1.08)	(0.4428)	(1.073)	(1.46)	(1.545)	(1.821)	(1.683)	(2.237)
D2006	0.2425***	0.2414	0.2208***	0.5418*	0.2438***	0.5956**	0.2335***	0.6521***
	(2.627)	(0.9159)	(3.408)	(2.046)	(2.975)	(2.079)	(3.918)	(2.68)
D2007	0.4031***	0.4314**	0.4273***	0.6637***	0.4181***	0.694***	0.433***	0.7312***
	(3.806)	(2.126)	(5.542)	(2.967)	(4.609)	(3.206)	(5.556)	(3.528)
D2008	0.3116***	0.3319***	0.2677***	0.3836***	0.3355***	0.4498***	0.2922***	0.4042***
	(3.791)	(3.013)	(3.844)	(3.108)	(4.665)	(3.041)	(4.285)	(2.96)
D2009								
constant	3.707***		3.673***		3.545***		3.678***	
	(4.128)		(5.417)		(3.996)		(5.485)	
Instruments	34	24	34	24	35	25	33	25
Groups	46	44	46	44	46	44	46	44
AR(2)	0.340 Valid	0.273 Valid	0.355 Valid	0.253 Valid	0.291 Valid	0.234 Valid	0.257 Valid	0.246 Valid
Hansen	0.055* Valid	**0.012 Invalid**	0.055* Valid	**0.012 Invalid**	**0.038 Invalid**	**0.031 Invalid**	**0.038 Invalid**	**0.031 Invalid**
H_0 period FE	39.83*** [0.0000] Reject	66.09*** [0.0000] Reject	60.86*** [0.0000] Reject	79.71*** [0.0000] Reject	60.35*** [0.0000] Reject	48.27*** [0.0000] Reject	55.62*** [0.0000] Reject	63.88*** [0.0000] Reject
L1 OLS	0.7608	0.7608	0.7608	0.7608	0.7564	0.7564	0.7564	0.7564
L1 period FE	0.5663	0.5663	0.5663	0.5663	0.5468	0.5468	0.5468	0.5468
H-statistic	**1.1016**		**1.0640**					
H=0	2.8444*** Reject		3.7042*** Reject					
H=1	0.2623 Accept		0.2229 Accept					
Wald test	4416.25	3258.19	8760.91	5145.79	5003.08	2690.38	8125.77	3875.10
Obs.	327	280	327	280	327	280	327	280

See notes to Table 5.1.

Tables 5.9 and 5.10 present the estimated revenue equations (without assets) and associated H-statistics for the Vietnamese banking system from 1999 to 2009 employing LN (REV) as the dependent variable after applying the GSM-type method to discard redundant dummy variables from the model. In the specification based on the two-step system estimator we first eliminate dummy variables with t-statistics less than one in absolute value (being D2000 to D2004) and report the resulting model in the third column of Table 5.9. This model is valid according to the various criteria that we employ. The H-statistic is 1.10 which is significantly different from zero but insignificantly different from one. The Vietnamese banking industry is in perfect competition. Secondly, we exclude D2009 and then D2005. These models are reported in the fourth and fifth columns of Table 5.9. The coefficients on the lagged dependent variables fall outside the range of this variables' coefficient estimated by OLS and FE and both are invalid. Table 5.9 also reports the one-step system estimator results for LN(REV). D2000 to D2004 are eliminated first because their t-ratios are below one in magnitude. The model is valid according to all criteria and is reported in column 7 of table 5.9. The H-statistic (being 1.09) is significantly different from zero but insignificantly different from one. This suggests that the Vietnamese banking industry behaves as if in perfect competition. Secondly, we exclude D2005 and D2009 and report the results of the model in the last column of Table 5.9. The coefficient on the lagged dependent variable (0.5461) lies outside of the desired range of the corresponding variable in the same model estimated by OLS (0.7497) and FE (0.5761). Hence, this model is not valid.

The results of the models based on the 'difference' estimator are presented in Table 5.10. In the specifications using the two-step difference estimator there are three models with dummy variables deleted. The first removes D2000 to D2004 the second additionally discards D2008 while the third also excludes D2006. The results of these models are reported in columns 3 to 5 of Table 5.10. All of these models show evidence of invalid instruments according to the Hansen test. In addition, the coefficient on the lagged dependent variable in column 5 (0.7559) lies outside of the range of this variables' coefficient estimated by OLS (0.7336) and FE (0.5937). Thus these models are invalid. The models based on the one-step difference estimator are also reported in Table 5.10. We first exclude time dummy variables with t-statistics less than 1.2 in magnitude, being D2000 to 2004 and report this model in column 7 of Table 5.10. The coefficient on the lagged dependent variable (0.7805) is also outside of the range of this variables' coefficient estimated by OLS (0.7577) and FE (0.5659) and so this model and its H-statistic are regarded as invalid. We additionally eliminate D2005 and D2008 and results of this model are presented in the last column of Table 5.10. This model is not valid as a result of invalid instruments according to the Hansen test (the p-value is 0.013).

In brief, we prefer the models using the one-step system estimator as they have the smallest coefficient standard error for the lagged dependent variable. In particular, the model reported in column 6 of Table 5.9 is chosen as it features the lowest standard error for the dependent variable of all the models, being 0.0655. The H-statistic (1.06) is significantly different from zero but not significantly different from one. This model was discussed in the section where LN(REV) is the dependent variable and includes all the time dummy variables (Table 5.8). Hence, deleting dummy variables did not improve models for LN(REV).

Table 5.9 GMM estimations (without assets) for the full sample (LN(REV), system estimator)

	2S				1S		
L1 LN(REV)	0.5879***	0.5683***	**0.5739*** **	**0.532*** **	0.6178***	0.574***	**0.5461*** **
	(8.931)	(7.629)	(7.565)	(7.15)	(9.421)	(8.471)	(8.288)
	{0.0658}	{0.0745}			{0.0655}	{0.0677}	
LN(PE/TE)	0.3113**	0.3409***	0.3172***	0.3764***	0.2454**	0.2844***	0.3098***
	(2.411)	(2.975)	(3.286)	(4.079)	(2.391)	(2.834)	(3.634)
LN(IE/FF)	0.1192	0.0971	0.0935	0.111	0.1301*	0.1535**	0.1827**
	(1.371)	(1.0880	(1.057)	(1.192)	(1.829)	(2.073)	(2.39)
LN(CE/FA)	0.0234	0.0376	0.0334	0.0193	0.0311	0.0278	0.028
	(0.5655)	(0.9063)	(0.8257)	(0.4662)	(0.9688)	(0.85)	(0.8061)
TC/TA	-0.3145	-0.3225	-0.324	-0.2622	-0.2382	-0.2898*	-0.3086*
	(-1.21)	(-1.312)	(-1.275)	(-1.067)	(-1.454)	(-1.723)	(-1.873)
CL/CD	-0.0803	-0.0909*	-0.0917*	-0.0814	-0.078*	-0.1007**	-0.1078**
	(-1.324)	(-1.95)	(-1.888)	(-1.566)	(-1.693)	(-2.15)	(-2.303)
LN(TA)							
LN(BR)	0.3301***	0.337***	0.3313***	0.3715***	0.3174***	0.3529***	0.3752***
	(4.855)	(4.432)	(4.347)	(4.762)	(5.017)	(5.356)	(5.877)
D1999							
D2000	0.0742				0.0941		
	(0.3608)				(0.7116)		
D2001	0.0321				0.0171		
	(0.1597)				(0.1322)		
D2002	-0.0204				-0.0475		
	(-0.1089)				(-0.4421)		
D2003	0.0702				0.0426		
	(0.5155)				(0.4313)		
D2004	0.031				0.0083		
	(0.2537)				(0.1025)		
D2005	0.1059	0.0689	0.0826*		0.0793	0.0555	
	(1.08)	(1.278)	(1.933)		(1.073)	(0.9892)	
D2006	0.2425***	0.1944***	0.2065***	0.1808***	0.2208***	0.1915***	0.1837***
	(2.627)	(2.984)	(4.16)	(3.448)	(3.408)	(3.166)	(4.491)
D2007	0.4031***	0.3676***	0.3881***	0.3594***	0.4273***	0.3985***	0.3872***
	(3.806)	(3.535)	(4.886)	(4.301)	(5.542)	(4.475)	(5.604)
D2008	0.3116***	0.2861**	0.3117***	0.2582***	0.2677***	0.2316**	0.2019***
	(3.791)	(2.282)	(4.016)	(3.416)	(3.844)	(2.191)	(2.92)
D2009		-0.0251				-0.0122	
		(-0.2639)				(-0.1312)	
constant	3.707***	3.817***	3.831***	4.015***	3.673***	4.075***	4.362***
	(4.128)	(6.122)	(6.173)	(5.725)	(5.417)	(6.105)	(6.54)
H_0 redundant period dummies	---	1.17 [0.9473] Accept	0.07 [0.7919] Accept	3.54* [0.0532] Accept	---	2.75 [0.7378] Accept	1.84 [0.3983] Accept
Instruments	34	30	29	28	34	30	28
Groups	46	46	46	46	46	46	46
AR(2)	0.340 Valid	0.367 Valid	0.372 Valid	0.372 Valid	0.355 Valid	0.326 Valid	0.347 Valid
Hansen	0.055* Valid	0.158 Valid	0.155 Valid	0.092* Valid	0.055* Valid	0.158 Valid	0.092* Valid
H_0 period FE	39.83*** [0.0000] Reject	35.04*** [0.0000] Reject	36.03*** [0.0000] Reject	25.39*** [0.0000] Reject	60.86*** [0.0000] Reject	42.50*** [0.0000] Reject	37.77*** [0.0000] Reject
L1 OLS	0.7608	0.7577	0.7572	0.7497	0.7608	0.7577	0.7497
L1 period FE	0.5663	0.5658	0.5838	0.5761	0.5663	0.5658	0.5761
H-statistic	**1.1016**	**1.1017**			**1.0640**	**1.0932**	
H=0	2.8444*** Reject	3.2775*** Reject			3.7042*** Reject	4.3694*** Reject	
H=1	0.2623 Accept	0.3026 Accept			0.2229 Accept	0.3726 Accept	
Wald test	4416.25	4180.91	4072.54	3891.73	8760.91	6330.98	5579.83
Obs.	327	327	327	327	327	327	327

See notes to Table 5.1.

Table 5.10 GMM estimations (without assets) for the full sample (LN(REV), difference estimator)

	2D				1D		
L1 LN(REV)	**0.7674*** **	0.7045***	0.7125***	**0.7559*** **	**0.8462*** **	**0.7805*** **	0.6618***
	(5.459)	(7.063)	(5.557)	(6.29)	(6.181)	(7.801)	(5.459)
LN(PE/TE)	0.0103	0.2824*	0.3082*	0.2072	0.1045	0.0816	0.2707
	(0.0538)	(1.815)	(1.793)	(1.172)	(0.5829)	(0.5633)	(1.551)
LN(IE/FF)	0.1701	0.1551	0.1674*	0.1431	0.1669*	0.1639*	0.2144***
	(1.286)	(1.479)	(1.661)	(1.458)	(1.787)	(1.709)	(2.686)
LN(CE/FA)	0.0496	0.0046	0.0226	0.0275	0.0544	0.0536	0.0587
	(0.748)	(0.0618)	(0.3102)	(0.3923)	(1.013)	(1.044)	(1.159)
TC/TA	-0.5231	-0.6972	-0.5964	-0.3247	-0.2988	-0.3404	-0.342
	(-0.6745)	(-0.8796)	(-0.9722)	(-0.6107)	(-0.708)	(-0.8503)	(-1.01)
CL/CD	-0.0132	0.0946	0.0793	0.0715	5.80E-04	-0.0039	-0.0048
	(-0.1754)	(1.397)	(1.23)	(1.058)	(0.0088)	(-0.0667)	(-0.091)
LN(TA)							
LN(BR)	0.1779	0.2846**	0.292*	0.2962*	0.2412**	0.2564**	0.3456***
	(1.195)	(2.138)	(1.818)	(1.935)	(2.396)	(2.541)	(3.034)
D1999							
D2000	0.0099				0.5842		
	(0.0187)				(1.054)		
D2001	-0.0346				0.5017		
	(-0.0728)				(0.9979)		
D2002	-0.0469				0.4202		
	(-0.1172)				(0.9744)		
D2003	0.0252				0.5202		
	(0.0576)				(1.155)		
D2004	0.0263				0.4206		
	(0.0738)				(1.1)		
D2005	0.1399				0.4837	0.06	
	(0.4428)				(1.46)	(0.988)	
D2006	0.2414	0.0887	0.0586		0.5418*	0.1488	0.1014***
	(0.9159)	(1.32)	(0.9913)		(2.046)	(1.621)	(2.093)
D2007	0.4314**	0.2442***	0.2055***	0.1703***	0.6637***	0.3076***	0.2539***
	(2.126)	(2.85)	(2.652)	(2.832)	(2.967)	(2.835)	(4.35)
D2008	0.3319***	0.0758			0.3836***	0.0819	
	(3.013)	(0.5599)			(3.108)	(0.5061)	
D2009		-0.2933*	-0.3633***	-0.4003***		-0.2653	-0.2727***
		(-1.775)	(-4.215)	(-5.128)		(-1.285)	(-3.399)
constant							
H_0 redundant period dummies	---	9.45 [0.1497] Accept	0.31 [0.5755] Accept	0.98 [0.3215] Accept	---	2.55 [0.7687] Accept	1.59 [0.5802] Accept
Instruments	24	19	18	17	24	20	18
Groups	44	44	44	44	44	44	44
AR(2)	0.273 Valid	0.177 Valid	0.168 Valid	0.138 Valid	0.253 Valid	0.202 Valid	0.198 Valid
Hansen	**0.012 Invalid**	**0.019 Invalid**	**0.013 Invalid**	**0.026 Invalid**	**0.012 Invalid**	0.069* Valid	**0.013 Invalid**
H_0 period FE	66.09*** [0.0000] Reject	45.65*** [0.0000] Reject	44.08*** [0.0000] Reject	49.67*** [0.0000] Reject	79.71*** [0.0000] Reject	44.46*** [0.0000] Reject	43.09*** [0.0000] Reject
L1 OLS	0.7608	0.7495	0.7373	0.7336	0.7608	0.7577	0.7373
L1 period FE	0.5663	0.5674	0.5951	0.5937	0.5663	0.5659	0.5951
H-statistic							
H=0							
H=1							
Wald test	3258.19	2705.88	2404.81	2432.32	5145.79	4799.54	3869.28
Obs.	280	280	280	280	280	280	280

See notes to Table 5.1.

Tables 5.11, 5.12 and 5.13 show the estimated revenue equations (without assets) and associated H-statistics for the Vietnamese banking system from 1999 to 2009 using LN (INT) as the dependent variable after applying the GSM-type method to exclude redundant dummy variables from the model. Table 5.11 presents the models based on the two-step system estimator. We first discard time dummy variables with t-statistics below one in absolute value (being D2000 to D2004) and second we additionally eliminate those with t-ratios less than 1.5 in magnitude (being D2009). These models are both valid and reported in columns 3 and 4 of Table 5.11. The H-statistics of these models (being 1.35 and 1.20) are significantly different from zero but insignificantly different from one. This means that the Vietnamese banking industry operates in perfect competition.

Table 5.12 reports the models using the one-step system estimator. We first exclude D2001, D2002 and D2004 and report the resulting model in the third column of Table 5.12. This model is valid according to all of our criteria. The H-statistic is 1.35 which is significantly different from zero but insignificantly different from one. The Vietnamese banking industry is in perfect competition. Secondly, we additionally remove a time dummy variable with a t-ratio less than one in absolute value (being D2009). This model is reported in the fourth column of Table 5.12. The Hansen test of this model (being 0.045) indicates that the instruments are not valid and so the model is not valid. Thirdly, we eliminate time dummy variables with t-ratios below 1.8 in magnitude (being D2003 and then D2000 as well). These models are valid according to all of our criteria and are reported in columns 5 and 6 of Table 5.12. The H-statistics of these two models are similar, being 1.27 and 1.25. These H-statistics are significantly different from zero and not significantly different from one. The Vietnamese banking industry behaves as if in perfect competition. Lastly, D2004 is eliminated as its t-statistic is less than two in absolute value. This model is reported in column 7 of Table 5.12. The coefficient on the lagged dependent variable (0.5479) lies outside the range of this variable' coefficient estimated by OLS (0.7446) and FE (0.5224) and so this model is not valid.

The models of the 'difference' estimator are showed in Table 5.13. In the specification of the two-step difference estimator, we first exclude time dummy variables with t-statistics less than 1.5 in absolute value, being D2000, D2001 and D2002. We second eliminate D2004, D2006 and D2008 and then third D2003 and D2005. All these models are reported in the columns 3 to 5 of Table 5.12. However, the Hansen tests for all of the models using the two-step difference estimator indicate that the instruments and therefore the models are invalid. There is a similar situation for the specifications using the one-step difference estimator reported in Table 5.13. We remove time dummy variables which t-ratios are below two in magnitude (being D2000, D2001, D2002 and D2004 and then D2003, D2005, D2006 and D2008). This leaves only one time dummy variable in the model that has a t-ratio higher than two in absolute value (being D2007). The results of these models are reported in columns 7 and 8 of Table 5.13. All of these models are also invalid as there is evidence of invalid instruments according to Hansen test.

Altogether, we favour the models based on one-step system estimator (Table 5.12) as they exhibit the smallest coefficient standard errors for the lagged dependent variable. In Table 5.12, we prefer the model reported in column 5 which features the lowest standard error for the dependent variable of all the models, being 0.0559. The H-statistic (1.27) is significantly different from zero but not significantly different from one. This suggests that the Vietnamese banking system behaves as if in perfect competition. As for other variables, the logarithmic price of labour and cost of fund are positive and significant. The logarithmic cost of fixed assets and LN(BR) are insignificant. TC/TA and CL/CD are both insignificantly different from zero at the 5% level (although they are significant at the 10% level). Removing the downward bias caused by including total assets in the models has transformed our inference of the Vietnamese banking system from monopolistic competition (models including assets) to perfect competition (models excluding assets). This is consistent with the prediction of Bikker *et al.* (2006a) and Goddard and Wilson (2009).

The disequilibrium approach is preferred for inference if the coefficient on the lagged dependent variable is significantly different from zero (t-statistic is higher than two in magnitude). The H-statistic is 1.06 when using LN(REV) as the dependent variable and 1.27 in the model where LN(INT/TA) is the dependent variable. The t-statistics of coefficients on lagged dependent variables are both significantly different from zero (being 9.421 and 10.97). This suggests that we favour the disequilibrium results. Thus, we can conclude that the Vietnamese banking system operates in perfect competition from 1999 to 2009 when assets are excluded from the models.

Table 5.11 GMM estimations (without assets) for the full sample (LN(INT), 2S)

	2S		
L1 LN(INT)	0.6465***	0.619***	0.6153***
	(8.325)	(7.912)	(7.964)
		{0.0782}	{0.0773}
LN(PE/TE)	0.2456*	0.2771***	0.2312***
	(1.862)	(2.932)	(2.975)
LN(IE/FF)	0.1931***	0.2012**	0.1997**
	(2.585)	(2.482)	(2.391)
LN(CE/FA)	0.0352	0.0368	0.0311
	(0.7089)	(0.7719)	(0.6414)
TC/TA	-0.2059	-0.3031	-0.3151
	(-0.9818)	(-1.277)	(-1.329)
CL/CD	-0.0749	-0.1028*	-0.1127**
	(-1.341)	(-1.931)	(-2.062)
LN(TA)			
LN(BR)	0.2787***	0.2997***	0.2988***
	(3.563)	(3.589)	(3.624)
D1999			
D2000	0.1616		
	(0.8339)		
D2001	-0.0312		
	(-0.1591)		
D2002	-0.0061		
	(-0.0324)		
D2003	0.1433		
	(0.9653)		
D2004	0.0621		
	(0.5269)		
D2005	0.1528	0.0981	0.1305**
	(1.545)	(1.555)	(2.375)
D2006	0.2438***	0.1744**	0.215***
	(2.975)	(2.34)	(4.265)
D2007	0.4181***	0.3358***	0.3912***
	(4.609)	(3.186)	(5.146)
D2008	0.3355***	0.2466**	0.315***
	(4.665)	(1.991)	(4.697)
D2009		-0.0854	
		(-0.7828)	
constant	3.545***	3.843***	4.044***
	(3.996)	(5.1)	(5.517)
H_0 redundant period dummies	---	6.17 [0.2898] Accept	0.61 [0.4337] Accept
Instruments	35	30	29
Groups	46	46	46
AR(2)	0.291 Valid	0.399 Valid	0.377 Valid
Hansen	**0.038 Invalid**	0.080* Valid	0.075* Valid
H_0 period FE	60.35*** [0.0000] Reject	54.68*** [0.0000] Reject	45.79*** [0.0000] Reject
L1 OLS	0.7564	0.7508	0.7513
L1 period FE	0.5468	0.5452	0.5582
H-statistic		**1.3523**	**1.2007**
H=0		3.8232*** Reject	4.6089*** Reject
H=1		0.9959 Accept	0.7704 Accept
Wald test	5003.08	4929.33	4498.88
Obs.	327	327	327

See notes to Table 5.1.

Table 5.12 GMM estimations (without assets) for the full sample (LN(INT), 1S)

	1S					
L1 LN(INT)	0.6274***	0.625***	0.6408***	0.6135***	0.5821***	**0.5479*** **
	(9.44)	(9.976)	(10.27)	(10.97)	(9.855)	(8.802)
		{0.0626}		{0.0559}	{0.059}	
LN(PE/TE)	0.2522**	0.261***	0.2288***	0.244***	0.2667***	0.3063***
	(2.587)	(2.972)	(2.894)	(3.219)	(3.283)	(3.777)
LN(IE/FF)	0.2087**	0.2196**	0.2129**	0.221**	0.2315**	0.2673***
	(2.464)	(2.545)	(2.485)	(2.447)	(2.509)	(2.766)
LN(CE/FA)	0.0242	0.0258	0.0268	0.0268	0.0236	0.0231
	(0.6733)	(0.716)	(0.7432)	(0.7446)	(0.6482)	(0.6041)
TC/TA	-0.216	-0.2187	-0.2089	-0.2501*	-0.2879*	-0.3084**
	(-1.459)	(-1.494)	(-1.441)	(-1.725)	(-1.959)	(-2.06)
CL/CD	-0.0757	-0.0758*	-0.0762*	-0.0877*	-0.1021**	-0.1072**
	(-1.623)	(-1.653)	(-1.676)	(-1.89)	(-2.152)	(-2.218)
LN(TA)						
LN(BR)	0.3121***	0.3145***	0.2998***	0.3211***	0.3462***	0.3745***
	(4.926)	(5.262)	(5.095)	(5.839)	(5.908)	(6.11)
D2000	0.1728	0.1518**	0.153**	0.1235		
	(1.338)	(2.021)	(2.002)	(1.641)		
D2001	0.0073					
	(0.0597)					
D2002	-0.0199					
	(-0.1806)					
D2003	0.1488	0.1292*	0.145*			
	(1.374)	(1.651)	(1.803)			
D2004	0.0718					
	(0.9369)					
D2005	0.1278*	0.1077*	0.1282**	0.0946*	0.0747	
	(1.683)	(1.774)	(2.431)	(1.952)	(1.489)	
D2006	0.2335***	0.2081***	0.2296***	0.1983***	0.1785***	0.1625***
	(3.918)	(3.57)	(5.784)	(5.435)	(4.781)	(4.852)
D2007	0.433***	0.4059***	0.4317***	0.4016***	0.3827***	0.3601***
	(5.556)	(4.56)	(6.205)	(5.948)	(5.536)	(5.007)
D2008	0.2922***	0.256***	0.2841***	0.2571***	0.2396***	0.1934***
	(4.285)	(2.634)	(4.304)	(3.704)	(3.375)	(2.608)
D2009		-0.0301				
		(-0.3421)				
constant	3.678***	3.726***	3.668***	3.949***	4.233***	4.544***
	(5.485)	(5.824)	(6.004)	(6.524)	(6.897)	(6.626)
H_0 redundant period dummies	---	3.48 [0.3238] Accept	0.12 [0.7323] Accept	3.25* [0.0714] Accept	2.69 [0.1009] Accept	2.22 [0.1365] Accept
Instruments	33	32	31	30	29	28
Groups	46	46	46	46	46	46
AR(2)	0.257 Valid	0.262 Valid	0.257 Valid	0.361 Valid	0.380 Valid	0.505 Valid
Hansen	**0.038 Invalid**	0.053* Valid	**0.045 Invalid**	0.059* Valid	0.075* Valid	**0.036 Invalid**
H_0 period FE	55.62*** [0.0000] Reject	58.82*** [0.0000] Reject	63.25*** [0.0000] Reject	55.81*** [0.0000] Reject	41.97*** [0.0000] Reject	34.29*** [0.0000] Reject
L1 OLS	0.7564	0.7537	0.7430	0.7497	0.7513	0.7446
L1 period FE	0.5468	0.5561	0.5519	0.5585	0.5582	0.5524
H-statistic		**1.3505**		**1.2725**	**1.2488**	
H=0		4.4143*** Reject		5.0140*** Reject	5.1087*** Reject	
H=1		1.1457 Accept		1.0737 Accept	1.0177 Accept	
Wald test	8125.77	7009.95	7083.16	6639.40	6350.59	5940.80
Obs.	327	327	327	327	327	327

See notes to Table 5.1.

Table 5.13 GMM estimations (without assets) for the full sample (LN(INT), difference estimator)

	2D				1D		
L1 LN(INT)	**0.867*****	0.745***	0.7573***	0.6989***	**0.8268*****	0.7322***	0.5824***
	(5.198)	(5.084)	(6.395)	(4.992)	(5.907)	(7.313)	(5.708)
LN(PE/TE)	0.1352	0.1733	0.2454	0.2922*	0.1816	0.1163	0.3219***
	(1.031)	(1.333)	(1.645)	(1.843)	(1.401)	(1.016)	(2.879)
LN(IE/FF)	0.2815*	0.2865**	0.2655**	0.2184	0.303**	0.2952**	0.3175***
	(1.891)	(2.223)	(2.175)	(1.431)	(2.545)	(2.446)	(2.906)
LN(CE/FA)	0.093	0.0317	0.0454	0.0247	0.0289	0.0282	0.0417
	(1.183)	(0.3741)	(0.5138)	(0.2585)	(0.4391)	(0.4455)	(0.655)
TC/TA	-0.1166	-0.342	-0.2687	-0.3541	-0.2453	-0.314	-0.3009
	(-0.2579)	(-0.8769)	(-0.5842)	(-0.7535)	(-0.6662)	(-0.9179)	(-1.107)
CL/CD	0.0261	0.0194	0.0615	0.0577	-0.0013	-0.0118	-0.0047
	(0.3797)	(0.2635)	(0.9326)	(0.9775)	(-0.0187)	(-0.2036)	(-0.0957)
LN(TA)							
LN(BR)	0.2596**	0.2282*	0.2709*	0.3358**	0.3511***	0.3541***	0.457***
	(2.109)	(1.684)	(1.707)	(2.007)	(3.15)	(3.258)	(3.696)
D1999							
D2000	0.8006				0.9293*		
	(1.385)				(1.867)		
D2001	0.605				0.7241		
	(1.199)				(1.626)		
D2002	0.5898				0.6754*		
	(1.252)				(1.655)		
D2003	0.7241	0.1535**	0.1116*		0.8271**	0.1286*	
	(1.585)	(2.177)	(1.934)		(2.075)	(1.66)	
D2004	0.5924	0.081			0.6488*		
	(1.563)	(0.7017)			(1.919)		
D2005	0.6258*	0.1572	0.0579		0.6687**	0.0587	
	(1.821)	(1.145)	(1.253)		(2.237)	(1.131)	
D2006	0.5956**	0.1729			0.6521***	0.0981	
	(2.079)	(0.9552)			(2.68)	(1.324)	
D2007	0.694***	0.3118	0.154**	0.1469**	0.7312***	0.2419***	0.1935***
	(3.206)	(1.335)	(2.578)	(2.271)	(3.528)	(2.597)	(3.79)
D2008	0.4498***	0.1674			0.4042***	0.0062	
	(3.041)	(0.5406)			(2.96)	(0.0425)	
D2009		-0.1897	-0.4094***	-0.3964***		-0.3354*	-0.292***
		(-0.4512)	(-4.792)	(-3.748)		(-1.823)	(-3.68)
constant							
H_0 redundant period dummies	---	2.67 [0.4460] Accept	2.07 [0.5578] Accept	4.26 [0.1190] Accept	---	7.43 [0.1150] Accept	6.14 [0.1888] Accept
Instruments	25	22	19	17	25	21	17
Groups	44	44	44	44	44	44	44
AR(2)	0.234 Valid	0.287 Valid	0.212 Valid	0.308 Valid	0.246 Valid	0.302 Valid	0.294 Valid
Hansen	**0.031** **Invalid**	**0.045** **Invalid**	**0.031** **Invalid**	**0.014** **Invalid**	**0.031** **Invalid**	**0.030** **Invalid**	**0.014** **Invalid**
H_0 period FE	48.27*** [0.0000] Reject	55.36*** [0.0000] Reject	47.79*** [0.0000] Reject	31.63*** [0.0000] Reject	63.88*** [0.0000] Reject	61.26*** [0.0000] Reject	39.95*** [0.0000] Reject
L1 OLS	0.7564	0.7573	0.7305	0.7306	0.7564	0.7551	0.7306
L1 period FE	0.5468	0.5398	0.5726	0.5706	0.5468	0.5498	0.5706
H-statistic							
H=0							
H=1							
Wald test	2690.38	2909.60	2088.75	1704.53	3875.10	4077.14	3019.23
Obs.	280	280	280	280	280	280	280

See notes to Table 5.1.

5.3.3. Arellano and Bond (1991) GMM estimations (with assets and with lagged input prices) for the full sample

Table 5.14 reports the estimated revenue equations (with assets and with lagged input prices) for the Vietnamese banking system from 1999 to 2009. The models estimated using LN(REV/TA) as the dependent are presented in columns 2 to 5 and the models using LN(INT/TA) as the regressand are reported in columns 6 to 9 of Table 5.14. All of these models are invalid. The coefficients on the lagged dependent variables using the system estimators fall outside the range of the corresponding variable's coefficient estimated by OLS and FE. The Hansen tests of the models using the difference estimators indicate that the instruments are invalid. We have employed GSM for all the models but we could not find valid models and associated H-statistics for inference.

Table 5.14 GMM estimations (with assets and with lagged input prices) for the full sample

	LN(REV/TA)				LN(INT/TA)			
	2S	2D	1S	1D	2S	2D	1S	1D
L1 LN(REV/TA)	**0.0552**	0.2382	**0.0609**	0.2005				
	(0.7232)	(1.037)	(0.8444)	(1.182)				
L1 LN(INT/TA)					**0.0437**	0.222	**0.0194**	0.2689
					(0.5111)	(1.006)	(0.2985)	(1.157)
L1 LN(PE/TE)	0.0962**	0.0661	0.0879	0.1063	0.0899	0.0558	0.0889	0.1036
	(2.039)	(0.3056)	(1.322)	(0.7631)	(1.234)	(0.397)	(1.228)	(0.8214)
L1 LN(IE/FF)	0.1011	-0.2608***	0.0734	-0.2455***	0.1086	-0.2748**	0.1246*	-0.3116***
	(1.492)	(-2.691)	(1.302)	(-3.938)	(1.238)	(-2.211)	(1.868)	(-2.622)
L1 LN(CE/FA)	-0.0223	0.0574	-0.0442	0.0328	-0.027	0.062	-0.0462	0.0444
	(-0.6316)	(1.363)	(-1.558)	(1.023)	(-0.6895)	(1.585)	(-1.576)	(1.245)
TC/TA	0.3156*	0.2145	0.3871***	0.2975*	0.3211***	0.1467	0.3413***	0.2744
	(1.823)	(0.8159)	(4.224)	(1.74)	(2.612)	(0.6304)	(4.433)	(1.175)
CL/CD	-0.0412	-0.0917	-0.0708	-0.1025**	-0.0015	-0.0734	-0.0466	-0.08*
	(-1.109)	(-1.472)	(-1.643)	(-2.301)	(-0.0376)	(-1.109)	(-1.062)	(-1.744)
LN(TA)	-0.1347***	-0.4065**	-0.1496***	-0.4028***	-0.1322***	-0.4189***	-0.1581***	-0.4396***
	(-4.523)	(-2.467)	(-3.093)	(-3.207)	(-2.95)	(-3.139)	(-3.198)	(-3.585)
LN(BR)	0.1313***	0.0943	0.1475***	0.0511	0.1317**	0.0995	0.159***	0.0956
	(4.382)	(0.6902)	(3.212)	(0.4905)	(2.566)	(0.7164)	(3.408)	(0.9366)
D1999								
D2000	0.0174	-1.411***	0.0043	-1.535***	0.1146	-1.429***	0.0088	-1.654***
	(0.1425)	(-2.895)	(0.0416)	(-4.717)	(0.7361)	(-3.403)	(0.0704)	(-4.806)
D2001	0.1464	-1.197***	0.113	-1.327***	0.1659	-1.293***	0.0617	-1.491***
	(1.494)	(-2.716)	(1.26)	(-4.481)	(1.193)	(-3.361)	(0.5479)	(-4.716)
D2002	0.0825	-1.194***	0.028	-1.289***	0.0449	-1.246***	-0.043	-1.441***
	(0.855)	(-3.496)	(0.2985)	(-4.985)	(0.4179)	(-4.06)	(-0.4272)	(-5.295)
D2003	0.0884	-1.011***	0.0626	-1.141***	0.1063	-1.07***	0.0736	-1.191***
	(1.114)	(-3.022)	(0.7852)	(-4.738)	(1.032)	(-4.045)	(0.8412)	(-5.011)
D2004	0.0521	-0.9044***	0.0242	-1.023***	0.0733	-0.9539***	0.0486	-1.063***
	(0.8108)	(-3.156)	(0.3868)	(-4.745)	(0.831)	(-3.937)	(0.7)	(-5.055)
D2005	0.1525***	-0.6531***	0.1087	-0.77***	0.1785**	-0.6921***	0.1425**	-0.7847***
	(2.77)	(-2.616)	(1.638)	(-3.928)	(2.432)	(-3.41)	(2.097)	(-4.186)
D2006	0.1203*	-0.5162***	0.0705	-0.5972***	0.0941	-0.565***	0.0806	-0.635***
	(1.941)	(-2.8)	(1.174)	(-4.066)	(1.368)	-(3.506)	(1.339)	(-4.557)
D2007	0.0709	-0.2811**	0.1024	-0.3131***	0.041	-0.3252***	0.0846	-0.3569***
	(1.143)	(-2.117)	(1.466)	(-3.434)	(0.6378)	(-2.735)	(1.194)	(-4.151)
D2008	0.4379***	0.128	0.4042***	0.0906	0.4538***	0.1411	0.452***	0.107
	(10.74)	(1.153)	(7.836)	(0.9758)	(7.422)	(1.516)	(9.462)	(1.211)
D2009								
constant	-0.9168		-0.7699*		-1.123*		-0.7976*	
	(-1.718)		(-1.759)		(-1.875)		(-1.673)	
Instruments	35	25	35	25	35	25	35	25
Groups	46	44	46	44	46	44	46	44
AR(2)	0.247	0.419	0.180	0.163	0.543	0.414	0.278	0.146
	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid
Hansen	0.675	**0.005**	0.675	**0.005**	0.274	**0.013**	0.274	**0.013**
	Valid	**Invalid**	Valid	**Invalid**	Valid	**Invalid**	Valid	**Invalid**
H_0 period FE	154.11***	57.23***	105.07***	147.00***	86.25***	93.28***	154.49***	186.95***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject
L1 OLS	0.3379	0.3379	0.3379	0.3379	0.3559	0.3559	0.3559	0.3559
L1 period FE	0.0871	0.0871	0.0871	0.0871	0.1408	0.1408	0.1408	0.1408
H-statistic								
H=0								
H=1								
Wald test	787.08	203.75	577.89	439.96	598.67	235.36	686.03	438.28
Obs.	327	280	327	280	327	280	327	280

See notes to Table 5.1.

5.3.4. Arellano and Bond (1991) GMM estimations (without assets and with lagged input prices) for the full sample

Table 5.15 reports the estimated revenue equations (without assets and with lagged input prices) and associated H-statistics for the Vietnamese banking system from 1999 to 2009. The models using LN(REV) as the dependent variable are presented in columns 2 to 5 of Table 5.15. The number of instruments is smaller than the number of cross-sectional units for both the 'two-step' and 'one-step' specifications. All of the F-tests reject the exclusion of the period fixed-effects suggesting that period dummy variables should be kept in the models and so the '2-way-FE' specifications are appropriate. The Hansen tests of the 'difference' estimators (both being 0.048) show that the instruments are invalid. Furthermore, the coefficient on the lagged dependent variable of the model using the two-step system estimator (0.6926) lies outside the range of this variable's coefficient estimated by OLS (0.8256) and FE (0.7168). Thus, this model is also considered invalid. However, the model estimated using the one-step system estimator is valid according to all of our criteria. Hence, we use this model based on the one-step system estimator for inference. The H-statistic (being -1.28) is significantly different from one but not significantly different from zero. Thus, the Vietnamese banking system is in monopoly when LN(REV) is the dependent variable between 1999 and 2009. As for the coefficients of the three input prices, the logarithmic interest expense per total funds is negative and significant while personal expense per person and capital expense per fixed asset are insignificant. LN(BR) is positive and significant. All other variables are jointly insignificant. We experiment to find valid specifications and H-statistics based upon the 'difference' estimator and two-step system estimator using the GSM procedure. For comparison purposes and consistency GSM will also be employed to the models using the one-step system estimator

The models based upon LN(INT) as the dependent variable are reported in columns 6 to 9 of the Table 5.15. All of the F-tests reject the exclusion of the period fixed-effects suggesting that period dummy variables should be kept in the models and so the '2-way-FE' specifications are appropriate. The coefficient on the lagged dependent variable based on the one-step difference estimator is 0.7459 which is outside of the range of the corresponding variable's coefficient estimated by OLS (0.934) and FE (0.127). However, the models using the 'system' and two-step difference estimators are valid for inference according to all of our criteria. The H-statistics of these models (ranging from -3.86 to -2.86) are not significantly different from both zero and one. Hence these H-statistics are poorly determined and uninformative. We will use the GSM-type procedure to eliminate redundant time period dummy variables in all the models to find valid specifications with well determined H-statistics.

Table 5.15 GMM estimations (without assets and with lagged input prices) for the full sample

	LN(REV)				LN(INT)			
	2S	2D	1S	1D	2S	2D	1S	1D
L1 LN(REV)	**<u>0.6926***</u>**	0.745***	0.7498***	**<u>0.8408***</u>**				
	(8.723)	(6.541)	(9.705)	(10.12)				
		{0.077}						
L1 LN(INT)					0.7965***	0.8068***	0.8274***	**<u>0.8525***</u>**
					(9.309)	(6.419)	(8.215)	(9.393)
					{0.0855}	{0.1257}	{0.1007}	
L1 LN(PE/TE)	0.0027	-0.3431	-0.0755	-0.3613*	-0.1494	-0.3526**	-0.1709	-0.3743***
	(0.0173)	(-1.367)	(-0.5435)	(-1.931)	(-1.311)	(-2.143)	(-1.201)	(-2.936)
L1 LN(IE/FF)	-0.2195*	-0.2657**	-0.2404***	-0.3339***	-0.345***	-0.3986***	-0.3327***	-0.4546***
	(-1.774)	(-2.298)	(-3.077)	(-4.073)	(-3.416)	(-3.134)	(-3.651)	(-4.095)
L1 LN(CE/FA)	-0.0218	0.0062	-0.005	0.0255	-0.035	0.0048	-0.0114	0.0481
	(-0.4818)	(0.1125)	(-0.146)	(0.527)	(-0.8346)	(0.0819)	(-0.3096)	(0.8576)
TC/TA	-0.2358	-0.5964	-0.1286	-0.2875	-0.0617	-0.2281	-0.03	-0.1817
	(-0.8641)	(-0.804)	(-0.6753)	(-0.6897)	(-0.2982)	(-0.615)	(-0.1454)	(-0.4959)
CL/CD	-0.0403	0.004	-0.0338	-0.0139	0.0025	0.004	-0.0061	-0.0116
	(-0.9068)	(0.0519)	(-0.7207)	(-0.2238)	(0.0551)	(0.0491)	(-0.1262)	(-0.1811)
LN(TA)								
LN(BR)	0.2505***	0.1241	0.2069***	0.1246	0.1679**	0.1478	0.1441	0.1655
	(3.481)	(0.7777)	(2.89)	(1.17)	(2.289)	(1.079)	(1.62)	(1.501)
D1999								
D2000	-0.4299*	-0.9493*	-0.4267**	-0.737*	-0.504***	-0.8448**	-0.4894***	-0.7102**
	(-1.815)	(-1.868)	(-2.308)	(-1.735)	(-2.626)	(-2.049)	(-2.747)	(-2.089)
D2001	-0.4293**	-0.9305**	-0.4702***	-0.7412*	-0.6436***	-0.9159**	-0.6152***	-0.8325***
	(-2.002)	(-2.05)	(-3.066)	(-1.963)	(-4.072)	(-2.403)	(-4.141)	(-2.712)
D2002	-0.485**	-0.9387**	-0.5208***	-0.75**	-0.5962***	-0.8793**	-0.6185***	-0.7977***
	(-2.403)	(-2.254)	(-3.357)	(-2.15)	(-3.992)	(-2.553)	(-3.801)	(-2.882)
D2003	-0.2968*	-0.7392*	-0.3784***	-0.5744*	-0.3765***	-0.6197**	-0.375***	-0.536**
	(-1.698)	(-1.802)	(-2.925)	(-1.74)	(-3.076)	(-2.052)	(-3.649)	(-2.053)
D2004	-0.2909**	-0.6551*	-0.3509***	-0.5163*	-0.3677***	-0.5513**	-0.383***	-0.5145**
	(-1.964)	(-1.878)	(-3.162)	(-1.811)	(-3.443)	(-2.105)	(-3.882)	(-2.336)
D2005	-0.1001	-0.4527	-0.1669	-0.3172	-0.1718	-0.3454	-0.182*	-0.3048
	(-0.7626)	(-1.417)	(-1.595)	(-1.243)	(-1.629)	(-1.463)	(-1.942)	(-1.532)
D2006	0.0833	-0.2349	0.0285	-0.0894	-0.0053	-0.1681	-0.0097	-0.1129
	(0.8696)	(-0.9327)	(0.3349)	(-0.4489)	(-0.0672)	(-0.8762)	(-0.1313)	(-0.7148)
D2007	0.2738***	0.0571	0.2732***	0.1804	0.2082***	0.0879	0.2369***	0.1377
	(3.373)	(0.291)	(4.025)	(1.153)	(2.628)	(0.5309)	(3.643)	(1.054)
D2008	0.2785***	0.1706	0.1981***	0.1309	0.2688***	0.1953**	0.2222***	0.1441*
	(3.165)	(1.561)	(3.08)	(1.499)	(3.37)	(2)	(3.67)	(1.842)
D2009								
constant	2.956***		2.659***		2.076**		1.925**	
	(3.499)		(3.964)		(2.375)		(2.182)	
Instruments	34	24	34	24	34	24	34	24
Groups	46	44	46	44	46	44	46	44
AR(2)	0.721	0.846	0.715	0.914	0.894 Valid	0.974	0.757 Valid	0.934
	Valid	Valid	Valid	Valid		Valid		Valid
Hansen	0.110	**<u>0.048</u>**	0.110	**<u>0.048</u>**	0.107 Valid	0.127	0.107 Valid	0.127
	Valid	**<u>Invalid</u>**	Valid	**<u>Invalid</u>**		Valid		Valid
H_0 period FE	82.83***	103.09***	130.87***	123.17***	186.74***	129.76***	169.11***	149.80***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject
L1 OLS	0.8256	0.8256	0.8256	0.8256	0.8420	0.8420	0.8420	0.8420
L1 period FE	0.7168	0.7168	0.7168	0.7168	0.7642	0.7642	0.7642	0.7642
H-statistic			**-1.2825**		**-2.6010**	**-3.8623**	**-2.9842**	
H=0			-1.1217		-1.3888	-1.2154	-1.0133	
			Accept		Accept	Accept	Accept	
H=1			-2.000***		-1.9228	-1.5301	-1.3529	
			Reject		Accept	Accept	Accept	
Wald test	8647.12	2272.69	12389.79	3786.45	8320.55	2154.35	13839.51	3386.83
Obs.	327	280	327	280	327	280	327	280

See notes to Table 5.1.

Tables 5.16 and 5.17 report the estimated revenue equations (without assets and with lagged input prices) and associated H-statistics for the Vietnamese banking system between 1999 and 2009 using LN(REV) as the regressand after applying the GSM-type procedure to remove insignificant time dummy variables from the model.

In the specifications using the two-step system estimator we remove time dummy variables with t-statistics below 0.8 in absolute value (being D2005, and then D2009 as well) and report these models in the third and fourth columns of Table 5.16. The coefficients on the lagged dependent variables of these models fall outside of the required range and so they are invalid. The results of the models using the two-step difference estimator are also presented in Table 5.16. We first discard D2007 which has t-ratio less than 0.8 in magnitude and report the resulting model in column 6. The Hansen test (being 0.048) shows that the instruments are invalid. Secondly, we additionally exclude dummy variables with t-statistics below one in absolute value (being D2008 and D2009). This model is presented in column 7 of Table 5.16. The coefficient on the lagged dependent variable (0.9245) lies outside the corresponding range of OLS (0.8309) and FE (0.6920). Hence all of the models reported in Table 5.16 are invalid.

The results of the models using the 'one-step' estimators are reported in Table 5.17. In the models based upon the one-step system estimator we exclude time dummy variables with t-ratios less than one in magnitude (being D2006 and then D2009) and present the resulting models in columns 3 and 4 of Table 5.17. These models are valid according to all of our criteria. The H-statistics of these three models are -1.28, -1.28 and -1.36, and are not significantly different from zero but are significantly different from one (and so seem more precisely estimated). Thus, the Vietnamese banking industry behaves as if in monopoly in the period of 1999-2009. In the models using the one-step difference estimator we also eliminate D2006 and then D2009 and report the results in columns 6 and 7. Both the Hansen tests and coefficients on the lagged dependent variables indicate that these models are invalid.

In short, we favour the models using the one-step system estimator as they are the only ones that are valid according to our criteria. We prefer the model reported in column 4 of Table 5.17 because it has the lowest standard error for the dependent variable of all the models (being 0.075). The H-statistic is -1.36 which is not significantly different from zero but is significantly different from one. This indicates that the Vietnamese banking system is in monopoly. As for other variables, the logarithmic price cost of fund is negative and significant. The logarithmic costs of labour and fixed assets are insignificant. All of the other control variables are insignificant except for LN(BR) which is positive and significant.

Table 5.16 GMM estimations (without assets and with lagged input prices) for the full sample (LN(REV), two-step estimation)

	2S			2D		
L1 LN(REV)	**0.6926***	**0.6926***	**0.722***	0.745***	0.745***	**0.9245***
	(8.723)	(8.723)	(8.903)	(6.541)	(6.541)	(6.7)
L1 LN(INT)						
L1 LN(PE/TE)	0.0027	0.0027	0.0147	-0.3431	-0.3431	-0.6204***
	(0.0173)	(0.0173)	(0.127)	(-1.367)	(-1.367)	(-3.218)
L1 LN(IE/FF)	-0.2195*	-0.2195*	-0.2126**	-0.2657**	-0.2657**	-0.4051***
	(-1.774)	(-1.774)	(-2.439)	(-2.298)	(-2.298)	(-4.008)
L1 LN(CE/FA)	-0.0218	-0.0218	-0.0415	0.0062	0.0062	0.0591
	(-0.4818)	(-0.4818)	(-0.8763)	(0.1125)	(0.1125)	(0.9946)
TC/TA	-0.2358	-0.2358	-0.2048	-0.5964	-0.5964	-0.2975
	(-0.8641)	(-0.8641)	(-0.6952)	(-0.804)	(-0.804)	(-0.8698)
CL/CD	-0.0403	-0.0403	-0.0179	0.004	0.004	-0.0422
	(-0.9068)	(-0.9068)	(-0.3994)	(0.0519)	(0.0519)	(-0.4516)
LN(TA)						
LN(BR)	0.2505***	0.2505***	0.2323***	0.1241	0.1241	0.0197
	(3.481)	(3.481)	(3.174)	(0.7777)	(0.7777)	(0.11)
D1999						
D2000	-0.4299*	-0.3298**	-0.3307**	-0.9493*	-1.006***	-1.012***
	(-1.815)	(-2.177)	(-2.445)	(-1.868)	(-2.965)	(-4.767)
D2001	-0.4293**	-0.3292***	-0.3182***	-0.9305**	-0.9877***	-1.034***
	(-2.002)	(-2.784)	(-2.931)	(-2.05)	(-3.44)	(-5.924)
D2002	-0.485**	-0.3849***	-0.3982***	-0.9387**	-0.9958***	-1.04***
	(-2.403)	(-3.328)	(-3.654)	(-2.254)	(-4.059)	(-7.956)
D2003	-0.2968*	-0.1967***	-0.2073***	-0.7392*	-0.7963***	-0.8137***
	(-1.698)	(-2.708)	(-2.745)	(-1.802)	(-3.326)	(-5.354)
D2004	-0.2909**	-0.1909***	-0.2077***	-0.6551*	-0.7122***	-0.7143***
	(-1.964)	(-3.686)	(-3.804)	(-1.878)	(-3.964)	(-6.162)
D2005	-0.1001			-0.4527	-0.5098***	-0.5179***
	(-0.7626)			(-1.417)	(-3.57)	(-6.887)
D2006	0.0833	0.1834***	0.1535***	-0.2349	-0.292***	-0.2827***
	(0.8696)	(3.019)	(3.759)	(-0.9327)	(-3.785)	(-5.039)
D2007	0.2738***	0.3738***	0.3327***	0.0571		
	(3.373)	(3.57)	(5.013)	(0.291)		
D2008	0.2785***	0.3786***	0.3185***	0.1706	0.1134	
	(3.165)	(4.562)	(5.868)	(1.561)	(0.8028)	
D2009		0.1001			-0.0571	
		(0.7626)			(-0.291)	
constant	2.956***	2.856***	2.499***			
	(3.499)	(3.34)	(2.941)			
H_0 redundant period dummies	--	0.58 [0.4457] Accept	0.58 [0.4457] Accept	--	0.08 [0.7711] Accept	3.79 [0.15] Accept
Instruments	34	34	33	24	24	22
Groups	46	46	46	44	44	44
AR(2)	0.721 Valid	0.721 Valid	0.666 Valid	0.846 Valid	0.846 Valid	0.996 Valid
Hansen	0.110 Valid	0.110 Valid	0.161 Valid	**0.048 Invalid**	**0.048 Invalid**	0.072 Valid*
H_0 period FE	82.83*** [0.0000] Reject	82.83*** [0.0000] Reject	92.08*** [0.0000] Reject	103.09*** [0.0000] Reject	103.09*** [0.0000] Reject	84.42*** [0.0000] Reject
L1 OLS	0.8256	0.8256	0.8238	0.8256	0.8256	0.8309
L1 period FE	0.7168	0.7168	0.7397	0.7168	0.7168	0.6920
H-statistic						
H=0						
H=1						
Wald test	8647.12	8647.12	8759.20	2272.69	2272.69	1810.08
Obs.	327	327	327	280	280	280

See notes to Table 5.1.

Table 5.17 GMM estimations (without assets and with lagged input prices) for the full sample (LN(REV), one-step estimation)

	1S			1D		
L1 LN(REV)	0.7498*** (9.705) {0.077}	0.7498*** (9.705) {0.077}	0.7523*** (9.967) {0.075}	0.8408*** (10.12)	0.8408*** (10.12)	0.9236*** (6.367)
L1 LN(PE/TE)	-0.0755 (-0.5435)	-0.0755 (-0.5435)	-0.0857 (-0.7076)	-0.3613* (-1.931)	-0.3613* (-1.931)	-0.4039* (-1.755)
L1 LN(IE/FF)	-0.2404*** (-3.077)	-0.2404*** (-3.077)	-0.2467*** (-3.448)	-0.3339*** (-4.073)	-0.3339*** (-4.073)	-0.3548*** (-3.167)
L1 LN(CE/FA)	-0.005 (-0.146)	-0.005 (-0.146)	-0.0048 (-0.1388)	0.0255 (0.527)	0.0255 (0.527)	0.0242 (0.4691)
TC/TA	-0.1286 (-0.6753)	-0.1286 (-0.6753)	-0.1261 (-0.6586)	-0.2875 (-0.6897)	-0.2875 (-0.6897)	-0.2393 (-0.5474)
CL/CD	-0.0338 (-0.7207)	-0.0338 (-0.7207)	-0.0331 (-0.7076)	-0.0139 (-0.2238)	-0.0139 (-0.2238)	-0.0085 (-0.1307)
LN(TA)						
LN(BR)	0.2069*** (2.89)	0.2069*** (2.89)	0.204*** (2.957)	0.1246 (1.17)	0.1246 (1.17)	0.0927 (0.6523)
D1999						
D2000	-0.4267** (-2.308)	-0.4553*** (-3.338)	-0.4529*** (-3.251)	-0.737* (-1.735)	-0.6476*** (-2.607)	-0.5686*** (-3.724)
D2001	-0.4702*** (-3.066)	-0.4987*** (-4.713)	-0.4953*** (-4.553)	-0.7412* (-1.963)	-0.6518*** (-3.252)	-0.5896*** (-4.689)
D2002	-0.5208*** (-3.357)	-0.5493*** (-4.943)	-0.5451*** (-4.774)	-0.75** (-2.15)	-0.6606*** (-3.794)	-0.6094*** (-5.158)
D2003	-0.3784*** (-2.925)	-0.4069*** (-5.338)	-0.402*** (-4.924)	-0.5744* (-1.74)	-0.485*** (-3.245)	-0.4377*** (-4.459)
D2004	-0.3509*** (-3.162)	-0.3795*** (-6.5)	-0.3725*** (-5.75)	-0.5163* (-1.811)	-0.4269*** (-4.076)	-0.3955*** (-5.305)
D2005	-0.1669 (-1.595)	-0.1955*** (-3.659)	-0.187*** (-3.073)	-0.3172 (-1.243)	-0.2278*** (-2.945)	-0.2063*** (-3.323)
D2006	0.0285 (0.3349)			-0.0894 (-0.4489)		
D2007	0.2732*** (4.025)	0.2447*** (3.515)	0.257*** (4.644)	0.1804 (1.153)	0.2698*** (3.981)	0.2452*** (4.86)
D2008	0.1981*** (3.08)	0.1696** (2.475)	0.1829*** (3.559)	0.1309 (1.499)	0.2203 (1.521)	0.1482** (2.394)
D2009		-0.0285 (-0.3349)			0.0894 (0.4489)	
constant	2.659*** (3.964)	2.687*** (4.049)	2.675*** (4.006)			
H_0 redundant period dummies	--	0.11 [0.7377] Accept	0.11 [0.7377] Accept	--	0.20 [0.6535] Accept	0.20 [0.6535] Accept
Instruments	34	34	33	24	24	23
Groups	46	46	46	44	44	44
AR(2)	0.715 Valid	0.715 Valid	0.744 Valid	0.914 Valid	0.914 Valid	0.862 Valid
Hansen	0.110 Valid	0.110 Valid	0.081 Valid*	**0.048** **Invalid**	**0.048** **Invalid**	**0.036** **Invalid**
H_0 period FE	130.87*** [0.0000] Reject	130.87*** [0.0000] Reject	89.19*** [0.0000] Reject	123.17*** [0.0000] Reject	123.17*** [0.0000] Reject	128.54*** [0.0000] Reject
L1 OLS	0.8256	0.8256	0.8279	0.8256	0.8256	0.8279
L1 period FE	0.7168	0.7168	0.7157	0.7168	0.7168	0.7157
H-statistic	**-1.2825**	**-1.2825**	**-1.3613**			
H=0	-1.1217 Accept	-1.1217 Accept	-1.2744 Accept			
H=1	-2.000*** Reject	-2.000*** Reject	-2.2106*** Reject			
Wald test	12389.79	12389.79	12340.62	3786.45	3786.45	3483.85
Obs.	327	327	327	280	280	280

See notes to Table 5.1.

Tables 5.18 and 5.19 report the estimated revenue equations (without assets and with lagged input prices) and associated H-statistics for the Vietnamese banking system between 1999 and 2009 when LN(INT) is the dependent variable after employing the GSM-type procedure to eliminate insignificant time dummy variables. In the specification using the two-step system estimator we exclude time dummy variables with t-ratios less than one in absolute values (being D2006 and D2009) and report the models in columns 3 and 4 of Table 5.18. As can be seen from the table, these two models are valid according to all of our criteria. However, only the H-statistic of the model in column 4 (being -2.61) is precisely estimated in the sense that it is not insignificantly different from both zero and one. This H-statistic is not significantly different from zero but is significantly different from one. This shows that the Vietnamese banking system is in monopoly using the two-step system estimator with LN(INT) as the dependent variable. In the specification using the two-step difference estimator we exclude time dummy variables with t-statistics below 0.8 in magnitude (being D2007 and D2009). These models are valid according to all of our criteria and are presented in columns 6 and 7 of Table 5.18. Nevertheless, the H-statistics (being -3.86 and -3.28) are not significantly different from both zero and one so these results are imprecisely estimated and uninformative.

The results of the models based on one-step estimation are presented in Table 5.19. In the specifications using the one-step system estimator we eliminate time dummy variables with t-ratios below one in absolute value (D2006 and then D2009) and report the resulting models in columns 3 and 4. These models are valid according to all the criteria we employ. The H-statistics (-2.98 and -2.02) are not significantly different from both zero and one and so these results are uninformative for inference. The models using the one-step difference estimator are also presented in Table 5.19. We discard D2006 and additionally remove D2009. These models are reported in columns 6 and 7. The coefficients on the lagged dependent variables fall outside of the range of the corresponding variable's coefficients estimated by OLS and FE. So these models are not valid.

Overall, we favour the models using the two-step system estimator for modelling LN(INT) (Table 5.18) as they provide the smallest coefficient standard error for the lagged dependent variable (so are the most precisely estimated). We prefer the model reported in column 4 of Table 5.18 which features the lowest standard error for the dependent variable of all the models (being 0.0872). The H-statistic (being -2.61) is not significantly different from zero but significantly different from one. Thus, we can conclude that the Vietnamese banking system operates in monopoly over the period 1999 to 2009 when total assets are excluded from the models using lagged input prices. As for the other variables, the logarithmic price cost of funds is negative and significant. The logarithmic costs of labour and fixed assets are insignificant. All other control variables are generally insignificant except for LN(BR) which is positive and significant.

We favour the results of the models using the disequilibrium approach if coefficients of first lagged dependent variables are significantly different from zero (t-statistics are higher than two in absolute values). The H-statistic is -1.36 when using LN(REV) as the dependent variable and -2.61 in the model where LN(INT) is the regressand. The t-statistics of coefficients on lagged dependent variables are both significantly different from zero (being 9.967 and 7.983). This indicates that we can employ the disequilibrium results for inference. Thus, we can conclude that the Vietnamese banking system is monopolistic from 1999 to 2009 when total assets are excluded from the models using lagged input prices.

Table 5.18 GMM estimations (without assets and with lagged input prices) for the full sample (LN(INT), two-step estimation)

	2S			2D		
L1 LN(INT)	0.7965***	0.7965***	0.7983***	0.8068***	0.8068***	0.7724***
	(9.309)	(9.309)	(9.156)	(6.419)	(6.419)	(6.239)
	{0.0855}	{0.0855}	{0.0872}	{0.1257}	{0.1257}	{0.1238}
L1 LN(PE/TE)	-0.1494	-0.1494	-0.145	-0.3526**	-0.3526	-0.381**
	(-1.311)	(-1.311)	(-1.566)	(-2.143)	(-2.143)	(-2.23)
L1 LN(IE/FF)	-0.345***	-0.345***	-0.3457***	-0.3986***	-0.3986***	-0.3874**
	(-3.416)	(-3.416)	(-3.799)	(-3.134)	(-3.134)	(-2.421)
L1 LN(CE/FA)	-0.035	-0.035	-0.0362	0.0048	0.0048	0.0226
	(-0.8346)	(-0.8346)	(-0.8774)	(0.0819)	(0.0819)	(0.4465)
TC/TA	-0.0617	-0.0617	-0.0582	-0.2281	-0.2281	-0.367
	(-0.2982)	(-0.2982)	(-0.2708)	(-0.615)	(-0.615)	(-0.8333)
CL/CD	0.0025	0.0025	0.005	0.004	0.004	-0.0234
	(0.0551)	(0.0551)	(0.1085)	(0.0491)	(0.0491)	(-0.2965)
LN(TA)						
LN(BR)	0.1679**	0.1679**	0.1664**	0.1478	0.1478	0.1406
	(2.289)	(2.289)	(2.222)	(1.079)	(1.079)	(0.9329)
D1999						
D2000	-0.504***	-0.4987***	-0.492***	-0.8448**	-0.9328***	-1.017***
	(-2.626)	(-3.401)	(-3.533)	(-2.049)	(-3.481)	(-6.061)
D2001	-0.6436***	-0.6383***	-0.6335***	-0.9159**	-1.004***	-1.074***
	(-4.072)	(-5.241)	(-5.283)	(-2.403)	(-4.11)	(-6.267)
D2002	-0.5962***	-0.591***	-0.5888***	-0.8793**	-0.9672***	-1.024***
	(-3.992)	(-6.007)	(-6.379)	(-2.553)	(-4.846)	(-7.956)
D2003	-0.3765***	-0.3713***	-0.3672***	-0.6197**	-0.7077***	-0.7565***
	(-3.076)	(-4.467)	(-4.305)	(-2.052)	(-4.356)	(-6.317)
D2004	-0.3677***	-0.3625***	-0.3604***	-0.5513**	-0.6393***	-0.6768***
	(-3.443)	(-5.432)	(-5.264)	(-2.105)	(-5.002)	(-6.433)
D2005	-0.1718	-0.1665***	-0.1642***	-0.3454	-0.4334***	-0.457***
	(-1.629)	(-2.901)	(-2.768)	(-1.463)	(-4.663)	(-6.591)
D2006	-0.0053			-0.1681	-0.2561***	-0.258***
	(-0.0672)			(-0.8762)	(-4.556)	(-4.988)
D2007	0.2082***	0.2135***	0.2158***	0.0879		
	(2.628)	(3.955)	(4.213)	(0.5309)		
D2008	0.2688***	0.2741***	0.2723***	0.1953**	0.1074	0.1613**
	(3.37)	(4.51)	(4.853)	(2)	(0.8954)	(2.156)
D2009		0.0053			-0.0879	
		(0.0672)			(-0.5309)	
constant	2.076**	2.071**	2.027**			
	(2.375)	(2.389)	(2.271)			
H_0 redundant period dummies	--	0.0000	0.0000	--	0.28	0.0000
		[0.9464]	[0.9464]		[0.5955]	[0.9464]
		Accept	Accept		Accept	Accept
Instruments	34	34	33	24	24	23
Groups	46	46	46	44	44	44
AR(2)	0.894 Valid	0.894 Valid	0.884 Valid	0.974 Valid	0.974 Valid	0.872 Valid
Hansen	0.107 Valid	0.107 Valid	0.111 Valid	0.127 Valid	0.127 Valid	0.115 Valid
H_0 period FE	186.74***	186.74***	158.88***	129.76***	129.76***	107.61***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	Reject	Reject	Reject	Reject	Reject	Reject
L1 OLS	0.8420	0.8420	0.8443	0.8420	0.8420	0.8461
L1 period FE	0.7642	0.7642	0.7651	0.7642	0.7642	0.7251
H-statistic	**-2.6010**	**-2.6010**	**-2.6128**	**-3.8623**	**-3.8623**	**-3.2771**
H=0	-1.3888	-1.3888	-1.4554	-1.2154	-1.2154	-1.1731
	Accept	Accept	Accept	Accept	Accept	Accept
H=1	-1.9228	-1.9228	--2.0124***	-1.5301	-1.5301	-1.5310
	Accept	Accept	Reject	Accept	Accept	Accept
Wald test	8320.55	8320.55	8168.67	2154.35	2154.35	1775.93
Obs.	327	327	327	280	280	280

See notes to Table 5.1.

Table 5.19 GMM estimations (without assets and with lagged input prices) for the full sample (LN(INT). one-step estimation)

	1S			1D		
L1 LN(INT)	0.8274***	0.8274***	0.8261***	**0.8525*** **	**0.8525*** **	**0.9938*** **
	(8.215)	(8.215)	(8.454)	(9.393)	(9.393)	(7.651)
	{0.1007}	{0.1007}	{0.0977}			
L1 LN(PE/TE)	-0.1709	-0.1709	-0.1668	-0.3743***	-0.3743***	-0.4697***
	(-1.201)	(-1.201)	(-1.343)	(-2.936)	(-2.936)	(-3.203)
L1 LN(IE/FF)	-0.3327***	-0.3327***	-0.33***	-0.4546***	-0.4546***	-0.5116***
	(-3.651)	(-3.651)	(-3.889)	(-4.095)	(-4.095)	(-3.387)
L1 LN(CE/FA)	-0.0114	-0.0114	-0.0115	0.0481	0.0481	0.0495
	(-0.3096)	(-0.3096)	(-0.3131)	(0.8576)	(0.8576)	(0.8007)
TC/TA	-0.03	-0.03	-0.0325	-0.1817	-0.1817	-0.0923
	(-0.1454)	(-0.1454)	(-0.1591)	(-0.4959)	(-0.4959)	(-0.2235)
CL/CD	-0.0061	-0.0061	-0.0062	-0.0116	-0.0116	-0.0045
	(-0.1262)	(-0.1262)	(-0.1289)	(-0.1811)	(-0.1811)	(-0.0675)
LN(TA)						
LN(BR)	0.1441	0.1441	0.1456*	0.1655	0.1655	0.1064
	(1.62)	(1.62)	(1.705)	(1.501)	(1.501)	(0.7556)
D1999						
D2000	-0.4894***	-0.4797***	-0.4793***	-0.7102**	-0.5973***	-0.4786***
	(-2.747)	(-3.456)	(-3.422)	(-2.089)	(-2.887)	(-3.473)
D2001	-0.6152***	-0.6056***	-0.6056***	-0.8325***	-0.7196***	-0.6305***
	(-4.141)	(-5.309)	(-5.235)	(-2.712)	(-4.024)	(-4.889)
D2002	-0.6185***	-0.6089***	-0.6094***	-0.7977***	-0.6848***	-0.6026***
	(-3.801)	(-5.015)	(-4.879)	(-2.882)	(-4.822)	(-6.185)
D2003	-0.375***	-0.3653***	-0.3661***	-0.536**	-0.4231***	-0.3433***
	(-3.649)	(-6.165)	(-5.8)	(-2.053)	(-3.554)	(-4.136)
D2004	-0.383***	-0.3733***	-0.3748***	-0.5145**	-0.4016***	-0.3524***
	(-3.882)	(-6.581)	(-6.116)	(-2.336)	(-4.785)	(-5.012)
D2005	-0.182*	-0.1723***	-0.1738***	-0.3048	-0.1919***	-0.1585***
	(-1.942)	(-3.637)	(-3.15)	(-1.532)	(-3.148)	(-2.94)
D2006	-0.0097			-0.1129		
	(-0.1313)			(-0.7148)		
D2007	0.2369***	0.2466***	0.2437***	0.1377	0.2506***	0.2234***
	(3.643)	(4.065)	(4.75)	(1.054)	(4.353)	(4.382)
D2008	0.2222***	0.2318***	0.2277***	0.1441*	0.257**	0.1578**
	(3.67)	(4.386)	(5.313)	(1.842)	(2.152)	(2.372)
D2009		0.0097			0.1129	
		(0.1313)			(0.7148)	
constant	1.925**	1.916**	1.923**			
	(2.182)	(2.163)	(2.18)			
H_0 redundant period dummies	--	0.02 [0.8956] Accept	0.02 [0.8956] Accept	--	0.51 [0.4748] Accept	0.51 [0.4748] Accept
Instruments	34	34	33	24	24	23
Groups	46	46	46	44	44	44
AR(2)	0.757 Valid	0.757 Valid	0.752 Valid	0.934 Valid	0.934 Valid	0.903 Valid
Hansen	0.107 Valid	0.107 Valid	0.111 Valid	0.127 Valid	0.127 Valid	0.116 Valid
H_0 period FE	169.11*** [0.0000] Reject	169.11*** [0.0000] Reject	152.89*** [0.0000] Reject	149.80*** [0.0000] Reject	149.80*** [0.0000] Reject	97.83*** [0.0000] Reject
L1 OLS	0.8420	0.8420	0.8443	0.8420	0.8420	0.8443
L1 period FE	0.7642	0.7642	0.7650	0.7642	0.7642	0.7651
H-statistic	**-2.9842**	**-2.9842**	**-2.9227**			
H=0	-1.0133 Accept	-1.0133 Accept	-1.0779 Accept			
H=1	-1.3529 Accept	-1.3529 Accept	-1.4468 Accept			
Wald test	13839.51	13839.51	13164.57	3386.83	3386.83	2840.89
Obs.	327	327	327	280	280	280

See notes to Table 5.1.

5.3.5. Summary of results from the non-structural model: disequilibrium approach[32]

Table 5.20 presents a summary of the main results obtained from disequilibrium approach which includes the models using current and lagged input prices. We employ the GSM-type procedure to the time period dummy variables in each model in an attempt to secure valid specifications and H-statistics. We report the favoured model in each case as that with the smallest coefficient standard error on the dependent variable. In addition to the full sample results considered so far we also summarise the results for models estimated on sub-samples of the data. In particular, we split the sample according to the type of bank (SOCBs and non-SOCBs) and through time (1999-2003 and 2004-2009).

The models using current input prices and including assets suggest that the full sample and sub-samples are generally in monopolistic competition. The removal of total assets from these models transforms our inference to suggest that the market is not significantly different from perfect competition except for the sub-sample for SOCBs which is almost monopolistic. We could not find valid specifications and H-statistics for the full sample for LN(REV/TA) and for most samples for LN(INT/TA) in the models based on lagged input prices. The revenue models indicate that the sub-samples generally operate in monopolistic competition but are close to monopoly. When assets are excluded from the models, our inference indicates monopoly for all samples. The substantial difference in the estimated coefficients (as reflected in the H-statistics) between the models with current and lagged input prices suggests endogeneity of current input prices. Hence we prefer the models using lagged input prices for inference.

The H-statistics are generally higher for models where revenue is the dependent variable. The H-statistics for the full sample of data is -1.36 for the model when LN(REV) is the dependent variable and -2.61 when LN(INT) is the regressand. Therefore the market is more competitive when based on revenue. This is consistent with the results from the equilibrium approach and our expectation. Turning to the exclusion of total assets from the models, this is different with

32 We also experiment to find valid specifications (and H-statistics) for the disequilibrium approach by excluding insignificant control variables (TC/TA, CL/CD and LN(BR)); treating input prices (LN(PE/TE), LN(IE/FF) and LN(CE/FA)) as the endogenous variables and lastly excluding insignificant input prices. However, we could not obtain better results.

equilibrium approach. The removal of total assets in the models based on lagged input prices transforms our inference of the market to more monopolistic.

The equilibrium approach (reported in Chapter 4) provides H-statistics that indicate monopolistic competition (being 0.45 and 0.43) while the disequilibrium approach gives H-statistics that suggest a highly monopolistic market (-1.36 and -2.61). As we mentioned earlier, the Arellano and Bond (1991) GMM estimator is preferred for inference if the coefficient on the lagged dependent variable is significantly different from zero (t-statistic is higher than two in magnitude). If this is not the case, we favour the fixed-effect estimator (used in the equilibrium approach) for inference. The disequilibrium approach is preferred for inference in the Vietnamese banking system as the t-ratios on the lagged dependent variables are statistically significant in our favoured models. Hence, the Vietnamese banking system behaves as if in monopoly from 1999 to 2009.

Table 5.20 Summary of results from the disequilibrium approach

		Current input prices				Lagged input prices			
		With assets		Without assets		With assets		Without assets	
		LN(REV/TA)	LN(INT/TA)	LN(REV)	LN(INT)	LN(REV/TA)	LN(INT/TA)	LN(REV)	LN(INT)
Full sample 1999-2009	Est.	1D	1D	1D	1S	N/A	N/A	1S	2S
	L1	0.1679**	0.1572**	0.6178***	0.6135***			0.7523***	0.7983***
		(2.573)	(2.392)	(9.421)	(10.97)			(9.97)	(9.16)
		{0.0652}	{0.0657}	{0.0655}	{0.0559}			{0.075}	{0.0872}
	H-sta.	**0.8265**	**0.9449**	**1.0640**	**1.2725**			**-1.3613**	**-2.6128**
	H=0	4.1443***	6.8143***	3.7042***	5.0140***			-1.2744	-1.4554
		Reject	Reject	Reject	Reject			Accept	Accept
	H=1	-0.8698	-0.3972	0.2229	1.0737			-2.2106***	-2.0124***
		Accept	Accept	Accept	Accept			Reject	Reject
non-SOCBs 1999-2009	Est.	1D	1S	1S	1S	1S	N/A	1S	2S
	L1	0.055	0.0821*	0.5791***	0.6093***	0.0454		0.7658***	0.7909***
		(0.7441)	(1.666)	(9.666)	(10.51)	(0.63)		(11.21)	(13.54)
		{0.0739}	{0.0492}	{0.0599}	{0.058}	{0.072}		{0.0683}	{0.058}
	H-sta.	**0.5471**	**0.6740**	**1.2902**	**1.4810**	**0.1145**		**-1.6834**	**-2.5720**
	H=0	3.0441***	8.6154***	6.1134***	5.4463***	1.3217		-1.3184	-1.7938
		Reject	Reject	Reject	Reject	Accept		Accept	Accept
	H=1	-2.5202***	-4.1676***	1.3750	1.7689	-10.219***		-2.1016***	-2.4912***
		Reject	Reject	Accept	Accept	Reject		Reject	Reject
SOCBs 1999-2009	Est.	2S	2D	1S	1S	2S	N/A	1S	2S
	L1	0.0963	0.1819*	0.6066***	0.6207***	0.075		0.7545***	0.7957***
		(1.135)	(1.832)	(10.67)	(8.943)	(0.96)		(10.6)	(10.35)
		{0.0848}	{0.099}	{0.0568}	{0.0694}	{0.078}		{0.0711}	{0.077}
	H-sta.	**0.6125**	**0.4936**	**0.0868**	**0.2288**	**0.2866**		**-1.5271**	**-2.2966**
	H=0	4.3020***	2.1338***	0.2689	0.5936	3.3697***		-1.7739	-1.8146
		Reject	Reject	Accept	Accept	Reject		Accept	Accept
	H=1	-2.7217***	-2.1889***	-2.828***	-2.0006***	-8.3860***		-2.9355***	-2.6047***
		Reject	Reject	Reject	Reject	Reject		Reject	Reject
Sub-sample 1999-2003	Est.	1S	1S	2S	2S	2S	N/A	N/A	2S
	L1	0.0185	0.0106	0.5845***	0.6000***	0.0315			0.7918***
		(0.1761)	(0.0589)	(8.94)	(8.39)	(0.42)			(14.94)
		{0.105}	{0.1331}	{0.0654}	{0.0715}	{0.075}			{0.053}
	H-sta.	**0.1539**	**0.4001**	**1.9898**	**2.5466**	**0.1378**			**-1.3478**
	H=0	1.1661	3.0838***	3.0198***	3.2122***	1.3475			-1.1735
		Accept	Reject	Reject	Reject	Accept			Accept
	H=1	-6.4120***	-4.6231***	1.5021	1.9508	-8.4281***			-2.0441***
		Reject	Reject	Accept	Accept	Reject			Reject
Sub-sample 2004-2009	Est.	2S	2S	1S	1S	2S	1S	2S	2S
	L1	0.0385	-0.0494	0.5976***	0.6***	0.315	-0.0076	0.7303***	0.7686***
		(0.7774)	(-1.634)	(10.21)	(10.25)	(0.42)	(-0.1075)	(11.06)	(13.49)
		{0.0495}	{0.030}	{0.0585}	{0.0586}	{0.075}	{0.0706}	{0.066}	{0.057}
	H-sta.	**0.6712**	**0.6600**	**0.6697**	**0.7812**	**0.1949**	**0.1941**	**-1.9988**	**-2.7293**
	H=0	9.8178***	9.7552***	2.1682***	2.6840***	2.1160***	3.3054***	-1.4462	-1.7821
		Reject	Reject	Reject	Reject	Reject	Reject	Accept	Accept
	H=1	-4.8092***	-5.0256***	-1.0692	0.7516	-8.7418***	13.7224***	-2.1698***	-2.435***
		Reject	Reject	Accept	Accept	Reject	Reject	Reject	Reject

See notes to Table 5.1.

5.4. Conclusion

Arellano and Bond (1991) developed a GMM estimator that is appropriate for estimating dynamic panels with small T and large N. The predetermined and endogenous variables in first differences are instrumented with suitable lags of their own levels. Strictly exogenous regressors and other instruments can enter the instrument matrix in the conventional instrumental variables fashion: in first differences, with one column per instrument. The original estimator is sometimes called "difference GMM" and the augmented one, "system GMM". We use this estimator in our panel analysis of a dynamic model based upon the disequilibrium approach for analysing the degree of competition in the Vietnamese banking system.

Our empirical results show that we prefer the disequilibrium approach to equilibrium approach to interpret the results. The H-statistics of the full sample (being -1.36 and -2.61) suggest that the Vietnamese banking system is monopolistic. These H-statistics are not significantly different from zero but significantly different from one.

As for the input prices, LN(IE/FF) is generally positive and significant in all the models, which suggest that the unit cost of funds has the most direct impact on revenue and interest income. LN(PE/TE) and LN(CE/FA) are almost insignificant. LN(BR) is positive and significant in all the models except for the sub-sample SOCBs. Other control variables are generally insignificant. Banks that open more branches increase their revenue and interest income.

Chapter 6 Bank efficiency

6.1. Introduction

In this Chapter, we will examine performance of the Vietnamese banking system that indicates the level of efficiency. Similar to bank structure, we will evaluate the Vietnamese banking system on the following lines: (1) bank efficiency; (2) bank efficiency in emerging and developing countries; and (4) bank efficiency in Vietnam. The recently developed semi-parametric model will be applied through the two-stage procedure. In the first stage, we use data envelopment analysis (DEA) to estimate the relative efficiency scores in the sample CCR (Charnes *et al.*, 1978) and BCC (Banker *et al.*, 1984). In the second stage, we apply the Simar and Wilson (2007) procedure to bootstrap the DEA scores with a truncated bootstrapped regression. Explanatory variables (being assets, non-performing loans, branch networks, the number of years since establishment and city banks) will also be included in the second stage for estimation. Efficiency scores will be investigated using asset size (being small, medium, large and very large banks) and bank type (being SOCBs, JSCBs and JVCBs). We also compare average efficiency scores with macroeconomic factors such as GDP and inflation.

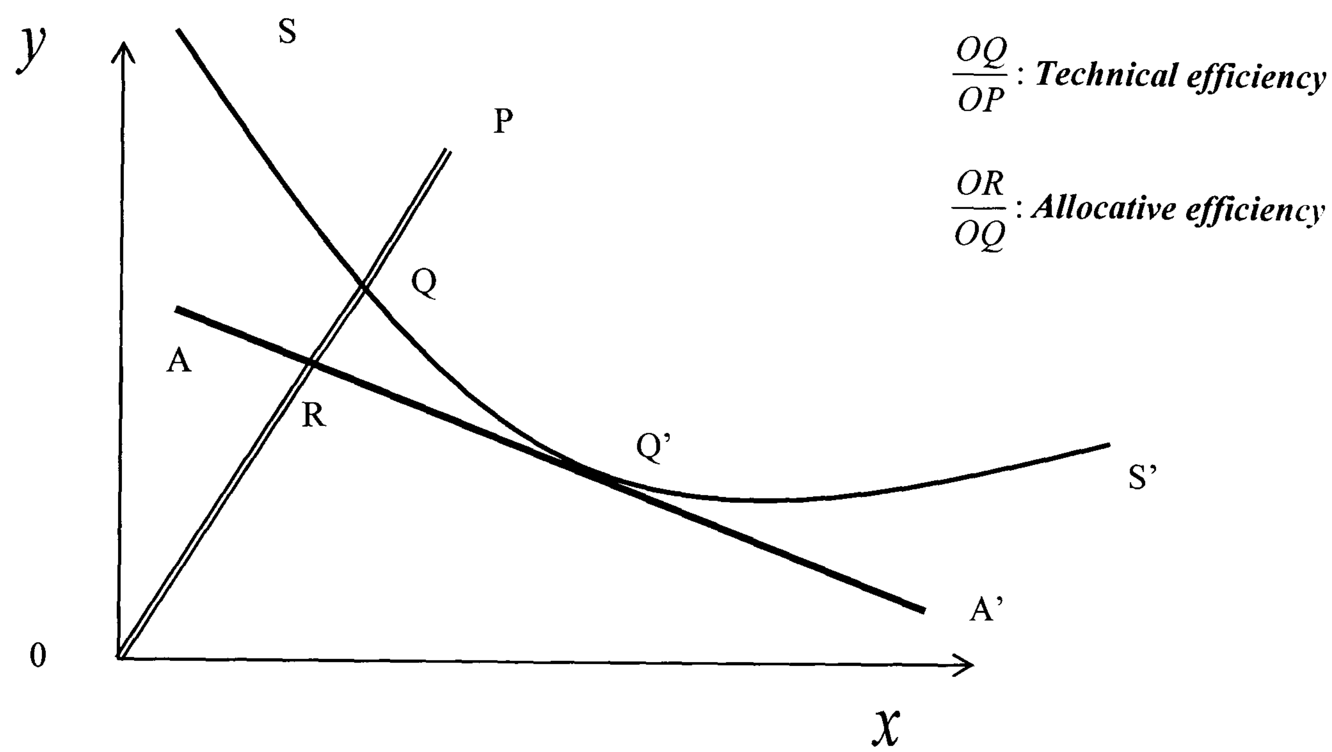
This Chapter is organised as follows: section 6.1 is the introduction; sections 6.2 and 6.3 are concerned with the literature review and methodology; section 6.4 contains empirical results; and section 6.5 sets out the conclusion.

6.2. Literature review

6.2.1. Bank efficiency

Notwithstanding the economies or countries, the structure of the banking market can be changed. We need to understand both market structure and efficiency. In this section, we will explain the banking market in a productive way to gain efficiency target. Productive efficiency includes technical and allocative (or economic) efficiencies.

Figure 6.1 Productive efficiency



Source: Farrell (1957)

Consider Figure 6.1, a bank employs two factors of production y and x to produce a single product, under the condition of constant returns to scale. Suppose the efficient production function is known; that is, the output that a perfectly efficient bank could obtain from any given combination of inputs x and y which are expressed by the isoquant SS'. The point P represents the inputs of the two factors, per unit of output, that the firm is observed to use. Q represents an efficient bank using the two factors in the same ratio as P. A bank produces the same outputs as P using only a fraction OQ/OP as much of each factor. It thus seems natural to define $\frac{OQ}{OP}$ as the *technical efficiency*. AA' has a slope equal to the ratio of the prices of the two factors, Q' and not Q is the optimal method of production. Now, although both points represent 100 per cent technical efficiency, the costs of production at Q' will only be a fraction $\frac{OR}{OQ}$ of those at Q. It is natural to define this ratio as the *allocative efficiency*.

In general, in technical efficiency (TE) a bank produces output y^0 with input x^0 (a vector where $x^0 = x_1, x_2, \ldots, x_n$) and the frontier production function is described by $\varphi(*)$. The firm is technically efficient if $y^0 = \varphi(x^0)$ and technically inefficient when $y^0 < \varphi(x^0)$. In allocative efficiency (AE), p_m is the price of input m. The firm is allocative efficient if $\varphi_m(x^0)/\varphi_n(x^0) = p_{m/}/p_n$, i.e., the ratio of derivatives of frontier production function, $\varphi(*)$, with respect to input m and input n, is equal to the ratio of prices of input m and n (assuming that $\varphi(*)$ is differentiable). On the contrary, the firm is allocative inefficient if $\varphi_m(x^0)/\varphi_n(x^0) \neq p_{m/}p_n$.

The mission is therefore to find frontier efficiency (or X-efficiency) $\frac{OR}{OQ}$ which measures deviations in performance from that of best-practice firms on the efficient frontier, holding constant a number of exogenous market factors such as the prices faced in local markets. That is, the frontier efficiency of an institution measures how well it performs relative to the predicted performance of the best firms in the industry if these best firms were facing the same market condition (Bauer *et al.*, 1998).

Four different approaches have been employed in evaluating bank input and output data. They are DEA (Data Envelopment Analysis), SFA (Stochastic Frontier Approach), TFA (Thick Frontier Approach) and DFA (Distribution-Free Approach). They differ in the assumptions made about the shape of the frontier, the existence of random error, and (if random error is allowed) the distributional assumptions imposed on the inefficiencies and random error in order to disentangle one from the other. These methods also often differ in whether the underlying concept of efficiency is technical or allocative, with the nonparametric DEA studies measuring technical efficiency and the parametric SFA, TFA, and DFA study usually measuring allocative efficiency (Ferrier and Lovell, 1990; Hunter and Timme, 1995 and Bauer *et al.*, 1998).

SFA (Parametric method): uses statistical techniques to estimate efficiency relative to the estimated frontier. In contrast to the deterministic statistical frontier approach, but in accordance with the typical non-frontier approach to the estimation of economic relationships, this approach allows the frontier to be stochastic. This approach specifies a function for cost, profit or production so as to determine the frontier, and treats the residual as a comprise error comprising (a) random error with a symmetric distribution – often normal; (b) inefficiency with an asymmetric distribution – often a half-normal on the grounds that inefficiencies will never be a plus for production or profit or a negative for cost (Mathews and Thompson, 2008: 157). The technique was first proposed by Aigner *et al.* (1977) and then developed by Greene (1990); Mester (1996) and Bauer *et al.* (1998).

TFA (Parametric method): uses the same functional form for the frontier cost function as SFA, but is based on a regression that is estimated using only the best performers in the data set. That is those in the lowest average-cost quartile for their size class. Parameter estimates from this estimation are then used to obtain estimates of best-practice cost for all of the firms in the data set (Bauer *et al.*, 1998: 94). Firms are ranked according to performance and it is assumed that (a) deviations from predicted performance values by firms from the frontier within the highest and lowest quartiles represent random error and (b) deviations between the highest and lowest quartiles represent inefficiencies (Mathews and Thompson, 2008: 157).

DFA (Parametric method): specifies a functional form for the cost function, as does SFA and TFA, but DFA separates inefficiencies from while the random error in a different way. It does not impose a specific shape on the distribution of efficiency (as does TFA). Instead, DFA assumes that there is a core efficiency or average efficiency for each firm which is constant over time, while random error tends to average over time. Unlike other approaches, a panel data set is required, and therefore only panel estimates of efficiency over the entire time interval are available (DFA-P) (Bauer *et al.*, 1998: 95).

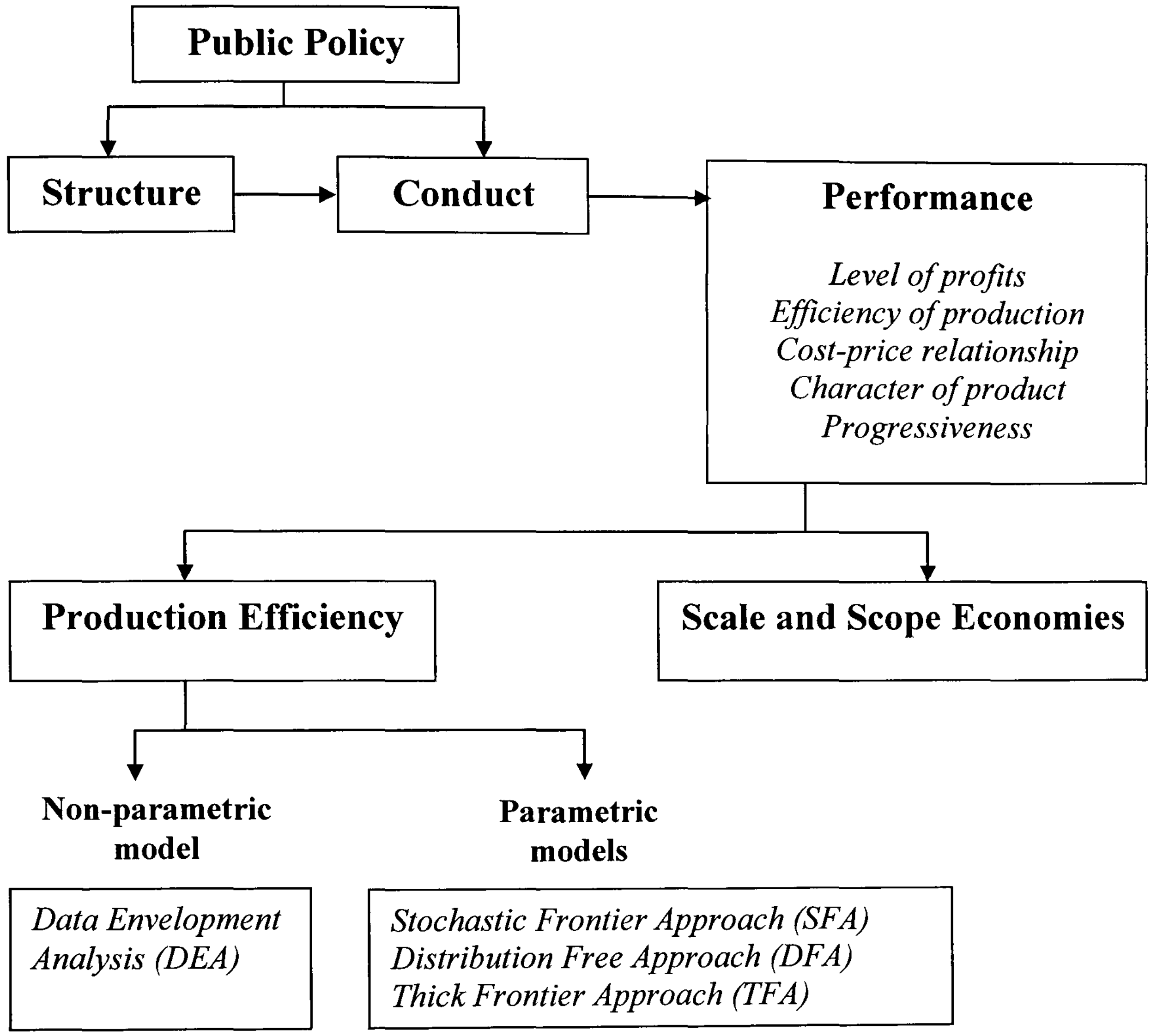
DEA (non-parametric method): uses linear programming techniques. In the usual radial forms of DEA which are based on technological efficiency, efficient firms are those for which no other firm (or linear combination of firms) produces as much as, or more of, every output (given inputs) or uses as little as, or less of, every input (given outputs). The DEA efficient frontier is composed of these un-dominated firms and the piecewise linear segments that connect the set of input/output combinations of these firms, yield a convex production possibilities set. An obvious benefit of DEA is that it does not require the explicit specification of a functional form and so imposes very little structure on the shape of the efficient frontier. DEA was first introduced by Charnel *et al.* (1978).

There have been several surveys of research on bank efficiency. Berger and Humphrey (1997) summarised and critically reviewed empirical estimates of financial institutions in 21 countries from 130 studies. They found that the non-parametric methods generally yield slightly lower mean efficiency estimates and seem to have greater dispersion than the results of the parametric models. Bauer *et al.* (1998) proposed a set of consistency conditions which frontier should meet to be more useful for regulatory analysis and other purposes by evaluating and comparing estimates of US bank efficiency. Casu *et al.* (2004) compared parametric and non-parametric estimates of productivity change in European banking between 1994 and 2000. They found that the competing methodologies do not yield markedly different results in terms of identifying the main components of productivity growth.

In brief, there is still no consensus as to the best method or set of methods for measuring frontier efficiency. Parametric approaches (SFA, TFA and DFA) impose a particular functional form that presupposes the shape of the frontier. Consequently, if the functional form is misspecified, measured efficiency may be confounded with specification error. On the other hand, the non-parametric approach (DEA) imposes less structure on the frontier, but does not allow for random error. If random error exists, the measure of efficiency may be confounded with these random deviations from the true efficient frontier (Goddard *et al.*, 2001: 124).

Above we have investigated the literature review of "market structure" in general and "bank structure" in particular. We examined "bank structure" from the basic knowledge of "market structure". As we emphasised in the last chapter, market conduct represents a necessary and logical link between structure and performance, being statistically associated to structure as its "cause" and to performance as its "effect". Moreover, the characteristics of market performance involve the level of profits, efficiency, the cost price relationship, the character of product and progressiveness. Hence, "bank efficiency" is used to explain "bank performance" which is, in reality, influenced by "bank structure" through "bank conduct". We should be aware that besides bank performance used by decision makers, bank efficiency also provides information to explain the information of merger and acquisitions or the probability of failure for authority regulators, etc (see Figure 6.2).

Figure 6.2 Relationship between bank structure and bank efficiency



6.2.2. Bank efficiency in emerging and developing countries

To the best of our knowledge, there was no survey of research on bank efficiency in emerging and developing countries. Table 6.1 clarifies the studies, data, models and main findings from emerging and developing countries.

Table 6.1 Studies on bank efficiency in emerging and developing countries

	Study	Data	Model	Findings
1	Bhattacharyya *et al.* (1997)	70 banks in India during the stage (1986-1991)	DEA, SFA	Public-owned banks are most efficient. Private-owned banks are the least efficient. Foreign banks were the least efficient at the beginning of the sample period, but by the end of the period they were nearly as efficient.
2	Hasan and Marton (2003)	193 Hungarian banks from 1993 to 1998	SFA	Foreign banks and banks with higher foreign bank ownership involvement were associated with lower inefficiency.
3	Chen *et al.* (2005)	43 Chinese banks from 1993 to 2000	DEA	The large state-owned banks and smaller banks are more efficient than medium sized banks.
4	Bonin *et al.* (2005)	225 banks from 11 EU transition countries from 1996 to 2000	SFA	Private ownership by itself is not sufficient to ensure bank efficiency. Efficiency appears to decrease nonlinearly with bank size, which is a puzzling result.
5	Fries and Taci (2005)	289 banks in 15 East European countries from 1994 to 2001	SFA	Private banks are more efficient than state-owned banks.
6	Havrylchyk (2006)	Polish banks from 1997 to 2001	DEA	Greenfield banks have achieved higher levels of efficiency than domestic banks. Foreign banks that acquired domestic institutions have not succeeded in enhancing their efficiency.
7	Fu and Heffernan (2007)	China's banking sector from 1985 to 2002	SFA	The joint-stock banks are found to be more X-efficient than the state-owned commercial banks.
8	Yildirim and Philippatos (2003)	325 banks from 12 Central and Eastern Europe countries from 1993 to 2000	SFA, DFA	Average cost efficiency level 72% and 77% by DFA and SFA. Poland and Slovenia appear to be the most cost efficient countries while the Russian Federation and the three Baltic States (Lithuania, Latvia, and Estonia) are the least efficient.
9	Matousek (2008)	147 banks from 8 new EU countries from 1995 to 2002	DFA	Estonia, Latvia and Slovenia display the highest efficiency. Czech Republic and Poland have the lowest efficiency.
10	Koutsomanoli-Filippaki *et al.* (2009)	10 Central and eastern Europe countries over the period 1998-2003	SFA	Except for Estonia no other countries has made significant efficiency gains. Most CCE countries increased productivity after 2000.

Source: author's findings.

6.2.3. Bank efficiency in Vietnam

In Vietnam, the research of Nguyen V (2007) measured efficiency by employing the DEA. His research has been applied to a sample of only 13 banks in Vietnam for the period of 2001-2003. His inputs are labour, capital and deposits. Outputs are interest and non-interest income. He argued that the average cost efficiency of the sampled banks was about 60.6%, and the average annual growth of the Malmquist index[33] was negative 2.2% over the study period. Conversely, total factor productivity (TFP) increased by 5.7% in 2003 relative to 2001, and

[33] Malmquist index is an extension of DEA (see Grifell-Tatje and Lovell, 1994).

the TFP of 2003 was 15.1% higher than that of 2002. This TFP improvement was achieved primarily by greater technical efficiency and, to some extent, by technological advancement. He also argued that there is a decline in technical efficiency of the Vietnamese banking system from 0.912 down to 0.895 in 2001 and 2002, respectively. Another interesting research by Nguyen XQ and De Borger (2008) considered single bootstrap efficiency and the Malmquist Index for 15 banks in the period of 2003-2006. They used labour, fixed asset, operating expense and deposit as inputs; and loan and investment as outputs. It was found that the productivity of Vietnamese banks tended to decrease over the small sample period, except for the year 2005. However, the bootstrapping results indicate that the productivity change between 2004 and 2005 was not significant. Both studies, however, did not consider the impacts of environmental variables on the inputs and outputs in the first period.

6.3. Methodology

The recently developed semi-parametric model of Simar and Wilson (2007) is applied through a two-stage procedure. In the first stage, we will use DEA to estimate the relative efficiency scores in the sample. In the second stage, we will apply the Simar and Wilson (2007) procedure to bootstrap the DEA scores with a truncated bootstrapped regression. Explanatory variables will be included in the second stage for estimation. These methods are applied to panel data from individual balance sheets and income statements of 48 Vietnamese banks in the period from 1999 to 2009.

A considerable amount of published research has appeared, with a significant portion focused on DEA applications of efficiency and productivity in both public and private sector activities. Ali *et al.* (2008) argued that there are more than 4,000 research articles published in journals or book chapters using DEA. Simar and Wilson (2007) also mentioned a Google hit of about 800 published articles and working papers using the two-stage DEA approach for efficiency. This study evaluates the technical efficiency of the Vietnamese banking system using non-parametric, output-orientation DEA with single and double bootstrap procedures.

There are some reasons for the use of the Simar and Wilson (2007) bootstrap procedure in DEA. Firstly, the true efficiency score is not observed directly but is empirically estimated. Secondly, the empirical estimates of the efficiency frontier are obtained based on the chosen sample of banks, thereby ruling out some efficiency production possibilities not observed in the sample (Simar and Wilson, 2007). Thirdly, the DEA two-stage procedure also depends upon other explanatory variables, which are not taken into account in the first-stage efficiency estimation. This implies that the error term must be correlated with the second-stage explanatory variables. Fourthly, the domain of the efficient score is restricted to the zero-one interval, which should be taken into account in the second-stage estimation (Simar and Wilson, 2007). The method introduced by Simar and Wilson (2007) overcomes these difficulties by adopting a procedure based on a double bootstrap that enables consistent inference within models and explains efficiency scores while simultaneously producing confidence intervals (Barros *et al.*, 2008: 3-4).

We extend the current research of efficiency in Vietnam in two ways. Firstly, we use a dataset of 48 banks for the period of 11 years (1999–2009). Nguyen V (2007) used DEA for 13 banks from 2001 to 2003. Nguyen XQ and De Borger (2008) applied single bootstrapping efficiency for 15 banks in from 2003 to 2006. Secondly, we employ bootstrapping procedures as Algorithm 1 and 2 of Simar and Wilson (2007). Both of the two studies in Vietnam did not regress efficiency scores on the environmental covariates in the second stage.

6.3.1. Input and output specification

There is no simple solution to the problem of input and output specification; reasonable arguments can be made for all approaches. There are two main approaches to the input and output specification of financial institutions (Sealey and Lindley, 1977; Favero and Papi, 1995; Grabowski *et al.*, 1993; Berger and Humphey, 1997:197; Mlima and Hjalmarsson, 2002 and Matthews and Thompson, 2008), namely the production approach and the intermediation approach. In order to choose a suitable method for the Vietnamese banking system, one needs to understand these approaches correctly.

Under the production approach, banks are mainly considered as producers of deposit accounts and loan services (Favero and Papi, 1995: 388). Financial institutions perform transactions and process documents for customers, such as loan applications, credit reports, checks or other instruments. Inputs are physical entities such as labour and physical capital. The proponents of the production approach argue that all deposits should be treated as an output since they are associated with liquidity and safekeeping and are involved in generating value added. Other outputs will be net interest income and non-interest income from the profit and loss account; or the number of accounts serviced or transactions processed. One problem with this method is that interest costs are ignored (Matthews and Thompson, 2008: 148-152). Moreover, detailed transaction flow data is typically propriety and not generally available.

Another method is the intermediation approach. This approach recognises that the main function of banks is to act as a financial intermediary. The selection of outputs and inputs is based on the bank's assets and liabilities. The main reason for the use of balance sheet data to measure inputs and outputs is because of the relative availability of the data. Deposits are seen as input in the production of loans (an output). A variant of the intermediation approach is the so-called asset approach that focuses on developments in the theory of intermediation. Outputs are strictly defined by assets and mainly by the production loans, in which banks have advantages over other financial institutions. The main shortcoming of the intermediation and asset approaches is that they do not take into account most of the services provided by banks. Details of inputs and outputs used in the production, intermediation and asset approaches can be found in Mlima and Hjalmarsson (2002: 20-21) and Favero and Papi (1995: 389).

It has been suggested by various writers that researchers can adopt any measure of output for the financial firm as long as the measure is consistent with the researcher's goal (Sealey and Lindley, 1977: 1252). Previous research on the Vietnamese banking system of Nguyen V (2007); Nguyen XQ and De Borger (2008) used core labour and deposits as inputs. While Nguyen V (2007) employed the two outputs of interest and non-interest income Nguyen XQ and De Borger (2008) added consumer loans as an output. Both of them could not collect purchased funds and business loan data.

In this paper, we regard the Vietnamese banking system as the transformer of deposits and purchased funds into customer loans and other loans. Therefore, we use the intermediation approach classified by Berger and Mester (1997). This choice is also due to the availability of data. All the criteria are indices of bank i in year t. Inputs are: (i) staff, measured by the number of employees; (ii) purchased funds are deposits from the SBV and other banks in the system; and (iii) customer deposits (or core deposits), which are described as total deposits from corporate and private customers. Outputs include: (i) customer loans, which are total loans for the corporate and private sectors; (ii) other loans: all other loans except customer loans; and (iii) securities, defined as investment and trading securities of the bank (Berger and Mester, 1997).

6.3.2. Bootstrap two-stage procedure

In the first stage, the technical efficiency of banks is estimated, using DEA in order to establish which bank is the most efficient. Their rankings are based on productivity in the period 1999-2009. In the second stage, the Simar and Wilson (2007) procedure is used to bootstrap the DEA scores with a truncated bootstrapped regression (Barros *et al.* 2008).

Stage 1[34]

Consider the jth bank with outputs and inputs Y_{rj}, X_{ij} (that are all positive) where U_r and V_i are the variable weights to be determined by the solution of this problem (Charnes *et al.*, 1978: 430).

$$\text{Max } \hat{\delta}_0 = \frac{\sum_{r=1}^{s} U_r Y_{r,0}}{\sum_{i=1}^{m} V_i X_{i,0}} \qquad \textbf{(6.1)}$$

Subject to:

$$\frac{\sum_{r=1}^{s} U_r Y_{r,j}}{\sum_{i=1}^{m} V_i X_{i,j}} \leq 1 ; \ j = 1, 2, \ldots, n \qquad \textbf{(6.2)}$$

$U_r, V_i \geq 0$; r = 1, 2, …, s; i = 1, 2, …, m

The true efficiency score $\hat{\delta}_i$ is not observed directly but is empirically estimated. Many studies have used a two-stage approach, where efficiency is estimated in the first stage, and then the estimated efficiencies (or ratios of estimated efficiencies, Malmquist indices, and many others) are regressed on covariates (typically different from those used in the first stage) that are viewed as presenting environmental variables (Simar and Wilson, 2007:32 and Barros

[34] Step 1 of Algorithm 1 and Algorithm 2

et al., 2008:3). We will use Simar and Wilson (2007) to estimate the $\hat{\delta}_i$ in the second stage. This technique has been applied in many areas such as banking (Barros *et al.*, 2008; Brissimis *et al.*, 2008 and Delis and Papanikolaou, 2009) and other sciences (Balcombe *et al.*, 2008, Kapelko *et al.*, 2007; Olson and Vu L, 2009; Alexander *et al.*, 2010 and Assaf *et al.*, 2011).

Stage 2[35]

Firstly, we need to understand the definition of a bootstrap. Keele (2008:178) defined the bootstrap as follows. Assume we have produced a statistical estimate, but perhaps the sample size is small or we have used a statistic for which there is no known sampling distribution. Either situation is problematic for classical inferential theory. To deal with this, we take new samples, typically of the same size, from the original sample and estimate the statistic for each new sample. An observed value from the original sample can appear more than once in any particular bootstrap sample. If we repeat this process enough times, we can form an empirical sampling distribution to construct confidence intervals for the estimate. We apply the principles of inference but treat our sample as the population. As Efron and Tibshirani (1993) and Hall *et al.* (1993) argued that bootstrap method has become more widely known and available, especially in the research of efficiency.

In this study, to implement the bootstrap procedure for DEA we assume that the original data is generated by a data generating process (DGP) and that we are able to simulate the DGP by taking a new or pseudo data set that is drawn from the original data set (step 3.3 in Algorithm 2). We then re-estimate the DEA model with this new data (steps 4 and 5 in Algorithm 2). By repeating this process 2000 times[36] (step 2 in Algorithm 1 and step 6 in Algorithm 2) we are able to derive an empirical distribution of these bootstrap values. The performance of the bootstrap methodology and the reliability of the statistical inference crucially depend on how well it characterises the true DGP (Balcombe *et al.*, 2008:1921). The number of bootstrap

[35] Steps 2 to 4 of Algorithm 1; steps 2 to 7 of Algorithm 2.

[36] The number of bootstrap replications is used to construct estimated of the confidence intervals in the two algorithms. Confidence-interval estimation is tantamount to estimating the tails of distributions, which necessarily requires more information. Hall (1986) suggested 1,000 replications for estimating confidence intervals. We followed Simar and Wilson (2007) and used 2,000 replications in our simulations. More accurate estimates can be achieved with a larger number of replications. However, the waiting time also rises when number of replications increase (see Simar and Wilson, 2007:44).

replications used to compute the bias-corrected estimates $\hat{\hat{\delta}}_i$ (step 3 in Algorithm 2 below) is 100 times[37].

The efficiency score, $\hat{\delta}_i$, of bank j obtained in the first stage are regressed on explanatory variables in the second stage (Efron and Tibshirani, 1993). Consider the following:

$$\hat{\delta}_{i,t} = \beta z_i + \varepsilon_i \tag{6.3}$$

Or

$$\hat{\delta}_{i,t} = \beta_0 + \beta_1 ROA_{i,t} + \beta_2 COA_{i,t} + \beta_3 ROE_{i,t} + \beta_4 CITY_{i,t} + \beta_5 LN(TA_{i,t}) + \beta_6 LN(NLCL_{i,t}) + \beta_7 LN(BR_{i,t}) + \beta_8 LN(AGE_{i,t}) + \varepsilon_{i,t} \tag{6.4}$$

Where: $\hat{\delta}_i$ represents the DEA-CCR model efficiency score, estimated in stage 1, and the other independent variables are environmental covariates.

Algorithm 1

Step 1 Using original data of outputs and inputs Y_{rj}, X_{ij} (that are all positive), compute DEA efficiency scores $\hat{\delta}_i$

Step 2 Use the method of maximum likelihood to obtain an estimate $\hat{\beta}$ of β as well as an estimate $\hat{\sigma}_\varepsilon$ of σ_ε in the truncated regression of $\hat{\delta}_i$ on z_i using m<n observations where $\hat{\delta}_i > 1$

Step 3 Loop over the next three steps **([3.1]-[3.3])** 2000 times to obtain a set of bootstrap estimates $A = \left\{ \left(\hat{\beta}^*, \hat{\sigma}^* \right)_b \right\}_{b=1}^{2000}$:

[3.1] For each i=1,...,m, draw ε_i from the $N(0, \hat{\sigma}_\varepsilon^2)$ distribution with left-truncation at $(1 - z_i \hat{\beta})$

[37] Simar and Wilson (2007:44) found that 100 replications are sufficient to compute the bias-corrected estimates which requires only computation of a mean and then a difference.

[3.2] Again for each i=1,...,m, compute $\delta_i^* = z_i \hat{\beta} + \varepsilon_i$

[3.3] Use the maximum likelihood method to estimate the truncated regression of δ_i^* on z_i, yielding estimates $\hat{\beta}^*, \hat{\sigma}^*_\varepsilon$

Step 4 Use bootstrap values in **A (step 3)** and the original estimates $\hat{\beta}, \hat{\sigma}_\varepsilon$ to construct estimated confidence intervals for each element of β and for σ_ε as described below

Algorithm 2

Step 1 Using original data of outputs and inputs Y_{rj}, X_{ij} (all positive), compute DEA efficiency scores $\hat{\delta}_i$

Step 2 Use the method of maximum likelihood to obtain an estimate $\hat{\beta}$ of β as well as an estimate $\hat{\sigma}_\varepsilon$ of σ_ε in the truncated regression of $\hat{\delta}_i$ on z_i using m<n observations where $\hat{\delta}_i > 1$

Step 3 Loop over the next four steps (**[3.1]-[3.4]**) 100 times to obtain a set of bootstrap estimates $A = \left\{ \left(\hat{\beta}^*, \hat{\sigma}^*_\varepsilon \right)_b \right\}_{b=1}^{100}$:

[3.1] For each i=1,...,m, draw ε_i from the $N(0, \hat{\sigma}^2_\varepsilon)$ distribution with left-truncation at $(1 - z_i \hat{\beta})$

[3.2] Again for each i=1,...,n, compute $\delta_i^* = z_i \hat{\beta} + \varepsilon_i$

[3.3] Set $x_i^* = x_i, y_i^* = y_i(\hat{\delta}_i / \delta_i^*)$ for all i=1,2,...n.

[3.4] Compute the new technical efficiency $\hat{\delta}_i^*$ by replacing $Y^* = [y_1^*, ..., y_n^*], X^* = [x_1^*, ... x_n^*]$

Step 4 For each i=1,...,n, compute the bias corrected estimator $\hat{\hat{\delta}}_i$ using bootstrap estimates in step 3.4 and the original $\hat{\delta}_i$

Step 5 Use the maximum likelihood method to estimate the truncated regression of $\hat{\hat{\delta}}_i$ on z_i, yielding estimates $\hat{\hat{\beta}}, \hat{\hat{\sigma}}$

Step 6 Loop over the next three steps (**[6.1]-[6.3]**) 2000 times to obtain a set of bootstrap estimates $K = \left\{ \left(\hat{\beta}^*, \hat{\hat{\sigma}}^* \right)_b \right\}_{b=1}^{2000}$:

[6.1] For each i=1,...,n, draw ε_i from the $N(0,\hat{\hat{\sigma}})$ distribution with left-truncation at $(1-z_i\hat{\beta})$

[6.2] Again for each i=1,...,m, compute $\delta_i^{**} = z_i\hat{\hat{\beta}}+\varepsilon_i$

[6.3] Use the maximum likelihood method to estimate the truncated regression of δ_i^{**} on z_i, yielding estimates $\hat{\hat{\beta}}^*, \hat{\hat{\sigma}}^*$

Step 7 Use bootstrap values in **K (step 6)** and the original estimates $\hat{\hat{\beta}},\hat{\hat{\sigma}}$ to construct $(1-\alpha)$ estimated confidence intervals for each element of β and for σ_ε

Estimate confidence intervals

Steps 1 and 2 in Algorithm 2 are the same as Algorithm 1. Steps 3 and 4 in Algorithm 2 employ a parametric bootstrap in the first-stage problem in order to produce bias-corrected estimates $\hat{\hat{\delta}}_i$ After step 3 in Algorithm 1 and step 6 in Algorithm 2, percentile bootstrap confidence intervals can be constructed as follows:

$$\Pr ob(Lower_{\alpha,j} \le \beta_j \le Upper_{\alpha,j}) = 1-\alpha$$

Where $Lower_{\alpha,j}$ and $Upper_{\alpha,j}$ are calculated using the empirical intervals obtained from the bootstrap values

$$\Pr ob(-\hat{b}_\alpha \le \hat{\hat{\beta}}_j^* - \hat{\hat{\beta}}_j \le -\hat{a}_\alpha) \approx 1-\alpha$$

And $Upper_{\alpha,j} = \hat{\hat{\beta}}_j + \hat{b}_\alpha ; Lower_{\alpha,j} = \hat{\hat{\beta}}_j + \hat{a}_\alpha$

Practical implementation of Algorithm 1 and 2

There are packages available to compute the DEA efficiency estimator such as DEAP (Data Envelopment Analysis Programme) by Tim Coelli; PIM-DEA; LIMDEP and STATA. Interpreters such as MATLAB, R, S-Plus, etc. can be used to organise the results from one package so that they may be fed to another package (Simar and Wilson, 2007). We have tried STATA. Recent commands of Lee and Ji (2009) can be used to estimate DEA using constant or variable returns to scale function. However, it takes a longer time to get the results with

STATA compared with FEAR on R package. Truncated regression and loop commands are also not well specified in STATA, compared with FEAR in R.

In this study, some commands in package FEAR for R are used. Firstly, command "dea" is employed to estimate constant or variable returns to scale, output-orientation (step 1 in Algorithm 1 and 2). Secondly, we used commands "treg" for truncated normal regression with the maximum likelihood method; and "rnorm.trunc" for random deviates generation (step 2 in Algorithm 1 and 2). Regarding truncated regression, the log-likelihood is maximised using a Newton method. The data in environmental variables should be scaled so that the data do not differ by too many orders of magnitude from one; otherwise, achieving convergence may be difficult (Wilson, 2010a: 34). Another drawback of FEAR in bootstrap is that characteristics make it fail to provide results in some cases. With a larger number of observations we need to eliminate variables in order to get the results in the bootstrap. In this study, FEAR version 1.14 and R version 1.11.1 will be used to estimate the DEA scores and truncated bootstrap models. Two methods are used to produce the results from R platform: (i) export data to an ascii file, and then an excel work file (Alain *et al.*, 2009: 69); or (ii) manipulate and insert codes from R into a LATEX document preparation system (Wilson, 2010b: 12). Results from this study will be produced using the second method.

6.3.3. Environmental variables specification

We employ explanatory variables to estimate their impacts upon efficiency scores of the Vietnamese banking system. The efficiency scores obtained in the first-stage will likely be correlated with the explanatory variables in the second-stage, such that the second stage estimates will then be inconsistent and biased. The Simar and Wilson (2007) bootstrap procedure is used to deal with this problem (Efron and Tibshirani, 1993; Barros *et al.*, 2008).

Following Berger and Mester (1997), we employ eight explanatory variables in the second stage to determine factors explaining in bank efficiencies. Three financial variables are: (1) profit before tax divided by total assets (ROA); (2) profit before tax divided by total equities (ROE); (3) total costs divided by total assets (COA). Five other characteristics of banks are also considered. CITY is a dummy variable that is equal to one if a bank is transformed from a rural commercial bank to a city commercial bank and zero otherwise. This variable aims to capture efficiency related to transforming banks. LN(TA) is the natural logarithm of total assets and LN(BR) is the natural logarithm of total branches and these provide information about the relationship between efficiency and asset and branch networks. LN(AGE) is the natural logarithm of the number of years the bank existed before 2009. Lastly, LN(NLCL) is the natural logarithm of the ratio of non-performing loans to customer loans. More details of environmental variables can be found in Berger and Mester (1997). As we have mentioned before, it is difficult to get convergence from the maximum likelihood regression variables if there are omitted variables or if the variables are poor proxies.

6.4. Empirical results

We will apply equations for efficiency estimations. Firstly, inputs and outputs are defined and estimated. Then efficiency scores are calculated for 48 Vietnamese commercial banks. Environmental variables are clarified in the nest step and Algorithm 1 and Algorithm 2 are completed by comparing all efficiency scores.

6.4.1. Efficiency scores

Table 6.2 reports characteristics of inputs and outputs. As the intermediation approach, there are three inputs and three outputs. The first column list names of the variables. Columns 2 to 6 give statistics which include mean, median, standard deviation, minimum and maximum.

Table 6.2 Descriptive statistics of inputs and outputs (Units: Million VND except for Staff)

Variables	Mean	Median	Std deviation	Minimum	Maximum
Inputs					
1. Staff (People)	2,363.59	485	5,380.34	31	35,135
2. Purchased Fund	4,717,463.63	953,304	9,114,539.41	0	65,317,125
3. Customer Deposit	16,876,982.94	2,801,850	39,407,328.37	796	34,964,4191
Outputs					
4. Customer Loan	15,412,044.60	2,642,000	39,384,206.14	496	372,438,322
5. Other Loan	5,603,227.19	1,029,387	11,005,779.19	226	72,637,734
6. Securities	3,182,009.32	189,737	7,871,634.06	0	44,573,879

Sources: Financial statements of 48 Vietnamese banks in the period of 1999-2009.

The average number of staff of a commercial bank in a year is 2,364 people. Some banks are very small in terms of size, branch networks and capital, especially when they are new members of the market. For instance, the total number of employees of the smallest bank is 31. A number of banks did not have securities trading and investment until 2003-2004 while some banks only have deposits from corporate and private customers, and not from SBV or other banks. Hence, the minimum securities and purchased funds are zero. The minimum number of staff in a bank in a year is 31 people and the maximum number is 35,135. All values of customer deposits are higher than customer loans.

In this study, the Farrell (1957) measure is applied to compute technical efficiency. In other words, inputs are exogenous and outputs are endogenous. Three types of technically efficient scores will be produced. Firstly, the CCR relationship between inputs and outputs measure the overall efficiency for each Decision Making Unit (DMU) (Charnes *et al.*, 1978). It is composed of a non-additive combination of pure technical and scale efficiencies. Secondly, BCC or variable return to scale relationship between inputs and outputs is used to measure pure technical efficiency for each DMU (Banker *et al.*, 1984). One important characteristic of the BCC index is that it gives a score that is equal to, or larger than, the score obtained by CCR index method. Lastly, the scale efficiency score is created by dividing the aggregate CCR by the technical efficiency BCC scores (Fare *et al.*, 1994). A unit is scale efficient when its size of operation is optimal. When its size is either increased or decreased its efficiency will drop (Barros *et al.*, 2008). Assuming that pure technical efficiency is attributed to managerial skill means that the BCC scores are interpreted as managerial skills. After implementing commands in R software we have efficiency scores assuming CCR and BCC, presented in Tables 6.3 and 6.4. All scores are from zero (0%) to one (100%). Banks with scores equal to one are efficient. Banks with scores of less than one are inefficient. This means a bank with a score of 0.70 is only 70% as efficient as the best-performing bank.

The average technical efficiency score for the whole system is 0.71 assuming constant return to scale and 0.78 assuming variable return to scale. One problem with the DEA approach is that the total residual (i.e. the gap between best practice and the bank's actual practice) is assumed to be due X-efficiencies, whereas some of it may be attributable to good luck, especially advantageous circumstances and other factors such as measurement errors. Hence, it would be expected that efficiency estimates by DEA would be lower than those obtained by the other methods trying to segregate the random error from X-efficiencies (Matthews and Thompson, 2008:156). The overall mean efficiency of US banks in the studies surveyed in Berger and Humphrey (1997) is 0.79. The mean for the non-parametric studies is 0.72 and that for the parametric studies 0.84. The value scores on non-parametric approach of US banks is similar, if slightly higher than those of Vietnamese banks or Vietnamese banks are almost efficient as US banks.

Table 6.3 Technical efficiency average scores in terms of asset size in 2009

Years	Small banks (Asset: 0-20,000 billion VND)		Medium banks (Asset: 20,000-50,000 billion VND)		Large banks (Asset: 50,000-100,000 billion VND)		Very large banks (Asset: More than 100,000 billion VND)	
	CCR	BCC	CCR	BCC	CCR	BCC	CCR	BCC
1999	**0.51**	0.52	0.46	**0.47**	0.71	0.71	0.49	**0.63**
2000	**0.49**	0.50	0.49	**0.50**	0.76	0.78	0.58	**0.69**
2001	0.56	0.57	0.46	**0.47**	0.68	0.71	0.68	0.82
2002	0.55	0.59	0.50	**0.54**	0.62	0.67	**0.73**	**0.93**
2003	0.55	0.64	**0.60**	**0.65**	0.59	0.62	0.70	**0.86**
2004	0.66	**0.74**	0.68	0.81	0.70	0.74	0.69	0.85
2005	0.72	0.74	0.72	0.80	0.73	0.78	0.73	0.89
2006	**0.73**	0.77	0.83	0.87	0.75	0.83	0.77	**0.94**
2007	0.81	0.85	0.84	**0.93**	0.86	0.94	**0.83**	0.94
2008	0.81	0.87	0.77	0.88	0.80	0.90	0.81	0.94
2009	0.83	0.89	0.75	0.85	0.87	0.95	0.85	0.99
Mean	0.66	0.70	0.65	0.71	0.73	0.78	0.71	0.86

Table 6.4 Technical efficiency average scores in terms of bank type

Years	State Owned Bank			Joint Stock Bank			Joint Venture Bank			Whole system						
														Banks	Efficient Banks	
	CCR	BCC	Banks	CCR	BCC	Banks	CCR	BCC	Banks	CCR	Change(+/-)	BCC	Change(+/-)		CCR	BCC
1999	0.52	0.64	5	0.54	0.56	10	0.54	0.55	2	0.54	(—)	0.58	(—)	17	1	1
2000	0.51	0.63	5	0.56	0.58	14	0.69	0.70	3	0.56	(0.02)	0.60	(0.02)	22	1	2
2001	0.59	0.73	5	0.57	0.59	16	0.69	0.71	4	0.59	(0.03)	0.64	(0.04)	25	4	5
2002	0.63	0.84	5	0.56	0.61	19	**0.71**	0.74	4	0.59	(0.00)	**0.67**	(0.03)	**28**	0	4
2003	0.66	0.83	5	0.56	0.62	20	**0.72**	0.79	4	0.60	(0.01)	**0.68**	(0.01)	29	2	5
2004	0.68	**0.89**	5	0.68	0.75	31	**0.68**	0.72	4	0.68	(0.08)	**0.77**	(0.09)	40	2	6
2005	0.74	0.94	5	0.71	0.75	32	**0.82**	0.85	4	0.72	(0.04)	**0.78**	(0.01)	41	4	8
2006	0.84	0.99	5	0.75	0.80	31	**0.77**	0.84	5	**0.76**	(0.04)	**0.83**	(0.05)	41	**7**	10
2007	0.87	**0.98**	5	**0.83**	0.90	34	0.75	0.78	5	**0.83**	(0.07)	0.89	(0.06)	44	9	18
2008	**0.86**	1.00	5	0.78	0.86	36	**0.89**	0.90	5	**0.80**	(-0.03)	0.88	(-0.01)	46	8	13
2009	0.83	1.00	5	**0.80**	0.88	36	**0.92**	0.92	4	0.82	(0.02)	**0.90**	(0.02)	46	8	**21**
Mean	0.70	0.86		0.70	0.76		0.76	0.79		0.71		0.78				

In 2009, HSBC (FCB) had average efficiency score of 1 for both CCR and BCC; Mean of non-SOCBs (JSCBs, JVCBs and BFBs): CCR (0.82) and BCC (0.85); Sources: Financial statements of 48 Vietnamese banks in the period of 1999-2009.

Tables 6.3 and 6.4 report efficiency average scores categorised as asset size and bank types. In Table 6.3, total assets in 2009 is be used to group the banks into small, medium, large and very large types.

- ✓ Small banks have total assets in 2009 less than 20,000 billion VND.
- ✓ Medium banks have total assets in 2009 from 20,000 to 50,000 billion VND.
- ✓ Large banks have total assets in 2009 from 50,000 to 100,000 billion VND.
- ✓ Very large banks have total assets in 2009 more than 100,000 billion VND.

The results indicate that large and very large banks are more efficient than small and medium banks. Very large banks include the four biggest SOCBs and two biggest JSCBs (namely the Asia Commercial Bank and Sacombank) in terms of customer loans, total assets and customer deposits. Large banks comprise five big JSCBs: Techcombank, Export-Import Bank, Military Bank, Maritime Banks, and Vibbank. Medium banks contain the remaining SOCBs, and the five other JSCBs. Small banks are all the JVCBs and newly established banks.

Large banks (five JSCBs) had the highest CCR measure (being 0.73) throughout 11 years. CCR average score of very large banks (0.71) is lower than large banks but their BCC average score is much higher (0.86). Three banks in the very large group, including the Bank for Foreign Trade, Asia Commercial Bank and Sacombank, received the awards from foreign organisations, regarding their business. The small and medium groups had similar average scores from 1999 to 2009. Medium and large banks were strongly affected by the crisis in 2008, making their scores fall from 2007 to 2008. Medium bank CCR scores reduced from 0.84 to 0.77 and 0.75 in 2007, 2008 and 2009, respectively. Large bank CCR scores dropped from 0.86 to 0.80 between 2007 and 2008, and recovered to 0.87 in 2009. The crisis also affected the very large banks, with CCR scores falling from 0.83 to 0.81 between 2007 and 2008. Small banks were safe from the crisis. Their CCR measure was unchanged at 0.81 in these years. Both small and very large banks raised their scores in 2009, to 0.83 and 0.85, respectively. Small banks have the smallest efficiency scores in the system, which is 0.66 assuming CCR and 0.70 assuming BCC.

From Table 6.4, averaging over all years and bank types, the initial estimates of average technical efficiency are 0.71 assuming CCR and 0.78 assuming BCC. In 1999 efficiency scores for the whole system were the lowest being 0.54 with CCR and 0.58 with BCC. There was only one bank (being the Export Import Commercial Bank) out of a total of seventeen banks that was on an efficient frontier in 1999. JSCBs and JVCBs were more efficient than SOCBs in 1999 with CCR scores of 0.54, 0.54 and 0.52, respectively. In terms of CCR, JVCBs had the highest average score over time of 0.76. SOCBs and JSCBs both had average CCR scores of 0.7. However, SOCBs was the leading group according to the BCC score with 0.86, followed by JVCBs, 0.79. JSCBs (0.76) had the largest number of banks and seem to be affected by some small and inefficient banks. Non-SOCBs (JSCBs, JVCBs and FCB) have the average CCR and BCC, being 0.82 and 0.85 while SOCBs have the corresponding values at 0.70 and 0.86. This indicates that the non-SOCBs and SOCBs have the similar technical efficiency but non-SOCBs are more efficient than SOCBs assuming overall efficiency.

In general, there was a clear upward trend of technical efficiency for the bank types over the years except for two time periods: 2001–2002 and 2007–2008. In the period from 2001 to 2002, the CCR measure for all banks showed no change of 0.59. The similar results are found in Nguyen V (2007), based on input and output data for thirteen commercial banks in Vietnam. He argued that there was a decline in efficiency from 0.912 to 0.895 in 2001 and 2002, respectively. In our study, there are more (28) banks. In 2002, none of them was at efficient frontier assuming CCR while four banks were completely efficient assuming BCC (the Bank for Agriculture and Rural Development, Bank for Investment and Development, Asia Commercial Bank and Petrolimex Group Bank). During the development of the banking system, there was a passage of banking reform in 2002 which could have affected banking efficiency. Basic interest rate from 2000 to 2002 was set by the SBV. Non-performing loans still accounted for 7.06% of total loans in 2002, before sharply plummeting to 4.74% in 2003. The only group affected by this change was the JSCBs and its efficiency score (CCR) fell from 0.57 to 0.56 between 2001 and 2002, remained constant at 0.56 in 2003, before sharply rising to 0.68 in 2004. SOCBs and JVCBs' efficiency scores only rose gradually in this period.

In the period from 2007 to 2008, the BCC measure for all banks declined by -0.01, and the CCR measure fell by -0.03. Before the reduction in 2008, the CCR efficiency measure hit a peak of 0.83 in 2007, which was the highest throughout the whole sample. This is consistent with our expectation. Prior to 2006, the average growth of GDP was 7.8% per year. The banking system had provided a great capital source for the economy, making up approximately 16% to 18% of GDP annually, which was almost equivalent to 50% of the total investment capital of the whole country. However, the global financial crisis at the end of 2007 and the beginning of 2008 had an impact on the efficiency scores. The banking system encountered many difficulties, resulting from a loss of balance in the source and use of funds, and the rapid increase in credit growth. Moreover, tightening monetary policy had caused many banks to become weaker. Compulsory measures were necessary for banks to reorganise and strengthen their organisations. Both SOCBs and JSCBs' efficiency score measures decreased in this period. SOCBs' CCR slightly declined from 0.87 to 0.86 while JSCBs' efficiency scores (CCR) sharply fell from 0.83 to 0.78 between 2007 and 2008. In contrast, JVCBs' CCR dramatically increased from 0.75 to 0.89.

After 2008, the Vietnamese economy, in parallel with the global economy, recovered. The efficiency scores reflected this change in 2009. For the whole banking system in 2009 the CCR score is 0.82 and the BCC score is 0.90 (both increased by 0.02 points from 2008). SOCBs still suffered from the crisis, not in terms of managerial skills but their leading roles in the economy of deposits and loans which are inputs and outputs, respectively. The SOCBs' CCR efficiency score plunged from 0.86 to 0.83. A positive correlation between DEA assuming CCR and BCC can be found in Figure 6.3.

Figure 6.3 Scatter plot of DEA-CCR and DEA-BCC scores

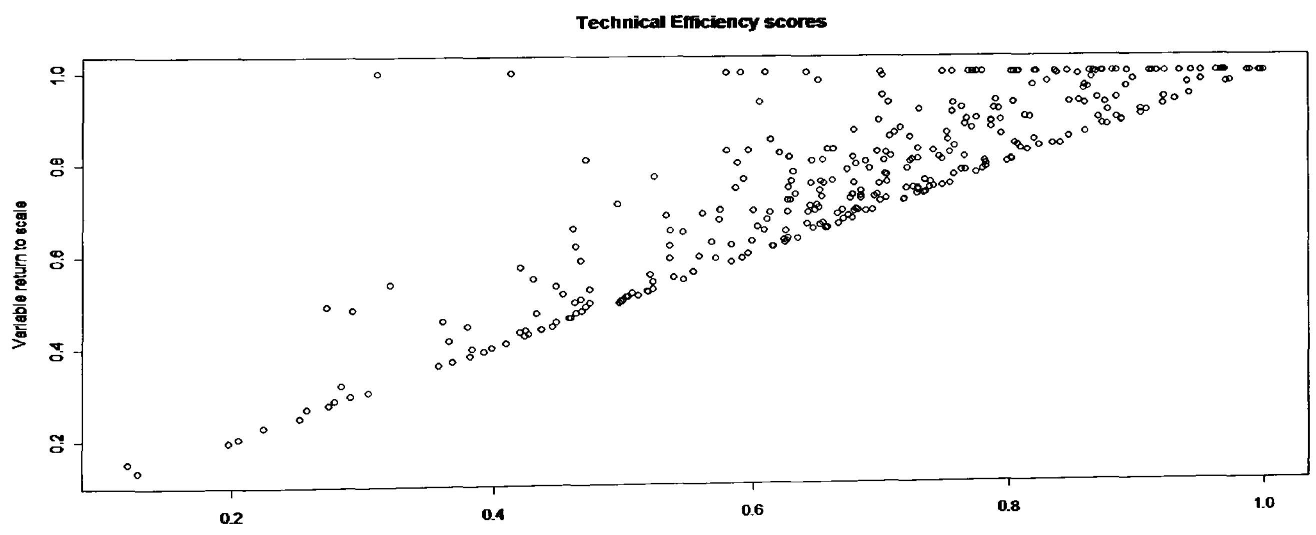


Table 6.5 gives the average scores of each of 48 Vietnamese banks over the period 1999 to 2009, assuming constant returns to scale (CCR), variable returns to scale (BCC) and scale efficiency. Due to data restrictions, efficiency scores of some banks could not be computed

throughout the whole period. Hence, (*) indicates a bank with data from 8 to 11 years; (**) a bank with data from 5 to 7 years; (***) a bank with data from 2 to 4 years; and (****) a bank with data of only one year. Part of the difficulty in collecting data is that some banks have only recently been established. The average score of groups and the whole banking system are also presented in Table 6.5.

Only two JSCBs (being the TienPhong Bank and BaoViet Bank) and one FCB (the HSBC Vietnam) are on efficient frontier (100%) during our sample period. However, the TienPhong Bank and BaoViet Bank were both established in 2008 while the HSBC Vietnam transformed from a branch of a foreign bank to a foreign commercial bank in 2009. They performed well in the first years of operation after the financial crisis (at the end of 2007 and beginning of 2008). Other banks with longer years of operation have been on the efficient frontier in some years but their average scores are lower than those of the newly found banks. As discussed above, during the periods 2001–2002 and 2007–2008 almost all banks reduced their efficiency scores. On the other hand, some banks are efficient in certain years but the average scores over the whole period indicate that all banks are relatively inefficient.

In the group of SOCBs, there are the five oldest banks in the system. The average DEA-CCR and DEA-BCC indices of the Bank for Foreign Trade are 0.83 and 0.93 respectively, which are the highest in the SOCBs group. The Bank for Agriculture and Rural Development, Mekong Housing Bank and Bank for Industry and Trade have the moderate average scores of 0.57, 0.66 and 0.69, respectively. The last bank in the group, the Bank for Investment and Development, remains 0.76 for CCR (and 0.81 for BCC). The average score of the whole group is 0.70 assuming CCR and 0.86 assuming BCC.

Scores in the JSCBs group are generally in the middle range. Data is not balanced in this group with four banks being established within the last two years. We could not collect data of a third of banks in the group. Banks with high efficiency scores with full data are the Asia Commercial Bank, Export-Import Bank, Habubank and Military Bank. Some other banks have high scores but we could not collect the full data of 11 years.

The third group, JVCBs, have five banks, but is slightly affected by data limitation. We could not collect data for all 11 years, but rather 8 to 10 years. The scores of JVCBs are the highest compared to other groups. These banks are joint ventures between banks in Vietnam and foreign banks. They may adopt suitable methods to keep their development stable and not affected by the crisis. With a larger number of banks, JSCBs had average efficiency score of 0.70 for CCR and 0.76 for BCC, compared to 0.76 and 0.79, respectively, for JVCBs. The last bank in the sample is a foreign commercial bank (HSBC Vietnam), which had both CCR and BCC scores of 1 in 2009.

As mentioned above, BCC measures pure technical efficiency reflecting management skills, the average score is higher than the CCR results. The rationale for interpreting BCC as management skills is based on the contrast between the CCR and BCC models. CCR measures overall technical efficiency, while BCC differentiates between technical efficiency and scale efficiency (Gollani and Roll, 1989). Therefore, the ratio between CCR and BCC enables the estimation of scale efficiency that reflects both managerial skills and scale effects, hence the BCC scores are interpreted as managerial skills (Barros and Peypoch, 2008). In general, the efficiency of the whole banking system has improved over our sample period.

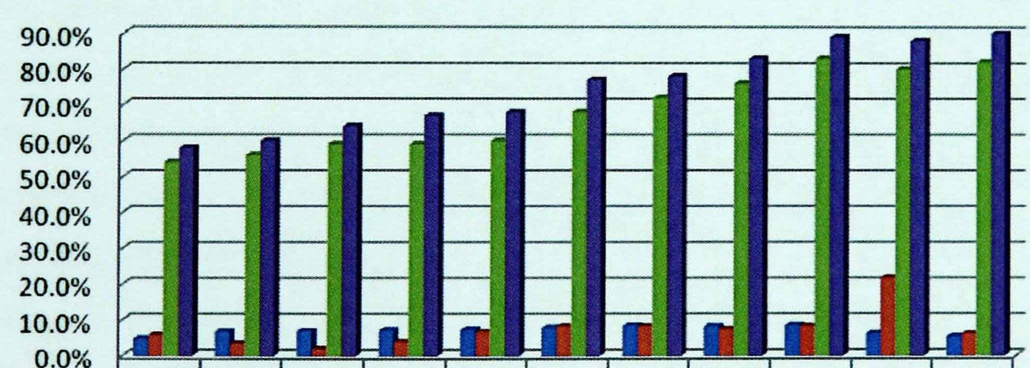
Table 6.5 Technical efficiency average scores for the Vietnamese banking system
(*) Banks with data from 8 to 10 years. (**) Banks with data from 5 to 7 years. (***) Banks with data from 2 to 4 years. (****) Banks with data of only one year

ID	Bank in groups	DEA-CCR	DEA-BCC	DEA-Scale Index
	State Owned Commecial Bank (SOCB - 5 banks)			
1	Bank for Agriculture and Rural Development	0.57	0.86	0.65
2	Bank for Investment and Development	0.76	0.91	0.83
3	Mekong Housing Bank	0.66	0.76	0.87
4	Bank for Foreign Trade of Vietnam	0.83	0.93	0.89
5	Vietnam Bank for Industry and Trade	0.69	0.86	0.79
	Joint Stock Commecial Bank (JSCB - 37 banks)			
6	Asia Commercial Bank	0.82	0.89	0.92
7	Saigon Thuong Tin Commercial Bank(*)	0.63	0.75	0.83
8	Technological and Commercial Bank	0.66	0.72	0.92
9	Vietnam Export Import Bank	0.79	0.84	0.92
10	Military Commercial Bank	0.81	0.86	0.94
11	Dong A Commercial Bank	0.54	0.63	0.87
12	Saigon Commercial Joint Stock Bank(**)	0.91	0.93	0.98
13	Vietnam International Commercial Bank(*)	0.58	0.66	0.90
14	Hanoi Building Commercial JS Bank	0.79	0.82	0.96
15	Maritime Commercial Bank	0.73	0.78	0.94
16	South East Asia Commercial Bank(**)	0.93	0.96	0.96
17	Vietnam Prosperity Commercial Bank	0.56	0.62	0.91
18	Sourthern Commercial Bank	0.49	0.57	0.87
19	Saigon Bank for Industry and Trade	0.61	0.67	0.93
20	Orient Commercial Bank(*)	0.53	0.60	0.91
21	North Asia Commercial Bank(**)	0.87	0.90	0.96
22	Housing Development Commercial Bank(*)	0.71	0.74	0.96
23	Nam A Commercial Bank(*)	0.52	0.56	0.93
24	Vietnam Tin Nghia Commercial Bank(**)	0.80	0.81	0.99
25	Gia Dinh Commercial Bank(**)	0.75	0.78	0.95
26	Kien Long Commercial Bank(*)	0.45	0.49	0.92
27	First Commercial Bank(***)	0.88	0.88	0.99
28	An Binh Commercial Bank(**)	0.82	0.90	0.91
29	Saigon - Hanoi Commercial Bank(**)	0.71	0.76	0.94
30	Ocean Commercial Bank(**)	0.89	0.98	0.90
31	Viet A Commercial Bank(*)	0.61	0.66	0.93
32	Nam Viet Commercial Bank(**)	0.82	0.89	0.91
33	Global Petro Commercial Bank(**)	0.81	0.90	0.91
34	Petrolimex Group Commercial Bank(*)	0.72	0.93	0.78
35	Great Trust Commercial Bank(**)	0.64	0.70	0.91
36	Great Asia Commercial Bank(**)	0.83	0.87	0.95
37	Western Commercial Bank(*)	0.76	0.79	0.96
38	Mekong Development Bank(*)	0.72	0.73	0.97
39	Lien Viet Bank(***Established in 2008)	0.94	0.94	0.99
40	Tien Phong Bank(***Established in 2008)	1.00	1.00	1.00
41	Vietnam Thuong Tin Bank(***Established in 2006)	0.88	0.90	0.97
42	Bao Viet Bank(****Established in 2008)	1.00	1.00	1.00
	Joint Venture Commecial Bank (JVCB - 5 banks)			
43	Indovina Bank	0.80	0.81	0.98
44	Shinhanvina Bank(*)	0.76	0.83	0.92
45	VID Public Bank	0.67	0.68	0.98
46	Vinasiam Bank(*)	0.85	0.86	0.98
47	Vietnam Russia Bank(**)	0.67	0.79	0.83
	Foreign Commecial Bank (FBB - 1 bank)			
48	HSBC Vietnam(****Established in 2009)	1.00	1.00	1.00
	Average Score of Groups			
	SOCB	0.70	0.86	0.81
	JSCB	0.70	0.76	0.92
	JVCB	0.76	0.79	0.96
	The whole banking system	0.71	0.78	0.91

There is an interesting relationship between our results on banking efficiency and macroeconomic data. As we analysed in Chapter 2, the banking system has developed strongly and efficiently and played a crucial role as the connection between production, consumption, and savings. The movement of macroeconomic data also reflects the movement of efficiency of banking system.

Figure 6.4 presents the relationships among our average efficiency scores and GDP and inflation. From 1999 to 2007, Vietnam had an average GDP growth of 7.8% a year, becoming one of the world's fastest growing economies. In 2007, GDP growth reached its highest value of 8.5% per year. Inflation fluctuated below 8.3%. Our banking efficiency scores of CCR increased gradually, except for having the same value of 0.58 in 2001 and 2002, and peaked at 0.83 in 2007. BCC also increased year after year and had an average score of 0.89 in 2007. In 2008, due to global financial crisis, GDP fell to 6.2 % in 2008, and 5.3% in 2009 and inflation sharply increased to a peak of 21.7% in 2008. Consequently, banking efficiency was strongly affected, lowering DEA assuming constant returns to scale and variable returns to scale to 0.8 and 0.88, respectively. These efficiency scores slightly increased in 2009, due to the establishment of new banks in the financial market. Although we use only six factors as inputs and outputs they clearly demonstrate the characteristics of the Vietnamese banking system from 1999 to 2009.

Figure 6.4 GDP, inflation rate, DEA-CCR and DEA-BCC average scores (1999-2009)



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
GDP (annual %)	4.8%	6.8%	6.9%	7.1%	7.3%	7.8%	8.4%	8.2%	8.5%	6.2%	5.3%
Inflation (annual %)	5.7%	3.4%	1.9%	3.9%	6.7%	8.2%	8.2%	7.3%	8.2%	21.7%	6.0%
CCR (%)	54%	56%	59%	59%	60%	68%	72%	76%	83%	80%	82%
BCC (%)	58%	60%	64%	67%	68%	77%	78%	83%	89%	88%	90%

Sources: Financial statements of 48 Vietnamese commercial banks in the period of 1999-2009; IMF (2011) and WB (2011).

There is also a relationship between the results and the reality of banking business in Vietnam. In the 2000s, there were banks that developed firmly and gradually in terms of loans, assets, deposits and branch networks. They are the Bank for Foreign Trade, Asia Commercial Bank and Sacombank. Their success was not only realised by customers and domestic organisations but they also attracted international recognition. Some international magazines started promoting Vietnamese banks from the 1990s. They are *Euromoney* (UK), *The Banker* (UK), *Global Finance* (US), *Asiamoney* (Hong Kong), etc. Certain requirements need to be met for a bank to receive an award. There are a variety of prizes, such as "Best bank in Vietnam", "Best domestic bank", "Best cash management bank", "Best trade finance bank", "Best online bank", "Best foreign exchange bank", "Best bank in international payment services", etc. In this study, we evaluate the correlation between our efficiency scores and the award "Best bank in Vietnam". Other awards have fewer requirements. The three banks mentioned above held this award from international organisations from 1999 to 2009. Table 6.6 demonstrates the relevance between banks' BCC scores in the year they received the award. DEA-BCC reflects the managerial skill of a bank. Hence, it is selected to compare with "Best bank in Vietnam" award. The average score of the whole system is also presented to explore the differences between our results and requirements of international organisations for a "Best bank in Vietnam". The criteria of our estimations (3-inputs and 3-outputs) and some organisations are as follows.

- ✓ Our DEA efficiency score: 3-input (labour, purchased fund and customer deposit) and 3-output (customer loan, other loan and securities).
- ✓ *Euromoney* (UK): the number of transactions, creativity, leadership ability, quality of assets and profit, business ratios and risk management.
- ✓ *The Banker* (UK): IT platform, risk management, customer relationship management capability and operational efficiency.
- ✓ *Global Finance* (New York, US): Profit before tax, non-performing loans, total assets, total deposits, total loans, the number of branches and strategy.
- ✓ *Asiamoney* (Hong Kong): profit, loans, management expertise and capital.

All three banks which had the prize of "Best bank in Vietnam" from 1999 to 2009 had high efficiency scores, and almost always higher than the average scores of the whole banking system. The Bank for Foreign Trade is a typical example. In two of the five years it received award, its scores were on the efficient frontier (100%). In one year its BCC was 0.96 and in all years it had far higher scores, compared to the average scores of the whole system. Similar results are observed for the Asia Commercial Bank. In 1999, when the average system score was only 0.58, it had a score of 0.78. In 2009, six international organisations recognised Asia Commercial Bank as the "Best bank in Vietnam", and its BCC score was 0.96. Of award recipients only the Sacombank had (slightly) lower BCC scores than the whole banking system efficiencies in 2007 and 2008. This is not surprising when the requirements for a "Best bank in Vietnam" capture many aspects beyond efficiency of banking business, such as the number of transactions, management expertise, creativity, customer relationship and IT development.

Table 6.6 Banks with award "Best bank in Vietnam" and DEA-BCC scores

Year	Award for	Awarded by	Our DEA-BCC	Mean of system
1999	Asia Commercial Bank	*Global Finance*	0.78	0.58
2000	Bank for Foreign Trade	*The Banker*	0.75	0.60
2001	Bank for Foreign Trade	*The Banker*	1.00	0.64
2002	Bank for Foreign Trade	*The Banker*	0.96	0.67
2003	Bank for Foreign Trade	*The Banker, Euromoney*	1.00	0.68
2004	Bank for Foreign Trade	*The Banker*	0.89	0.77
2005	Asia Commercial Bank	*The Banker*	0.75	0.78
2006	Asia Commercial Bank	*Euromoney*	0.87	0.83
2007	Sacombank	*Euromoney*	0.77	0.89
2008	Asia Commercial Bank Sacombank	*Euromoney* *Finance Asia, Global Finance*	0.90 0.76	0.88
2009	Asia Commercial Bank	*Asiamoney, The Asset, The Banker, Global Finance, Euromoney, Finance Asia*	0.96	0.90

Sources: Financial statements of 48 Vietnamese commercial banks in the period of 1999-2009.

6.4.2. Regression results on environmental variables

Eight environmental variables will be used to model our measures of efficiency. Details of these variables are presented in Table 6.7. There are three raw data variables that capture the characteristics of profit before tax, cost, asset and equity. They are all in the form of ratios and are profit before tax on assets (ROA), costs on assets (COA) and profit before tax on equities (ROE). There is one dummy variable called CITY (defined as banks that have been transformed from rural to city banks). The remaining four variables are in logarithmic form being total asset (LNTA), non-performing loans (LNNLCL), the number of branches (LNBR) and the number of years since establishment (LNAGE).

Table 6.7 Descriptive statistics of regression variables

Variables	Mean	Median	Std deviation	Minimum	Maximum
Raw data					
1. ROA	0.01	0.01	0.02	-0.09	0.30
2. COA	0.07	0.06	0.06	0	1.24
3. ROE	0.11	0.12	0.26	-3.56	2.01
Other charcteristics					
4. CITY (Dummy)	0.18	0	0.39	0	1
5. LNTA	15.43	15.29	1.96	8.57	20
6. LNNLCL	-4.28	-4.28	1.14	-8.81	0
7. LNBR	3.27	3.22	1.52	0	7.74
8. LNAGE	2.68	2.77	0.48	0	3.09

Source: Financial statements of 48 Vietnamese banks in the period of 1999-2009.

In this section, we first regress the DEA efficiency scores $\hat{\delta}_i$ on our environmental variables and obtain the coefficients shown in the second column of Table 6.8 (CCR) and Table 6.9 (BCC). 95% confidence intervals using the asymptotic normal approximation and reported in columns 3 and 4 of Tables 6.8 and 6.9 and using Algorithm 1 in columns 5 and 6. Using Algorithm 2, we regress $\hat{\hat{\delta}}_i$ on the covariates to obtain the parameters estimates shown in column 7 of Tables 6.8 and 6.9 and the confidence interval estimates in columns 8 and 9, also obtained with Algorithm 2. The relationship between efficiency scores and eight environmental variables are analysed using the following models for both CCR and BCC. Results are presented in Tables 6.8 and 6.9.

$$\hat{\delta}_{i,t} = \beta_0 + \beta_1 ROA_{i,t} + \beta_2 COA_{i,t} + \beta_3 ROE_{i,t} + \beta_4 CITY_{i,t} + \beta_5 LNTA_{i,t} + \beta_6 LNNLCL_{i,t} + \beta_7 LNBR_{i,t} + \beta_8 LNAGE_{i,t} + \varepsilon_{i,t} \quad \textbf{(6.5)}$$

$$NormalCI(lowerbound)_{i,t} = \beta_0 + \beta_1 ROA_{i,t} + \beta_2 COA_{i,t} + \beta_3 ROE_{i,t} + \beta_4 CITY_{i,t} + \beta_5 LNTA_{i,t} + \beta_6 LNNLCL_{i,t} + \beta_7 LNBR_{i,t} + \beta_8 LNAGE_{i,t} + \varepsilon_{i,t} \quad \textbf{(6.6)}$$

$$NormalCI(upperbound)_{i,t} = \beta_0 + \beta_1 ROA_{i,t} + \beta_2 COA_{i,t} + \beta_3 ROE_{i,t} + \beta_4 CITY_{i,t} + \beta_5 LNTA_{i,t} + \beta_6 LNNLCL_{i,t} + \beta_7 LNBR_{i,t} + \beta_8 LNAGE_{i,t} + \varepsilon_{i,t} \quad \textbf{(6.7)}$$

$$Algorithm1CI(lowerbound)_{i,t} = \beta_0 + \beta_1 ROA_{i,t} + \beta_2 COA_{i,t} + \beta_3 ROE_{i,t} + \beta_4 CITY_{i,t} + \beta_5 LNTA_{i,t} + \beta_6 LNNLCL_{i,t} + \beta_7 LNBR_{i,t} + \beta_8 LNAGE_{i,t} + \varepsilon_{i,t} \quad \textbf{(6.8)}$$

$$Algorithm1CI(upperbound)_{i,t} = \beta_0 + \beta_1 ROA_{i,t} + \beta_2 COA_{i,t} + \beta_3 ROE_{i,t} + \beta_4 CITY_{i,t} + \beta_5 LNTA_{i,t} + \beta_6 LNNLCL_{i,t} + \beta_7 LNBR_{i,t} + \beta_8 LNAGE_{i,t} + \varepsilon_{i,t} \quad \textbf{(6.9)}$$

$$\hat{\hat{\delta}}_{i,t} = \beta_0 + \beta_1 ROA_{i,t} + \beta_2 COA_{i,t} + \beta_3 ROE_{i,t} + \beta_4 CITY_{i,t} + \beta_5 LNTA_{i,t} + \beta_6 LNNLCL_{i,t} + \beta_7 LNBR_{i,t} + \beta_8 LNAGE_{i,t} + \varepsilon_{i,t} \quad \textbf{(6.10)}$$

$$Algorithm2CI(lowerbound)_{i,t} = \beta_0 + \beta_1 ROA_{i,t} + \beta_2 COA_{i,t} + \beta_3 ROE_{i,t} + \beta_4 CITY_{i,t} + \beta_5 LNTA_{i,t} + \beta_6 LNNLCL_{i,t} + \beta_7 LNBR_{i,t} + \beta_8 LNAGE_{i,t} + \varepsilon_{i,t} \quad \textbf{(6.11)}$$

$$Algorithm2CI(upperbound)_{i,t} = \beta_0 + \beta_1 ROA_{i,t} + \beta_2 COA_{i,t} + \beta_3 ROE_{i,t} + \beta_4 CITY_{i,t} + \beta_5 LNTA_{i,t} + \beta_6 LNNLCL_{i,t} + \beta_7 LNBR_{i,t} + \beta_8 LNAGE_{i,t} + \varepsilon_{i,t} \quad \textbf{(6.12)}$$

Table 6.8 CCR estimations for the Vietnamese banking system

	$\hat{\delta}_i$	Normal Confidence Interval		Algorithm 1 Confidence interval		$\hat{\hat{\delta}}_i$	Algorithm 2 Confidence interval	
		Lower bound	Upper bound	Lower bound	Upper bound		Lower bound	Upper bound
Models	**(6.5)**	**(6.6)**	**(6.7)**	**(6.8)**	**(6.9)**	**(6.10)**	**(6.11)**	**(6.12)**
C	-0.45775***	-0.46556***	-0.44994***	-15.1625***	-3.4288	-0.40344*	-3.58024***	0.4319*
	(-3.894)	(-3.916)	(-5.016)	(-5.519)	(-1.475)	(-2.254)	(-6.512)	(-2.41)
ROA	1.17453**	0.915069*	1.433985**	8.9923	9.0357	1.66912*	0.84701	3.06622
	(2.73)	(2.278)	(2.693)	(0.864)	(0.734)	(2.082)	(0.187)	(0.52)
COA	-0.12672	-0.19976	-0.05368	0.9983	2.4978	-0.46706	-0.70756	-0.5247
	(-1.195)	(-1.155)	(-0.411)	(0.295)	(0.625)	(-1.794)	(-0.482)	(-0.274)
ROE	-0.01814	-0.02262	-0.01366	-0.2441	-0.2404	-0.01542	-0.12173	0.02215
	(-0.641)	(-0.646)	(-0.517)	(-0.302)	(-0.351)	(-0.292)	(-0.314)	(0.075)
CITY	0.13777***	0.117951***	0.157589***	0.852	1.9189***	0.15655***	0.83747***	1.29033***
	(6.463)	(6.422)	(6.473)	(1.79)	(3.411)	(4.271)	(4.053)	(4.783)
LNTA	0.08477***	0.077263***	0.092288***	0.2366	0.9756***	0.07882***	0.27064***	0.64998***
	(11.373)	(12.651)	(11.4)	(1.495)	(5.216)	(6.467)	(3.939)	(7.246)
LNNLCL	-0.00999	-0.01402	-0.00597	-0.4084*	-0.2954	-0.01213	-0.29634**	-0.28288***
	(-1.723)	(-1.734)	(-0.979)	(-2.186)	(-1.869)	(-0.996)	(-3.307)	(-4.122)
LNBR	-0.0683***	-0.07773***	-0.05887***	-0.767**	-0.1482	-0.06535***	-0.52196***	-0.20596*
	(-7.648)	(-7.658)	(-7.688)	(-3.271)	(-0.747)	(-4.277)	(-4.641)	(-2.391)
LNAGE	-0.01823	-0.0352	-0.00126	-0.2421	0.1462	-0.09615***	-0.44138**	-0.41797*
	(-1.904)	(-1.904)	(-0.09)	(-0.567)	(0.404)	(-3.454)	(-2.813)	(-2.04)

See notes to Table 3.5.

Table 6.9 BCC estimations for the Vietnamese banking system

	$\hat{\delta}_i$	Normal Confidence Interval		Algorithm 1 Confidence interval		$\hat{\hat{\delta}}_i$	Algorithm 2 Confidence interval	
		Lower bound	Upper bound	Lower bound	Upper bound		Lower bound	Upper bound
Models	**(6.5)**	**(6.6)**	**(6.7)**	**(6.8)**	**(6.9)**	**(6.10)**	**(6.11)**	**(6.12)**
C	-0.14823*	-0.58274*	0.286094	-11.3434***	-0.88988	-0.82386***	-3.23167***	0.040893***
	(-1.969)	(-2.353)	(1.76)	(-4.471)	(-0.418)	(-4.418)	(-7.129)	(-3.945)
ROA	0.41245	-0.630859	-0.19404	-1.7693	-1.76862	1.71195*	1.68167	2.37927
	(1.296)	(-0.866)	(-0.175)	(-0.156)	(-0.185)	(2.05)	(1.021)	(1.427)
COA	0.25488	0.12007	0.3897	0.04922	1.4085	-0.3481	-1.20862	-1.161357
	(-0.372)	(0.508)	(1.082)	(0.016)	(0.382)	(-1.283)	(-0.72)	(-0.779)
ROE	-0.02137	-0.04764	0.004895	0.4029	0.46161	-0.03668	-0.11539	-0.007451
	(-0.125)	(-0.653)	(0.102)	(0.539)	(0.735)	(-0.668)	(-0.339)	(-0.025)
CITY	0.11051***	0.101083**	0.11994*	1.501**	0.1957***	0.50579	0.896433***	1.14578***
	(6.082)	(3.036)	(2.365)	(2.889)	(5.125)	(1.159)	(4.274)	(4.846)
LNTA	0.05278***	0.012908	0.09265***	0.7642***	0.10469***	0.16377	0.398456***	0.6336***
	(8.446)	(1.166)	(5.494)	(4.424)	(8.245)	(1.129)	(5.713)	(8.06)
LNNLCL	-0.01298	-0.02044	-0.005512	-0.2758	-0.22767	-0.01177	-0.14649	-0.122284
	(-1.683)	(-1.213)	(-0.499)	(-1.598)	(-1.571)	(-0.928)	(-1.865)	(-1.755)
LNBR	-0.05098*	0.02885	0.073114***	-0.913***	-0.5192**	-0.06386***	-0.54171***	-0.358705***
	(-2.513)	(1.364)	(5.268)	(-4.215)	(-2.854)	(-4.012)	(-5.496)	(-4.102)
LNAGE	-0.04214	-0.07513	-0.009146	0.1314	0.29392	-0.08342**	-0.165158	-0.13495
	-1.894	(-1.951)	(-0.362)	(0.333)	(0.887)	(-2.877)	(-1.037)	(-0.752)

See notes to Table 3.5.

From Tables 6.8 and 6.9, both the parameters and confidence interval estimates by regressing efficiencies on the covariates in Algorithm 2 are slightly different from those obtained from regressing the confidence intervals as in Algorithm 1. As Simar and Wilson (2007) pointed out, given that the results are based on Monte Carlo simulation using Algorithm 1 and 2, this is not surprising and we should prefer the results from Algorithm 2 over those from Algorithm 1. The confidence interval estimates from either Algorithm 1 or 2 are rather different from the interval estimates obtained using the asymptotic normal distribution. This too is not surprising according to Simar and Wilson (2007:55).

It is interesting to note that the intervals estimated with both Algorithm 1 and 2 sometimes do not cover the corresponding parameter estimate. In particular, Algorithm 2 produces estimated confidence intervals in the last two columns of Tables 6.8 and 6.9 that do not cover the corresponding coefficients in the seventh column (being COA, CITY, LNTA, LNNLCL, LNBR and LNAGE). Simar and Wilson (2007) argued that unlike the conventional confidence intervals based on the normal approximation, the bootstrap confidence intervals incorporate an implicit bias correction. It is well known that maximum likelihood often produces biased estimates in finite sample. Although we expect the procedure to be bias asymptotically, we are far from the asymptotic result.

Regarding the raw data variables, ROA is positive and significant for the CCR measure of efficiency based on the normal approximation and the truncated regression of Algorithm 2. Banks with a high ratio of profit over assets are likely to be more efficient than the others in terms of constant returns to scale measure. COA and ROE are insignificant in both CCR and BCC measures. Banks with high cost and equity seems to perform less effectively than others.

Turning to the other characteristics of banks, banks transformed from rural to city commercial banks (CITY) and total assets (LNTA) are generally positive and significant based upon CCR and BCC measures. There are around ten banks which transformed from rural commercial banks to city commercial banks in the 2000s. They have performed well in terms of total assets, loans and deposits under this research. Raising total assets appears to be an effective tool for increasing bank efficiency. This is consistent with structural and non-structural models and our expectation. Non-performing loans (LNNLCL) and the number of years since establishment (LNAGE) are insignificant except for the Algorithm 2. For LNNLCL, lower bound and upper bound of Algorithm 2 (CCR model) indicate that banks with high non-performing loans have smaller efficient scores than the others. LNBR is generally negative and significant, which indicates that banks with small number of branch networks (JVCB or newly established banks) are generally more efficient than the other banks.

6.5. Conclusion

The Simar and Wilson (2007) method is used to estimate bank efficiency in Vietnam for the following reasons. Firstly, under the technical view, based on Simar and Wilson (2007), we found that: a) the efficiency score is not observed directly but is empirically estimated; b) some efficiency production possibilities are not observed in the sample including input and output data; c) other explanatory variables, which are included in the second-stage, were not taken into account in the first-stage; d) the efficiency score, which takes the value from zero to one, needs to be used in the second stage. Finally, under the literature view, this is the first time that the Simar and Wilson (2007) double bootstrap procedure has been applied to such a large number of banks in Vietnam. Characteristics of total assets, branches, loans and deposits are taken into account in the estimation.

The technical efficiency scores of DEA of 48 banks in 11 years were presented. The average technical efficiency scores for the whole system are 0.71 assuming constant returns to scale (CCR) and 0.78 assuming variable returns to scale (BCC). There were decreasing trends of efficiency scores between 2001 and 2002, and between 2007 and 2008. This result is consistent with those obtained by Nguyen V (2007) for a smaller number of banks between 2001 and 2002. In terms of asset size, large and very large banks performed better than small and medium banks. Regarding bank type, SOCBs, JSCBs and JVCBs have similar efficiency scores. Non-SOCBs are more efficient than SOCBs assuming overall efficiency. A two-stage procedure was also applied to provide information of environmental factors on efficiency scores. Efficiency scores and estimates of confidence intervals in Algorithm 1 and 2 are regressed on environmental variables. Generally, banks transformed from rural to city commercial banks (CITY) and total assets (LNTA) are statistically significant and positive. Number of branches (LNBR) is generally negative and significant while non-performing loans (LNNLCL) and the number of years since establishment (LNAGE) are almost insignificant.

Chapter 7 Bank Risks Management

7.1. Introduction

In this Chapter, we will examine what type of risk methods banks employ; which risk management procedures they use and how they relate risk management with efficiency and other control variables. These control variables are the type of bank in terms of form (being SOCBs and non-SOCBs), the type of bank in terms of asset size, shareholders (banks with and without foreign shareholders) and the number of years since establishment. For this purpose, we will carry out a survey of the Vietnamese commercial banks using a questionnaire. The forms of question in the questionnaire are matrix (five point Likert scale from "strongly agree" to "strongly disagree"), multiple choice, choice by rank, close-ended and open ended questions. Seventeen questions are used which are divided into four parts, including risk identification, risk monitoring system, credit risk analysis and efficiency improvement suggestions. Kruskall-Wallis and Pearson chi-square tests will be employed to test for relations between bank risk management with efficiency and other variables.

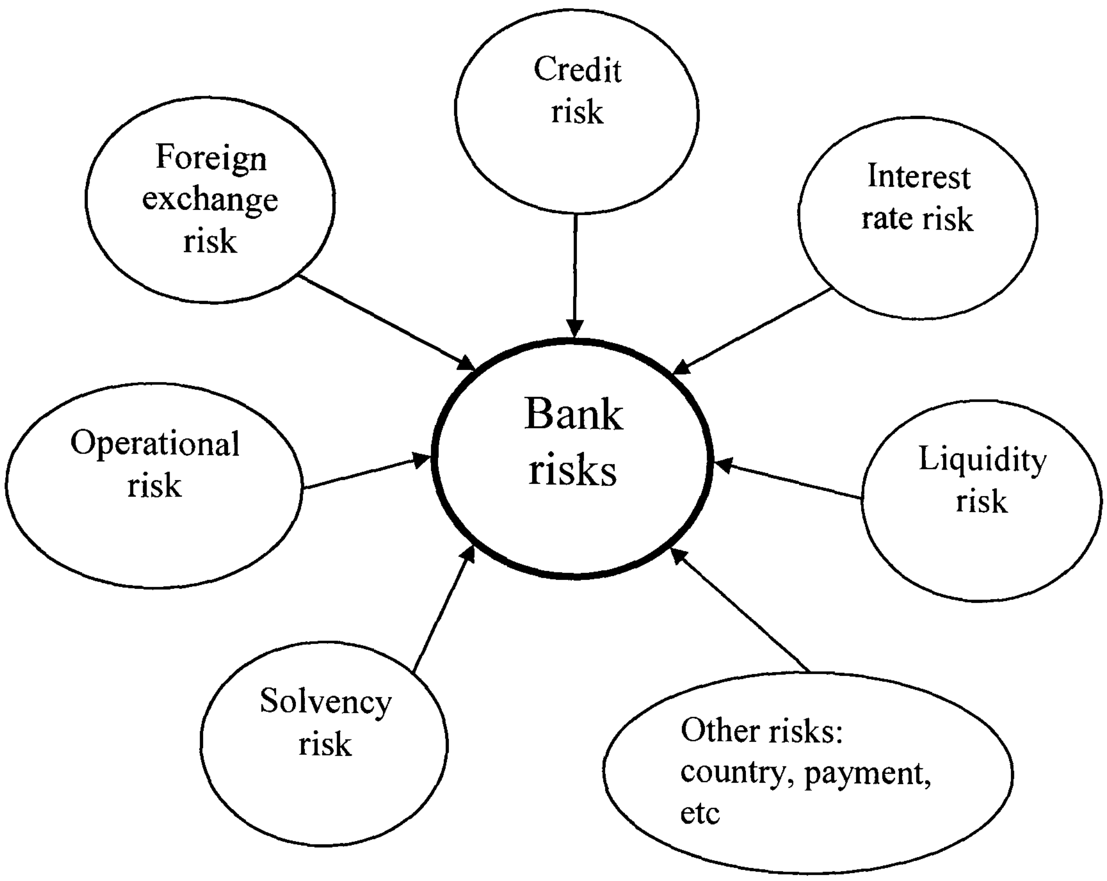
This Chapter is organised as follows: section 7.1 is the introduction; section 7.2 depicts bank risk; sections 7.3 and 7.4 are concerned with literature review and methodology; section 7.5 contains survey results; and section 7.6 sets out the conclusion.

7.2. Bank risks

For any privately owned bank, management's goal is to maximise shareholders' value. If the institution is publicly listed and markets are efficient, returns are proportional to the risks taken; if the bank is small and unlisted, managers will try to maximise the value of the owner's investments by seeking the highest returns for what they deem to be acceptable levels of risk. With increased pressure on banks to improve shareholders' returns, banks have had to assume higher risks and, at the same time, manage these risks to avoid losses. Recent changes in the banking environment (deregulation, globalisation, conglomeration, etc.) have posted serious risk challenges for banks but have also offered productive opportunities. On the other hand, the management of banking risks is becoming increasingly important in the light of the new Basel Accord (Basel II), which introduced a link between minimum regulatory capital and risk. In particular, banks will be required to adopt more formal and quantitative risk measurement and risk management procedures and processes. It is not only regulators that have placed an increased emphasis on risk management in an attempt to foster financial stability and economic development; it is also all the more important for bankers to manage their capital more efficiently in order to maximise risk-adjusted returns from their business activities (Casu *et al.*, 2006: 259 and 279; Heffernan, 2005: 101 and 172; Bessis, 2010; Mullineux and Murinde, 2003:327 and 670). Another important issue that needs to be considered is the type of risk. Any profit-maximising business, including banks, must deal with macroeconomic risks, such as the effects of inflation or recession and microeconomic risks like new competitive threats. Breakdowns in technology, commercial failure of a supplier or customer, political interference or a natural disaster are additional potential risks all firms face. The risks specific to the business of banking are: credit risk, interest risk, liquidity risk, foreign exchange risk, market risk, operational risk, solvency risk, and other risks (payment risk, country risk, etc.) (see Figure 7.1).

Credit risk is the most important risk in the banking sector. This is the risk that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms. The second type of bank risk is interest rate risk. This is the risk arising from the mismatching of the maturity and the volume of a bank's assets and liabilities as part of their asset transformation function. The relationship between assets and liabilities is reflected in liquidity risk. It is generated in the balance sheet by the mismatch between the sizes and maturity of assets and liabilities. It is the risk that the bank is holding insufficient liquid assets on its balance sheet and thus is unable to meet requirements without impairing its financial or reputational capital. Regarding the currency, foreign exchange risk is the risk that exchange rate fluctuations affect the value of a bank's assets, liabilities and off-balance sheet activities denominated in foreign currency. Market risk is the risk of losses in on- and off-balance sheet positions arising from movements in market prices. Operational risk is the risk associated with the possible failure of a bank's systems, controls or other management failure (including human error). Solvency risk is the risk of being unable to absorb losses, generated by all types of risks, with the available capital (Casu *et al.*; 2006:259-272 and Bessis, 2010:28-35).

Figure 7.1 Type of bank risks



7.3. Literature review

In general, there have been a large number of studies published about risk management. However, the number of the empirical studies on risk management practices in financial institutions is relatively small. Indeed, there is very little risk management research using questionnaires.

Anderson (2010) argued that five main risk management techniques have been identified in the literature: (1) eliminating risks (Carey, 2001); (2) using hedging to control risk (Abraham, 2008); (3) minimising the potential negative impact of any risks (Leong, 1996); (4) transferring risks to partners or clients (Oldfield and Santomero, 1997); and (5) diversifying operations to reduce the impact of any single risk (Lang and Nayda, 2008). Risk management plays a very significant part in the operation of financial institutions, and especially for banks where their operational risks are also often financial risks (Carey, 2001). However, it is important to acknowledge that there are several other sources of risk that exist outside banks' control. Abraham (2008) added that the fractional reserve system acts as a source of instability to most commercial and investment banks. This is because the main purpose of investment banks is to ensure the efficient operation of financial markets and hence the efficient allocation of risk. Another critical factor influencing the risk management practices of banks is the competing influences of individual and organisational judgements of the risks faced by banks. Bankers tended to limit their perceptions of the risk associated with lending to new customers and overestimate the risks associated with lending to their existing customers, due to the bonuses they received for acquiring new customers. Value at risk analysis is relevant to any consideration of risk management and assessment, as it is a risk quantification tool with a long history of use in trading risks (Leong, 1996). Indeed, more recently it has been used to evaluate the levels of interest rate risk and credit risk that banks carry on their bank balance sheets, making it a critical part of any risk management strategy. When applied to a bank as a whole, value at risk represents a more rigorous way of examining the volatility of the given bank's economic value of equity. However, such an approach is not always beneficial to the bank. This is because stress tests of value at risk measures include simulations where several assumptions are required (Leong, 1996). Finally, Monte Carlo simulation offers the most accuracy, by modelling the potential risks and value changes over a very large number of possible scenarios, and determining what the most likely value at risk is for these scenarios. Whilst this approach is best for capturing factors, such as option risk, it is very computationally and time intensive (Lang and Nayda, 2008).

Oldfield and Santomero (1997) described three risk mitigation strategies as follows: (1) simple business practices aimed at eliminating risks; (2) the transfer of risk to other participants better able to bear it; and (3) the active management of risks. The financial sector needs to focus on actively managing risks, through their balance sheets and other financial products. However, there is still evidence that credit risk poses a significant risk to a bank's continued operations. Lang and Nayda (2008) examined how various credit segmentation strategies could aid in the prevention of credit card default, thus assisting banks in achieving better risk mitigation and hence higher returns on capital. Evidence from this study indicated that using fully updated information on the financial histories of consumers would make it possible for banks to mitigate much of the credit risk, and hence almost eliminate the need to compensate for higher risks. Al-Tamimi (2007) estimated the degree to which the UAE banks use risk management practices and techniques in dealing with different types of risk. They also compared risk management practices between the two sets of banks (national and foreign banks). The study was based on both primary and secondary data, with a questionnaire used as a source of primary data. Their study revealed that UAE banks were efficient in credit risk management but there were significant differences between UAE banks and foreign banks regarding risk management.

Bank risks management in Vietnam

Dinh TTH and Kleimeier (2007) proposed a credit scoring model (CSM) for Vietnamese retail loans. To develop this CSM they used a database of all retail loans signed between 1992 and 2005 of only one Vietnamese commercial bank. This loan population contains still outstanding as well as repaid mortgages, consumer loans, credit loans or business loans to borrowers from all over Vietnam. Results showed that a CSM can reduce loan default. Be replacing its informal credit assessment method with a CSM, the bank can expect a decrease in its default ratio from 3.3% to 2%. Banks can use a CSM to implement risk-based pricing to manage its loan portfolio composition. By setting a lower interest rate for less risky borrowers, a bank will be more competitive in this loan market segment and be able to attract more low-risk borrowers. A CSM reduces the time and thus cost spent by the loan officer on loan assessment. Tran B (2008) highlighted the importance of "corporate governance" as part of the management function in the Vietnamese banking sector. His research methods included a survey of listed companies, interviews and case studies investigating "corporate governance" in the banking sector. He tried to address the issue of corporate governance in banking and mentioned that the risk management process still has room for improvement. He suggested a lack of bank risk management for the banking system.

7.4. Methodology

The purpose of the questionnaire is to estimate how Vietnamese banks evaluate risk; which risk management procedures they use and how they relate risk management with efficiency and other control variables (such as type of bank in terms of forms, type of bank in terms of asset size, shareholders and the number of years since establishment). Therefore, our methodology was carried out through 4 steps: (1) The scope of survey research; (2) Collecting survey data; (3) Setting up data for analysis; (4) Analysing survey data (Vaus, 2004). "Analysing survey data" will be considered in section 7.5.

7.4.1. The scope of survey research

Bank risk includes the problems that arose for the banking system from the Asian financial crisis in 1998 and global crisis in 2009. Our research addresses these questions of whether Vietnamese banks understand risk and risk management, and whether Vietnamese banks have efficient risk management practices and monitoring system. We also consider whether Vietnamese banks have efficient credit risk management. The use of a questionnaire will help us to answer these questions. Generally, there are two methods to analyse survey data, namely parametric and non-parametric methods.

Firstly, the parametric method (one-way or one-factor ANOVA) is used to detect differences between the populations means of more than two groups, in terms of one variable measured over these groups. The assumptions underlying the parametric ANOVA approach are (i) Each group is an independently selected random sample; (ii) Each group contains sample data drawn from a normal population; (iii) The data in each group have been drawn from populations that have equal variance (Coshall, 2011:130). Secondly, the parametric methods required data measured at the interval or ratio levels. Business data are not always at these levels of measurement. Market research regularly produces data at the nominal (e.g. "agree" versus "disagree" with a proposition about product) and ordinal (e.g. ranked preferences) levels. The study of bank risk management is a field in which data at nominal and ordinal levels are particularly evident. In such instances we have recourse to nonparametric statistical methods. Serious doubts about the normality assumption even when the data are at interval or ratio levels is another situation in which nonparametric methods may be preferred over parametric ones. Many authors refer to nonparametric methods as distribution free, in that they make relatively few assumptions about the nature of the population distribution. In statistics, the power of a hypothesis test is defined as its ability to reject the null hypothesis when indeed it should be rejected. Obviously, statistical tests should have high power. Nonparametric hypothesis tests often possess almost as much as power as do parametric tests, when the normality and other assumptions are satisfied. The former are often more powerful when the required assumptions are not satisfied.

There are numerous nonparametric tests including (i) the sign test; (ii) the Mann-Whitney test and (iii) the Kruskal-Wallis test one way ANOVA. The first test is the sign test which is the oldest and most widely used test. This is applicable when we have paired or matched samples. The methodology underlying the sign test depends on whether we have relatively small or large samples. The second test is the Mann-Whitney test which considers two independent samples. There are two situations. Firstly, the two samples may be drawn at random from two populations. Secondly, the samples may be generated by the random assignment of two treatments to the members of some sample whose origins are arbitrary. For example, we may randomly assign individuals in a consumer panel to one of two different forms of product advertisement (treatments) and seek their evaluation of the medium to which they have been exposed. When we wish to test for differences in central tendency and have at least ordinal measurement, the Mann-Whitney test has good power. The third test is the Kruskal-Wallis test that is applied when there are more than two independent samples. The Kruskal-Wallis test is the most efficient in that it uses more of the information available in the sample readings (Coshall, 2011:137).

7.4.2. Collecting survey data

Research design: A qualitative interview-based study is the most appropriate methodological approach for an explanatory research project of this kind. Vietnam is a relatively under-studied country, and this research is explanatory in nature. In this context, good personal relationships between researchers and interviewees play a crucial role in gathering and securing relatively sensitive information that is not normally in the public domain.

Sample: The interviewees are general directors/deputy general directors and relevant senior managers of banks currently operating in Vietnam. Firstly, we try to contact general directors/deputy general directors of banks, and brief them on the nature of the research. They could decide whether to answer the questionnaire directly or whether to pass it to those directly involved in risk management (mostly the head of the risk management department or credit department).[38] Secondly, if we could not contact general directors/deputy general directors of the banks we would liaise with the head/deputy of risk or relevant risk management department. Lastly, if this fails we would contact the bank directly. A covering letter is reproduced in Appendix V.

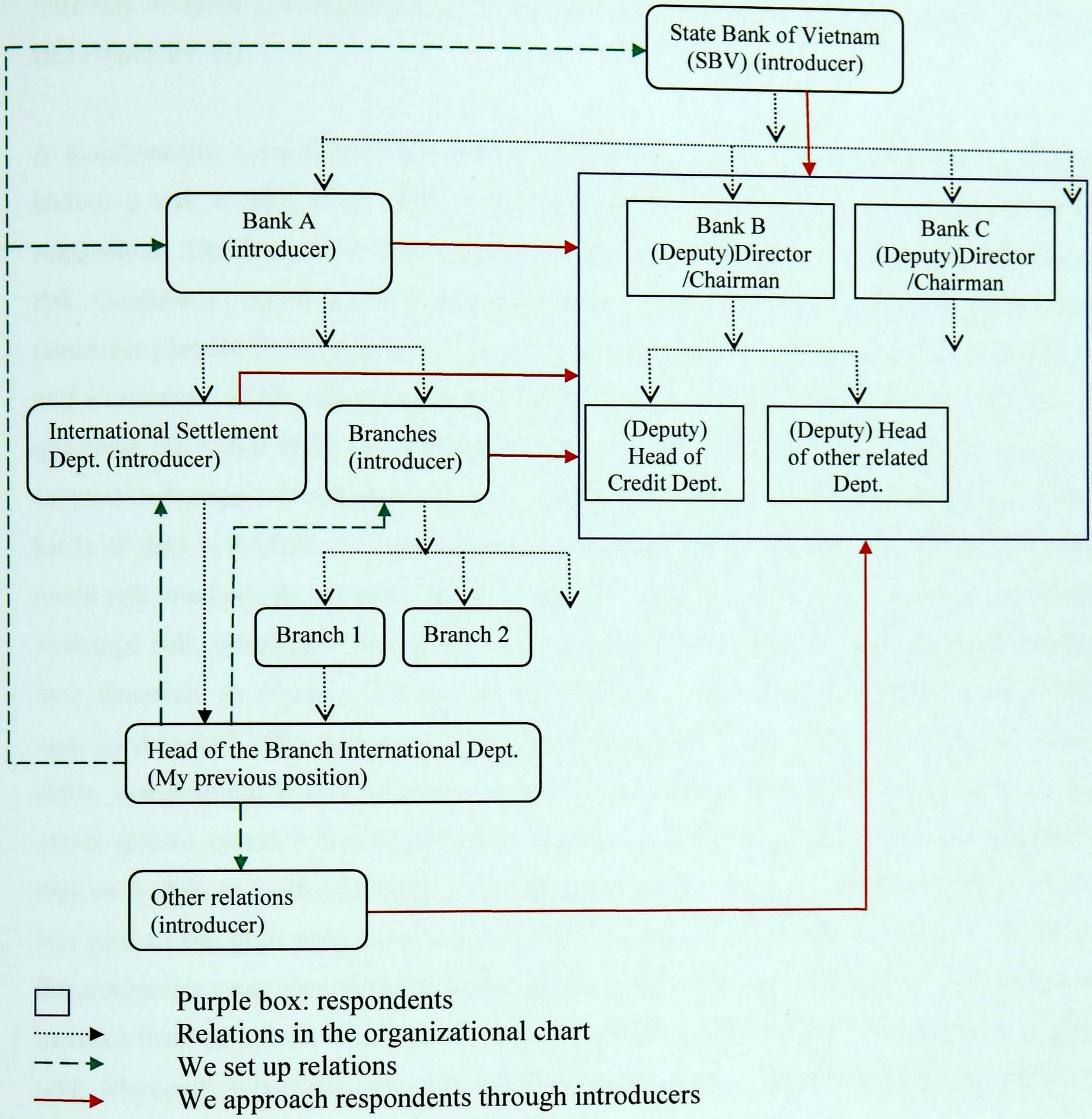
This survey was conducted between June and July 2010. However, preparatory work, including establishing relationships, was carried in August 2008 and December 2009, our first and second journeys to Vietnam. We very much appreciate the unfailing support "introducers" have given to the procedure we used to carry out the survey. In total, 38 respondents from 38 out of 48 banks,[39] located in Hanoi, Ho Chi Minh City and some other provinces in Vietnam, were interviewed (see Table 7.1). This sample provides a relatively robust cross section of bank risk management in Vietnam. Figure 7.2 shows the survey approach. Relations between the State Bank of Vietnam (SBV) and banks are illustrated as black discrete arrows. Figure 7.2 also illustrates a typical organisational chart for a commercial bank. The purple box is the area we need to approach. They are the bank's chairman or board of directors; (deputy) head of risks management department or other relevant departments. Blue discrete arrows are the relations we have set up through "introducers". Red solid arrows are relations made by "introducers".[40]

[38] In reality, most managers agreed to participate in the interviews and/or set up interviews with relevant bank officials.

[39] There are 10 banks where we could not get the answers or where the respondents are not qualified to act as our target.

[40] I used to be the head of the branch's international settlement department.

Figure 7.2 Interview's approach



Interview structure: our target is to obtain one answer from a bank that represents the bank's whole philosophy. Therefore, the interviewee should be in the highest position or a person who understands all business areas in general and risk management in particular. Due to the seniority role of the interviewee in the bank, we could not ask them to answer a long list of questions. We are aware that they do not have much time to spare. Therefore, the time for an informal meeting is set at around 10–15 minutes, and so a number of less than twenty questions are reasonable. The questions, however, need to ensure that all interviewees would not provide the same answers. Moreover, they also need to focus on bank risk management.

The types of questions used are matrix (five point Likert scale from "strongly agree" to "strongly disagree"), multiple choice, choice by rank, close-ended and open ended questions (see Appendix VI).

A questionnaire consisting of seventeen questions is created and divided into four parts, including risk identification, risk monitoring system, credit risk analysis, and efficiency suggestions. The first part of four questions sought to shed light on banks' understanding of risk. Question 11 (Q11) is "Risk management is an important part of management reporting (Business plan for the next year)". Question 12 (Q12) is "The bank is aware of the strengths and weaknesses of the risk management systems of other banks". Respondents to these two questions (Q11 and Q12) are required to give a rating: AS (strongly agree), A (agree), N (neutral/undecided), D (disagree) and SD (strongly disagree). Question 13 (Q13) is "What kinds of risks is the bank dealing with most at the moment?". There are 10 options, including credit risk, market risk, solvency risk, liquidity risk, interest rate risk, operational risk, foreign exchange risk, systematic risk, model risk and other risks (country, settlement, performance, etc). Question 14 (Q14) is "What are the high risk areas in your banking services after unsecured loans?". The choices are securities related loans, property (real estate loans), credit cards, consumption loans, international settlement services, foreign exchange services and others (please specify). Respondents to these two questions (Q13 and Q14) are required to rank each of those kinds of risks/areas to indicate how risky they are to the bank. Place 1 in the box next to the most risky kind/area, 2 next to the second most risky kind/area and so on. Respondents are not allowed to place the same number in more than one box. The reason we includes these questions is to see how banks understand and clarify the risks they are coping with. Moreover, when they rank their kinds/areas of risks, we can see the difference between choices of banks.

The second part consists of five questions that identify which risk management procedure banks use. Question 21 (Q21) is "Which of the following departments does the bank has?". Answers to this question can be risk management centre, assets and liabilities company (ALCO), inspection department, internal audit teams or none of the above. Question 22 (Q22) is "The bank has regular training programmes for staff in the area of risk management?". Answers are never, weekly, monthly, quarterly and yearly. Question 23 (Q23) is "What methods does the bank employ to intensify the risk management and financial capacity in the future?". Respondents are required to rank this question using the following methods: restructuring the organisation and operations; developing the internal control and audit system; applying new technology in banking operations; diversify banking services; improve quality of banking services and care of customers; to control credit growth, NPLs decrease with focus on credit quality; to decrease lending in foreign currencies, cut down the amount of short-term loans for mid and long-term lending; and to actively seek funding sources for investment and indirect investment into valuable papers to mitigate credit risks, and others (please specify). Question 24 (Q24) is "What are the methods should be done by the SBV to prevent banking risks? (You can choose more than one)". The respondents can choose the answers as follows: strengthen the role of the state management in settlements; provide necessary information of customers for commercial banks through CIC (Credit Information Centre); improve the legal framework for operations of the systems; apply IT to strengthen the effectiveness of inspection over the systems; to closely coordinate monetary policy with fiscal policy to ensure macroeconomic stability for the system others (please specify). The last question is question 25 (Q25) "Do you think that after the recent financial crisis, the increase in the minimum of capital adequacy ratio (CAR) from 8% to 9% (following Basel) for the Vietnamese banking system is necessary at the moment". The responses to this question range from strongly agree (SA) to strongly disagree (SD). The reason we add these questions (Q21 to Q25) is to examine how banks monitor and control risks. They can apply methods to intensify risk management. Moreover, they can suggest managerial methods for the SBV to use for indirectly controlling bank risk management. Question 25 (Q25) seeks to determine whether banks agree or disagree with a change in Basel II in Vietnam (from 8 to 9%).

The third part has four questions and examines credit risk management. Question 31 (Q31) is "This bank's policy requires collateral for all granting loans". This is a ranking question from strongly agree (SA) to strongly disagree (SD). Question 32 (Q32) is "What is the maximum loan amount for unsecured loans (loans without guarantee) in your bank?". Question 33 (Q33) is "What are the guarantees for loans most used by customers of your bank?". Answers to this question could be: house, land, automobile, credit cards, saving books, saving accounts, stocks, physical gold and foreign currencies. Question 34 (Q34) is another ranking question "In measuring credit risk of loans, the bank adopts guidance provided in Decision No. 493/2005/QD-NHNN dated 22nd April 2005 and Decision No. 18/2007/QD-NHNN dated 25th April 2007 of the SBV". The purpose of these questions is to look at credit risk analysis.

Credit risk is normally the most important type of risk as it presents the main function of banks.

The last part comprises four questions that focus on relationships between bank risks and bank efficiency. Questions 41, 42 and 43 (Q41, Q42 and Q43) are ranking questions from strongly agree (SA) to strongly disagree (SD). Question 41 (Q41) is "Do you think that banks with good performance also have good risk management". Question 42 (Q42) is "Do you think that risk management is an important competitive condition of the bank in the system?". Question 43 (Q43) is "Do you think that banks adopting successful risk management would have higher total assets/total loans/total deposits than others?" Question 44 (Q44) is an open question. "What would you suggest to improve the bank efficiency?". Interviewees are encouraged to give suggestions to improve bank efficiency. The reason for these questions is to see the difference between performance, structure and efficiency.

7.4.3. Setting up the data for analysis

There are three common methods of manual data entry. Firstly, spread sheet packages such as EXCEL – each column can be defined as a variable and each row as a case. Columns can be set to accept only certain types of data (e.g. numeric). Secondly, database packages such as ACCESS – data entry forms can be set up that simulate the questionnaire and accept only present types of data and a present range of values for each variable. Thirdly, specialised data entry programmes such as SPSS – Statistical Package for the Social Sciences (Replaced by PASW– Predictive Analytics Software from September 2009 version 17.0.3). In this study, the PASW package is employed for entering data. All interview data is transcribed and stored verbatim.

7.5. Analyzing survey data

7.5.1. Control variables

In Table 7.1, we provide summary information for the survey data. Most respondents are high-ranking bank managers. Fifteen interviewees are general directors/deputy general director and one interviewee is a chairman. Some of these first-level respondents pass the questions to second-level risk management managers.[41] First and second-level interviewees account for 76.3% (29) of the 38 respondents. In some cases, top managers or "introducers" could not contact risk management managers due to their meetings, travelling, or business trips. We could not contact these people either. First-level managers or "introducers" have to advise me of other managers. They are not high ranking officers but they understand bank risk management, structure and efficiency. They might be head of the supervisory board, a special assistant in risk management, secretary to the management board or head of the international settlement department. Third-level interviewees constitute 23.7% (9) of the 38 respondents.

[41] In reality, some banks do not have specific risk management departments or are establishing this department. Several banks use other departments such as credit risk, credit-reassessment and debt departments to function as the risk department.

Table 7.1 Frequency statistics of respondents

Criteria	Choices	Frequency	(%)
Position	(Deputy) General Director/Chairman	16	42.1
	(Deputy) Head of Risk/Credit/Credit-reassessment/Debt-Fund Dept.	13	34.2
	(Deputy, Assistant, Member) Head of Supervisory/Secretary/International Settlement Dept.	9	23.7
Type of bank in terms of form	State owned commercial bank	6	15.8
	Non-state owned commercial bank	32	84.2
Type of bank in terms of asset size in 2009 (20,000 billionVND)	Assets less than 20,000 billion VND	19	50.0
	Assets more than 20,000 billion VND	19	50.0
Type of bank in terms of asset size in 2009 (50,000 billionVND)	Assets less than 50,000 billion VND	26	68.4
	Assets more than 50,000 billion VND	12	31.6
Type of bank in terms of asset size in 2009 (100,000 billionVND)	Assets less than 100,000 billion VND	32	84.2
	Assets more than 100,000 billion VND	6	15.8
Establishment	Less than 15 years (from 1999)	17	44.7
	More than 15 years (from 1999)	21	55.3
Foreign shareholders	With foreign shareholders	15	39.5
	Without foreign shareholders	23	60.5
Location	Hanoi	13	34.2
	Ho Chi Minh City	13	34.2
	Other provinces	12	31.6
E1 Average efficiency score (BCC) using a 0.59 cut-off point	Less than 0.59 (E1: low efficiency)	7	18.4
	More than 0.59 (E1: high efficiency)	31	81.6
E2 Average efficiency score (BCC) using a 0.89 cut-off point	Less than 0.89 (E2: low efficiency)	26	68.4
	More than 0.89 (E2: high efficiency)	12	31.6

Sources: Replies from 38 bank managers.

Regarding the type of banks, there are five SOCBs and one Vietnam Development Bank (this is a non-profit bank). There are also 27 JSCBs, two JVCBs and three FCBs giving 32 non-SOCBs. By reference to asset size, there are nineteen banks with assets less than 20,000 billion VND, 26 banks with assets less than 50,000 billion VND and 32 banks with assets less than 100,000 billion VND. Seven banks have been in existence for less than five years in 2009 and seventeen banks have been established less than 15 years. Fifteen banks have foreign shareholders. The location entry indicates the place where a bank sets up its head office. In efficiency scores, we have two efficiency groups[42]. There are seven banks with efficiency scores less than 0.59 (E1 banks) and 26 banks with efficiency scores less than 0.89 (E2 banks). 31 and 12 are the number of banks with average efficiency scores more than 0.59 and 0.89, respectively.

7.5.2. Unusable questions

We could not produce useful variables for questions Q11, Q25, Q31, Q33, Q34, Q41, Q42 and Q43. This means there was no difference in responses across respondents. In other words, interviewees answered in the same way to these questions. Another problem arose with the chi-square contingency statistic. For example, in question Q12 using the five point Likert scale, we received nineteen answers of strongly agree (SA) and nineteen answers of agree (A). Thus, expected frequencies of other choices neutral/undecided (N), disagree (D) and strongly disagree (SD) have values at zero. Given this, we divided the answer into only two categories, namely strongly agree (SA) and agree (A) instead of five categories. We have valid Kruskal-Wallis and Pearson chi-square tests for the questions: Q12, Q13 and Q14 (risk identification); Q21, Q22, Q23 and Q24 (risk monitoring system); Q32 (credit risk analysis) and Q44 (efficiency improvement suggestions).

Criteria for validity

Computation of the test statistic of the Kruskal-Wallis test employs the average of the ranks allocated to each sample. The test examines ***the differences*** in average ranks of variables to assess if they are so disparate as to be likely to have been drawn from populations with the same distribution. Examination of the chi-square test in the Kruskal-Wallis test ($p<0.05$) indicates rejection of the null hypothesis of the same distribution. In addition to the Kruskal-Wallis test, the Pearson chi-square statistic tests whether the row and the column variables in a contingency table are ***independent***. The probability value of the Pearson chi-square test ($p<0.05$) indicates the rejection of the independence at the 5% level. In the case of 2X2 tables, the formulae for Pearson chi-square tests is modified by the inclusion of Yates' continuity

[42] We have divided efficiency scores into smaller groups but they provided invalid results.

correction which is reported in the row denoted "Continuity correction". If any expected frequency in a 2X2 contingency table is less than or equal to five, then SPSS automatically uses Fisher's exact test instead of the chi-square statistic to assess the notion of independence (Coshall, 2011:97). In this case, Fisher's exact test is favoured for inference over Pearson's chi-square test (and Yates' continuity correction). The 2-sided probability value of Fisher's exact test ($p<0.05$) indicate the rejection of the independence at the 5% level.

Further, one should not use the Pearson chi-square contingency statistic if more than 20% of the cells have expected values less than or equal to five when using contingency tables larger than 2X2. In this case, the Mantel-Haenszel test is used for inference. The Mantel-Haenszel statistic is found in the row labelled "Linear-by-Linear Association". It tests whether the variables under study are linearly related. The likelihood ratio statistic is also reported in the contingency table. It has a chi-square distribution and is based on "maximum likelihood theory". It is an alternative to the Pearsonian chi-square test and is valid in large samples (the two statistics yield very similar results). The probability values of the likelihood ratio and Linear-by-Linear tests ($p<0.05$) indicate the rejection of the independence at the 5% level.

In this research, the Kruskal-Wallis test will be employed in parallel with the Pearson chi-square test (or Fisher's exact test) to assess the existence of relations between risk management and efficiency and other control variables such as form of bank (SOCBs and non-SOCBs), bank asset size, shareholder type (banks with and without foreign shareholders) and the number of years since establishment.

7.5.3. Hypotheses testing

The hypotheses that we test are given below:

- ✓ *Hypothesis 1:* there is a difference between banks with small and large asset size (20,000 billion VND in 2009) in terms of the location of bank, risk identification and risk monitoring system.
- ✓ *Hypothesis 2:* there is a difference between SOCBs and non-SOCBs in terms of asset size.

- ✓ *Hypothesis 3:* there is a difference between banks with and without foreign shareholders in terms of risk intensification methods prioritised.
- ✓ *Hypothesis 4:* there is a difference between the degree of efficiency of banks (defined with DEA-BCC scores) in terms of risk identification, risk monitoring system, credit risk analysis and efficiency improvement suggestions.
- ✓ *Hypothesis 5:* there is a difference between banks with different number of years since establishment in terms of risk awareness.

We discuss our results regarding each hypothesis below.

7.5.3.1. Hypothesis 1

Table 7.2 reports the Kruskal-Wallis test statistic with banks categorised by asset size. On the left hand side of Table 7.2, the first column specifies the control variable and the second column indicates the type of bank in terms of asset size. There are small banks (defined as total assets being less than 20,000 billion VND in 2009) and large banks (where total assets were more than 20,000 billion VND in 2009). The third column gives the number of banks in each of these two categories, while the fourth column gives the mean rank of the variables that are ranked by the size of the control variable. The Kruskal-Wallis test is based on the ranking of the bank by the control variable. Banks are ranked in ascending order where the bank with the smallest value of the control variable is assigned the lowest rank of one, whereas the bank with the largest value of the control variable receives the highest rank of n. The mean rank indicates the relative average size ranking of a particular control variable between the categories of small and large banks.

In Table 7.2 the mean rank is greater for large asset size banks for the number of departments, which suggests that large banks have move departments than small banks. In contrast, the mean rank is larger for small banks compared to large banks for the control variables location of bank, risk identification (Q13) and risk monitoring system (Q22). For example, with the control variable location, larger banks tend to be located in the larger cities such as Hanoi and Ho Chi Minh City while small banks are typically situated in other provinces. We code location as follows: Hanoi (1), Ho Chi Minh City (2) and other provinces (3). Question 13 (Q13) originally had ten options for interviewees. However, after analyzing the data, we divided Q13 into two groups: (1) credit risk, liquidity risk and operational risk and (2) credit risk, liquidity risk and foreign exchange risk. All the banks choose credit risk and liquidity risk as the most two important types of risk. Question 22 (Q22) on training programmes attended also has five options for respondents which we divide it into two groups: (1) bank has training programme of less than a quarter and (2) bank has training programme of one year or no training. Hence, the mean rank of Q13 and Q22 indicate that small banks regard credit, liquidity and foreign exchange as their priority risks while large banks are more concerned of credit, liquidity and operational risk and that small banks have less frequent training programmes than large banks.

The right-hand side of Table 7.2 gives the chi-square test statistic. For all of the control variables the test statistics are jointly significant at the 5% level. Therefore, we find that there is a significant difference between small and large banks in terms of the location, risk identification, the number of training programmes attended and risk monitoring system. These results are consistent with our expectations.

Table 7.2 Output from the Kruskal-Wallis test between type of bank as asset size (20,000 billion VND in 2009) and the location of bank, risk identification (kind of risks) and risk monitoring system (risk departments and training programmes)

	Ranks			Test statistics		
	Type of bank as asset size	N	Mean Rank	Chi-square	df	Asymp. Sig.
Location of bank	Assets below 20,000 billion VND	19	23.87	6.605	1	.010
	Assets above 20,000 billion VND	19	15.13			
	Total	38				
Kind of risks (Q13)	Assets below 20,000 billion VND	19	23.00	5.078	1	.024
	Assets above 20,000 billion VND	19	16.00			
	Total	38				
Departments (Q21)	Assets below 20,000 billion VND	19	15.16	6.525	1	.011
	Assets above 20,000 billion VND	19	23.84			
	Total	38				
Training programmes (Q22)	Assets below 20,000 billion VND	19	23.50	6.578	1	.010
	Assets above 20,000 billion VND	19	15.50			
	Total	38				

(Location of bank): Bank's head office; (Q13): What kind of risks is the bank dealing with most at the moment?; (Q21): Which of the following department(s) does the bank has?; (Q22): The bank has regular training programmes for staff in the area of risk management; Sources: Replies from 38 bank managers.

Tables 7.3 and 7.4 show, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by asset size and location of bank (Crosstab). The left hand side of Table 7.3 specifies the type of bank by asset size. In column 2, the count (being the number of banks in a category) is followed by the percentage of banks in a category according to size, the percentage of banks in a category by location and then the un-standardised residuals. The top of the table categorises banks by their location. There are three banks with total assets of less than 20,000 billion VND that set up their head offices in Hanoi.

This frequency represents only 15.8% of the nineteen banks with small asset size and 23.1% of the thirteen banks located in Hanoi. There are ten large banks in Hanoi, which is 52.6% of the nineteen large banks and 76.9% in Hanoi. There are also seven small banks that have head offices in Ho Chi Minh City. This frequency represents 36.8% of the nineteen banks with small asset size and 53.8% of the thirteen banks in Ho Chi Minh City. Further, six large banks account for 31.6% of the nineteen large banks and 46.2% in Ho Chi Minh City. The head offices of nine small banks are located in other provinces and this frequency represents 47.4% of the nineteen small banks and 75% of the twelve banks located in other provinces. Only three large banks are located in other provinces and these banks make up 15.8% of the large banks and 25% of the twelve banks in other provinces.

This suggests that many small banks are located in other provinces, but not Hanoi while large banks are located primarily in Hanoi and Ho Chi Minh City. 68.4% of the banks in our sample are in either Hanoi or Ho Chi Minh City. This is consistent with our expectation because Hanoi and Ho Chi Minh City are the two leading cities in Vietnam in terms of financial services. Hence, large banks would be expected to be concentrated in these two locations. The un-standardised residuals indicate whether the distribution of the banks is independent of the categories. Nine small banks are located in other provinces and the corresponding (un-standardised) residual of 3.0 means that there are 3.0 more banks in this cell of the contingency table than we would have expected (if asset size and location were independent). As we suggested earlier, small banks tend to operate in other provinces rather than Hanoi and Ho Chi Minh City. The banks do not appear to be independently distributed among location categories.

The chi-square statistic to formally test for independence between asset size and location is presented in Table 7.4. As expected frequencies in Table 7.3 are small (more than 20% of the cells have expected values less than or equal to five in contingency table larger than 2X2) we use the likelihood ratio and Linear-by-Linear tests for inference. The probability values of the likelihood ratio and Linear-by-Linear tests (being 0.027 and 0.010) indicate the rejection of the null hypothesis of independence at the 5% level and we can conclude that location of bank depends on bank size.

Table 7.3 Output from the contingency analysis between type of bank in terms of asset size (20,000 billion VND in 2009) and location of bank

Type of bank in terms of asset size in 2009		Location of bank			
		Hanoi	Ho Chi Minh city	Other provinces	Total
Below 20,000 billion VND	Count	3	7	9	19
	% within asset size 20,000 billion VND in 2009	15.8%	36.8%	47.4%	100.0%
	% within location	23.1%	53.8%	75.0%	50.0%
	Residual	-3.5	.5	3.0	
Above 20,000 billion VND	Count	10	6	3	19
	% within asset size 20,000 billion VND in 2009	52.6%	31.6%	15.8%	100.0%
	% within location	76.9%	46.2%	25.0%	50.0%
	Residual	3.5	-.5	-3.0	
Total	Count	13	13	12	38
	% within asset size 20,000 billion VND in 2009	34.2%	34.2%	31.6%	100.0%
	% within location	100.0%	100.0%	100.0%	100.0%

(Location of bank): Bank's head office.

Table 7.4 Chi-square tests between type of bank in terms of asset size (20,000 billion VND in 2009) and location of bank

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.846	2	.033
Likelihood Ratio	7.193	2	**.027**
Linear-by-Linear Association	6.589	1	**.010**
N of Valid Cases	38		

Table 7.5 and 7.6 present, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by asset size and risk identification in terms of kind of risks (Crosstab). In Table 7.5, all of the banks deal with the two most important types of risks, namely credit risk and liquidity risk. After these two types of risks, some banks focus on operational risk and others on foreign exchange risk. There are seven banks that consider operational risk as one of the three main risks which are 36.8% of the nineteen small banks and 33.3% of the 21 banks that concentrate on operational risk. There are also fourteen banks with total assets less than 20,000 billion VND that account for 73.7% of the nineteen small banks and 66.7% of banks that regard operational risk as one of the three most important types of risks. In contrast, twelve banks make up 63.2% of the nineteen small banks and 70.6% of the seventeen banks that consider foreign exchange risk as one of the three most important risks. Five banks account for 26.3% of the nineteen large banks and 29.4% of the seventeen banks that consider foreign exchange as the third important risk. This indicates that large banks are more aware of the possible failure of a bank's systems, controls or other management failure (including human error) than small banks. Small banks have problems with their foreign currency and this suggests that they generally do not have a strong budget of foreign currency which can sponsor activities relating to assets, liabilities and off-balance

sheet. In fact, small banks have difficulties obtaining foreign currency, especially during the 2008-financial-crisis. Large banks paid more attention to operational risk management.

In Table 7.5, there is a 2X2 contingency table where one expected frequency is equal to five in absolute value. Hence, Fisher's exact test[43] is more appropriate than the Continuation correction (or Pearson chi-square test) to assess the notion of independence. This F-test and its associated level of significance are presented in Table 7.6. The probability value for Fisher's exact tests of 2-sided is 0.049 which indicates the rejection of the null hypothesis of independence at the 5% level. We can conclude that kind of risks does depend on bank size (20,000 billion VND in 2009).

Table 7.5 Output from the contingency analysis between type of bank in terms of asset size (20,000 billion VND in 2009) and risk identification (kind of risks)

Type of bank in terms of asset size in 2009		Kind of risks (Q13) Credit-Liquidity-**Operational**	Kind of risks (Q13) Credit-Liquidity-**Foreign exchange**	Total
Below 20,000 billion VND	Count	7	12	19
	% within asset size in 2009	36.8%	63.2%	100.0%
	% within Q13	33.3%	70.6%	50.0%
	Residual	-3.5	3.5	
Above 20,000 billion VND	Count	14	5	19
	% within asset size in 2009	73.7%	26.3%	100.0%
	% within Q13	66.7%	29.4%	50.0%
	Residual	3.5	-3.5	
Total	Count	21	17	38
	% within asset size in 2009	55.3%	44.7%	100.0%
	% within Q13	100.0%	100.0%	100.0%

(Q13): What kind of risks is the bank dealing with most at the moment?

Table 7.6 Chi-square tests between type of bank as asset size (20,000 billion VND in 2009) and risk identification (kind of risks)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.216	1	.022		
Continuity Correction[a]	3.832	1	.050		
Likelihood Ratio	5.348	1	.021		
Fisher's Exact Test				**.049**	.024
Linear-by-Linear Association	5.078	1	.024		
N of Valid Cases	38				

a. Computed only for a 2x2 table.

Table 7.7 and 7.8 show, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by asset size and risk monitoring system (risk departments) (Crosstab). In Table 7.7, there are nine small banks with less than two risk departments which constitute 47.4% of the nineteen banks with small asset size and 69.2% of

[43] SPSS reports only probability values (2-sided and 1-sided) of the Fisher's exact test

the thirteen banks that have less than two departments. Four large banks have less than two departments. This frequency accounts for 21.1% of the nineteen large banks and 30.8% of the banks with less than two departments. Eight small banks have three departments and this makes up 42.1% of the small banks and 61.5% of the banks that have three departments while five large banks with three departments constitute 26.3% of the large banks and 38.5% of the thirteen banks with three departments. There are only two banks with four departments which is 10.5% of the nineteen large banks and 16.7% of the banks with four departments. However, ten large banks have four departments which constitute 52.6% of the nineteen large banks and 83.3% of the twelve large banks. This is consistent with our expectation. Large banks set up more risk departments to control the system than small banks. In Table 7.8, as expected frequencies are small (more than 20% of the cells have expected values less than or equal to five in contingency table larger than 2X2) we use likelihood ratio and Linear-by-Linear tests for inference. The likelihood ratio and Linear-by-Linear tests (being 0.014 and 0.010) indicate the rejection of the null hypothesis of independence at the 5% level and we can conclude that bank size (20,000 billion VND in 2009) does depend on risk monitoring system (risk departments).

Table 7.7 Output from the contingency analysis between type of bank in terms of asset size (20,000 billion VND in 2009) and risk monitoring system (risk departments)

Type of bank in terms of asset size in 2009		Risk departments (Q21)			
		Less than two depts.	Three depts.	Four depts.	Total
Below 20,000 billion VND	Count	9	8	2	19
	% within asset size in 2009	47.4%	42.1%	10.5%	100.0%
	% within Q21	69.2%	61.5%	16.7%	50.0%
	Residual	2.5	1.5	-4.0	
Above 20,000 billion VND	Count	4	5	10	19
	% within asset size in 2009	21.1%	26.3%	52.6%	100.0%
	% within Q21	30.8%	38.5%	83.3%	50.0%
	Residual	-2.5	-1.5	4.0	
Total	Count	13	13	12	38
	% within asset size in 2009	34.2%	34.2%	31.6%	100.0%
	% within Q21	100.0%	100.0%	100.0%	100.0%

(Q21): Which of the following department(s) does the bank has?

Table 7.8 Chi-square tests between type of bank in terms of asset size (20,000 billion VND in 2009) and risk monitoring system (risk departments)

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.949	2	.019
Likelihood Ratio	8.494	2	**.014**
Linear-by-Linear Association	6.589	1	**.010**
N of Valid Cases	38		

Table 7.9 and 7.10 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by asset size and number/frequency of risk training programmes (Crosstab). There are six small banks that have risk training programmes at least quarterly. This is 31.6% of the nineteen small banks and 30% of the twenty that have risk training courses at least quarterly. Fourteen large banks have training programmes at least quarterly. This represents 73.7% of the nineteen large banks and 70% of the 20 banks which have training programmes at least quarterly. There are thirteen small banks with no more than one training programme per year. This comprises 68.4% of the nineteen small banks and 72.2% of the eighteen banks that operate a one-year-training-programme or no training. Five large banks have no more than one training programme per year which account for 26.3% of the nineteen large banks and 27.8% of the eighteen banks that have no more than one training programme per year. This is also consistent with our expectation. Banks with large asset sizes provide more frequent risk training programmes for staff (being weekly, monthly or quarterly) than do small banks.

Table 7.9 is a 2X2 contingency table where one expected frequency is equal to five in absolute value. Hence, Fisher's exact test is favoured for inference. In Table 7.10, Fisher's 2-sided exact test probability value is 0.022 which indicates the rejection of the null hypothesis of independence at the 5% level. Thus, type of bank categorised by asset size (20,000 billion VND in 2009) depends on the frequency of risk training programmes.

Table 7.9 Output from the contingency analysis between type of bank in terms of asset size (20,000 billion VND in 2009) and risk monitoring system (training programmes)

Type of bank in terms of asset size in 2009		Training programmes (Q22)		
		Less than a quarter	One year or No training	Total
Below 20,000 billion VND	Count	6	13	19
	% within asset size in 2009	31.6%	68.4%	100.0%
	% within Q22	30.0%	72.2%	50.0%
	Residual	-4.0	4.0	
Above 20,000 billion VND	Count	14	5	19
	% within asset size in 2009	73.7%	26.3%	100.0%
	% within Q22	70.0%	27.8%	50.0%
	Residual	4.0	-4.0	
Total	Count	20	18	38
	% within asset size in 2009	52.6%	47.4%	100.0%
	% within Q22	100.0%	100.0%	100.0%

(Q22): The bank has regular training programmes for staff in the area of risk management.

Table 7.10 Chi-square tests between type of bank in terms of asset size (20,000 billion VND in 2009) and risk monitoring system (training programmes)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.756	1	.009		
Continuity Correction[a]	5.172	1	.023		
Likelihood Ratio	6.974	1	.008		
Fisher's Exact Test				**.022**	.011
Linear-by-Linear Association	6.578	1	.010		
N of Valid Cases	38				

a. Computed only for a 2x2 table.

In general, it can be concluded that Hypothesis 1 of our research is confirmed. There is a difference between small and large banks (asset size 20,000 billion VND in 2009) in terms of the location of a bank, its risk identification (kind of risks) and risk monitoring system (number of risk departments and frequency of training programmes).

7.5.3.2. Hypothesis 2

Table 7.11 reports the Kruskal-Wallis test statistic with banks categorised by form. We divide the system into two groups. They are SOCBs (state owned commercial banks) and non-SOCBs (non-state owned commercial banks). In the control variables, there are two categories, namely banks with asset size 50,000 and 100,000 billion VND in 2009. The mean rank is greater for SOCBs for both asset size categories, which suggest that SOCBs tend to have larger total assets than non-SOCBs. The right-hand side of Table 7.11 gives the chi-square test statistic. For both of the control variables the test statistics (with probability values being 0.003 and 0.000) are both significant at the 1% level. Therefore, we find that there is a significant difference between SOCBs and non-SOCBs in terms of asset size which is consistent with our expectation.

Table 7.11 Output from the Kruskal-Wallis test between type of bank in terms of form (SOCBs and non-SOCBs) and asset size (50,000 and 100,000 billion VND in 2009)

	Ranks			Test statistics		
	Type of bank as form (SOCBs and non-SOCBs)	N	Mean Rank	Chi-square	df	Asymp. Sig.
Banks with asset size 50,000 billion VND in 2009	SOCBs	6	29.33	8.600	1	.003
	non-SOCBs	32	17.66			
	Total	38				
Banks with asset size 100,000 billion VND in 2009	SOCBs	6	32.33	23.803	1	.000
	non-SOCBs	32	17.09			
	Total	38				

Sources: Replies from 38 bank managers.

Table 7.12 and 7.13 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by form (SOCBs and non-SOCBs) and asset size (Crosstab). In the contingency analysis in Table 7.12, there is only one SOCB that comprises 16.7% of the six SOCB and 3.8% of the 26 banks with asset size below 50,000 billion VND. Twenty-five banks represent 78.1% of the 32 non-SOCBs and 96.2% with total assets less than 50,000 billion VND. There are five SOCBs which account for 83.3% of the SOCBs and 41.7% of the twelve banks with assets above 50,000 billion VND. There are seven banks that is 21.9% of the 32 non-SOCBs and 58.3% of the 12 banks that have assets more than 50,000 billion VND. The SOCBs categorised by asset size below 100,000 billion VND has one bank that comprise 16.7% of the 6 SOCBs and 3.1% of the banks with asset size below 100,000 billion VND. There are 31 banks that comprise 96.9% of the 32 non-SOCBs and 96.9% of the banks with asset size below 100,000 billion VND. There are 5 banks that make up 83.3% of the 6 SOCBs and 83.3% of the banks with asset size above 100,000 billion VND. There is only one bank that represents 3.1% of the 32 non-SOCBs and 16.7% of the six banks with asset size above 100,000 billion VND. This is also consistent with our bank structure results when four SOCBs stay in five-bank-ratio in terms of total assets.

In Table 7.12, two expected frequencies in the asset size of 50,000 billion VND and three expected frequencies in the asset size of 100,000 billion VND that are less than or equal to five in absolute values. In these cases, Fisher's exact test is more appropriate than all other chi-square tests. In Table 7.13, the 2-sided probabilities of Fisher's exact tests are 0.008 and 0.000 which indicate the rejection of the null hypothesis of independence at the 1% level. We can conclude that the type of bank in terms of form (SOCBs and non-SOCBs) depends on asset size (50,000 and 100,000 billion VND in 2009).

Table 7.12 Output from the contingency analysis between type of bank in terms of form (SOCBs and non-SOCBs) and asset size (50,000 and 100,000 billion VND in 2009)

-		Asset size in 2009			Asset size in 2009		Total
		Below 50,000 billion VND	Above 50,000 billion VND		Below 100,000 billion VND	Above 100,000 billion VND	
SOCB	Count	1	5	Count	1	5	6
	% within form	16.7%	83.3%	% within form	16.7%	83.3%	100.0%
	% within asset 50,000 billion VND in 2009	3.8%	41.7%	% within asset 100,000 billion VND in 2009	3.1%	83.3%	15.8%
	Residual	-3.1	3.1	Residual	-4.1	4.1	
Non-SOCB	Count	25	7	Count	31	1	32
	% within form	78.1%	21.9%	% within form	96.9%	3.1%	100.0%
	% within asset 50,000 billion VND in 2009	96.2%	58.3%	% within asset 100,000 billion VND in 2009	96.9%	16.7%	84.2%
	Residual	3.1	-3.1	Residual	4.1	-4.1	
Total	Count	26	12	Count	32	6	38
	% within form	68.4%	31.6%	% within form	84.2%	15.8%	100.0%
	% within asset 50,000 billion VND in 2009	100.0%	100.0%	% within asset 100,000 billion VND in 2009	100.0%	100.0%	100.0%

Table 7.13 Chi-square tests between type of bank in terms of form (SOCBs and non-SOCBs) and asset size (50,000 and 100,000 billion VND in 2009)

	Asset size 50,000 billion VND in 2009					Asset size 100,000 billion VND in 2009				
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.833	1	.003			24.447	1	.000		
Continuity Correction[a]	6.217	1	.013			18.787	1	.000		
Likelihood Ratio	8.370	1	.004			18.842	1	.000		
Fisher's Exact Test				**.008**	.008				**.000**	.000
Linear-by-Linear Association	8.600	1	.003			23.803	1	.000		
N of Valid Cases	38					38				

a. Computed only for a 2x2 table.

In general, it can be concluded that Hypothesis 2 of our research is confirmed. There is a difference between SOCBs and non-SOCBs in terms of asset size (SOCBs tend to be larger in terms of asset size than non-SOCBs).

7.5.3.3. Hypothesis 3

Table 7.14 reports the Kruskal-Wallis test statistic with banks categorised according to whether or not they have foreign shareholders. Question 23 (Q23) originally had eight options for interviewees. However, after analyzing the data, we divided Q23 into two groups: (1) restructure the organisation and other methods and (2) strengthen internal control and other methods (see Table 7.15). The mean rank is greater for banks with foreign shareholders for risk intensification. This suggests that foreign banks regard internal control as the priority task to intensify risk management instead of restructuring the organisation which is prioritised more by non-foreign shareholders. This is consistent with our expectation. The right-hand side of Table 7.14 gives the chi-square test statistic. The probability value of this test statistic is 0.011 which is significant at the 5% level. Therefore, we find that there is a significant difference between banks with and without foreign shareholders in terms of risk intensification.

Table 7.14 Output from the Kruskal-Wallis test between type of bank in terms of foreign shareholders and risk intensification

	Ranks			Test statistics		
	Do banks have foreign bank share holders	N	Mean Rank	Chi-square	df	Asymp. Sig.
Risk intensification (Q23)	Foreign shareholders	15	24.43	6.525	1	.011
	Non-foreign shareholders	23	16.28			
	Total	38				

(Q23): What methods does the bank employs to intensify the risk management and financial capacity in the future?; Sources: Replies from 38 bank managers.

Table 7.15 and 7.16 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by whether they have foreign shareholders and the risk intensification methods employed (Crosstab). Four banks that have foreign shareholders prioritise restructuring. This is 26.7% of the fifteen banks with foreign shareholders and 20% of the 20 banks that regard restructuring the organisation as the most important method to intensify the risk management. There are sixteen banks without foreign shareholders prioritise restructuring. This accounts for 69.6% of the 23 banks without foreign shareholders and 80% of the 20 banks prioritising the restructure of the organisation. In contrast, there are eleven banks that have foreign shareholders and focus on internal control. This makes up 73.3% of the fifteen banks with foreign shareholders and 61.1% of the eighteen banks that employ internal control as the priority method to intensify risk management. Only seven banks without foreign shareholders focus on internal control. This represents 30.4% of the 23 banks without foreign shareholders and 38.9% of the eighteen banks that use internal control. It can be seen that banks without foreign shareholders tend to focus on organisational restructure while the banks with foreign shareholders typically emphasise the importance of internal control and audit system.

Table 7.15 is a 2X2 contingency table where one expected frequency (being four) is less than five in absolute value. Hence, Fisher's exact test is preferred for inference. In Table 7.16, the probability value of Fisher's exact test (2-sided) is 0.019. Thus we reject the null hypothesis of independence and conclude that the type of bank categorised by whether it has foreign shareholders depends on the risk intensification methods prioritised.

Table7.15 Output from the contingency analysis between banks with foreign shareholders and risk intensification

Bank with foreign share holders		Risk intensification (Q23): **Restructure**-Inter control-Services-Credit growth-New technology	Risk intensification (Q23): **Inter control**-Service-Credit growth-Loan type-New technology-New funding sources	Total
Foreign shareholders	Count	4	11	15
	% within banks with foreign share holders	26.7%	73.3%	100.0%
	% within Q23	20.0%	61.1%	39.5%
	Residual	-3.9	3.9	
No foreign shareholders	Count	16	7	23
	% within banks with foreign share holders	69.6%	30.4%	100.0%
	% within Q23	80.0%	38.9%	60.5%
	Residual	3.9	-3.9	
Total	Count	20	18	38
	% within banks with foreign shareholders	52.6%	47.4%	100.0%
	% within Q23	100.0%	100.0%	100.0%

(Q23): What methods does the bank employs to intensify the risk management and financial capacity in the future?

Table 7.16 Chi-square tests between banks with foreign shareholders and risk intensification

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.702	1	.010		
Continuity Correction[a]	5.091	1	.024		
Likelihood Ratio	6.909	1	.009		
Fisher's Exact Test				**.019**	.011
Linear-by-Linear Association	6.525	1	.011		
N of Valid Cases	38				

a. Computed only for a 2x2 table.

Generally, our hypothesis 3 is confirmed. There is a difference between banks with and without foreign shareholders in terms of risk intensification methods prioritised.

7.5.3.4. Hypothesis 4

To assess the correlation between the efficiency scores and other factors we divided efficiency scores into two groups, according to two different criteria namely: E1 (average efficiency scores using a 0.59 cut-off point) and E2 (average efficiency scores using a 0.89 cut-off point).

E1 (Average efficiency scores using a 0.59 cut-off point)

Table 7.17 reports the Kruskal-Wallis test statistic with banks categorised by average efficiency scores E1 where an efficiency score below 0.59 is low efficiency and above 0.59 is high efficiency. Question 32 (Q32) originally had seven options for interviewees. However, after analyzing the data, we divided Q32 into two groups: (1) banks offer less than one billion VND unsecured loans and (2) banks offer more than one billion VND unsecured loans. The mean rank is larger for high efficiency banks compared to low efficiency banks for the number of years since establishment and credit risk analysis (Q32A). This indicates that banks with an average efficiency score above 0.59 have typically been in existence longer than banks with efficiency score of less than 0.59 and can offer more than one billion VND for an unsecured loan. In contrast, the mean rank is greater for low efficiency banks in terms of risk monitoring system, which suggests that relatively inefficient banks (E1) generally disagree that they are aware of the strengths and weaknesses of the risk management system of other banks while banks that have efficiency scores above 0.59 are more aware of the strengths and weaknesses of other banks. This is consistent with our expectation. The right-hand side of Table 7.17 provides the chi-square test statistic. For all of the control variables the probability values of the test statistics are between 0.000 and 0.017 indicating significance at the 5% level. Therefore, we find that there is a significant difference between low and high efficiency banks in terms of the number of years since establishment, risk monitoring system and credit risk analysis (unsecured loans). This is consistent with our expectation.

Table 7.17 Output from the Kruskal-Wallis test between banks with E1 (average efficiency scores using a 0.59 cut-off point) and the number of years since establishment, risk monitoring system and credit risk analysis

	Ranks			Test statistics		
		N	Mean Rank	Chi-square	df	Asymp. Sig.
Bank established within 15 years in 2009	E1: low efficiency	7	11.71	5.674	1	.017
	E1: high efficiency	31	21.26			
	Total	38				
Risk awareness (Q12)	E1: low efficiency	7	30.29	13.090	1	.000
	E1: high efficiency	31	17.06			
	Total	38				
Unsecured loans (Q32)	E1: low efficiency	7	11.43	7.331	1	.007
	E1: high efficiency	31	21.32			
	Total	38				

(E1) Average efficiency score (BCC) using a 0.59 cut-off point; (Q12): The bank is aware of the strengths and weaknesses of risk management system of other banks; (Q32) What is the maximum loan for unsecured loan (loan without guarantees) in your bank?; Sources: Replies from 38 bank managers.

Table 7.18 and 7.19 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by average efficiency scores (E1) and the number of years since establishment (Crosstab). There are six banks with average efficiency scores less than 0.59 that have been established for less than 15 years. This frequency constitutes 85.7% of the seven low efficiency banks and 35.3% of the seventeen banks that have been in existence for less than 15 years. There are eleven high efficiency banks that have been established for less than 15 years. This makes up 35.5% of the 31 high efficiency banks and 64.7% of the seventeen banks that have been established for less than 15 years. In contrast, there is only one low efficiency bank that has been established for more than 15 years. This represents 14.3% of the seven banks that have average efficiency scores less than 0.59 and 4.8% of the 21 banks that have been in existence for more than 15 years. There are 20 high efficiency banks that have been existed for more than 15 years. This comprises 64.5% of the 31 high efficiency banks and 95.2% of the 21 banks that have been established for more than 15 years. Hence, banks with average efficiency scores greater than 0.59 are typically banks that have been in existence for a long time.

Table 7.18 is a 2X2 contingency table where one expected frequency (being one) is less than five in absolute value. Hence, Fisher's exact test is preferred for inference. In Table 7.19, the 2-sided probability value of Fisher's exact test is 0.031 indicating the rejection of the null hypothesis of independence at the 5% level. Hence we can conclude that the type of bank categorised by average efficiency scores (with cut-off point of 0.59) depends on the number of years since establishment.

Table 7.18 Output from the contingency analysis between banks with E1 (average efficiency scores using a 0.59 cut-off point) and the number of years since establishment

E1 average efficiency scores using a 0.59 cut-off point		Bank established within 15 years in 2009: less than 15 years	Bank established within 15 years in 2009: more than 15 years	Total
E1: low efficiency	Count	6	1	7
	% within E1	85.7%	14.3%	100.0%
	% within the number of years since establishment	35.3%	4.8%	18.4%
	Residual	2.9	-2.9	
E1: high efficiency	Count	11	20	31
	% within E1	35.5%	64.5%	100.0%
	% within the number of years since establishment	64.7%	95.2%	81.6%
	Residual	-2.9	2.9	
Total	Count	17	21	38
	% within E1	44.7%	55.3%	100.0%
	% within the number of years since establishment	100.0%	100.0%	100.0%

(E1) Average efficiency score (BCC) using a 0.59 cut-off point.

Table 7.19 Chi-square tests between banks with E1 (average efficiency scores using a 0.59 cut-off point) and the number of years since establishment

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.828	1	.016		
Continuity Correction[a]	3.973	1	.046		
Likelihood Ratio	6.192	1	.013		
Fisher's Exact Test				**.031**	.022
Linear-by-Linear Association	5.674	1	.017		
N of Valid Cases	38				

a. Computed only for a 2x2 table.

Table 7.20 and 7.21 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by average efficiency scores (E1) and risk identification (risk awareness) (Crosstab). There is only one bank with an average efficiency score of less than 0.59 that agrees with the statement that they are aware of other banks risk management strengths and weaknesses. This represents 14.3% of the seven less efficient banks and 3.7% of the 27 banks that understand the strengths and weaknesses of the risk management system of other banks. There are 26 high efficiency banks that are aware of strengths and weaknesses of other banks. This accounts for 83.9% of the 31 relatively efficient banks and 96.3% of the 27 banks that are aware of other banks' risk management systems. On the other hand, six relatively inefficient banks are not aware of other banks risk management. This constitutes 85.7% of the seven less efficient E1 banks and 54.5% of the eleven banks that disagree or do not answer the question. There are five comparatively efficient banks that are not aware of other banks risk management. This makes up 16.1% of the 31 efficient banks and 45.5% of the eleven banks that disagree or cannot decide whether they are aware of other banks' risk management. Thus, banks with efficiency scores that are more than 0.59 have better information about other banks' risk management than banks with efficiency scores below 0.59.

Table 7.20 is a 2X2 contingency table where two expected frequencies (being five and one) are equal and less than five in absolute values. Hence, Fisher's exact test is preferred for inference. In Table 7.21, the probability value of Fisher's exact test (2-sided) is 0.001 which indicates the rejection of the null hypothesis of independence the 1% level. Therefore, we can conclude that the type of bank categorised by average efficiency scores (being 0.59) depends on the risk identification (risk awareness).

Table 7.20 Output from the contingency analysis between banks with E1 (average efficiency scores using a 0.59 cut-off point) and risk awareness

E1 average efficiency scores using a 0.59 cut-off point		Risk awareness (Q12)		
		Agree	Disagree or undecided	Total
E1: low efficiency	Count	1	6	7
	% within E1	14.3%	85.7%	100.0%
	% within Q12	3.7%	54.5%	18.4%
	Residual	-4.0	4.0	
E1: high efficiency	Count	26	5	31
	% within E1	83.9%	16.1%	100.0%
	% within Q12	96.3%	45.5%	81.6%
	Residual	4.0	-4.0	
Total	Count	27	11	38
	% within E1	71.1%	28.9%	100.0%
	% within Q12	100.0%	100.0%	100.0%

(E1) Average efficiency score (BCC) using a 0.59 cut-off point; (Q12): The bank is aware of the strengths and weaknesses of risk management system of other banks.

Table 7.21 Chi-square tests between banks with E1(average efficiency scores using a 0.59 cut-off point) and risk awareness

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	13.444	1	.000		
Continuity Correction[a]	10.273	1	.001		
Likelihood Ratio	12.594	1	.000		
Fisher's Exact Test				**.001**	.001
Linear-by-Linear Association	13.090	1	.000		
N of Valid Cases	38				

a. Computed only for a 2x2 table.

Table 7.22 and 7.23 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by average efficiency scores (E1) and credit risk analysis in terms of unsecured loans (Crosstab). There are five banks with average efficiency scores less than 0.59 that have a maximum unsecured loan of one billion VND. This frequency comprises 71.4% of the seven low efficiency E1 banks and 45.5% of the eleven banks with unsecured loans of less than one billion VND. There are six high efficiency banks with unsecured loans below one billion VND that represent 19.4% of the 31 relatively efficient E1 banks and 54.5% of the eleven banks that have less than one billion VND in unsecured loan. In contrast, there are only two less efficient banks with unsecured loans in excess of one billion VND that account for 28.6% of the seven comparatively inefficient E1 banks and 7.4% of the 27 banks that have unsecured loan above one billion VND. There are 25 high efficiency banks with unsecured loans above one billion VND that represent 80.6% of the 31 comparatively efficient banks and 92.6% of the 27 banks that have more than one billion VND for an unsecured loan. Banks with average efficiency scores more than 0.59 tend to be able to offer higher unsecured loans (without guarantees; being higher risk) than less efficient banks.

Table 7.22 is a 2X2 contingency table where two expected frequencies (being five and two) are equal and less than five in absolute values. Hence, Fisher's exact test is preferred for inference. In Table 7.23, the 2-sided probability value of Fisher's exact test is 0.014 which indicates the rejection of the null hypothesis of independence at the 5% level. Hence we can conclude that the type of bank categorised by average efficiency scores (with a 0.59 cut-off point) is correlated with the amount of unsecured loan that is available.

Table 7.22 Output from the contingency analysis between banks with E1 (average efficiency scores using a 0.59 cut-off point) and unsecured loans

E1 average efficiency scores using a 0.59 cut-off point		Unsecured loans (Q32) Less than one billion VND	More than one billion VND	Total
E1: low efficiency	Count	5	2	7
	% within E1	71.4%	28.6%	100.0%
	% within Q32	45.5%	7.4%	18.4%
	Residual	3.0	-3.0	
E1: high efficiency	Count	6	25	31
	% within E1	19.4%	80.6%	100.0%
	% within Q32	54.5%	92.6%	81.6%
	Residual	-3.0	3.0	
Total	Count	11	27	38
	% within E1	28.9%	71.1%	100.0%
	% within Q32	100.0%	100.0%	100.0%

(E1) Average efficiency score (BCC) using a 0.59 cut-off point; (Q32) What is the maximum loan for unsecured loan (loan without guarantees) in your bank?

Table 7.23 Chi-square tests between banks with E1 (average efficiency scores using a 0.59 cut-off point) and unsecured loans

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.529	1	.006		
Continuity Correction[a]	5.210	1	.022		
Likelihood Ratio	6.890	1	.009		
Fisher's Exact Test				**.014**	.014
Linear-by-Linear Association	7.331	1	.007		
N of Valid Cases	38				

a. Computed only for a 2x2 table.

E2 (Average efficiency scores using a 0.89 cut-off point)

Table 7.36 reports the Kruskal-Wallis test statistic with banks categorised by average efficiency scores according to the E2 criterion. The mean rank is larger for more efficient E2 banks according to risk area identification, risk monitoring methods and efficiency improvement suggestions. Question 21 (Q21) originally had seven options for interviewees. However, after analyzing the data, we divided Q21 into two groups: (1) unsecured loans, securities and credit cards and (2) unsecured loans, securities and consumption loans. All the banks choose unsecured loans and credit cards as the most two risky areas. This indicates that banks with average efficiency scores less than 0.89 generally regard credit cards as the third risky area after unsecured and securities loans. Question 24 (Q24) originally had six options for interviewees. All banks consider the following methods the SBV should employ to prevent risks: provide information through CIC, improve legal framework, apply IT to management, corporate macro policies. Some banks focus on inspection of SBV as the next method while others prefer management of liquidity and risk training programmes. As the mean rank is larger for more efficient E2 banks, comparatively inefficient banks focus on strengthen inspection of SBV as the important method to prevent risks. This is consistent with our expectation. The right-hand side of Table 7.36 gives the chi-square test statistic for independence. All of the control variables test statistics (the probability range from 0.013 to 0.026) are high significant at the 5% level. Therefore, we find that there is a significant difference between high and low efficiency banks in terms of the risk areas identified, risk monitoring methods and suggestions for bank efficiency improvements which is consistent with our expectation.

Table 7.24 Output from the Kruskal-Wallis test between banks with E2 (average efficiency scores using a 0.89 cut-off point) and risk area identification, risk monitoring methods and efficiency improvement suggestions

	Ranks			Test statistics		
	E2	N	Mean Rank	Chi-square	df	Asymp. Sig.
Risk areas (Q14)	E2: low efficiency	26	17.46	6.140	1	0.013
	E2: high efficiency	12	23.92			
	Total	38				
SBV methods (Q24)	E2: low efficiency	26	17.42	4.940	1	0.026
	E2: high efficiency	12	24.00			
	Total	38				
Bank efficiency (Q44)	E2: low efficiency	18	16.11	5.151	1	0.023
	E2: high efficiency	20	22.55			
	Total	38				

(E2) Average efficiency score (BCC) using a 0.89 cut-off point; (Q14): What are the highly risky areas in your banking businesses? (Q24): What are the methods should be done by the SBV to prevent banking risks?; (Q44): What would you suggest to improve bank efficiency? Sources: Replies from 38 bank managers.

Table 7.25 and 7.26 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by average efficiency scores (E2) and risk area identification (Crosstab). All the banks consider unsecured loans and securities as the most high risk areas in banking businesses. After these two risk areas, some banks focus on credit cards and other on consumption loans. There are 24 banks with average efficiency score less than 0.89 that emphasise credit cards as a risk area. This represents 92.3% of the 26 less efficient E2 banks and 77.4% of the 31 banks that give credit cards as the third priority in terms of risky area. There are seven relatively efficient banks that specify credit cards in the top three risk areas. This comprises 58.3% of the twelve comparatively efficient banks and 22.6% of the 31 banks that highlight credit cards as one of the risky areas. In contrast, only two of the less efficient banks indicate consumption to be one of the three main risky areas. This accounts for 7.7% of the 26 low efficiency E2 banks and 28.6% of the seven banks that consider consumption as one of the risky areas. There are also five relatively efficient banks that specify consumption as a top three risks. This constitutes 41.7% of the twelve more efficient banks and 71.7% of the seven banks that choose consumption as a main risk area. This suggests that highly efficient banks have good systems to control credit cards while low efficient banks still have problems with this type of business.

Table 7.25 is a 2X2 contingency table where two expected frequencies (being five and two) are equal and less than five in absolute values. Hence, Fisher's exact test is preferred for inference. In Table 7.26, the 2-sided probability value of Fisher's exact test is 0.022 which indicates the rejection of the null hypothesis of independence at the 5% level. Therefore, we can conclude that the type of bank categorised by average efficiency scores (being 0.89) is related to the main risk area identified by the banks.

Table 7.25 Output from the contingency analysis between banks with E2 (average efficiency scores using a 0.89 cut-off point) and risk area identification

E2 average efficiency scores using a 0.89 cut-off point		Risk areas (Q14)		
		Unsecured-Securities- **Credit Cards**	Unsecured-Securities- **Consumption**	Total
E2: low efficiency	Count	24	2	26
	% within E2	92.3%	7.7%	100.0%
	% within Q14	77.4%	28.6%	68.4%
	Residual	2.8	-2.8	
E2: high efficiency	Count	7	5	12
	% within E2	58.3%	41.7%	100.0%
	% within Q14	22.6%	71.4%	31.6%
	Residual	-2.8	2.8	
Total	Count	31	7	38
	% within E2	81.6%	18.4%	100.0%
	% within Q14	100.0%	100.0%	100.0%

(E2) Average efficiency score (BCC) using a 0.89 cut-off point; (Q14): What are the highly risky areas in your banking businesses?

Table 7.26 Chi-square tests between banks with E2 (average efficiency scores using a 0.89 cut-off point) and risk area identification

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.306	1	.012		
Continuity Correction[a]	4.248	1	.039		
Likelihood Ratio	5.904	1	.015		
Fisher's Exact Test				**.022**	.022
Linear-by-Linear Association	6.140	1	.013		
N of Valid Cases	38				

a. Computed only for a 2x2 table.

Table 7.27 and 7.28 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by average efficiency scores (E2) and risk monitoring methods (Crosstab). All the banks consider the following methods the SBV should employ to prevent risks: (1) provide information through CIC; (2) improve legal framework; (3) apply IT to management and (4) coordinate macro policies. After these four methods, some banks focus on (a) inspection of SBV or (b) management of liquidity and risk training programmes. There are 22 banks with average efficiency score less than 0.89 and regard inspection as the fifth most important method to prevent risks. This represents 84.6% of the 26 less efficient E2 banks and 78.6% of the 28 banks that consider inspection of SBV as fifth most important method to prevent risk. There are six relatively efficient banks specify inspection in the fifth risk prevention method. This constitutes 50% of the twelve more efficient E2 banks and 21.4% of the 28 banks that suggest inspection of SBV as a top five risk mitigation. In contrast, only four inefficient banks emphasise liquidity and risk training as the fifth and sixth risk prevention methods. This accounts for 15.4% of the 26 less efficient E2 banks and 40% of the ten banks that emphasise the following two risk prevention methods (1) management of liquidity between SBV and commercial banks and (2) risk training programmes for staff of commercial banks. There are six comparatively efficient banks that emphasise liquidity and training. This is 50% of the twelve more efficient E2 banks and 60% of the ten banks that emphasise liquidity and training as risk prevention methods. Banks with low efficient scores tend to regard inspection of SBV as more important than liquidity management and staff training than more efficient banks.

Table 7.27 is a 2X2 contingency table where one expected frequency (being four) is less than five in absolute value. Hence, Fisher's exact test is preferred for inference. In Table 7.28, the 2-sided probability value of Fisher's exact tests is 0.045 which indicates the rejection of the null hypothesis of independence at the 5% level. Therefore, we can conclude that the type of bank categorised by average efficiency scores (with the 0.89 at the cut-off point) depends on the risk monitoring methods emphasised.

Table 7.27 Output from the contingency analysis between banks with E2 (average efficiency scores using a 0.89 cut-off point) and risk monitoring methods

E2 average efficiency scores using a 0.89 cut-off point		Unsecured loans (Q24)		
		CIC-Legal-IT-Macro policies-**Inspection**	CIC-Legal-IT-Macro policies-**Liquidity with banks-Training**	Total
E2: low efficiency	Count	22	4	26
	% within E2	84.6%	15.4%	100.0%
	% within Q24	78.6%	40.0%	68.4%
	Residual	2.8	-2.8	
E2: high efficiency	Count	6	6	12
	% within E2	50.0%	50.0%	100.0%
	% within Q24	21.4%	60.0%	31.6%
	Residual	-2.8	2.8	
Total	Count	28	10	38
	% within E2	73.7%	26.3%	100.0%
	% within Q24	100.0%	100.0%	100.0%

(E2) Average efficiency score (BCC) using a 0.89 cut-off point; (Q24): What are the methods should be done by the SBV to prevent banking risks?

Table 7.28 Chi-square tests between banks with E2 (average efficiency scores using a 0.89 cut-off point) and risk monitoring methods

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.074	1	.024		
Continuity Correction[a]	3.445	1	.063		
Likelihood Ratio	4.841	1	.028		
Fisher's Exact Test				**.045**	.034
Linear-by-Linear Association	4.940	1	.026		
N of Valid Cases	38				

b. Computed only for a 2x2 table.

Table 7.29 and 7.30 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by average efficiency scores (E2) and the suggestions to improve bank efficiency (Crosstab). There are sixteen banks with average efficiency scores less than 0.89 that do not suggest any efficiency improvement measure. This accounts for 88.9% of the eighteen less efficient E2 banks and 59.3% of the 27 banks that do not give any efficiency improvement suggestions. There are eleven relatively efficient banks that make no efficiency improvement suggestions. This is 55% of the 20 more efficient banks and 40.7% of the 27 banks that do not indicate any efficiency improvement. On the other hand, only two less efficient banks provide improvement suggestions. This comprises 11.1% of the eighteen relatively inefficient E2 banks and 18.2% of the eleven banks that provide suggestions including Basel II, internal control, people, IT and services. There are nine comparatively efficient banks that make efficiency improvement suggestions. This constitutes 45% of the 20 more efficient E2 banks and 81.8% of the eleven banks that give efficiency improvement suggestions. This implies that high efficiency banks tend to suggest more solutions to improve efficiency than low efficiency banks.

Table 7.29 is a 2X2 contingency table where one expected frequency (being two) is less than five in absolute value. Hence, Fisher's exact test is preferred for inference. In Table 7.30, the 2-sided probability value of Fisher's exact test is 0.033 which indicates the rejection of the null hypothesis of independence at the 5% level. Therefore, we can conclude that the type of bank categorised by average efficiency scores (being 0.79) depends on the degree to which efficiency improvement suggestions are made.

Table 7.29 Output from the contingency analysis between banks with E2 (average efficiency scores using a 0.89 cut-off point) and efficiency improvement suggestions

E2 average efficiency scores using a 0.89 cut-off point		Bank efficiency (Q44)		
		Do not know	Risk management (Basel II)-Internal control-People-IT-Service	Total
E2: low efficiency	Count	16	2	18
	% within E2	88.9%	11.1%	100.0%
	% within Q44	59.3%	18.2%	47.4%
	Residual	3.2	-3.2	
E2: high efficiency	Count	11	9	20
	% within E2	55.0%	45.0%	100.0%
	% within Q44	40.7%	81.8%	52.6%
	Residual	-3.2	3.2	
Total	Count	27	11	38
	% within E2	71.1%	28.9%	100.0%
	% within Q44	100.0%	100.0%	100.0%

(E2) Average efficiency score (BCC) using a 0.89 cut-off point; (Q44): What would you suggest to improve bank efficiency?

Table 7.30 Chi-square tests between banks with E2 (average efficiency scores using a 0.89 cut-off point) and efficiency improvement suggestions

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.290	1	.021		
Continuity Correction[a]	3.771	1	.052		
Likelihood Ratio	5.644	1	.018		
Fisher's Exact Test				**.033**	.024
Linear-by-Linear Association	5.151	1	.023		
N of Valid Cases	38				

a. Computed only for a 2x2 table.

In brief, hypothesis 4 is confirmed. There is a significant difference between low efficient E1 and high efficient E1 banks in terms of the number of years since establishment, risk monitoring methods and credit risk analysis. Further, there is a significant difference between low efficient E2 and high efficient E2 banks in terms of the risk area identification, risk monitoring methods and efficiency improvement suggestions.

7.5.3.5. Hypothesis 5

Table 7.31 reports the Kruskal-Wallis test statistic with banks categorised by the number of years since establishment and ranked according to their degree of awareness of other banks risk management systems. The mean rank is larger for banks that have been established for more than 15 years with risk awareness, which suggests that banks that have been in existence more than 15 years are more aware of the strengths and weaknesses of risk management than those that less than 15 years old. The right-hand side of Table 7.31 gives the chi-square test statistic. The test statistics probability value is 0.029 which indicates a significant correlation at the 5% level. Therefore, we find that there is a significant difference between young and old banks in terms of their risk awareness, which is consistent with our expectation.

Table 7.31 Output from the Kruskal-Wallis test between the number of years since establishment and risk awareness

	Ranks			Test statistics		
		N	Mean Rank	Chi-square	df	Asymp. Sig.
Risk awareness (Q12)	Less than 15 years	17	22.94	4.777	1	029
	More than 15 years	21	16.71			
	Total	38				

(Q12): The bank is aware of the strengths and weaknesses of the risk management system of other banks; Sources: Replies from 38 bank managers.

Table 7.32 and 7.33 report, respectively, the output from the contingency analysis and the chi-square tests with the type of bank categorised by the number of years since establishment and a bank's degree of risk awareness (Crosstab). There are nine banks that have been established less than 15 years and that are aware of other banks risks management. This represents 52.9% of the seventeen young banks and 33.3% of the 27 banks that understand the strengths and weaknesses of the risk management system of other banks. There are eighteen older banks that understand other banks' risk management systems. This accounts for 85.7% of the 21 older banks and 66.7% of the 27 banks that are aware of other banks' risk management. On the other hand, eight younger banks do not understand other banks' risk management systems. This constitutes 47.1% of the seventeen younger banks and 72.7% of the eleven banks that are not aware of other banks' risk management systems. There are three older banks that have no knowledge of other banks' risk management systems. This makes up 14.3% of the 21 older banks and 27.3% of the eleven banks that do not say that they are aware of other banks' risk management. Thus, older banks tend to have better information about other banks' risk management systems than younger banks.

Table 7.32 is a 2X2 contingency table where one expected frequency (being three) is less than five in absolute value. Hence, Fisher's exact test is preferred for inference. In Table 7.33, the

2-sided probability value of Fisher's exact test is 0.037 which indicates the rejection of the null hypothesis of independence at the 5% level. Therefore, we can conclude that the type of bank categorised by the number of years is significantly correlated with a bank's risk awareness.

Table 7.32 Output from the contingency analysis between the number of years since establishment and risk awareness

Bank established within 15 years in 2009		Risk awareness (Q12)		
		Agree	Disagree or undecided	Total
Young banks	Count	9	8	17
	% within the number of years since establishment	52.9%	47.1%	100.0%
	% within Q12	33.3%	72.7%	44.7%
	Residual	-3.1	3.1	
Old banks	Count	18	3	21
	% within the number of years since establishment	85.7%	14.3%	100.0%
	% within Q12	66.7%	27.3%	55.3%
	Residual	3.1	-3.1	
Total	Count	27	11	38
	% within the number of years since establishment	71.1%	28.9%	100.0%
	% within Q12	100.0%	100.0%	100.0%

(Young banks): Banks have been in existence for less than 15 years in 2009; (Old banks): Banks have been in existence for more than 15 years in 2009; (Q12): The bank is aware of the strengths and weaknesses of the risk management system of other banks.

Table 7.33 Chi-square tests between the number of years since establishment and risk awareness

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.906	1	.027		
Continuity Correction[a]	3.442	1	.064		
Likelihood Ratio	4.995	1	.025		
Fisher's Exact Test				**.037**	.031
Linear-by-Linear Association	4.777	1	.029		
N of Valid Cases	38				

a. Computed only for a 2x2 table.

Generally, hypothesis 5 is confirmed. There is a significant difference between the young banks (banks have been in existence for less than 15 years in 2009) and old banks (banks have been in existence for more than 15 years in 2009) in terms of the risk awareness.

7.6. Conclusion

The study of banking risk management is a field in which data at nominal and ordinal levels are particularly evident. In such instances we have recourse to nonparametric statistical methods. Serious doubts about the normality assumption, even when the data are at interval or ratio levels, is another situation in which nonparametric methods may be preferred over parametric ones. Many authors refer to nonparametric methods as distribution free, in that they make relatively few assumptions about the nature of the population distribution. In this study, the nonparametric Kruskal-wallis and chi-square tests are employed to test the relations between the control variables and risk management questions.

This study finds that banks with asset size more than 20,000 billion VND in 2009 are almost all located in Hanoi and Ho Chi Minh City while banks with asset size less than 20,000 billion VND in 2009 tend to set up their head offices in other provinces. We also find that the two most important types of risks that facing the Vietnamese banking system are credit risk and liquidity risk. Further, almost all small banks consider foreign exchange as the third most important type of risk, while larger banks typically regard operational risk as one of the three most risky areas. Our data also suggest that small banks normally have fewer risk departments and less training programmes for staff than larger banks. Another finding is that SOCBs generally have a larger asset size than non-SOCBs. Further, banks with foreign shareholders tend to focus on developing internal control and audit system as priority methods to intensify risk management and financial capacity while banks without foreign shareholders typically prefer to restructure the organisation and operations.

It is also found that banks with efficiency scores of more than 0.59 (high efficient E1 banks) are generally more aware of other banks' risk management systems and have been in existence for longer than banks with efficiency scores less than 0.59 (low efficient E1 banks). Moreover, banks with efficiency scores of more than 0.59 (high efficient E1 banks) could offer more than one billion VND in unsecured loans for customers while low efficient E1 banks offer less than one billion VND unsecured loans. Banks with efficiency scores greater than 0.89 (high efficient E2 banks) generally give more suggestions to improve bank efficiency (Basel II, internal control, human resource management, IT, customer services, etc.) than banks with efficiency scores below 0.89 (low efficient E2 banks). Our survey indicates that all banks regard unsecured loans and securities as the two most important areas of risk. Almost low efficient E2 banks regard credit cards as the third priority in terms of risk areas while 41.7% of high efficient E2 banks in our sample consider consumption as one of the risky areas. Low efficient E2 banks prefer to strengthen inspection of SBV to help preventing risks, while high efficient E2 banks favour: (i) management of liquidity between SBV and banks; and (ii) risk training programmes for staff. Finally, we find that banks that have been in existence for more than 15 years are generally more aware of the strengths and weaknesses of the risk management systems of other banks than younger banks.

This is the first time that a survey of the risk management has been carried out, which provides new information on the Vietnamese banking system. All the results are consistent with our empirical results from previous chapters and our expectation. The most interesting finding is that credit and liquidity are the two most important types of risks with 38 top bank managers. This is consistent with the effect of 2008-global-crisis on the Vietnamese banking system. Credit and liquidity risks are also priority concerns of the SBV and Government. Top managers of banks provided policy recommendations to improve bank efficiency as follows: (1) application of Basel II; (2) increase internal control; (3) human resource management; and (4) IT and quality of customer services. Inspection by SBV is also needed to prevent potential risks. Another policy recommendation is the intensification of risk management. Almost bank managers prefer to restructure banking system where some small banks are not really efficient in the market. Hence, merger and acquisitions should be the popular trend in the coming years. The SBV needs to have policies for restructuring the system and promoting competition in the banking sector of Vietnam.

Chapter 8 Conclusion

8.1. Summary of contributions and findings

A few empirical studies on the structure of the Vietnamese banking system have applied the structural model (SCP) and non-structural model (Panzar-Rosse). However, these studies suffered from methodological problems since they employed variables that did not reflect true business activities in the Vietnamese banking sector. Furthermore, other research on bank efficiency focused only on the efficiency scores and did not take into consideration the impact that environmental variables have on the inputs and outputs. No study has yet considered bank structure for a large number of banks and long period of time in the system neither is there any study providing a systematic analysis of bank efficiency and risk management.

The thesis contributes to the research on banking in general and Vietnam in particular. First, at the theoretical level, this thesis investigates the development of Vietnamese banking in four stages: (1) the period prior to 1986; (2) 1986–1995; (3) 1996–2005; (4) 2006 until now. In each stage, macroeconomic and microeconomic aspects of the role of banks such as regulation, interest rate, exchange rate, non-performing loans, positions of SOCBs, and many others are included in the analysis. We also put an emphasis on the Vietnamese crises of 1997 and 2008. The current banking system including the SBV, state owned commercial banks (SOCBs); joint stock commercial banks (JSCBs); joint venture commercial banks (JVCBs) and branches of foreign bank (BFBs) are also discussed. Through such investigations, we are able to incorporate a number of financial fundamentals to the bank structure and efficiency models that capture the features of the Vietnamese banking system.

The second contribution of the thesis is the construction of a unique data set of 48 Vietnamese commercial banks in the period from 1999 to 2009. This time span covers both the post 1997 Asian and 2008 Global crises, which allows us to estimate the impacts of financial crises on the banking system.

Thirdly, at the empirical level, this thesis provides for the first time a comprehensive application of the extended structural (SCP) and non-structural (Panzar-Rosse) models. We analyse the behaviour of the sub-sample as type (SOCBs and non-SOCBs) and period (1999–2003 and 2004–2009). Moreover, in the non-structural model, we employ models using current and lagged input prices both with and without assets as Bikker *et al.* (2006) and Goddard and Wilson (2009). Both equilibrium approach (fixed-effect estimator) and disequilibrium approach (Arellano and Bond (1991) estimator) are used to examine bank structure. This is also the first comprehensive study that employs the semi-parametric model through the two-stage procedure for the Vietnamese banking system. Lastly, it is worth mentioning that to be able to carry out a comparative analysis and provide policy recommendation in risk management, we carry out a survey of 38 Vietnamese commercial banks using a questionnaire. The forms of questionnaire are matrix (five point Likert scale from "strongly agree" to "strongly disagree"), multiple choice, choice by rank, close-ended and open ended questions. The structured questionnaire contains seventeen questions and is divided into four parts including risk identification, risk monitoring system, credit risk analysis and efficiency improvement suggestions.

The main findings of the thesis can be summarised in the following way: the market structure of the Vietnamese banking system, bank efficiency and risk management. In terms of the market structure, concentration ratio and Herfindahl-Hirschman index indicate that the impact of large commercial banks on the market behaviour has been gradually reduced over the period from 1999 to 2009 but they still dominate the whole banking system. The SCP and EH estimations do not support either traditional (SCP) or efficient hypotheses (EH). The results of the full sample, sub-sample 2004–2009 and 43 non-SOCBs are similar, which suggest that MS is insignificant and CR is negative and significant. There is generally no relation between MS and CR and the dependent variables for the sub-sample 1999–2003. For the five SOCBs, CR is insignificant and MS is negative and significant when revenue and interest income are the dependent variables. In the non-structural models both equilibrium (fixed-effect estimations) and disequilibrium approaches (Arellano and Bond (1991) GMM estimations) are employed to investigate the banking system. Bikker *et al.* (2006a) and Goddard and Wilson (2009) provided a critical analysis of using for estimation a revenue elasticity using a specification that includes a quantity-type variable among the controls, or using a specification which, through rescaling, converts a revenue variable into a price-type variable. Therefore, we report the models with and without assets in each approach. In order to avoid possible simultaneity between input prices and revenue, which might arise if banks exercise monopoly power in their factor markets, Shaffer (2004) suggested using lagged input prices as covariates in the revenue equation. Hence, we also report the models with lagged input prices. The non-structural model indicates preferences for the disequilibrium approach without assets to interpret the full sample. According to the disequilibrium approach, the H-statistics of the full sample (being -1.36 and -2.61) and the sub-samples (from -2.86 to -1.35) suggest the Vietnamese banking system is in monopoly. These H-statistics are not significantly different from zero but significantly different from one. The removal of total assets from all other models transforms our inference regarding the market toward being more monopolistic as indicated in Bikker *et al.* (2006a) and Goddard and Wilson (2009). Moreover, the H-statistics are generally higher for models where revenue is the dependent variable. Therefore, the market is more competitive when based on revenue comparing with interest income. The results also show that the non-SOCBs are more competitive than SOCBs. LN(IE/FF) is generally positive and significant in all the models of equilibrium and disequilibrium approaches, which suggests that unit cost of fund has the most direct impact on revenue and interest income. LN(BR) is positive and significant in all the models except for the sub-sample SOCBs. Banks open more branches when they also grow their revenue and interest income.

Regarding bank efficiency based on Simar and Wilson (2007), the empirical results show that the average technical efficiency scores for the whole system are 0.71 assuming constant returns to scale (CCR) and 0.78 assuming variable returns to scale (BCC). There were decreasing trends of efficiency scores between 2001 and 2002, and between 2007 and 2008. This result is consistent with those obtained by Nguyen V (2007) for a smaller number of banks between 2001 and 2002. In terms of asset size, large and very large banks performed better than small and medium sized banks. Regarding bank type, SOCBs, JSCBs and JVCBs have similar efficiency scores. However, CCR measure of non-SOCBs (being 0.82) indicates that non-SOCBs are more efficient than SOCBs (0.70) assuming overall efficiency. This is consistent with the results from the non-structural models. A two-stage procedure was also applied to provide information of environmental factors on efficiency scores. Efficiency scores and estimates of confidence intervals in Algorithm 1 and 2 are regressed on environmental variables. Turning to the other characteristics of banks, CITY (banks transformed from rural to city banks) and LNTA (total assets) are generally positive and significant, based upon CCR and BCC measures. There are around ten banks which transformed from rural commercial banks to city commercial banks in the 2000s. They have performed well in terms of total assets, loans and deposits under this research. Raising total assets appears to be an effective tool for increasing the efficiency of banks. This is consistent with the structural and non-structural models and our expectation. LNNLCL (non-performing loans) and LNAGE (the number of years since establishment) are insignificant except for the Algorithm 2. For LNNLCL, lower bound and upper bound of Algorithm 2 (CCR model) indicate that banks with high non-performing loans have smaller efficient scores than the others. LNBR (number of branches) is generally negative and significant, which indicates that banks with a small number of branch networks (JVCBs or newly established banks) are more efficient than the other banks.

With regards to risk management, the two most important types of risks facing the Vietnamese banking system are credit risk and liquidity risk. Banks with asset size less than 20,000 billion VND in 2009 have in general less resources to employ more quantitative risk analysts, regular training programmes for staff compared to banks with asset size more than 20,000 billion VND in 2009. Banks with foreign shareholders tend to focus on developing internal control and audit systems as priority methods to intensify risk management and financial capacity. Banks without foreign shareholders typically prefer to restructure the organisation and operations. Banks with efficiency scores of more than 0.59 (high efficient E1 banks) are generally more aware of other banks' risk management systems and have been in existence for longer than banks with efficiency scores of less than 0.59 (low efficient E1 banks). Suggestions to improve bank efficiency are the application of Basel II, increased internal control, human management, IT and quality of customer services. All the banks regard unsecured loans and securities as the two most important risk areas. Banks with efficiency scores of less than 0.89 (low efficient E2 banks) prefer to strengthen inspection by SBV to help prevent risks while banks with efficiency scores of more than 0.89 (high efficient E2 banks) favour management of liquidity between SBC and banks and risk training programmes for staff.

8.2. Policy implications

A number of policy implications arise out of this thesis. The first policy implication concerns the relation between loan and bank revenue and interest income. In Chapter 2, we argued that tightening monetary policies starting in 2008 still have a big impact on the banking system in terms of compulsory reserves, loans and deposits. In parallel with the speed of the country's economic development, the loan growth rate grew dramatically. As loan growth rate is higher than deposit growth rate, commercial banks have to use sources such as the inter-bank market to meet borrowing demands. The misuse of this capital resource causes serious imbalance in the capital structure and implicates high liquidity risk in the banking system. Moreover, when the inflation rate and deficit in trade balance have become more serious, the government used traditional tightening of monetary policy in order to reduce money supply circulation – the main reason for high inflation. Generally, the banking system encounters many difficulties, resulting from loss of balance in the source and use of funds, and the rapid increase in credit growth. This is also supported by our results from Chapters 3 to 5 when customer loans increase, revenue and interest income generally decrease from 2004 to 2009. Thus, SBV needs to balance between high demand of loans from the public and macroeconomic policies of the government. Chapter 4 also shows that revenue is more competitive than interest income in all the models from 1999 to 2009. Sources of revenue might by securities, credit cards, derivative products, etc. SBV needs to strengthen the regulations on the current sources (credit cards, derivative products) and set up regulations on new service such as securitisations.

Secondly, only a few banks (most of them are SOCBs) still dominate the banking system. From Chapter 3, although CR decreases from 1999 to 2009 but it still represents a high proportion of total system. 5-bank-ratio for loans, assets and deposits were 0.64, 0.57 and 0.60 in 2009. Small banks have performed better in the 2000s but they might not compete against large and very large banks in the system. Chapter 5 suggests that the Vietnamese banking system is monopolistic (the H-statistics of the full sample are are -1.36 and -2.61). The H-statistics are not significantly different from zero but significantly different from one. The results from Chapter 6 indicate that large and very large banks are more efficient than small and medium banks. Small banks have the smallest efficiency scores in the system which are 0.66 assuming CCR and 0.70 assuming BCC. From Chapter 7, banks with foreign shareholders regard internal control and audit system as priority methods to intensify risk management while other banks prefer restructuring their organisations and operations. These findings indicate that most of the bank top managers would like to have a restructure in the banking system where some small banks are not really efficient in the market. Hence, merger and acquisitions should be the popular trend in the coming years. The SBV needs to have policies for restructuring the system and promoting competition in the banking sector of Vietnam.

Our results also show that the non-SOCBs are more competitive and efficient than SOCBs. In Chapter 6, CCR measure of non-SOCBs (being 0.82) indicates that non-SOCBs are more efficient than SOCBs (0.70) assuming overall efficiency. Results from Chapters 3 and 5 indicate that banks open more branches when they also grow their revenue and interest income. However, Chapter 5 also shows that when SOCBs open more branches their revenue and interest income decrease. Thus SBV should have policies to enhance the development of the small and medium banks in terms of branch networks.

The fourth implication considers the relation between non-performing loans and bank efficiency scores. Chapter 6 (results from lower bound and upper band of Algorithm 2 – CCR model) suggests that non-performing loans also partially affect bank efficiency scores (as Algorithm 2 of Simar and Wilson, 2007). When non-performing loans increase, the efficiency scores decrease from 1999 to 2009. The burden of non-performing loans (NPLs) has slowed the reform process in Vietnam and hampered the further expansion of the economy (Hoang T, 2006). Thus SBV should focus more methods on preventing non-performing loans, such as increasing minimum capital adequacy ratio, decreasing credit limits to customers, limiting capital contributions and share purchases.

The last implication is the type of banking risk. In Chapter 7, we found that credit and liquidity are the two most important types of risks with 38 top bank managers. Hence, there should be more controls from the SBV on credit and liquidity risks. Regular risk training programmes from SBV are necessary to guarantee consistency in risk management. Top managers of banks from our survey provide the following suggestions to improve bank efficiency: (1) application of Basel II; (2) increase internal control; (3) human resource management; and (4) IT and quality of customer services. Inspection by SBV is also needed to prevent potential risks.

8.3. Suggestions for future research

As far as we are aware there is no such a study that would comprehensively analyse the Vietnamese banking sector. Nevertheless, we would like to suggest several possible extensions in this particular research. Firstly, Chapter 2 clearly showed that the government and SBV have tried to adapt the banking sector to extensive qualitative economic changes since 1986 by issuing a large number of directives and acts. Nevertheless, it is not clear that sometimes within the regulatory environment whether these documents will have positive effects or was premature and thus destabilise the whole financial system. Most of the internal research that has taken places within Vietnam comments only on the present condition instead of raising the possibility of the change that could be made to the regulatory environment. Hence, research on the impact of these policies on the financial system is a demanding requirement, especially for the coming years. The particular focus should be on corporate governance, securitisation and risk management with the special emphasis on the implementation of Basel II and III.

Although, we have set up a unique database, there is a possibility to collect data of the branches of foreign banks even they account for only small percentage of the banking system in terms of loans, deposits and assets. The full data might help us to provide more exact results of the structural models. Next step should be to investigate bank efficiency of newly set up commercial banks and the "old" banks. An annual analysis in the last years would provide to current research that tries to establish whether or not ownership structure matters but also the differences in term of bank efficiency between "new" and "old" banks. A further interesting area that needs to be explored is the inclusion of non-performing loan (NPL) in the structural models to examine its relation with revenue, interest income and profit before tax.

Thirdly, efficiency estimation as parametric methods such as SFA, DFA and TFA could be employed to compare with non-parametric method (DEA) to verify out results. Last but not least, in bank risk management, we received valid 38 respondents out of 48 banks from the survey and this presents 80% of the banking system. Although there are 76.3% of respondents are the top managers or direct heads of risk departments. We can increase the number of respondents and quality of answers and focus more on risks intensification and efficiency suggestions.

Appendix I Explanation of data

Income statement includes data on interest and similar income; interest and similar expenses; fee and commission income; fee and commission expenses; other incomes; other operating expenses; provision for credit losses; profit before tax; tax; reserve. Where:

- ✓ Net interest and similar income = interest and similar income - interest and similar expenses.
- ✓ Net fee and commission income = fee and commission income - fee and commission expenses.
- ✓ Total incomes = interest and similar income + fee and commission income + other income.
- ✓ Total expenses = interest and similar expenses + fee and commission expenses + other operating expenses + provision for credit losses.
- ✓ Profit before tax = total incomes - total expenses.
- ✓ Profit after tax = profit before tax – tax.

Balance sheet includes data on tangible fixed assets (defined as net fixed assets in Bloomberg); total assets; total deposits; chartered capital; off balance sheet (or contingencies and commitment); available for sale securities; held-to-maturity securities.

- ✓ Fixed asset = cost – accumulated depreciation.

  Before 2004: fixed assets = tangible fixed asset + construction in progress and purchased fixed assets.

  From 2005: fixed assets = tangible fixed asset.

- ✓ Total loans = customer loans + balances with SBV + loans and advances to other banks + other loans.
- ✓ Net loans = total loans – reserve/provision for loan losses.
- ✓ Purchased funds = borrowings from government and SBV + deposits and borrowings from other banks.
- ✓ Investment securities = available for sale securities + held-to-maturity securities.

- ✓ (or Net investment securities = investment securities - provision for diminution in value of investment securities).
- ✓ Fundable funds: customer deposits + purchased funds.
- ✓ Total equity = total capital + statutory reserve + retained earnings.
- ✓ Total capital = chartered capital + other capital.
- ✓ Physical capital = fixed assets + premises.
- ✓ Capital expenses = asset expenses + depreciation and amortisation.
- ✓ Premises = buildings + land use right.
- ✓ The land use right: *in intangible fixed assets.*

Non-performing-loans:

Before 2004, a loan is nonperforming when payments of interest and principal are past due by 90 days or more, or at least 90 days of interest payments have been capitalised, refinanced or delayed by agreement, or payments are less than 90 days overdue, but there are other good reasons to doubt that payments will be made in full" (Decisions No. 488/2000/QĐ-NHNN5 and 1145/QĐ-NHNN dated 18th October 2002 of the Governor of the SBV). However, from 2005, non-performing loans are defined from categories 3 to 5 as Decisions No. 493 dated 22nd April 2005 and 18/2007/QĐ-NHNN dated 25th April 2007 of the Governor of the SBV.

Total loans = Sum Groups 1 + 2 + 3 + 4 + 5.

Group 1: Current: Undue debt or overdue less than 10 days.

Group 2: Special mentioned: overdue from 10 to 90 days.

Group 3: Sub-standard: overdue from 91 to 180 days.

Group 4: Doubtful: overdue from 181 to 360 days.

Group 5: Bad: overdue over 360 days.

Annual report includes data on total employees, payroll and other staffs costs.

Appendix II Data on loans, assets, deposits and capital of 46 Vietnamese commercial banks in 2009 (Unit: 1,000VND)

ID	Bank	Loans	Assets	Deposits	Capital
1	Bank for Agriculture and Rural Development	372,438,322	482,919,788	349,644,191	23,691,729
2	Bank for Investment and Development	206,401,908	296,432,087	187,280,394	12,414,664
3	Mekong Housing Bank	20,136,341	40,097,711	14,907,351	823,394
4	Bank for Foreign Trade of Vietnam	141,621,146	255,495,883	169,071,562	12,146,020
5	Vietnam Bank for Industry and Trade	163,121,060	245,411,855	148,507,411	12,217,857
6	Asia Commercial Bank	62,357,978	167,881,047	86,919,196	7,814,138
7	Saigon Thuong Tin Commercial Bank	59,657,004	104,019,144	60,527,019	8,078,178
8	Technological and Commercial Bank	42,092,767	92,581,504	62,347,400	5,400,788
9	Vietnam Export-Import Bank	38,381,855	66,029,254	38,766,464	12,526,947
10	Military Commercial Bank	29,587,941	69,008,288	39,978,448	6,172,886
11	Dong A Commercial Bank	3,435,554	42,520,402	27,973,540	3,400,553
12	Saigon Commercial Bank	31,310,489	54,492,474	30,113,315	3,977,512
13	Vietnam International Commercial Bank	27,352,682	56,638,942	32,364,898	2,401,389
14	Hanoi Building Commercial JS Bank	13,358,000	29,240,379	13,648,467	3,001,455
15	Maritime Commercial Bank	23,871,616	63,882,044	30,053,287	3,180,607
16	Southeast Asia Commercial Bank	9,625,900	30,596,995	12,345,847	5,068,600
17	Vietnam Prosperity Commercial Bank	15,813,269	27,543,006	16,489,544	2,290,546
18	Southern Commercial Bank	19,785,791	35,473,136	14,720,676	2,618,937
19	Saigon Bank for Industry and Trade	9,722,120	11,875,915	8,481,534	1,500,716
20	Orient Commercial Bank	10,216,975	12,686,213	8,051,896	2,066,766
22	Housing Development Commercial Bank	8,230,884	19,127,427	9,459,244	1,554,043
23	Nam A Commercial Bank	5,012,921	10,938,109	4,500,523	1,252,872
24	Vietnam Tin Nghia Commercial Bank	9,644,746	15,940,139	6,642,225	3,399,018
25	Gia Dinh Commercial Bank	2,314,882	3,329,942	1,161,517	1,035,939
26	Kien Long Commercial Bank	4,874,377	7,478,452	6,286,488	1,000,000
27	First Commercial Bank	1,136,000	1,640,000	1,323,896	1,084,000
28	An Binh Commercial Bank	12,882,962	26,576,000	15,001,842	4,223,158
29	Saigon-Hanoi Commercial Bank	12,828,748	27,469,197	14,672,147	2,043,043
30	Ocean Commercial Bank	10,188,901	33,784,958	23,376,979	2,001,212
31	Viet A Commercial Bank	12,041,505	15,816,725	10,809,533	1,522,119
32	Nam Viet Commercial Bank	9,959,607	18,689,952	9,629,727	1,000,000
33	Global Petro Commercial Bank	5,986,296	17,319,049	8,214,754	1,990,406
34	Petrolimex Group Commercial Bank	6,267,026	10,418,510	6,896,041	1,000,000
35	Great Trust Commercial Bank	5,213,995	8,527,731	3,896,487	1,502,815
36	Great Asia Commercial Bank	4,249,434	7,077,701	4,766,310	1,000,645
37	Western Commercial Bank	1,770,769	10,426,017	3,414,105	1,142,202
38	Mekong Development Bank	2,383,033	2,523,817	677,246	1,000,001
39	Lien Viet Bank	5,423,254	17,366,930	8,279,963	3,650,000
40	Tien Phong Bank	3,192,582	10,728,532	4,230,310	1,489,222
41	Vietnam Thuong Tin Bank	3,820,645	7,256,848	4,750,866	1,049,301
42	Bao Viet Bank	2,255,568	7,269,755	3,514,340	1,500,000
43	Indovina Bank	9,108,855	10,937,425	7,988,364	2,155,625
44	Shinhanvina Bank	3,673,185	5,725,340	4,263,562	1,569,295
45	VID Public Bank	3,848,446	6,368,000	4,157,011	1,335,000
47	Vietnam Russia Bank	4,492,460	6,349,695	3,616,949	2,192,384
48	HSBC Vietnam	13,512,645	36,689,324	26,353,491	3,000,000

Note: We could not collect data of the North Asia Commercial Bank (21) and Vinasiam Bank (46) in 2009; Sources: Financial statements of 46 Vietnamese commercial banks.

Appendix III The general-to-specific methodology (GSM) (Stewart, 2006)

The general-to-specific method is a way of finding a favoured parsimonious model for inference. That is, a model free from evident misspecification and including only significant (or "necessary" variables). One way of implementing the steps of this method are:

1) **Specify a model that is sufficiently general so that there is no evidence of model misspecification** – tests of the underlying assumptions of the linear regression model cannot be rejected.

(a) For time-series data this typically involves adding lagged values of the dependent and explanatory variables to remove evident misspecification (primarily autocorrelation when using time-series data).

(b) The number of lagged variables to include in the model is normally initially set equal to:

- ✓ The frequency of the data plus one for models involving *levels* (undifferenced) variables: For example, for annual data (one observation per year) use 2 lags and for quarterly data use five lags.
- ✓ The frequency of the data for models in *first differences*: For example, for annual data use 1 lag and for quarterly data use four lags.

2) **Sequentially delete insignificant variables** until a model that includes significant variables and does not feature evident misspecification is found.

(a) Use t-ratios to identify *potential* redundant variables.

(b) Apply F-tests *relative to the general model* to exclude all variables with t-ratios below a certain value, e.g.:

- ✓ First, remove the variable with the smallest t-ratio magnitude applying the F-test. If it is insignificant exclude it and conduct another F-test on more variables.
- ✓ Second, add the next most insignificant variable to those to be deleted and test the joint insignificance of both variables. If they are insignificant exclude them and conduct another F-test.

✓ Continue adding the next most insignificant variable to the set of redundant variables to be tested until none of the remaining variables have t-ratios below two in magnitude *or* the F-test is rejected.

- If the model has no evident misspecification it is a parsimonious representation of the general model and is favoured for drawing inference.
- If any of the F-tests are rejected, the variable(s) that cause the rejection need to be identified, through experimentation. These variables should be kept in the model and F-tests continued as before.
- If excluding variables causes model misspecification identify the variable(s) that need to be kept in the model to avoid misspecification, and keep them in the model

Appendix IV The equilibrium of the three input prices

The general dynamic linear regression model, also called the autoregressive distributed lag model, is

$$Y_t = \alpha_0 + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \alpha_1 Y_{t-1} + u_t \qquad \textbf{(8.1)}$$

The static long-run solution (equilibrium) of this model may be obtained by assuming that the variables do not change from period to period, thus:

$$X = X_t = X_{t-1} = X_{t-2}$$

$$Y = Y_t = Y_{t-1}$$

Imposing this condition, two equations yields:

$$Y = \alpha_0 + \beta_0 X + \beta_1 X + \beta_2 X + \alpha_1 Y \qquad \textbf{(8.2)}$$

$$=> Y - \alpha_1 Y = \alpha_0 + \beta_0 X + \beta_1 X + \beta_2 X$$

$$=> Y(1 - \alpha_1) = \alpha_0 + (\beta_0 + \beta_1 + \beta_2) X$$

$$=> Y = \left[\frac{\alpha_0}{(1-\alpha_1)}\right] + \left[\frac{(\beta_0+\beta_1+\beta_2)}{(1-\alpha_1)}\right] X \qquad \textbf{(8.3)}$$

In the long-run a one unit increase in X causes a $\left[\frac{(\beta_0+\beta_1+\beta_2)}{(1-\alpha_1)}\right]$ unit increase in Y

Testing hypotheses on coefficients in the long-run static equilibrium solution

Applying t-tests to test hypotheses on the long-run coefficients require their estimated coefficient standard errors. Because the long-run coefficients, β_k^* , involve ratios of sums/differences of coefficients from the autoregressive distributed lag model, α_ks and β_ks appropriate standard error can be derived from:

$$s_{\beta_k^*} = \sqrt{Var(\beta_k^*)} = \sqrt{Var\left(\frac{a}{b}\right)} \cong \sqrt{\left(\frac{1}{b^2}\right) Var(a) + \left(\frac{a^2}{b^4}\right) Var(b) - 2\left(\frac{a}{b^3}\right) Cov(ab)} \quad \textbf{(8.4)}$$

Where $\beta_k^* = \frac{a}{b}$

Hence, for the following long-run coefficient:

$$\beta_k^* = \left[\frac{(\beta_0+\beta_1+\beta_2)}{(1-\alpha_1)}\right]$$

The approximate coefficient standard error is:

$$s_{\beta_k^*} = \sqrt{Var\left[\frac{(\beta_0+\beta_1+\beta_2)}{(1-\alpha_1)}\right]}$$

$$\Rightarrow s_{\beta_k^*} \cong \sqrt{\begin{array}{l}\left[\frac{1}{(1-\alpha_1)^2}\right] Var(\beta_0+\beta_1+\beta_2) + \left[\frac{(\beta_0+\beta_1+\beta_2)^2}{(1-\alpha_1)^4}\right] Var(1-\alpha_1) \\ -2\left[\frac{(\beta_0+\beta_1+\beta_2)}{(1-\alpha_1)^3}\right] Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)]\end{array}} \quad \textbf{(8.5)}$$

To calculate model **(8.5)** expanded expressions for both $Var(1-\alpha_1)$ and $Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)]$ need to be obtained. To calculate each term one first needs to obtain the quantity $E(1-\alpha_1)$ thus:

$$E(1-\alpha_1) = E(1) - E(\alpha) = 1 - E(\alpha) \quad \textbf{(8.6)}$$

$Var(1-\alpha_1)$ can be expressed from its definition as follows:

$$Var(1-\alpha_1) = E[(1-\alpha_1) - E(1-\alpha_1)]^2 \quad \textbf{(8.7)}$$

Substitution of model **(8.6)** into model **(8.7)** gives:

$$Var(1-\alpha_1) = E[1-\alpha_1 - 1 + E(\alpha_1)]^2$$

$$\Rightarrow Var(1-\alpha_1) = E[-\alpha_1 + E(\alpha_1)]^2$$

$$\Rightarrow Var(1-\alpha_1) = Var(\alpha_1)$$

$Var(\beta_0+\beta_1+\beta_2)$ can be expressed from its definition as follows:

$$Var(\beta_0+\beta_1+\beta_2) = E[(\beta_0+\beta_1+\beta_2) - E(\beta_0+\beta_1+\beta_2)]^2 \quad \textbf{(8.8)}$$

Substitution of model **(8.6)** into model **(8.8)** gives:

$$Var(\beta_0+\beta_1+\beta_2) = E[\beta_0+\beta_1+\beta_2-E(\beta_0)-E(\beta_1)-E(\beta_2)]^2$$

$$=>Var(\beta_0+\beta_1+\beta_2) = E[\beta_0-E(\beta_0)+\beta_1-E(\beta_1)+\beta_2-E(\beta_2)]^2$$

$$=>Var(\beta_0+\beta_1+\beta_2) = E\{[\beta_0-E(\beta_0)]+[\beta_1-E(\beta_1)]+[\beta_2-E(\beta_2)]\}^2$$

=>

$$Var(\beta_0+\beta_1+\beta_2) = E[\beta_0-E(\beta_0)]^2+E[\beta_1-E(\beta_1)]^2+E[\beta_2-E(\beta_2)]^2+$$
$$2E[\beta_0-E(\beta_0)][\beta_1-E(\beta_1)]+E[\beta_1-E(\beta_1)][\beta_2-E(\beta_2)]+E[\beta_2-E(\beta_2)][\beta_0-E(\beta_0)]$$

=>
$$Var(\beta_0+\beta_1+\beta_2) = Var(\beta_0)+Var(\beta_1)+Var(\beta_2)+2Cov(\beta_0\beta_1)+2Cov(\beta_1\beta_2)-2Cov(\beta_2\beta_0)$$

$Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)]$ can be expressed from its definition as follows:

=>
$$Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)] = E[(\beta_0+\beta_1+\beta_2)-E(\beta_0+\beta_1+\beta_2)][(1-\alpha_1)-E(1-\alpha_1)]$$
(8.9)

Substitution of model **(8.6)** into model **(8.9)** gives:

$$=>Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)] = E[(\beta_0+\beta_1+\beta_2)-E(\beta_0+\beta_1+\beta_2)][1-\alpha_1-1+E(\alpha_1)]$$

$$=>Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)] = E[(\beta_0+\beta_1+\beta_2)-E(\beta_0+\beta_1+\beta_2)][-\alpha_1+E(\alpha_1)]$$

$$=>Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)] = E[(\beta_0+\beta_1+\beta_2)-E(\beta_0+\beta_1+\beta_2)]\{-[\alpha_1-E(\alpha_1)]\}$$

$$=>Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)] = -E\{[(\beta_0+\beta_1+\beta_2)-E(\beta_0+\beta_1+\beta_2)][\alpha_1-E(\alpha_1)]\}$$

=>
$$Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)] = -E\{[\beta_0-E(\beta_0)]+[\beta_1-E(\beta_1)]+[\beta_2-E(\beta_2)]\}[\alpha_1-E(\alpha_1)]$$

=>
$$Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)] = -E\{[\beta_0-E(\beta_0)][\alpha_1-E(\alpha_1)]-[\beta_1-E(\beta_1)][\alpha_1-E(\alpha_1)]+$$
$$[\beta_2-E(\beta_2)][\alpha_1-E(\alpha_1)]\}$$

$$=>Cov[(\beta_0+\beta_1+\beta_2)(1-\alpha_1)] = -Cov(\beta_0\alpha_1)-Cov(\beta_1\alpha_1)-Cov(\beta_2\alpha_1)$$

Appendix V Covering letter

2 June 2010

To whom it may concern

Mr. Thao Ngoc Nguyen is registered as a full-time PhD student at the London Metropolitan Business School. Mr. Thao Ngoc Nguyen is currently working on his dissertation that is focused on Risk management in the Vietnamese banking system. He prepares a research survey that is based on direct interviews with managers of individual Vietnamese banks.

As Thao's Supervisor, I would kindly ask you to take part in this Survey so Thao may successfully finish his excellent research project.

Please do not hesitate to contact me if you have any questions regarding this project.

Yours Sincerely,
(signed)

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Appendix VI The Questionnaire

Risk identification

Please give your rating: SA (strongly agree), A (agree), N (neutral/undecided), D (disagree), SD (strongly disagree).

	SA	A	N	D	SD
Q11 Risk management is an important part of management reporting (Business plan for the next year).					
Q12 The bank is aware of the strengths and weaknesses of risk management systems of other banks.					

Q13 What kinds of risks is the bank dealing with most at the moment? (Please rank each of these kinds of risk to indicate how risky they are to your bank. Place 1 to the box next to the most risky kind, 2 next to the second most risky kind and so on. Do not place the same number in more than one box).

☐ Credit risk ☐ Liquidity risk ☐ Operational risk
☐ Market risk ☐ Interest rate risk ☐ Foreign exchange risk
☐ Solvency risk ☐ Model risk ☐ Systematic risk
☐ Other risks: Country, Settlement, Performance, etc

Q14 What are the highly risk areas in your banking businesses (Please rank each of these areas to indicate how risky they are to your bank. Place 1 to the box next to the most risky area, 2 next to the second most risky area and so on. Do not place the same number in more than one box).

☐ Securities related loans ☐ Property (real estate) related loans ☐ Credit Cards
☐ Consumption loans ☐ International Settlement ☐ Foreign exchange
☐ Others (please specify)

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Risk monitoring system

Q21 Which of the following department does the bank has?

☐ Risk management centre ☐ ALCO ☐ Inspection department
☐ Internal audit teams ☐ None of the above

Q22 The bank has regular training programmes for staff in the area of risk management?

☐ Never ☐ Weekly ☐ Monthly ☐ Quarterly ☐ Yearly

Q23 What methods does the bank employ to intensify the risk management and financial capacity in the future? (Please rank each of these methods to indicate how important they are to your bank when the bank decides to employ. Place 1 to the box next to the most important method, 2 next to the second most important method and soon. Do not place the same number in more than one box).

☐ Restructuring the organisation and operations.

☐ Developing the internal control and audit system.

☐ Applying new technology in banking operations.

☐ Diversify banking services, improve quality of banking services and care of customers.

☐ To control credit growth, NPLs decrease with focus on credit quality.

☐ To decrease lending in foreign currencies, cut down the amount of short-term loans for mid and long-term lending.

☐ To actively seek funding sources for investment and indirect investment into valuable papers to mitigate credit. risks.

☐ Others (please specify).

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Q24 What are the methods should be done by the SBV to prevent banking risks? (You can choose more than one).

☐ Strengthen the role of the state management in settlements.

☐ Provide necessary information of customers for commercial banks through CIC (Credit Information Centre).

☐ Improve the legal framework for operations of the systems.

☐ Apply IT to strengthen the effectiveness of inspection over the systems.

☐ To closely coordinate monetary policy with fiscal policy to ensure macroeconomic stability for the system.

☐ Others (please specify).

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Q25 Please give your rating: SA (strongly agree), A (agree), N (neutral/undecided), D (disagree), SD (strongly disagree).

Do you think that after recent financial crises, the increase in the minimum of Capital Adequacy Ratio (CAR) from 8% to 9% (as **Basel**) for the Vietnamese banking system is necessary at the moment.

SA	A	N	D	SD

Credit risk analysis

Q31 Please give your rating: SA (strongly agree), A (agree),N (neutral/undecided), D (disagree), SD (strongly disagree).

This bank's policy requires collateral for granting all loans.

SA	A	N	D	SD

Q32 What is the maximum loan amount for unsecured loans (loans without guarantee) in your bank?

☐ None (The bank does not have unsecured loans).

☐ VND1 - VND 19,999,999.

☐

- [ ] VND 20,000,000-VND 39,999,999.
- [ ] VND 40,000,000-VND 59,999,999.
- [ ] VND 60,000,000-VND 79,999,999.
- [ ] VND 80,000,000-VND 99,999,999.
- [ ] VND 100,000,000 or more please specify (if possible)................................

Q33 What are the guarantees for loans most used by customers of your bank? (You can choose more than one)

☐ Home	☐ Land	☐ Automobile	☐ Credit cards
☐ Saving books	☐ Saving accounts	☐ List stocks	
☐ Unlisted stocks	☐ Physical Gold	☐ Foreign currencies in cash	

Q34 Please give your rating: SA (strongly agree), A (agree),N (neutral/undecided), D (disagree), SD (strongly disagree).

	SA	A	N	D	SD
In measuring credit risk of loans, the bank adopts guidance provided in Decision No. 493/2005/QĐ-NHNN dated 22nd April 2005 and Decision No. 18/2007/QĐ-NHNN dated 25th April 2007 of the SBV.					

Efficiency improvement suggestions

Please give your rating: SA (strongly agree), A (agree),N (neutral/undecided), D (disagree), SD (strongly disagree).

	SA	A	N	D	SD
Q41 Do you think that banks with good performance also have good risk management?					
Q42 Do you think that risk management is an important competitive condition of the bank in the system?					
Q43 Do you think that banks adopting successful risk management would have higher total assets/total loans/total deposits than others?					

Q44 What would you suggest to improve bank efficiency?

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Personal Information

Full name: ____

Current Position: ____

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