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Chapter 1 Introduction

1.1. The nature of this study

This thesis is an empirical examination of banking performance in Indonesia. It examines three specific issues: competition in provincial banking markets, the productive efficiency of Indonesian banking with special attention to a comparison of foreign and domestic banks, and the role of Indonesian banks in monetary policy transmission.

A feature of this research is the high quality data. The data consists of monthly accounting statements of various banks used in the chapter on monetary policy transmission, quarterly data employed in the chapter to study banks' efficiency and annual bank accounting statements at provincial level used in the competition chapter. All the data come from the supervisory returns that Indonesian banks are required to make under Indonesian financial regulations.

The thesis contains three distinct research studies on three different issues – competition, efficiency and monetary transmission. Because these topics are not closely related, there is no separate literature review chapter; instead each of the three research chapters contains its own literature review.

1.2. Purposes and contribution of this study

This thesis seeks to provide some insight about Indonesian banking. The main questions addressed in this thesis are the following:

- How competitive are Indonesia's provincial markets?
- Has the foreign acquisition's banks improved cost-efficiency of Indonesia's banking system? Is the cost-efficiency of foreign acquisition's banks different than domestic owned banks in Indonesia?

- How do Indonesian banks respond to a shift in monetary policy? How does this response vary with bank characteristics?

There are many studies on these issues using data from developed countries especially from the US but relatively few studies using data from emerging markets.

1.3. The geography and population structure of Indonesia

In examining competition, efficiency and monetary transmission, the reader should be aware of the geography and population structure of Indonesia.

The archipelago of Indonesia is located in South-east Asia and made up of more than 17,000 islands, of which about 6,000 are inhabited. With its thousands of islands, covering some 5 million sq km, there are substantial hurdles for transport and communication in Indonesia (CIA, the World Fact Book, 2009).

Figure 1.1 Map of Indonesia

This figure shows the map of Indonesia. There are 33 provinces separated in five big islands: Java, Sumatra, Kalimantan, Sulawesi (Celebes), and Irian Jaya. The capital city is Jakarta located in Java. Source: Central Intelligence Agency (2009). Available at : https://www.cia.gov/library/publications/the-world-factbook/geos/id.html.

In 2008, the total population was 220 million, but the distribution was very uneven (See table 1.1). The island of Java contains many of the most densely populated areas in Indonesia with more than 120 million inhabitants, or some 940 persons per square kilometre. The population density of Jakarta, the capital city (which is situated in Java) is 12,162 persons per sq km while in contrast the West Irian Jaya population density is only 6 persons per sq km (BPS-Statistics Indonesia, 2010).

Much of the economic activity of the country and the majority of financial transactions are conducted in Jakarta. It has the highest regional GDP per capita at Rp33.9 million per capita or equivalent to about USD3,390. The lowest is Gorontalo with only Rp2.2 million per capita (See table 1.1).

We exploit this geographical diversity in Chapter 3 of this thesis. The available data for each province cover all banks operating in the provinces. The information collected on individual banks at provincial locations allows us to investigate the impact of geography on banking competition in Indonesia.

Table 1.1
Selected Indonesia's Provincial Data

No	Provinces	Capital city	Area (km2)	Average from 2000 to 2008			
				Population	Pop Density	GDP growth	GDP/ cap
1	West Java	Bandung	38,921.7	19,500,409	1,082	5.7	6.4
2	Banten	Serang	9,310.5	4,519,239	1,033	6.0	6.5
3	Jakarta	Jakarta	4,943.2	4,430,523	12,162	6.1	33.9
4	Yogyakarta	Yogyakarta	3,261.1	1,673,392	1,087	4.6	5.1
5	Central Java	Semarang	32,713.1	16,005,384	985	5.2	4.5
6	East Java	Surabaya	41,892.2	18,171,040	786	5.9	7.2
7	Bengkulu	Bengkulu	10,718.5	784,596	81	5.6	4.1
8	Jambi	Jambi	24,068.4	1,343,013	60	6.3	4.9
9	Nanggroe Aceh Darussalam	Banda Aceh	30,397.2	2,044,773	74	-5.8	10.3
10	North Sumatra	Medan	42,735.1	6,261,946	176	6.1	7.2
11	West Sumatra	Padang	23,493.9	2,304,069	111	6.0	6.5
12	Riau	Pekan baru	46,516.7	2,333,121	56	4.5	17.6
13	South Sumatra	Palembang	33,712.2	3,436,966	115	5.1	7.5
14	Riau Islands	Tanjung Pinang	4,768.6	641,525	169	6.7	24.2
15	Bangka Belitung	Pangkal Pinang	8,773.3	529,940	66	4.0	8.6
16	Lampung	Lampung	22,563.5	3,575,400	192	5.1	4.2
17	South Kalimantan	Banjarmasin	21,165.4	1,660,369	87	5.6	7.2
18	West Kalimantan	Pontianak	62,181.7	2,099,826	34	5.2	5.9
19	East Kalimantan	Samarinda	98,971.9	1,526,666	15	2.9	33.6
20	Central Kalimantan	Palangkaraya	77,810.9	1,034,232	13	5.9	7.4
21	Central Sulawesi	Palu	35,264.1	1,178,341	35	7.7	5.2
22	South Sulawesi	Makassar	26,960.7	3,778,211	166	6.4	5.2
23	North Sulawesi	Manado	8,069.4	1,071,316	155	5.8	6.2
24	West Sulawesi	Mamuju	8,909.7	493,108	59	8.8	3.7
25	Gorontalo	Gorontalo	6,568.8	466,717	78	7.3	2.2
26	South East Sulawesi	Kendari	19,416.2	1,000,546	55	7.6	4.1
27	West Nusa Tenggara	Mataram	12,036.3	2,101,492	217	2.3	3.7
28	Bali	Denpasar	4,482.7	1,694,676	633	5.5	6.3
29	East Nusa Tenggara imur	Kupang	25,336.1	2,154,506	95	5.2	2.4
30	Maluku	Ambon	24,335.6	649,227	27	5.0	2.7
31	Papua	Jayapura	155,995.5	1,097,212	7	-0.1	10.4
32	North Maluku	Ternate	20,459.8	458,062	23	5.5	2.6
33	West Irian Jaya	Manokwari	57,648.2	370,018	6	6.9	8.3

Source: Statistical Year Book (various years) published by BPS Statistics-Indonesia . All data is in average from 2000-2008 except data of area is in 2008. Pop density is population density that denotes the ratio of population to provincial areas. GDP/cap denotes gross domestic product of provincial areas to population.

1.4. Thesis Organization

This thesis is organized as follows: Chapter 2 is a review of the current structure of Indonesian banking sector, discussing how the banking sector has developed and the role of banks in the wider economy.

Chapter 3 investigates competition in Indonesia's provincial markets. It uses structural-conduct-performance (SCP) model, efficient-structure hypothesis model and new empirical industrial organization (NEIO) model. It distinguishes a group of metropolitan provinces, the remaining provinces in Java and Sumatra and another group consisting of other smaller provinces (The Periphery). In the SCP model, the relationship between market structure and performance in the banking system are investigated from 2001 to 2008. OLS estimation incorporating both the measures of concentration, and also efficiency and other control variables in the regression is employed to test the price-concentration similar to Hannan and Berger (1989) and efficiency hypotheses following Berger (1995). The NEIO model is the dynamic Panzar and Rosse model (Goddard and Wilson, 2009) employed to estimate individual banks' market power over the same period.

Chapter 4 estimates cost-efficiency within the banking sector using panel data from 2000Q3 to 2009 Q3. A stochastic frontier model is estimated to measure cost-efficiency. This is used to compare the level and change of efficiency in different sub-groups of the industry: state-owned banks, domestic private owned banks, and two groups of foreign banks, those acquired before the 1997-1998 crises and other acquired more recently.

Chapter 5 tests how Indonesian banks respond to the shift in monetary policy and how the response varies with the banks' characteristics. It distinguishes banks by size, liquidity and capitalization and examines the banks' responses using two different measures of monetary policy stance. Generalized Method of Moment estimator is used to investigate the effect to the banks' balance sheet to allow for correlating lagged dependent variable and error term.

Chapter 6 concludes by summarizing the major findings, discussing policy implication, identifying some limitations of the study, and making suggestions for future research.

Chapter 2 An Overview of the Indonesian Banking Sector

2.1. Introduction

In order to set the stage for the later analyses, this chapter provides an overview of the Indonesian banking sector.

This chapter is structured as follows: Section 2.2 gives an overview of the current structure of Indonesian banking. Section 2.3 describes how the banking system has developed. Section 2.4 explains the role of banks in the wider economy.

2.2. The current structure of Indonesian banking

This subsection describes the institutional structure of the Indonesian banking, and presents some descriptive measures of market structure.

2.2.1. Institutional Structure of Indonesia's Banking Sector

There were 124 commercial banks operating in Indonesia at the end of December 2008 (see table 2.1). The number was reduced significantly after the crisis of 1997-1998 because of bank closures, and mergers and acquisitions (M&As). Subsequently, during the period of 2000-2008, a further 13 banks were closed, 21 banks merged and one bank changed status to become an export and import financing agency. There was also one new, additional foreign bank that opened and started operations in April 2003 (a branch of the Bank of China).

Out of the total banks in 2008, the government hold the majority of ownership in 31 banks out of 124 banks (25%), consisting of 5 state owned banks, and 26 provincial development banks (BPD). Of the remainder 47 banks are domestic

private ownership, 31 are joint-venture bank majority owned by foreigners and 10 are branch offices of foreign banks.

Table 2.1 Number of banks based on type

	2000	2001	2002	2003	2004	2005	2006	2007	2008	% change between 2000-2008
1. State owned banks:										
a. Government of Republic of Indonesia	5	5	5	5	5	5	5	5	5	0.0
b. Local (provincial) governments	26	26	26	26	26	26	26	26	26	0.0
2. Private domestic owned banks	78	77	71	69	63	57	55	51	47	-39.7
3. Foreign owned banks:										
a. Joint venture	29	23	26	24	25	28	29	33	31	6.9
b. Branch office	10	10	10	11	11	11	11	11	10	0.0
4. Sharia banks	3	3	3	3	4	4	4	4	5	66.7
Total	151	144	141	138	134	131	130	130	124	-17.9

This table shows number of banks based on different types of banks operating in Indonesia from December 2000 to December 2008. Source: Bank Indonesia. Various years. Indonesian Banking Statistics.

Finally there are five sharia banks operating in the country. The sharia banking development in Indonesia was firstly marked by the establishment of Bank Muamalat Indonesia by the Indonesian Ulema Council and the Government on 1 November 1991. The other banks are Bank Syariah Mandiri, Bank Syariah Mega, Bank Syariah Bukopin and Bank Syariah BRI. Moreover, there is other twenty-six banks open sharia banking units. Sharia banking has experienced quite rapid growth in recent years. However, its market share was very small at only 1.9% of total assets of banking system.

There is one other type of bank that is similar in many respects to commercial banks. These are rural banks that have typically had mutual ownership and offered retail and small business banking services in rural areas. A recent trend had been for large rural banks to convert from a type of cooperative to a limited liability company, allowing them to expand their businesses to larger cities. In 2008, there were 1,733 rural banks consisting of 1,375 in the legal entity form of Limited Liability Company, 324 in local company form and 34 cooperative banks. Most of these banks (65%) have less than Rp5 billion (USD50,000) of total assets in December 2008. Total assets of banking system were Rp32,5 trillion (USD3,25 billion). This makes the share of rural banks was small, representing only 1.4% of the total banking system.

2.2.2. Market Structure of Indonesia's Banking Sector

Having looked at the different categories of banks, we can now look at the share of different markets.

Table 2.2
Banking markets' structure

(unit trillion Rupiah)

Bank Type	Assets (% of total)		Loans (% of total)		Demand Deposits (% of total)		Saving Accounts (% of total)		Time Deposits (% of total)	
	2000	2008	2000	2008	2000	2008	2000	2008	2000	2008
State owned banks	522.4 (50.2)	847.6 (36.7)	108.1 (38.2)	470.7 (36)	59.3 (37.2)	151.8 (35.3)	68.5 (44.6)	237.4 (47.6)	184.7 (48.1)	280.6 (34)
Private domestic owned banks	358.3 (34.4)	220.5 (9.5)	86.3 (30.5)	136.3 (10.4)	52.7 (33.1)	30.2 (7.0)	76.9 (50.1)	29.2 (5.9)	146.5 (38.2)	115.6 (14)
Provincial government banks	26.1 (2.5)	185.3 (8.0)	10.1 (3.6)	96.4 (7.4)	10.8 (6.8)	70.7 (16.5)	4.8 (3.1)	37.5 (7.5)	4.2 (1.1)	35.0 (4.2)
Joint venture banks	50.2 (4.8)	789.5 (34.2)	30.4 (10.7)	465.4 (35.6)	9.8 (6.1)	125.2 (29.1)	0.4 (0.3)	170.7 (34.2)	12.5 (3.3)	313.2 (38.0)
Foreign branch offices	82.3 (7.9)	233.7 (10.1)	46.9 (16.6)	113.4 (8.7)	26.7 (16.7)	49.4 (11.5)	2.7 (1.8)	14.1 (2.8)	35.4 (9.2)	65.0 (7.9)
Shariah banks	1.9 (0.2)	34.0 (1.5)	1.3 (0.5)	25.6 (2.0)	0.2 (0.1)	2.7 (0.6)	0.3 (0.2)	9.6 (1.9)	0.5 (0.1)	15.4 (1.9)
Total	1,041.1	2,310.6	283.1	1,307.7	159.6	430.0	153.6	498.6	383.7	824.7

This table presents market share of Indonesian banks in December 2000 and 2008. Demand deposits are a flexible deposit with very small interest rates. Saving accounts are an instant access that customers can withdraw their money instantly by using ATM cards. Time deposits are deposit with fixed time period and interest rates. Metropolitan is the area with the largest banking markets and the most populous provinces. Java and Sumatra has moderate banking markets and population compared to Metropolitan. The Rest has the smallest banking markets and less population provinces compare to other groups. Source: Bank Indonesia. December 2000 and 2008. Indonesian Banking statistics.

Table 2.2 presents market share statistics for the six main types of banks in 2000-2008. During this period, the market share of state owned banks decreased slightly with the exception for the market share in saving accounts. The increase of foreign presences in the Indonesian banking markets, as it is shown by the increase of market share of joint venture banks.

The increase market share of joint venture banks came from the acquisition of large banks by foreign investors. The original market share of joint venture banks in December 2000 was only 4.8% and now it has increased to 34.2%. The change will be beneficial for the Indonesian market if the investors bring better management and technology and improved efficiency, an issue discussed in Chapter 4.

The market share of foreign bank branch offices is relatively small compared to state owned banks and joint venture banks. In December 2008, the total assets of foreign branches were US$23.4 billion.

2.3. How the banking system has developed

This subsection provides a brief account of the development of the Indonesian banking sector since the mid 1980s. It begins with the Indonesian banking deregulation in 1988; It then discusses the banking crisis of 1997-1998 and the policy responses after the crisis, and finally it discusses foreign acquisition on Indonesian banks that have occurred since 2000. Appendix 1 presents s a time line for all the various regulatory changes.

2.3.1. Banking deregulation 1988

The current legislation framework for banking is based on the Indonesian banking deregulation announced in 1988 (the October 1988 policy package). This simplified the procedures to obtain license for the opening of banks offices, for converting business focus from non-foreign exchange to foreign exchange, and for opening the new banks.

The establishment of new banks, which had been prevented since 1973, was once again possible. The minimum paid-up capital for the establishment of private commercial banks was fixed at Rp10 billion (USD 5 million). One important innovation in 1988 was to allow the establishment of joint venture banks with foreign parties. These must be categorized as a major bank in the country of origin and this country should have diplomatic relationship with the Indonesian government. The requirements for a national bank to establish a joint venture bank was similar to the requirements for establishing a new bank, namely the criteria of soundness and capital adequacy. The paid up capital shall be at a minimum amount of Rp50 billion (USD25 million). The foreign partner

was allowed to own a maximum of 85% of the capital investment. The banks are allowed to domicile in Jakarta, Surabaya, Semarang, Bandung, Medan, Denpasar and Makassar and open one branch office in each of those cities.

On the prudential front, the government sought to strengthen the soundness of banks by issuing regulations on lending limit, and net open position. The legal lending limit was aimed to improve sound banking principles in lending and to reduce the risk of bad debt. The limit was applied to the loans provided to individual borrowers, group of borrowers, shareholders, and executive staffs. In addition, the government also imposed a limit on the net open position of banks' foreign reserves, either foreign asset or net foreign liabilities, equivalent to 25 per cent of the bank's equity.

2.3.2. Banking crisis 1997-1998

The October 1988 package sparked off substantial increase in the number of banks, with a large number of local conglomerates establishing their own banks. The regulatory and supervisory framework was improved substantially, but enforcement, particularly of the legal lending limit, remained a problem. Also while the doors were wide open for new banks to enter the market, no proper exit mechanism was set up for failing banks.

After the depreciation of the Thai baht in July 1997, the Indonesian rupiah came under severe downward pressure. The defence of the rupiah was abandoned and the authorities adopted an orthodox approach to exchange rate pressure. They floated the rupiah then raised interest rates sharply to moderate its slide. By October 1997, the currency had depreciated by close to 40%—at that stage the largest depreciation among the Asian crisis countries. GDP fell by 13.1% between 1997 and 1998 (Economic Report on Indonesia, 2000).

This currency and economic crisis transmitted to the banking system through bank's short term foreign currency debts and also through rupiah's loan due to high interest rates and falling incomes. The non-performing loan ratio had

increased to over 32% by the end of 1997 and peaked at close to 50% by December 1998. Local banks' line of credit with Bank Indonesia had reached Rp15.3 trillion (USD1.7 billion), up from only Rp1.4 trillion (USD156 million) at the end of July 1997. By May 1998, this overdraft had ballooned to Rp79.7 trillion (USD8,9 billion) (Enoch et al., 2001). Most of banks become illiquid and many banks were insolvent.

Loan quality was especially weak amongst state-owned banks that did follow strict commercial criteria for extending loans. As of mid 1998 there were seven state banks, accounting for 50% of total banking sector assets that were deeply insolvent and would have been closed if they were private banks.

2.3.3. Policy responses after the crisis

During 1998-2000, banking policy was firmly focused on completing the banking resolution, especially the bank recapitalization program, and the accelerations of the restructuring and write down of non-performing loans. The management of problem banks and distressed assets were conducted by Indonesian Bank Restructuring Agency (IBRA) which was formed on January 26th, 1998 to operate for five years. Other measures were aimed at building greater resilience by improving banking structure, tightening rules on bank supervision, and the introduction of improved corporate governance.

In October 2000, the Government and Bank Indonesia (BI) completed the final phase of the bank recapitalization programme. During 2000, six banks were recapitalized including Bank Bali, Bank Danamon, Bank Niaga, Bank Negara Indonesia, Bank Rakyat Indonesia, and Bank Tabungan Negara. The government issued additional recapitalization bonds with the amount of Rp148.6 trillion (USD15,6 billion) and made up the total to be Rp430.4 trillion (USD45,1 billion) (Economic Report on Indonesia, 2000).

In restructuring the loans, banks had choice whether to restructure internally or externally. Banks conducted internal restructuring in their asset management

department. Externally, they can use either the Debt Restructuring Task Force established by Bank Indonesia, the Jakarta Initiative or Indonesian Banking Restructuring Agency (IBRA). At the end of 2000, non IBRA debt restructuring was underway for 20,430 debtors owing a total of Rp59.9 trillion (USD6,3 billion) in bad debts, or 71.4 percent of all non performing loans. Meanwhile, IBRA managed in total Rp286.3 trillion (USD30 billion) of bad debts (Economic Report on Indonesia, 2000).

The bank rehabilitation programme continued in 2000-2003 through the establishment of the government guarantee programme for commercial banks, monitoring the recapitalization programme, and enhancing the bank restructuring programme. Meanwhile, banking system resilience was pursued through the implementing a code of good corporate governance, and enhancing regulation and supervision in accordance with the 25 Basel Core Principles for Effective Banking Supervision (Economic Report on Indonesia: 2000, 2001, 2002 and 2003).

The other important policy was the divestment of government shares in the nationalized banks. This initiative was intended to ease government budget constraints and improve efficiency and performance of overall banking sector. Since 2002, government divested its shares in Bank Central Asia, Bank Niaga, Bank Danamon and Bank International Indonesia. The government also sold three state-owned banks shares through public offering in Indonesian Stock Exchange (Economic Report on Indonesia, 2003).

To increase market confidence and strengthen banking infrastructure, the government established the Deposit Insurance Agency on 22 September 2005 (Act No. 24 Year 2004 concerning the Indonesian Deposit Insurance Corporation (DIAI)).[1] In addition, the Government, DIAI and BI have also developed a policy framework for the financial safety net to delineate the roles

[1] DIAI insures time deposit, demand deposits and saving accounts. Since October 2008, the maximum amount of deposits insured is Rp2 billion (USD200,000) for each depositor in one bank (DIAI Annual Report, 2009)

and functions of each three institutions in maintaining financial stability especially in crisis management. The framework was set in a memorandum of understanding (MOU) that sets out the mechanism for collaboration among the institutions in the Financial Stability Forum which serves as facility for coordination, information sharing and later as decision body to decide bank bailout.

The government finally terminated the IBRA in April 30th, 2004 and transferred the assets to newly established agency–State-owned Asset Management Company (SAMC). Meanwhile, Bank Indonesia launched a further major structural reform of the Indonesian banking sector (See Appendix 2 for more detail about the reform known as the Indonesian Banking Architecture).

2.3.4. Foreign acquisitions in Indonesian banks

During the period 2000 to 2009, seventeen banks were acquired by foreign investors (see table 2.3). The increased foreign presence has changed the structure of banking system's total assets, with the new foreign bank share rising from 4.8% (December 2000) to 34.2% (December 2008).

Table 2.3
List of foreign acquisitions on Indonesian banks

	Date	Bank Name	Investor	Country
1	Feb-02	Bank Central Asia	Farralon Capital Management	US
2	Nov-02	Bank Niaga	Khazanah Nasional Berhad	Malaysia
3	Jun-03	Bank Danamon	Temasek	Singapore
4	Feb-04	Bank Internasional Indonesia	Temasek	Singapore
5	Nov-04	Bank Lippo	Khazanah Nasional Berhad	Malaysia
6	Jun-05	Bank Permata	Jardine Group and Standard Chartered Bank	Hong Kong and UK
7	Jun-05	Bank Bumputera Indonesia	Tun Daim Zainuddin	Malaysia
8	Jun-05	Bank NISP	OCBC Bank	Singapore
9	Dec-05	Bank Century	First Gulf	British Islands
10	Jan-06	Bank Buana	UOB Bank	Singapore
11	Jun-06	Bank Indomonex	State Bank of India	India
12	May-07	Bank Artha Niaga Kencana	Commonwealth Bank	Australia
13	May-07	Bank Halim Indonesia	ICBC	China
14	Jun-02	Bank Swadesi	Bank of India	India
15	Sep-07	Bank Nusantara Parahyangan	Kinoshita Family and MUFG	Japan
16	Dec-07	Bank Bintang Manunggal	Hana Bank	Korea
17	Aug-08	Bank Tabungan Pensiunan Nasional	Texas Pacific	US

Source: Banks' Annual Reports (various years).

Most investors are non bank financial firms including hedge funds, sovereign wealth funds and individuals. Most of the new owners are of Asian origin from Singapore, Malaysia, South Korea and India. This acquisition suggests a geographical motive of the investors and to the Indonesian banking sector because of familiarity with Indonesia's economic and financial condition, regulation, and culture; or the opportunity to finance trade between those countries and Indonesia.

2.4. Banks in the wider economy

This sub section discusses Indonesia's macroeconomic development and the role of banks in macroeconomy. It is important to give background for the following chapters especially about monetary policy transmission.

2.4.1. Macroeconomic development

After the financial crisis, the Indonesian economy has achieved high growth averaging 5% since 2000 and peaking at 6.3% in 2007 (See table 2.4). The growth has been characterized by productivity improvements and diversification of activities in various economic sectors including trading, telecommunication, transportation, utility, construction and services sectors. (Economic Report on Indonesia, 2007). From its external activities, Indonesia Balance of Payment's has recorded a net current account surplus during the last ten years.

Table 2.4 Macroeconomic indicators

Indicators	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average 2000-2009
Macroeconomics											
GDP growth (%-yoy)	4.9	3.4	4.4	4.7	5.0	5.7	5.5	6.3	6.1	4.5	5.0
Inflation rate (%-yoy)	9.3	12.5	10.0	5.1	6.4	17.1	6.6	6.6	11.1	2.8	8.7
External											
Export (USD bn)	65.4	57.4	59.2	64.1	70.8	87.0	103.5	118.9	107.6	99.3	83.3
Import (USD bn)	40.4	34.7	35.7	39.5	50.6	69.5	73.9	85.3	100.2	78.6	60.8
Current Account (USD bn)	8.0	6.9	7.8	8.1	1.6	0.3	10.8	10.4	0.7	3.6	5.8
Reserves (USD bn)	29.4	28.0	32.0	36.3	36.3	34.7	42.6	56.9	48.4	57.7	40.2
Exchange rate (Rp/USD)	9,595	10,400	8,950	8,570	8,948	9,713	9,169	9,140	10,950	9,400	9,484
Government											
Budget Def/Surplus (%GDP)	-2.7	-1.7	-1.3	-1.7	-1.0	-0.5	-1.0	-1.1	-0.1	-1.6	-1.3
Market											
Stock mkt index	416	392	425	692	1,000	1,163	1,806	2,746	1,355	2,534	1,253

Source: Bank Indonesia. Various years. Economic Report on Indonesia and Monetary Policy Reviews. %-yoy denotes percentage change year on year.

Indonesia has seen inflation fall substantially since 2001. The inflation rate has declined steadily from 12.5% in 2001 to 2.8% in 2009 (except for temporary increases in 2005 and 2008).

The jump of the inflation rate in 2005 was caused by the increased price due to the reduction of oil price subsidy since 1 October 2005, the increased transport tariffs and the increased price of foodstuff and processed food. The y-o-y annual inflation rate in October 2005 reached its peak at 17.1%, up compared to the previous month 6.4% (Economic Report on Indonesia, 2005).

The inflation rate was also increased in 2008 as a result of soaring energy and global food prices. This induced higher inflation rates, both in developing and developed countries. Pressures stemming from a higher global oil price that peaked more than $140 per barrel subsequently forced the government to raise its subsidized fuel prices, by an average of 28.7%, in May 2008 (Economic Report on Indonesia, 2008). On one hand, this succeeded in maintaining the confidence of investor in Indonesian fiscal sustainability. But on the other hand, it triggered a sharp increase in inflation. In 2009, the inflation rate was significantly reduced due to the decline international commodity prices as a result of the global economic slowdown and also slower growth of domestic demand (Economic Report on Indonesia, 2009).

Indonesia's exports are mainly in primary and manufactured products. The manufacturing products are including electronic equipment, textiles and textiles products. These products are mainly shipped to Japanese and US markets. However, since 2007, Indonesia's exports to China and India have expanded. This made China Indonesia's fifth largest export market, displacing Singapore and Korea. Nevertheless, Japan, the United States and the Euro zone remain Indonesia's most important export destinations. The slowing of economic growth in the major export destinations had negative effects on Indonesia's exports. However, the increased in intra-trade activities between Asian countries has helped Indonesia to maintain its export (Economic Report on Indonesia, 2009).

Indonesia's imports have been dominated by raw materials especially nickel, iron and synthetic rubber, and capital goods, which together average over 90% of Indonesia's total imports. Since 2004, imports excluding oil and gas have steadily climbed, despite a temporary fall in the wake of the October 2005 fuel price hike that weakened domestic demand. Mid-2006 marked the onset of resurgent import growth, which peaked in mid-2008. Robust domestic demand spurred by the pace of domestic economic activity and soaring commodity

prices were the key factors in the rapid growth in imports excluding oil and gas during 2008-09 (Economic Report on Indonesia, 2009).

The strong performance of Indonesia's balance of payment during the last seven years gave an opportunity to strengthen the country's foreign reserves. At the end of 2009, Indonesia's foreign reserves achieved approximately USD57.7 billion or equal to 5 month imports and interest payment on government's foreign borrowing. This has risen by 1.5 times from the reserves position of seven years ago. In 2007, some of the reserves were used for earlier repayment of Indonesia's borrowing from the International Monetary Fund.

The 2008 global financial crisis caused foreign capital outflow from Indonesia's capital markets. This resulted in a period of depreciation from September to October. Prior to that the rupiah had traded around Rp9.600 per US $ but then the fall of Indonesian Composite Stock Index by 54%, the increased yield on Government Securities to 20%, and the condition of excess demand in the foreign exchange market along with a falling current account surplus created pressure on Rupiah to depreciate.. In 2009, the exchange rate has been stabilized to Rp9,400 per USD managed within a range of Rp8500-9500 per USD (See table 2.2) (Economic Report on Indonesia, 2009).

The deficit of fiscal position has been low and stable on an average of 1.3% to GDP. The Government shows firm disciplines in maintaining the budget deficit around 1%. Although it is manageable, the increase of oil prices and its subsequent impact in the rising of inflation and interest rates could still create problem for government debt service. The government's total debt to GDP ratio in December 2007 was 78.3% and domestic debts at 40% (mostly in the form of bonds held by banks).

2.4.2. The role of banks in macroeconomy

The role of banks becomes more important in the Indonesian economy during 2000-2009. The ratio of banks' total asset to GDP has increased from 74.9% in

2000 to 116.4% in 2009 (See table 2.5). As in other developing countries, Indonesia's capital markets are underdeveloped and they are still small in size. The total value of stock issuance to GDP is only 7.46% in 2009 (Bapepam Annual Report, 2009).

Table 2.5
Selected banking sector's balance sheet items (as % of GDP)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average 2000-2009
Total assets	74.9	76.5	73.8	73.0	76.8	84.0	91.7	101.1	111.0	116.4	87.9
Certificates of Bank Indonesia	8.0	9.3	10.2	11.9	12.6	12.0	18.6	21.3	15.5	11.7	13.1
Securities	32.2	29.5	26.3	23.0	19.9	18.6	17.2	16.4	14.8	14.0	21.2
Total loans	20.4	21.9	24.6	28.2	33.8	39.7	42.9	51.0	62.8	66.5	39.2
Working capital loans	12.5	12.6	13.7	14.9	17.5	20.3	22.5	27.1	32.9	32.7	20.7
Consumer loans	2.9	4.1	5.3	7.1	9.1	11.8	12.3	14.4	17.6	20.1	10.5
Investment loans	5.0	5.3	5.6	6.1	7.2	7.7	8.2	9.5	12.3	13.7	8.0
Total deposits	50.1	55.5	55.5	57.0	58.1	64.4	69.7	76.9	84.2	87.9	65.9
Saving accounts	11.1	11.9	12.8	15.5	17.9	16.1	18.1	22.3	23.9	28.1	17.8
Demand deposits	11.5	13.1	13.0	14.2	14.8	16.1	18.3	20.6	20.7	18.7	16.1
Time deposits	27.6	30.5	29.6	27.3	25.4	32.3	33.3	33.9	39.6	41.1	32.1

This table presents selected balance sheet items of banking system as a percentage of gross domestic product. Certificate Bank Indonesia refers to Bank Indonesia's short term bills (T-bills). Source: Bank Indonesia.Various years. Indonesian banking statistics and Economic Report on Indonesia.

Bank lending has increased rapidly with the average growth of 20% (y-o-y in nominal terms). Lending is the dominant assets of banks. Most of lending is given in the form of working capital loans to companies. This followed in importance by consumer loans and investment loans, respectively. The consumer loans have increased considerably from only 2.9% in 2000 to 20.1% in 2009 due to expansion in the short term uncollateralized loans for purchasing consumer products. Mortgage lending remains low. Securities holding have been decreasing, mainly because of the maturing of bonds issued under the bank re-capitalisation programme.

Appendices

Appendix 1: Timeline of Indonesia's banking policies and regulations, 1988-2008

Date	Banking Policies and Regulations
1988	In October 1988, the Indonesian government announced a second financial liberalization after 1983. Specifically, it: (1) liberalized the entry of private banks; (2) liberalized the entry of foreign banks through joint ventures; and (3) eased requirements for the opening of branches for all banks.
1991	The introduction of prudential regulations' guidance in February 1991. The new regulations included: (1) a requirement that all banks should meet a capital adequacy ratio (CAR) of 8% by the end of 1993; (2) the introduction of new ratio-based standards of soundness and a point-rating system for all banks; and (3) the granting to the central bank of the authority to issue cease-and-desist orders to any bank defying its guidance.
1992	The new Banking Act (Act No. 7 of 1992) was enacted to replace the Banking Act of 1967. It provided for the implementation of prudential regulations, administrative sanctions against noncompliant banks, criminal penalties for bank managers and employees, a "legal lending limit" restricting intra-group lending, and a division of roles between the central bank and the Ministry of Finance for supervising unsound banks.
1998	Amendment of the Banking Act No. 7 of 1992 (Act No. 10 of 1998) the central bank was given all powers from the issuance and revocation of banking licenses to the imposition of administrative sanctions. Indonesian Banking Restructuring Agency (IBRA) was set up to administer the government's blanket guarantee program, to supervise, manage and restructure distress banks, and to manage the government's assets in banks under restructuring status, and to optimize the recovery rate of asset disposals of distressed banks (Presidential Decree No 27 of Year 1998).
1999	The new Central Bank Act (Act No. 23 of 1999) was enacted, replacing the Central Bank Act of 1968. The new Act explicitly states that the central bank is "an independent national institution, which is free from intervention of the Government.

2000 Banking policy focused on bank recapitalization.

2001 Banking policies and regulations are aimed to restructure banking sector by issuing regulations on the procedure of banking restructuring at IBRA, increased bank's transparency, improved capital and implemented principles of knowing your customers.

2002 Regulations were focused on improving the quality of assets especially loans. This was including the prudential principles in buying restructured loans from IBRA.

2003 Implemented regulations on fit and proper test for banks 'board of commissioner and board of director, implementing risk management, establishing internal audit and the estimation of capital by including market risk factors and on net open position.

2004 Amendment of the Central Bank Act of 1999 (Act No. 3 of 2004). The amendment established a relationship of checks and balances among the president, House of Representatives and central bank. The 2004's Law provided the newly-empowered parliament with more say over the selection of the central bank board, aligning the political oversight of the central bank with Indonesia's new democratic political system.

Deposit insurance law was enacted in September (Act No. 24 of 2004). This law aims to provide bank depositors with a greater level of confidence, while limiting the central bank's financial exposure to future bank runs. The law created a self-funding deposit insurance system under an independent authority that covers deposits under Rp100 million.

Indonesian Banking Architecture (IBA) Programme was launched. This was a further major structural reform of the Indonesian banking sector after the crisis.

2005 Regulations were focused on the transparency and prudential procedures for new products sold in banks or via banks for example securities and mutual funds products. The prudential regulations on legal lending limit and capital.

Indonesian Deposit Insurance Corporation (LPS) started to operate on 22 September 2005

2006 January Policy Package was launched:

- to adjust the maximum legal lending limit (LLL) and risk weighted assets in the capital calculation, and the quality assessment of productive assets.

- to facilitate bank mergers and acquisitions based on the principles of honest brokering.

2007 Providing more incentive for bank consolidation and the implementation of single presence policies to synergize banks' operation with the same owner.

2008 Focused to avoid crisis and to balance between strengthening the banks' capital and loan growth. In avoiding the potential spill over of the crisis, BI issued policy to enhance banking liquidity and limit derivatives only for hedging purposes.

Source: Bank Indonesia. Various years. Economic Report on Indonesia. DIAI.2005.Annual Report.

Appendix 2: Indonesian Banking Architecture

Bank Indonesia launched a major structural reform of the Indonesian banking sector in 2004 –known as the Indonesian banking architecture (IBA). It was executed through a number of work programs (Economic Report on Indonesia, 2004):

1. Reinforcing the structure of the national banking system

   This program was aimed to strengthen bank capacity for business and risk management and the expansion of the scale of business in order to support increased capacity for bank credit expansion. By 2019, the programs are expected to improve the structure of the banking system. This structure is envisaged as follows:

   - Two or three banks likely to emerge as international banks. These banks possess capacity and ability to operate on an international scale and having total capital exceeding Rp50 Trillion
   - Up to 5 national banks. These banks have a broad scope of business and operating nationwide with total capital between Rp10 Trillion (USD1 Billion) and Rp50 trillion (USD 5 Billion).

- 30 to 50 specialized banks with operations focused on particular business segments according to the capability and competence of each bank. These banks will have capital of Rp100 billion (USD 10 Million) up to Rp10 trillion (USD 1 Billion).
- Rural Banks are the banks operate in rural area, and banks with limited scope of business, having capital of less than Rp100 billion (USD 10 Million).

2. Improvement in the quality of banking regulation

   This program was aimed at improving the effectiveness of regulation conducted by Bank Indonesia and achieving compliance with regulatory standards based on international best practices (the 25 Basle Core Principles for Effective Banking Supervision).

3. Improvement of the supervisory function

   This program aims to improve the effectiveness and efficiency of bank supervision conducted by BI. This objective is conducted by improving the competency of bank examiners, improving coordination among supervisory agencies, development of risk-based supervision, more effective enforcement, and consolidation of the banking sector organization within Bank Indonesia.

4. Quality improvements in bank management and operations

   This program is focused on improving good corporate governance, quality of risk management, and the operational capabilities of management.

5. Development of banking infrastructure

   This program is aimed at developing supporting infrastructure for effective banking operations, such as a credit bureau, domestic credit rating agency, and a credit guarantee scheme.

6. Improvement of customer protection

   This program is aimed at empowering customers through the establishment of a mechanism for customer complaints, establishment of an independent mediation agency, improved transparency of information on banking products, and education to customers.

Chapter 3 Competition in Indonesian Provincial Banking Deposit Market

3.1. Introduction

Bank concentration and competition has been widely studied by banking economists. This has been motivated by concern over high levels of concentration and lack of competition in many of these markets, by the facts that banks play a crucial intermediary role and by the importance of branches network in a country's banking market. In this chapter, we set out market power model, efficient-structure hypothesis model, and the new empirical industrial organization (NEIO) model and estimate the models using Indonesian provincial banking data from 2001-2008.

The Structure-Conduct-Performance (SCP) will follow model develop by Berger and Hannan (1989) and the test for efficient-structure hypothesis model uses modification of Berger (1995) model. The NEIO model is that suggested by Panzar and Rosse (1987). In this study we use a dynamic model of Panzar and Rosse (PR) based on the model developed by Goddard and Wilson (2009). They suggested that the long run equilibrium effect of PR of fixed effects models was mainly characterised by disequilibrium conditions. This finding necessitated the use of a dynamic estimator to be applied to a dynamic revenue equation for market power inferences.

We find that traditional SCP model does not reveal much evidence of relationship between concentration and price. The concentration ratio of three largest banks (CR3) in the results do not carry negative sign as expected to explain the relationship that higher market concentration will lead to lower deposit prices. PR modelling however clearly suggests imperfect competition.

The weakness of PR modelling is that it does not tell us much about the sources of imperfect competition and so what might be done to change matters.

However estimations using the ES specification is an informative accompany tool. This reveals that the geography of Indonesia has modest impact on competition (with the implication that developments that help overcome geographical barriers, e.g. new banking technologies) can usefully promote competition in Indonesian deposit markets.

The chapter is structured as follows: the remainder of this section will describe the provincial banking market focussing on deposit markets. Section 3.2 illustrates the structure and distribution of pricing and return of banking in Indonesia's provincial banking markets. Section 3.3 presents a review of literature, the theory of competition, methods of competition measurement and the result of empirical studies. The data and the empirical model are discussed in Section 3.4. The regression results are reported in Section 3.5. Section 3.6 concludes.

3.2. Provincial Banking Markets

As described in the introduction (Section 1.3), there are considerable differences between the provinces of Indonesia in terms of population density, economic growth and geography. Banks with strong financial capability and good networking technology can expand their branches to compete in several provinces. These banks then compete with single province banks (provincial government owned banks and private banks head quartered in the provincial areas).

During 2000-08, the number of bank branches has increased by 28 per cent to 824 offices (see table 3.1).

For the purposes of this chapter, the provincial banking markets have been sub-divided into three groups. Group 1 is "Metropolitan Area" that has the largest population density and number of banks per head of population. It consists of Jakarta, Banten and West Java provinces. Group 2 ("Java and Sumatra")

consists of the reminded of the Java and Sumatra islands i.e. excluding Jakarta, Banten and West Java. This area has a moderate population density and number of banks per head of population. Finally, Group 3 ("the Periphery") contains Kalimantan island, Sulawesi island, Maluku island, Papua island and the other smaller provinces. This area has the lowest population density and number of bank's offices per head of population.

Table 3.1
Number of banks' offices in provincial markets

	2001	2002	2003	2004	2005	2006	2007	2008
1. Banks	144	141	138	134	131	130	130	124
2. Provincial Office:	645	672	699	730	764	795	837	824
A. Metropolitan Area	*173*	*177*	*178*	*185*	*188*	*189*	*189*	*182*
B. Java & Sumatra	*281*	*293*	*311*	*323*	*333*	*350*	*375*	*371*
C. The periphery	*191*	*202*	*210*	*222*	*243*	*256*	*273*	*271*

This table presents the number of bank offices at provincial level. This office is the coordinator office of bank branches in a provincial area that submits the financial reports to the regulator. Metropolitan area consists of three provinces: Jakarta, Banten and West Java. Java and Sumatra is a group of other provinces located in the island of Java and Sumatra i.e. excluding Jakarta, Banten and West Java. The periphery is the provinces with the lowest population density and number of banks' offices per head of population . Bank Indonesia. Various years. Unpublished.

Table 3.1 reports the number of bank offices in provincial markets. The banks in the metropolitan area hold more assets than other areas. Thus while Metropolitan accounts for only 2 in 8 branches, it accounts for more than 60 percent of assets, loans and deposits.

Table 3.2
Provincial banking assets and liabilities

(unit trillion Rupiah)

Provincial Groups	Assets (% of total)		Loans (% of total)		Demand Deposits (% of total)		Saving Accounts (% of total)		Time Deposits (% of total)	
	2000	2008	2000	2008	2000	2008	2000	2008	2000	2008
Metropolitan	761.1	1,587.4	188.8	800.7	119.8	270.0	67.2	198.4	286.4	569.5
	(73.1)	*(68.7)*	*(66.7)*	*(61.2)*	*(74.8)*	*(62.7)*	*(43.5)*	*(39.8)*	*(74.3)*	*(69.1)*
Java and Sumatra	227.0	584.6	71.4	409.6	33.4	131.8	71.4	238.5	85.8	221.5
	(21.8)	*(25.3)*	*(25.2)*	*(31.3)*	*(20.8)*	*(30.6)*	*(46.3)*	*(47.8)*	*(22.3)*	*(26.9)*
The Periphery	53.1	138.6	22.7	97.2	7.0	28.8	15.7	61.6	13.1	33.7
	(5.1)	*(6.0)*	*(8.0)*	*(7.4)*	*(4.4)*	*(6.7)*	*(10.2)*	*(12.4)*	*(3.4)*	*(4.1)*
Total	1,041.1	2,310.6	282.9	1,307.5	160.2	430.6	154.3	498.5	385.3	824.7

This table presents market share of Indonesia's provincial groups' markets in December 2000 and 2008. Demand deposit is a flexible deposit with very small interest rates. Saving accounts are an instant access that the customers can withdraw their money instantly by using ATM cards. Time deposits are deposit with fixed time and interest rates. See Section 3.2 for explanation of different provincial groups. Source: Bank Indonesia. 2000 and 2008. Indonesian Banking Statistics.

Table 3.2 reports the assets and liabilities, by provincial group. The largest demand deposit market was Metropolitan (62.7%) followed by Java and Sumatra (30.6%), and the Periphery (6.7%). For saving account, the largest is Java and Sumatra (47.8%), Metropolitan (39.8%) and the Periphery (12.4%). In time deposits market, the largest is metropolitan (69.1%), java and Sumatra (26.9%) and the Periphery (4.1%).

Table 3.3
Distribution of the pricing of bank deposits
End of December 2008 (in %)

	Time Deposits				Demand Deposits				Saving Accounts			
	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max
National	4.94	10.10	10.68	17.39	0.21	2.65	2.59	8.91	0.00	3.93	4.01	9.14
Metropolitan	4.94	10.72	11.08	17.39	0.33	3.38	2.90	8.91	0.00	4.13	4.18	9.14
Java and Sumatra	6.61	10.36	10.74	16.01	0.21	2.66	2.53	6.49	1.00	4.13	4.12	8.41
The Periphery	6.74	9.79	10.57	15.28	0.55	2.52	2.50	5.70	1.27	3.74	4.00	6.66

This table shows the distribution of deposits interest rates based on types and provincial groups. National is the country's deposit market. See section 3.2 for explanation about different provincial groups. Source: Bank Indonesia. 2008. Unpublished.

Table 3.3 reports the statistics for annual interest rates on deposits by type of deposits and geographical locations. The data show that Metropolitan market offers the lowest and the highest rates for time deposits and saving accounts and the highest rates for demand deposits.

The metropolitan area has the highest average of deposit rates compared to other provincial groups. Some banks in Metropolitan area offer higher time deposit rates and demand deposit rates than other provincial groups.

Table 3.4
Bank deposits spreads against 1-month Certificate of Bank Indonesia's rate

Provincial Groups	Spread (%)								
	2001			2005			2008		
	Time deposits	Demand deposits	Saving Accounts	Time deposits	Demand deposits	Saving Accounts	Time deposits	Demand deposits	Saving Accounts
Metropolitan	2.29	11.46	8.97	1.20	9.03	7.87	0.02	7.55	6.65
Java and Sumatra	2.31	12.12	8.11	1.33	9.36	7.53	0.31	8.11	6.64
The Periphery	2.27	12.64	8.03	1.73	9.52	7.77	0.67	8.20	6.92

Spread is the 1-month Bank Indonesia Certificate interest rates minus deposit rates. Provincial groups refer to definition on Section 3.2. Source: Bank Indonesia. 2001, 2005 and 2008. Unpublished.

Table 3.4 reports the spreads of average bank deposit rates against the market rate (1 month Certificate of Bank Indonesia's bills minus deposit rates). These spreads can be interpreted as measures of the gross revenue or return to deposit taking activity, because the Certificate of Bank Indonesia rate measures the risk free income that can be obtained from investment of deposits. Later this chapter uses these spreads as a dependent variable measuring returns on deposit taking. The spreads have been decreasing since 2001 in all provincial markets. For example the spread of time deposit in Metropolitan area in 2001 was 2.29% while in 2008 fell to 0.02% (See table 3.4). This may imply that the markets become more competitive.

Deposit markets in Metropolitan area and Java and Sumatra are appear more competitive than in The Periphery. In 2008, the return of time deposit in Metropolitan and Java and Sumatra were 0.02% and 0.31% respectively while in the Periphery was 0.67.

3.3. Literature Review

3.3.1. Theory of Competition

Structural concepts of competition emerged during the nineteenth century. The pioneers were Jevons (1871), Marshall (1890, 1919), Edgeworth (1881), Clark (1899), and Knight (1921), who contributed to the development of the standard models of perfect competition and monopoly (see Hay and Morris, 1991, for a review). In this modern economic theory, a market is said to be purely competitive if it has a large number of firms selling a homogenous commodity, and the market share of each individual firms is so small that no individual firm finds itself able to influence the commodity's price by changing the quantity of output it sells. To make competition in economic theory not only "pure" but also "perfect", several additional structural conditions are added: free entry and exit, perfect information, and no transaction costs (Scherer and Ross, 1990).

Violations of the major structural preconditions for pure competition lead to a rich variety of market structures. Table 3.5 presents six major types of market structure, using the two-way classification based on the number of sellers and the nature of the product. The difference between homogeneity and differentiation in this classification implies the degree of substitutability among competing seller's products. In contrast to the pure competition concept, the monopoly concept assumes a market with only one seller with complete control over price.

However, most markets are neither purely competitive nor monopolistic but fall somewhere in between. Chamberlin (1933) made a very important theoretical advance by developing new theories of monopolistic competition and oligopoly (Cournot, 1838 and Bertrand, 1883, systematically analyze behaviour under oligopoly, see Hay and Morris, 1991). The concept of monopolistic competition is characterised by a large number of sellers (and

buyers), easy entry, and a differentiated product. The oligopoly theory assumes a market structure where a relatively small number of sellers control the market.

Table 3.5

Major types of market structure

	No of firms	Entry conditions	Product differentiation
Perfect competition	Many	Free entry	Identical products (homogeneity)
Imperfect competition:			
a. Monopolistic competition	Many	Free entry	Some differentiation
b. Oligopoly	Few	Barriers to entry	Some differentiation/homogeneity
Monopoly	One	No entry	Complete differentiation

Source: Lipczynski, Wilson and Goddard (2009)

Under the theory of monopolistic competition, although a large number of sellers may supply a single market, each firm's product has some unique characteristics, which allow the firm some discretion over price and the ability to pursue a policy at least somewhat different from their competitors. Under oligopoly theory, firms realise their actions are interdependent because the fewness of firms in the market. The nature of competition under oligopoly ranges from active price competition to implicit or explicit forms of collusion (Goddard, Molyneux and Wilson, 2001).

Pure monopolist, oligopolists, and monopolistic competitors share a common feature, that is, under given demand conditions, each can increase the quantity of output it sells only by reducing its price. Therefore, all three types of market structure possess some degree of power over price, which is called monopoly power or market power (Scherer and Ross, 1990).

3.3.2. Market Power and Efficiency Hypothesis

3.3.2.1. The Structure-Conduct-Performance Paradigm

To describe the relationship between market structure and the performance of firms, Mason (1939, 1949), and Bain (1951, 1956, 1959) developed the structure-conduct-performance (SCP) paradigm. According to this approach, the structure of a market influences the conduct of the firms operating in the markets, which in turn influences the performance of those firms. For example, a perfectly competitive market structure leads to efficient economic performance with price equal to marginal cost, inefficient firms driven from the market, and long-run economic profits equal to zero. In contrast, a monopolistic market structure results in poor economic performance with price exceeding marginal cost, inefficient firms surviving in the long run, and economic profits greater than zero.

Under this approach, the finding of a positive relationship between firm profitability and the market structure elements is predicted by two hypotheses: traditional structure conduct performance (SCP) and relative market power (RMP). The traditional SCP hypothesis proposes that banks are able to extract monopolistic rents in more concentrated markets by their ability to offer lower deposit rates and charge higher loan rates in these markets. The RMP hypothesis asserts that only firms with large market shares and well differentiated products are able to exercise market power in pricing these products and earn supernormal profits (Shepherd, 1982; Smirlock, 1985 regards it as the product differentiation hypothesis). The difference between SCP and RMP is that in the latter, market power does not occur solely in concentrated markets. Generally, the MP hypothesis suggests that antitrust or regulatory action may help improve efficiency by bringing prices closer to marginal costs.

3.3.2.2. The Chicago School Approach and Efficient Structure Hypothesis

Although the SCP paradigm was highly influential, it has been subject to criticism for a number of different reasons. The SCP paradigm draws heavily on microeconomic theory and the neoclassical theory of the firm. However, the theory does not always specify precisely the relationship between structure, conduct and performance variables. In the empirical studies, the SCP paradigm often finds associations in the anticipated direction between structure, conduct and performance variables. However, such relationships are often only weakly statistical significant.

Following the Chicago school approach, two major efficient structure (ES) hypotheses have been generated; the X-efficiency version of the efficient structure (ESX) hypothesis and the scale efficiency version of the efficient structure (ESS) hypothesis.

Under the X-efficiency hypothesis (ESX), the firms with superior management or production processes operate at lower costs and subsequently reap higher profits. The resulting higher market shares may also lead to higher market concentration (See Demsetz, 1973, 1974; Peltzman 1977). The scale-efficiency hypothesis (ESS) states that firms have similar production and management technology but operate at different levels of economies of scale. Firms operating at optimal economies of scale will have the lowest costs and the resulting higher profits will lead to higher market concentrations. Both versions of the efficient-structure-hypothesis provide an alternative explanation for the positive relationship between profit and market structure (See Lambson 1987).

In short the efficient structure hypothesis suggests that the market power hypothesis might not be supported even if the significantly positive relationship between market structure and profitability exists. Instead, they hypothesise that both market concentration and/or large market share are the results of banks

with superior efficiency. Thus, the efficient-structure hypothesis has a different policy implication antitrust or regulatory actions are likely to be counterproductive.

3.3.3. NEIO model: Panzar and Rosse (PR)

The criticism about SCP paradigm led to the realization that a number of conduct and performance variables have feedback effects on structure, and that causality within SCP is two-way and not just a one way process, guided eventually to a shift away from the presumption that structure is the most important determinant of the level of competition. Instead, some economists argued that the strategies (conduct) of individual firms were equally, if not more, important (Scherer and Ross, 1990). Theories that focus primarily on strategy and conduct are subsumed under the general heading of the new empirical industrial organisation (Schmalensee, 1982). According to this approach, firms are not seen as passive entities. Instead they are active decision makers, capable of implementing a wide range of diverse strategies. A key aspect is also the used of firm-level data to make inferences about supply and demand.

The Rosse and Panzar (1977) model further developed by Panzar and Rosse (1982, 1987) and abbreviated here to the PR model, uses firm (or bank)-level data. It investigates the extent to which a change in factor input prices is reflected in (equilibrium) revenues. Under perfect competition, an increase in input prices raises total revenues by the same amount as the rise in costs. Under a monopoly, an increase in input prices will increase marginal costs, reduce equilibrium output, and consequently reduce total revenues. The PR model also provides a measure ("H-statistic") between 0 and 1 of the degree of competitiveness of the industry, with less than O being collusive (joint monopoly) competition, less than 1 being monopolistic competition/collusive oligopoly, and 1 being perfect competition/contestable market. It can be shown, if the bank faces a demand with constant elasticity and a Cobb-Douglas

technology, that the magnitude of H can be interpreted as an inverse measure of the degree of monopoly power, or alternatively, as we do, as a measure of the degree of competition.

The advantage of the PR model is that because it uses bank-level data it allows for bank-specific differences in production function. It also allows one to study differences between types of banks (e.g., large versus small, foreign versus domestic). Its drawback is that it assumes that the banking industry is in long-run equilibrium; however, a separate test exists to determine whether this condition is satisfied. As we have access to bank-level information and as we want to study differences among banks, we apply the PR model to our provincial Indonesian data.

Dynamic Panzar and Rosse approach

A dynamic Panzar Rosse model has been developed by Goddard and Wilson (2009). Their approach is motivated by criticism of static Panzar and Rosse, that it can cause a downward bias of the estimated coefficients (Church and Ware, 2000 and Shaffer, 2001).

The absence of any dynamic effects in a fixed effect model means that specifications of this type may also be criticized from the perspective of time-series econometrics. If revenue is actually dependent on the past revenue, then the misspecification of the equation results in a pattern of autocorrelation in the disturbance terms. This creates difficulties for either fixed effects (FE) or random effects (RE) estimation. With small T and auto correlated disturbances, the FE and RE estimators are severely downward biased, creating the potential for seriously misleading inferences to be drawn concerning the nature or intensity of competition.

Another criticism was by Brozen (1971) who argued that the relevant micro theory identifies market equilibrium relationships between variables such as concentration and profitability, however, there is no certainty that a profit

figure observed at any moment in time is an equilibrium value. In banking literature, Goddard et.al (2004) finds that convergence towards long run equilibrium is less than instantaneous.

The reason for using a dynamic approach is to resolve these problems and obtain unbiased estimates to calculate H-statistic. Although the micro theory underlying the Panzar-Rosse test is based on a static equilibrium framework, in practice the speed of adjustment towards equilibrium might well be less than instantaneous, and markets might be out of equilibrium either occasionally, or frequently, or always. As a result, the estimation of the H-statistic may have a misspecification bias in the revenue equation. Misspecification bias arises in the case where there is partial, not instantaneous, adjustment towards equilibrium in response to input price shocks. Partial adjustment necessitates the inclusion of a lagged dependent variable among the covariates of the revenue equation. The latter should have a dynamic structure, and the static version (without a lagged dependent variable), widely used in the previous literature, is misspecified. This is also the reason to use Generalised Method of Moment (GMM) estimator.

3.3.4. Review of Empirical Works

This subsection presents empirical studies of competition in deposit markets. We do not discuss empirical studies of competition in other banking markets such as consumer or corporate lending.

3.3.4.1. Structure conduct performance (SCP) empirical studies

There are many studies, at least going back to Berger and Hannan (1989), investigating the impact of bank market concentration on bank deposit rates. Table 3.6 summarizes the findings of this literature. Studies employ both three bank concentration ratio (CR3) and the HHI as concentration measures. Overall, most papers find a negative impact of an increase in concentration on

time and savings deposit rates, the effects vary across samples and specifications.

Table 3.6
Empirical studies in SCP approach

Study	Period/ Obs	Dependent Variable	Countries	Results
Berger and Hannan (1989)	1983-85/ 3500-4000	Deposit rates: MMDA, Super NOW, 4 type of CDs.	US	Banks in the most concentrated local markets pay MMDA rates that range from 25 to 100 basis points less than those paid in the least concentrated markets,
Calem and Carlino (1991)	1985/ 444/466	MMDA, 3 &6-mo CD rates	US	Between 12-42 basis point
Radecki (1998)	1996-1997/ 390	Deposit rates: saving, NOW and time deposit	US	An increase of 20 percentage points in the three-firm concentration level causes savings account rates to fall on the order of 20 to 30 basis points.
Corvoisier and Gropp (2002)	1993-96/ 246	Margin between money market minus deposit rates	EU Countries	Demand deposit: increased by 100-200 bp. On the other hand, saving and time deposit decreased by 100-200 bps in a more concentrated market.
Hannan and Prager (2004)	1996 and 19 99/ 6,141/5,209	Saving, NOW and time deposit rates	US	MSA: Saving: 5 bp, Time deposit: 3 bp and demand: 10 bp. State level: saving: -33, time dep: -6bp and demand dep: -4bp

3.3.4.2. Efficient-structure hypothesis (ES) empirical studies

As discussed in the previous section, an important critique of SCP model is the fact that it considers market power to be the only explanation for differences in market share. The efficient-structure hypothesis (ES) has been developed as an important alternative explanation.

Table 3.7
Empirical studies in ES approach

Study	Period/ Obs	Variables	Country	Results
Berger (1995)	1980-90/ 1,928	Dep. Var: ROA, Variables: X-efficiency, Scale-efficiency.	US	Partial support to X-efficiency.
Goldberg and Rai (1996)	1988-91/ 303	Dep.Var: ROA, ROE and NIM Variables: CR3, X-efficiency, wage, total assets, total liabilities to total asset ratio, per capita income and time dummies	11 European countries	Find evidence to support the Efficient-structure hypothesis for banks located in countries with low concentration of banks.
Berger and Hannan (1998)	1988/ 5,263	Dep.Var: Cost efficiency. Variable: HHI	US	Banks in more concentrated markets exhibit lower cost efficiency.
Bos (2004)	1992-98/ 351	Dep.var: ROA. Variables: CR3, MS, HHI, loan to asset, liquid assets to total assets, operating expenses over operating income, total deposits	The Netherlands	Cournot model with the modified Efficiency hypothesis has the highest fit and is the only specification where all the control variables also carry the expected sign.

The efficiency-structure hypothesis attributes differences in performance to differences in efficiency (Berger (1995), Goldberg and Rai (1996)). According to the Efficiency hypothesis, both high market share and good performance result from high efficiency.

Berger (1995) uses the US's banking data from 1980 to 1990 and develops a series of tests to incorporate efficiency directly into the model to resolve the conflict between structure-conduct-performance (SCP) and efficient-structure hypothesis (ES). Four testable hypotheses are specified, SCP, relative market power hypothesis (RMP), efficient structure hypothesis using X-inefficiency (ESX) and efficient structure hypothesis using scale efficiency (ESS). He finds that the empirical results indicate some limited support for two of the four

hypotheses, although the importance of these theories may be questioned. The data provide partial support for the X-efficiency version of the ES hypothesis (ESX). X-efficiency or superior management of resources is consistently associated with higher profits, when controlling for the effects of the other three hypotheses, as required under the hypothesis. However, support for the other necessary condition of ESX that X-efficiency is positively related to concentration or market share so that it can explain the positive profit-structure relationship, is much weaker. The data also provide some support for the relative-market power hypothesis (RMP).

The relationship between market structure and performance has been studied extensively for American banking. In contrast, relatively little work has been done to investigate this relationship for European banking and emerging markets. Goldberg and Rai (1996) study the traditional structure-performance hypothesis (SCP) and the efficient-structure hypothesis using European banking data. They do not find a positive and significant relationship between concentration and profitability for a sample of banks across 11 European countries over a four year period, 1988-91. However, they find evidence to support one of the two versions of the efficient-structure hypothesis for banks located in countries with low concentration of banks.

Bos (2004) uses data from the Netherlands' banking and applies the modified Efficiency hypothesis. Comparing with SCP and Cournot model, he finds that the ES has the highest fit and the only specification where all the control variables also carry the expected sign. Evidence from the Cournot model suggests that he cannot reject the existence of market power, although its impact on performance may be small.

Turning into emerging markets, the existing banking competition studies provide no direct insights in these markets. The primary focus has been on the US followed by Europe. There are few such studies in emerging markets and that none of them find positive significant relationship between market

structure and bank performance (See Mohieldin (2000) and Perera et al. (2007)). There are few SCP studies of emerging economies that are easily accessible e.g. via internet. Amongst these none of them find support to SCP model.

3.3.4.3. Estimates of the Panzar and Rosse model

Many previous studies have examined the competitive structure of the banking industry in various countries by using the H-statistics. A summary of previous P-R studies on banking is presented in Table 3.8. Overall, the previous empirical estimations of P-R model for developed countries show varying results.

Table 3.8
Panzar and Rosse's empirical studies in developed markets

Study	Period	Dependent Variable	Countries	Results
Nathan and Neave (1989)	1982-84	Total revenue less provision	Canada	Monopolistic competition Hstat: 0.45 – 1.058
Vesala (1995)	1985-92	Total interest revenue or loan interest	Finland	MC (except 1989-90) Hstat: 0.182 – 1.381
Molyneux et al. (1996)	1986-88	Total revenue less provision	Japan	Monopoly H-stat: -0.00039 – 0.4226
De Bandt and Davis (2000)	1992-96	Interest income or total income	France, German and Italy	MC(large banks in all and small bank in Italy) Hstat: -0.004 – 0.729
Bikker and Haaf (2002)	1988-98	Total interest revenue to total asset	23 EU and non EU	MC(all, competition weaker in small markets and stronger in international markets). Hstat:
Claessens and Laeven (2004)	1994-2001	Interest revenue to total assets	50 industrialized and developing	Monopolistic competition Hstat: 0.60-0.80
Weill (2004)	1994-99	Total revenue	12 EU	MC(decreased over the period). Hstat: 0.439-0.734
Casu and Girardone(2005)	1997-2003	Total revenue to total assets	EU	Monopolistic competition Hstat: 0 – 0.94
Bikker etal (2006)	1986-2005	interest income to total assets	101 countries	Monopolistic competition is the most common. Hstat: 0.504
De Rozas(2007)	1986-2005	Net income to total asset	Spain	Monopolistic competition Hstat: 0.55-0.79
Matthews et al.(2007)	1980-2004	Revenue	UK	Monopolistic competition H-stat: 0.46-0.78
Goddard and Wilson (2009)	1998-2004	Revenue	France, Germany, Italy, Japan, the UK and the US	Monopolistic competition H-stat: 0.32

MC=monopolistic competition; MO=monopoly; PC=perfect competition

Vesala (1995) conducts an empirical analysis of Finnish banking sector after deregulation in the mid 1980s. Concern about characterisation of bank's pricing behaviour and measurement of the level of price competition and its evolution over time. He analyses the nature and level of oligopolistic competition and finds that the H-stat value is always positive and support the Chamberlinian monopolistic competition model (except 1989 and 1990 when the data are consistent even with perfect competition). H-stats using interest revenue as dependent variable are within range of 0.182 – 1.381, while using loan interest revenue are in the range of 0.171 – 1.460

De Rozas (2007) assess the level of competition prevailing in the Spanish banking system. The estimation outcome reveals a gradual rising path for the H-statistic, thus suggesting a more competitive environment among larger banks. This finding runs counter to the widespread hypothesis which states that concentration impairs competition. In addition, a noteworthy increase in the degree of competition is identified at the turn of the eighties, when several liberalization-oriented policy measures came into force.

Matthews et al. (2007) report an empirical assessment of competitive conditions among the major British banks, during a period of major structural change. Specifically, estimates of the Rosse–Panzar H-statistic are reported for a panel of 12 banks for the period 1980–2004. The sample banks correspond closely to the major British banking groups' specified by the British Banking Association. The robustness of the results of the Rosse–Panzar methodology is tested by estimating the ratio of Lerner indices obtained from interest rate setting equations. The results confirm the consensus finding that competition in British banking is characterised by the theoretical model of monopolistic competition. There is evidence that the intensity of competition in the core market for bank lending remained approximately unchanged throughout the 1980s and 1990s. However, competition appears to have become less intense in the non-core (off-balance sheet) business of British banks.

In the emerging markets, a number of studies of banking competitive structure by employing Panzar and Rosse approach have been conducted since 2002. Though there exist studies on banking in emerging markets in Asia, these literatures focus mostly on China and India. As far as, we are aware, there are no studies using Indonesian banks' data.

A summary of previous PR studies on banking in emerging markets is presented in Table 3.9. The results of previous empirical estimations of PR model show that most banking markets are characterised by monopolistic competition.

Table 3.9
Panzar and Rosse's empirical studies in emerging markets

Study	Period	Dependent Variable	Countries	Results
Gelos and Roldos (2002)	1994-99	Interest revenue to total assets	8 European and Latin American	(MC except Argentina and Hungary (near PC)) Hstat: 0.47-0.97
Claessens and Laeven (2004)	1994-2001	Interest revenue to total assets	50 industrialized and developing	Monopolistic competition Hstat: 0.60-0.80
Drakos and Konstantinou (2005)	1992-2000	Total income	Central Eastern European and former Soviet Union	Monopolistic competition Hstat: 0.294-0.323
Bikker et al. (2006)	1986-2005	Interest income or interest income to total assets	101 countries	Monopolistic competition is the most common. Hstat: 0.504
Yildirim and Philippatos (2007)	1992-99	Total interest revenue (or total revenue) to total assets	14 Central and South East European and the Russian Federation	MC(Lithuania, Macedonia); PC(Latvia); Neither MC nor PC(other) Hstat: 0.19-0.75
Yildirim and Philippatos (2007)	1993-2000	Total revenue to total assets	11 Latin American	Monopolistic competition Hstat: 0.62-0.83
Zhu (2008)	1992-2006	Total interest revenue to total asset	15 CEE and 7 Central and South American	Monopolistic competition H-stat: 0.39-0.42
Delis (2009)	1996-2006	Total revenue	22 Central and Eastern European	Monopolistic competition Hstat: 0.110 – 0.205
Dalley and Matthews (2009)	1998-2007	Total revenue	Jamaica	Monopolistic competition Hstat: 0.24 – 0.40

MC=monopolistic competition; MO=monopoly; PC=perfect competition

The first study of PR in emerging market is conducted by Gelos and Roldos (2002). They examine the evolution of market structure in emerging market banking systems during the 1990s. While significant bank consolidation has been taking place in these countries, reflected in a sharp decline in the number of banks, this process has not systematically been associated with increased concentration as measured by standard indices. The econometric estimates based on Panzar-Rosse (1987) methodology suggest that, overall; markets have not become less competitive in a sample of eight European and Latin American countries. They conclude that lowering barriers to entry, by doing such things allowing increased participation of foreign banks, appears to have prevented a decline in competitive pressures associated with consolidation. They report H-stat in the early period ranging from 0.50-0.84 and H-stats in the later period ranging from: 0.47-0.97.

There is only one study using emerging market data and dynamic model. Daley & Matthews (2009) employ the generalized method of moments (GMM) dynamic panel estimator as proposed by Arellano and Bond (1991) and find that the Jamaican banking market reflected a monopolistic competition over the period 1998 to 2007.

3.4. Data and Methodology

3.4.1. Data

We use unconsolidated annual bank accounts data obtained from Bank Indonesia statistics for the years 2001-2008. This data is compiled by each bank's main branch in every province and reports on the banking services provided in the provincial markets. We eliminated observations with missing data on any of the variables, and we applied rules to exclude outliers based on the 1^{st} and 99^{th} percentiles of the distributions of the dependent variable in the revenue equation. We also eliminated banks for which fewer than 2 bank-year

observations were available for the estimation. After cleaning the data, we have 5,966 annual observations on 133 banks.

Table 3.10
Definitions of Variables

Variables		Description
Dependent Variables		
Time deposit rate	r	Time deposit interest rates paid by a bank in a provincial banking market
Demand deposit rate	r	Demand deposit interest rates paid by a bank in a provincial banking market
Saving account rate	r	Saving account interest rates paid by a bank in a provincial banking market
Log total revenue	rev	Interest and non-interest income
Log operating revenue	rev	Interest income
Input prices		
Log labour price	P1	Personnel costs/total assets
Log physical capital price	P2	Total depreciation and other capital expenses/total fixed assets
Log wholesale funding price	P3	Interbank money market funding interest rates
Concentration ratio (%)		
CR of time deposits	CR3	Concentration of a top three time deposit provincial banking market
CR of demand deposits	CR3	Concentration of a top three demand deposit provincial banking market
CR of saving accounts	CR3	Concentration of a top three saving account provincial banking market
Market share(%)		
Market share of time deposits	MS	Bank's share of time deposit market in provincial banking market.
Market share of demand deposits	MS	Bank's share of demand deposit market in provincial banking market.
Market share of saving accounts	MS	Bank's share of saving account market in provincial banking market.
Bank specific variables (%)		
Operating costs to operating income ratio	CTI	Operating costs divided by operating income.
Total loans to total assets ratio	*X*	Total loans (investment, consumer and working capital loans divided by total assets.
Total deposits to total asset ratio	*X*	Total deposits (time deposits, demand deposits, saving accounts) divided by total assets.
Geographical variables		
Number of bank per population	*X*	The number of bank branches divided by the number of 100,000 populations.
Population density	*X*	The number of population divided by the area in a province
Provincial GDP growth	*X*	Annual GDP growth of a province.

The table presents the summary statistics of basic variables used in the competition estimations. In the SCP, efficient-structure hypothesis (ES) and dynamic NEIO (Panzar and Rosse). The input costs variables are: price of labour, price of fixed asset, price of funds. All financial values are inflation-adjusted to the base year 2000.

Table 3.10 presents the definition of variables used in the SCP, EH and PR estimations. The variables are divided into six groups: dependent variables, input prices, concentration ratio, market share, bank specific variables and geographical variables.

Table 3.11
Data description

Variables	No of observations	Mean	Standard deviation	Minimum	1st Quartile	2nd Quartile	3rd Quartile	Maximum
Dependent Variables								
Time deposit rate	5,956	9.96	3.41	0.00	7.20	9.53	12.26	82.80
Demand deposit rate	5,956	3.67	2.15	0.00	2.39	3.30	4.71	51.00
Saving account rate	5,956	5.55	2.88	0.00	3.92	5.00	6.84	63.19
Log total revenue	5,966	10.61	2.04	0.00	9.47	10.58	11.83	17.42
Log operating revenue	5,964	10.13	2.21	0.00	8.93	10.15	11.47	17.26
Input prices								
Log labour cost	5,966	8.39	1.81	0.00	7.19	8.19	9.50	14.82
Log fixed asset cost	5,966	6.90	1.67	0.00	5.83	6.72	7.90	13.56
Log wholesale funding cost	5,966	2.34	0.27	2.01	2.08	2.28	2.55	2.87
Concentration ratio(CR)								
CR of time deposits (%)	5,966	46.36	13.81	23.10	34.48	44.90	55.26	100.00
CR of demand deposits (%)	5,966	55.77	20.55	20.14	38.76	53.37	75.00	100.00
CR of saving accounts (%)	5,966	54.90	10.89	24.33	48.10	55.16	60.42	100.00
Market share								
Market share of time deposits (%)	5,966	4.41	7.54	0.00	0.29	1.30	5.14	62.92
Market share of demand deposits (%)	5,966	4.40	11.13	0.00	0.07	0.53	2.71	95.18
Market share of saving accounts (%)	5,966	4.41	7.83	0.00	0.08	0.93	4.38	74.54
Bank specific variables								
Operating costs to operating income ratio (%)	5,956	20.72	17.05	1.58	11.74	16.18	22.39	100.00
Total loans to total assets ratio (%)	5,966	65.23	38.01	0.00	25.48	85.76	100.00	100.00
Total deposits to total asset ratio (%)	5,966	3.04	3.47	0.00	0.60	1.51	4.48	45.13
Geographical variables								
Number of bank per population	5,966	7.93	8.18	0.00	3.40	5.07	7.83	36.08
Population density	5,966	2,242	4,533	0.00	76	213	1,026	13,845
Provincial GDP growth	5,705	11.39	1.35	7.51	10.37	11.49	12.61	13.25

The table presents the summary statistics of variables used in the competition estimations. In the SCP, efficient-structure hypothesis and dynamic NEIO (panzar and rosse). The input costs variables are: cost of labor proxied by cost of labour, cost of fixed asset, cost of funds, proxied by the wholesale funding rate. All financial values are inflation-adjusted to the base year 2000. Number of bank per population is the number of banks against 100.000 population and population density is the population over the area of province. Source: Bank Indonesia. Various years. Unpublished; The data for population density and provincial GDP growth were from BPS-Statistics Indonesia, various years. Trends of the selected socio-economic indicators of Indonesia.

Table 3.11 shows the descriptive statistics of basic variables used in the cost efficiency estimations. As performance measure in the SCP model we use each bank's average deposit rates: time deposit, demand deposit, and saving account rates (See Appendix 1 for more detail about types of deposits). As a performance measurement in the ES models, there is a wide range of indices used in the literature. No agreement exists as to which measures are superior. Performance measures range from purely financial measures such as profits,

return on equity (ROE), and return on assets (ROA) to more eclectic measures such as market share stability, expenses and the number of bank employees. In this study, the difference between 1-month Bank Indonesia Certificate interest rate and deposit rates is used to get an appropriate measure for the potential profit received by banks from their various deposit products.

To measure the degree of bank concentration in the provincial markets using both the SCP and the efficient-structure hypothesis (ES) models, we use the "three banks" concentration ratio (CR3) based on deposits. CR3 that is defined as the proportion of deposit attributed to the top three firms in the industry. The CR3 ratio has been decreasing steadily over the entire period, especially in Metropolitan. We use a market share variable, also based on deposits.

For all models, a range of standard control variables are included (see Molyneux et al. (1997) for discussion). The number of control variables included is purposely restricted to avoid high correlation between different control variables. For each specification we checked whether including respectively excluding those altered sign or significance of the other variables. On this basis, the set of explanatory variables used below is robust and the variables are not highly correlated. For comparison purposes, we report the same set of control variables for all estimations, even if for some specifications control variables are insignificant.

To control for risk, we used loan over assets that are associated with increased risk if we have higher the ratio of loan to assets. We expect the ratio to carry a positive sign, reflecting a higher return to a more risky position. However, it is not really clear on how the risk variable should affect deposit rates.

We use the natural logarithm of total deposit as a proxy for total demand in each province. It is measured in millions of rupiahs and in constant prices. It is expected to carry a negative sign if there is potential competition from both existing competitors and possible entrants. On the other hand, if the market is

less contestable, an increase in its size leads to a positive expected effect on performance.

Lacking a reasonable measure of transportation cost per unit of distance for each market, we employ the number of banks per 100,000 population (population per square km) as a crude proxy for average transportation costs, based on the notion that it is more difficult to travel a given distance in more densely populated areas (Metropolitan Area) than in less densely populated areas (the Periphery). We expect it to have a negative sign.

We use population density as a proxy for market demand and expect a negative sign. This is because in more densely populated areas, competition should increase and decrease the return. We also use provincial gross domestic product growth to control the level of economic environment as we anticipated higher economic development proxies for market demand.

Time dummies are also introduced to account for the interest rate cycle, changes in minimum balance requirements, and other time-specific factors.

In the ES's estimation, we also include a cost variable; the ratio of total operating cost over total operating income. It is expected to have a negative coefficient, since the increase of cost deposit will lower bank's revenue.

Finally, we use a time trend to capture the change of market power over the years and expect to have a negative sign where the increased competition will decrease market power and revenues.

3.4.2. The application of production technology for the PR model

In applying the PR model, it is important to clearly define the production activity of the banks since they are not exactly comparable to other types of firms. In the literature, there are two main approaches to measure the flow of services provided by banks.[2] Under the production approach, banks treated as

[2] As discussed in Colwell and Davis (1992)

firm which employ capital and labour to produce services for both deposit and loan account holders. Outputs are measured by the number of deposit and loan transaction processed over a given time period. Total costs include operating expenses only. Output is treated as a flow, showing the given amount of output produced per unit of time. However, such detailed transaction flow data are not generally available. The numbers of deposit and loan account services are sometimes used instead. In this event, output is treated as a stock, i.e. a given amount of output at one point in time.

Under the intermediation approach, banks are treated as financial intermediaries between borrowers and depositors rather than producers of loan and deposit services. Outputs are measured by the value of loans and investments. Total costs include operating costs plus interest costs. Output is also treated as a stock. However, neither of these approaches captures all the functions performed by banking institutions (Heffernan, 1996).

Following Berger and Humphrey (1997), the intermediation approach is adopted in this study, with some modification to capture the dual roles of banks as (1) providing transaction services and (2) intermediating funds from depositors to borrowers. As a result, bank deposits have been treated as inputs as well as outputs at the same time. Bank deposits not only have input characteristics, because they are paid for in part by interest payments, and the funds raised provide the bank with the raw material of investible funds, but they also have output characteristics, since they are associated with a substantial amount of liquidity, safe keeping, and payments services provided to depositors.

3.5. Model Specification

This subsection will present the different models used to tests market power model (SCP), efficient-structure hypothesis (ES) and new empirical industrial organization model (PR).

3.5.1. Market-power and efficient-structure hypothesis

The next two sub-sections will examine market power hypothesis using price-concentration model and efficient structure hypothesis employing the modified Berger (1995) model.

3.5.1.1. Market-power hypothesis: structure-conduct-performance model

We will employ price-concentration model and will use different type of deposit prices following the standard approach by Berger and Hannan (1989):

$$r_{ijt} = \alpha_0 + \alpha_1 CR3_{jt} + \alpha_2 X_{ijt} + \varepsilon_{ijt} \quad (3.1)$$

where

r_{ijt} : the interest paid at time t on time deposit rate or demand deposit rate or saving account rate by bank i located in the local banking market j

$CR3_{jt}$: a measure of concentration in local market j at time t using Concentration Ratio of top three banks based on deposits.

X_{ijt} : denotes a vector of control variables that may differ across banks, provincial markets, or time periods. These control variables include factors exogenous to the bank that may affect prices through market conditions or cost considerations.

ε_{ijt} : error term

Coefficients are represented by α_0, α_1 and α_2, while ε_{ijt} denotes the error term. Since the prices employed here (deposit interest rates) are paid to consumers rather than by consumers, this hypothesis implies a negative price-concentration relationship, or α_1<0.

The usual form of the efficient-structure hypothesis, however, maintains that because of the dominance of efficient firms in concentrated markets, production in such markets is more efficient on average. To the extent that greater efficiency is reflected in a lower marginal cost of producing output of a given quality, firms in concentrated markets should find it in their interests to offer consumers more favourable prices, higher quality, or both. Put into the context of our banking application, if banks in concentrated markets are more efficient on average in gathering deposit funds and transforming them into profitable investments, the marginal dollar of deposits should have more value to them. Thus they should, if anything, bid more for deposits, implying a positive price-concentration relationship, or, $\alpha_1 \geq$O.

3.5.1.2. Efficient-structure hypothesis

We would like to test the market by estimating reduced forms that include direct measures of efficiency and nest for the two hypotheses. Our main equation is a modification of Berger (1995) model:

$$\text{Spread}_{ijt} = \beta_0 + \beta_1 CR3_{jt} + \beta_2 MS_{jt} + \beta_3 CTI_{ijt} + \sum_k \gamma_k X_{k,ijt} + \varepsilon_{ijt}, \qquad (3.2)$$

Spread_{ijt} : the 1 month Certificate of Bank Indonesia minus deposits interest rates paid by bank i at time t in the local banking market j

$CR3_{jt}$: concentration ratio of top three banks in local market j at time t

MS_{jt} : a measure of market share in local market j at time t

CTI_{ijt} : the cost efficiency ratio (operating cost to operating income ratio of bank i at time t in the local banking market j).

$X_{k,ijt}$: vector of control variables that may differ across banks and provinces

ε_{ijt} : error term

Under the efficient-structure hypothesis, causation is expected to run from efficiency to profits and prices and then to market structure. Hence, the expected signs of the coefficients in the estimation of Eq. (3.2) are as follows: $\beta_1 = 0$, $\beta_2 = 0$, and $\beta_3 < 0$ More efficient firms will have higher return and the signs of the coefficients of CTI_i should be negative.

A necessary condition for the efficient-structure hypothesis to hold is that efficiency affects market structure. The following two equations are also tested to ensure that the necessary conditions hold:

$$CR3_j = CTI_{it} + X_{ijt} + \varepsilon_{ijt} \quad (3.3)$$

$$MS_{ijt} = CTI_{it} + X_{ijt} + \varepsilon_{ijt} \quad (3.4)$$

The unconditional relationship between market structure and efficiency will establish that efficient firms will gain market shares and will also be responsible for higher market concentration. Thus, the coefficients of CTI_{it} are positive in equations (3.3) and (3.4).

This chapter applies the above methodology to test the efficient-structure paradigm for Indonesian banks over a nine-year period. It differs from the Berger (1995) methodology in that it uses different measures of efficiencies and a different mean of revenue. The efficiency measure in this chapter is cost to income ratio. We will also use cost efficiency from the stochastic frontier approach estimation on translog cost function for robustness check.

3.5.2. Modified Panzar and Rosse Model

We estimate the revenue equation using the fixed effects generalized method of moments as in Goddard and Wilson (2009):

$$\Delta ln(\text{rev}_{i,t}) = \alpha \Delta ln(\text{rev}_{i,t-1}) + \sum_f \beta_f \Delta ln(P_{f,i,t}) + \sum_g \beta_g \Delta ln(P_{g,i,t-1}) + \sum_k \gamma_k \Delta \ln(DEP_{k,i,t}) + \theta_t + \Delta \varepsilon_{i,t} \quad (3.5)$$

where i=1, …, N and t=1, …, T. N denotes the number of banks, T the total number of time periods (quarterly); rev denotes total revenue, P denotes input prices namely: labor prices, physical capital prices, and wholesale funding prices. DEP denotes total deposits. θ_k denotes time dummy variables from 2000 to 2009, ν_i denotes individual bank effect and ε_{it} denotes error term.

The lagged value of this variable is included on the right hand side to capture persistence in total revenue and also potentially mean-reverting dynamics in total revenue (i.e., the tendency of the total revenue to return to some equilibrium value).

We use the general method of moments (GMM) developed by Arellano and Bond (1991). They design both 1-step estimation and 2-step estimation. The difference between them consists in the specification of an individual specific weighting matrix. The 2-step estimation uses the 1-step's residuals, so it is more efficient.

Finally, the H-statistics is calculated from the estimates based on the result from equation 3.5:

$$\widehat{H} = \sum \beta_f \Big/ (1 - \alpha) \quad (3.6).$$

3.6. Empirical Results

This section presents the results for baseline models and robustness checks. The baseline models consist of the tests for market powers and efficient-

structure hypothesis and the new empirical industrial organisation model (NEIO).

3.6.1. Baseline Model Results

This subsection presents regressions results using structure-conduct-performance, efficient-structure-hypothesis and Panzar and Rosse models.

3.6.1.1. Structure-conduct-performance model

Table 3.12a
Regression result of SCP: price-concentration model (time deposits)

	Time deposits							
	Dependent variable: Time deposit interest rates							
	All		Metropolitan		Java and Sumatra		The Periphery	
	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*
CR3	0.018	0.015	0.077	0.002	0.016	0.167	0.015	0.173
Number of banks	-1.299	0.000	1.149	0.110	-1.103	0.021	-2.635	0.000
Population density	0.001	0.872	0.024	0.136	-0.002	0.955	0.237	0.015
Time deposit	1.502	0.000	-0.217	0.840	1.357	0.000	1.857	0.000
Total assets	-1.513	0.000	-1.645	0.000	-1.515	0.000	-1.618	0.000
Market share	0.037	0.131	0.212	0.734	-0.033	0.493	0.026	0.540
Metropolitan	-0.204	0.507						
Java and Sumatra	-0.342	0.018						
Year 2002	-1.286	0.000	-1.524	0.000	-1.487	0.000	-1.393	0.000
Year 2003	-6.547	0.000	-7.521	0.000	-6.851	0.000	-6.430	0.000
Year 2004	-6.075	0.000	-7.446	0.000	-6.525	0.000	-5.813	0.000
Year 2005	-0.722	0.001	-0.678	0.262	-0.626	0.057	-0.828	0.009
Year 2006	-3.158	0.000	-2.272	0.000	-3.017	0.000	-3.462	0.000
Year 2007	-4.407	0.000	-3.964	0.000	-4.479	0.000	-4.280	0.000
Constant	18.884	0.000	33.804	0.086	20.450	0.000	19.545	0.000
R-squared	0.898		0.994		0.914		0.899	
Number of obs	264		24		104		136	

This table presents the result of OLS regressions for SCP model (similar to Hannan and Berger, 1989). The dependent variable is time deposit rates. CR3 is the concentration ratio of top three banks time deposit; Log number of banks; Population density is the number of populations over each km-square provincial areas (1000/sq km); Log of time deposits; Log of total assets; Market share of time deposits in each provinces; Dummy metropolitan, dummy Java and Sumatra, and dummy time from 2002 to 2007.

Table 3.12b
Regression result of SCP: price-concentration model (demand deposits)

	Demand deposit							
	Dependent variable: Demand deposit interest rates							
	All		Metropolitan		Java and Sumatra		The Periphery	
	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*
CR3	-0.012	0.000	0.008	0.591	-0.015	0.000	-0.014	0.000
Number of banks	0.056	0.699	1.787	0.005	-0.483	0.113	-0.266	0.358
Population density	0.004	0.156	0.002	0.716	0.011	0.596	0.171	0.005
Demand deposits	0.380	0.000	1.248	0.055	0.719	0.000	0.238	0.042
Total assets	-0.709	0.000	-1.737	0.000	-0.782	0.000	-0.560	0.000
Market share	0.027	0.032	0.996	0.022	0.027	0.350	0.005	0.777
Metropolitan	0.318	0.103						
Java and Sumatra	-0.069	0.468						
Year 2002	1.003	0.000	-0.033	0.898	0.669	0.002	1.301	0.000
Year 2003	-0.572	0.000	-2.028	0.000	-1.015	0.000	-0.111	0.578
Year 2004	-0.982	0.000	-2.126	0.000	-1.368	0.000	-0.714	0.000
Year 2005	-0.371	0.008	-0.210	0.503	-0.294	0.137	-0.424	0.033
Year 2006	-0.565	0.000	-0.095	0.756	-0.695	0.001	-0.519	0.012
Year 2007	-0.838	0.000	-0.715	0.014	-0.920	0.000	-0.712	0.001
Constant	10.471	0.000	6.238	0.350	9.527	0.000	10.637	0.000
R-squared	0.677		0.952		0.755		0.696	
Number of obs	264		24		104		136	

This table presents the result of OLS regressions for SCP model (similar to Hannan and Berger, 1989). The dependent variable is demand deposits rates. CR3 is the concentration ratio of top three banks demand deposits; Log number of banks; Population density is the number of populations over each km-square provincial areas (1000/sq km); Log of demand deposits; Log of total assets; Market share of demand deposits in each provinces; Dummy metropolitan, dummy Java and Sumatra, and dummy time from 2002 to 2007.

Table 3.12c
Regression result of SCP: price-concentration model (saving accounts)

	Saving accounts							
	Dependent variable: Saving account interest rates							
	All		Metropolitan		Java and Sumatra		The Periphery	
	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*
CR3	-0.001	0.937	-0.093	0.071	0.028	0.011	-0.002	0.834
Number of banks	-2.198	0.000	3.534	0.001	-2.492	0.000	-3.316	0.000
Population density	0.008	0.043	0.076	0.016	-0.056	0.081	0.284	0.002
Saving accounts	2.271	0.000	-3.479	0.246	2.433	0.000	2.542	0.000
Total assets	-1.846	0.000	-3.693	0.000	-1.833	0.000	-1.986	0.000
Market share	0.026	0.209	-0.317	0.778	-0.102	0.037	-0.002	0.944
Metropolitan	0.127	0.661						
Java and Sumatra	-0.094	0.497						
Year 2002	1.028	0.000	0.529	0.147	0.604	0.062	1.042	0.001
Year 2003	-2.633	0.000	-5.044	0.000	-3.321	0.000	-2.391	0.000
Year 2004	-3.166	0.000	-6.483	0.000	-3.680	0.000	-3.020	0.000
Year 2005	-0.959	0.000	-1.451	0.070	-0.778	0.011	-1.095	0.000
Year 2006	-1.363	0.000	-1.178	0.040	-1.069	0.001	-1.668	0.000
Year 2007	-1.657	0.000	-1.627	0.004	-1.554	0.000	-1.573	0.000
Constant	12.490	0.000	103.833	0.050	10.536	0.000	14.186	0.000
R-squared	0.834		0.983		0.869		0.860	
Number of obs	264		24		104		136	

This table presents the result of OLS regressions for SCP model (similar to Hannan and Berger, 1989). The dependent variable is saving account rates. CR3 is the concentration ratio of top three banks saving accounts; Log number of banks; Population density is the number of populations over each km-square provincial areas (1000/sq km); Log of saving account; Log of total assets; Market share of saving accounts in each provinces; Dummy metropolitan, dummy Java and Sumatra, and dummy time from 2002 to 2007.

The results are reported in table 3.12a, 3.12b and 3.12c for the three types of deposits offered in Indonesian banking markets. Each tables present as regressors CR3 and seven control variables (number of banks, population density, time deposit, total assets, market share, metropolitan, and Java and Sumatra). Fixed-effects time dummies (Year 2002 to Year 2007) are also included to account for the influence of the interest rate cycle, and other possible changes in the deposits market over the sample period.

The estimated coefficients of the concentration variable for all three types of deposits are mostly significant but have different signs. The coefficients are negative and significant for demand deposits for Java and Sumatra and the periphery. In the contrary to the SCP, some of them are positive for time deposit for metropolitan and saving account for the periphery.

For example, look at saving accounts, in Java and Sumatra and the periphery, the concentration variable (CR3) coefficients are negative and statistically significant at the 1% level. With saving account rates and CR3 expressed in percentage points, the coefficient of 0.015 implies a 1.13% decrease in saving account deposit rates moving from the least concentrated market in the sample (CR3 = 25) to the most concentrated market in the sample (CR3 = 100), (0.015 (25 - 100)= 1.13).

The finding that banks in more concentrated markets pay less saving account rates is consistent with the implications of the structure-performance hypothesis, but the fact that there are more positive significant or insignificant coefficients are the prediction of the usual form of the efficient-structure hypothesis. Thus, while both efficiency and market structure effects may play roles in explaining profitability, the results presented here suggest the dominance of the efficient-structure hypothesis over structure-performance hypothesis in determining time deposit rates in metropolitan and saving account rates in the periphery.

3.6.1.2. Efficient-structure hypothesis

Table 3.13a-c present the results of the efficient-structure hypothesis. They confirm that there is a role of efficient-structure variable. Consistent with expectations, the cost ratio proxied by operating costs over operating income is negative and significant in the metropolitan and Java and Sumatra.

Table 3.13a
Regression result of efficient-structure hypothesis (Time deposits)

	Time deposits							
	Dep. Variable: The difference between 1 month CBI rate and time deposit rates							
	All		Metropolitan		Java and Sumatra		The Periphery	
	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*
CR3	-0.065	0.026	0.096	0.540	-0.172	0.002	-0.009	0.841
MS	1.115	0.026	2.744	0.161	1.147	0.200	-0.422	0.508
CTI	-0.698	0.000	-1.670	0.000	-0.756	0.028	0.152	0.538
Loan to asset	0.002	0.092	0.002	0.171	0.002	0.356	0.004	0.016
Size of deposit	-0.128	0.000	-0.238	0.000	-0.095	0.009	-0.071	0.030
Population density	0.004	0.000	-0.006	0.221	-0.018	0.248	-0.001	0.956
Number of banks per population	0.032	0.496	0.693	0.032	0.040	0.573	-0.153	0.087
GDP growth	-0.016	0.000	-0.016	0.000	-0.023	0.000	-0.025	0.000
Time trends	-0.183	0.000	-0.151	0.015	-0.219	0.000	-0.136	0.000
Constanta	3.417	0.000	3.079	0.004	3.967	0.000	2.641	0.000
R squared	0.052		0.097		0.044		0.049	
Number of obs	5,609		1,453		2,445		1,711	

This table present the result of OLS regressions for efficient-structure hypothesis model (similar to Berger, 1995). The dependent variables are the difference between 1-month CBI rate and time deposit rates. CR3 is the concentration ratio of top three banks time deposits; MS is the market share of time deposits in each provinces; CTI is the cost to income ratio; Loan to assets ratio is to describe banks' risk. ; Size is the log of bank time deposits; Population density is the number of populations over each km-square provincial areas (1000/sq km). Number of banks per population is the ratio number of banks per 100,000 population. GDP growth denotes the growth of the provincial gross domestic product and Time trend.

Table 3.13b
Regression result of efficient-structure hypothesis (Demand deposits)

	Demand deposits							
	Dep. Variable: The difference between 1 month CBI rate and demand deposit rates							
	All		Metropolitan		Java and Sumatra		The Periphery	
	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*
CR3	-0.110	0.000	0.509	0.000	-0.065	0.078	-0.359	0.000
MS	-0.245	0.561	3.690	0.042	-0.413	0.529	-0.385	0.542
CTI	1.636	0.000	1.237	0.042	2.396	0.000	1.806	0.000
Loan to asset	0.015	0.000	0.012	0.000	0.024	0.000	0.021	0.000
Size of deposit	-0.051	0.020	-0.122	0.004	-0.006	0.859	-0.087	0.057
Population density	0.001	0.316	-0.042	0.000	-0.019	0.324	-0.132	0.001
Number of banks per population	0.206	0.001	2.809	0.000	0.202	0.016	0.114	0.439
GDP growth	-0.025	0.000	-0.022	0.000	-0.028	0.000	-0.051	0.000
Time trends	-0.413	0.000	-0.271	0.000	-0.511	0.000	-0.380	0.000
Constanta	8.900	0.000	3.156	0.006	8.087	0.000	10.955	0.000
R squared	0.104		0.116		0.112		0.149	
Number of obs	5,377		1,419		2,329		1,629	

This table present the result of OLS regressions for efficient-structure hypothesis model (similar to Berger, 1995). The dependent variables are the difference between 1-month CBI rate and demand deposit rates. CR3 is the concentration ratio of top three banks demand deposits; MS is the market share of demand deposits in each provinces; CTI is the cost to income ratio; Loan to assets ratio is to describe banks' risk. ; Size is the log of bank demand deposits; Population density is the number of populations over each km-square provincial areas (1000/sq km). Number of banks per population is the ratio number of banks per 100,000 population. GDP growth denotes the growth of the provincial gross domestic product and Time trend.

Table 3.13c
Regression result of efficient-structure hypothesis (Saving accounts)

	Saving accounts							
	Dep. Variable: The difference between 1 month CBI rate and saving account rates							
	All		Metropolitan		Java and Sumatra		The Periphery	
	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*
CR3	-0.076	0.044	0.686	0.009	-0.288	0.000	0.119	0.046
MS	1.332	0.038	2.353	0.194	2.604	0.021	-0.921	0.342
CTI	0.591	0.012	0.932	0.098	0.766	0.048	0.956	0.009
Loan to asset	0.008	0.000	0.003	0.132	0.014	0.000	0.012	0.000
Size of deposit	0.002	0.929	-0.055	0.127	-0.015	0.692	0.104	0.034
Population density	0.005	0.000	-0.003	0.610	0.030	0.079	-0.015	0.662
Number of banks per population	0.011	0.848	-0.127	0.755	0.039	0.646	0.219	0.109
GDP growth	-0.017	0.000	-0.017	0.000	-0.025	0.000	-0.026	0.001
Time trends	-0.001	0.955	0.029	0.464	-0.107	0.003	0.031	0.387
Constanta	5.077	0.000	2.486	0.059	6.198	0.000	2.585	0.000
R squared	0.026		0.037		0.039		0.046	
Number of obs	5405		1317		2383		1705	

This table present the result of OLS regressions for efficient-structure hypothesis model (similar to Berger, 1995). The dependent variables are the difference between 1-month CBI rate and saving accounts rates. CR3 is the concentration ratio of top three banks saving accounts; MS is the market share of saving accounts in each provinces; CTI is the cost to income ratio; Loan to assets ratio is to describe banks' risk. ; Size is the log of bank saving account; Population density is the number of populations over each km-square provincial areas (1000/sq km). Number of banks per population is the ratio number of banks per 100,000 population. GDP growth denotes the growth of the provincial gross domestic product and Time trend.

The coefficient of CR3 continues to vary widely. It is positive and statistically significant in three cases: metropolitan area demand deposits and saving accounts, and saving accounts in the periphery). It is also negative and statistically significant in those market groupings (Java and Sumatra in all forms of deposits and the periphery is demand deposits). Thus there is support for efficient-structure hypothesis for time deposit markets in metropolitan and Java and Sumatra.

The coefficient for market share is mostly positive and insignificant except for demand deposits in metropolitan and saving accounts in Java and Sumatra. The coefficients for market share are mostly insignificant. This would seem to be evidence in favor of the existence of efficient-structure hypothesis. Taken as such, these results may suggest that there is evidence of some market power on the Indonesian provincial banking markets.

Loan to asset ratio that represents risk carries expected, positive and significant coefficients in time deposit market in the periphery, all groups in demand deposit markets and in Java and Sumatra and the periphery for saving accounts.

The variable represents the size of the deposit market is mostly negative and significant. The strongest result is in time deposits markets in metropolitan and Java and Sumatra. The only insignificant results are for saving accounts in metropolitan and Java and Sumatra.

The coefficients of the population density are only significant and have negative sign in demand deposit market in metropolitan and the periphery. This may suggest that in that area, where there are many banks population density tends to increase bank competition and narrow interest rate spreads and revenue.

The coefficients on the number of banks per population variable are mainly insignificant. The only negative and significant results are in demand deposits markets in metropolitan and the periphery's areas.

The coefficients of the growth of provincial gross domestic products are negative and highly significant for all products and in all provincial areas. This suggests that the increase of economic activity in the provincial area is associated with less demand for deposits and have a lower rate of return.

Finally, the time trend has the expected negative significant coefficients for most types of deposits in various markets. The revenue of banks has been decreasing as a result of increased competition over the years.

Table 3.14
Tests for efficient-structure hypothesis

	Model 1						Model 2					
	Dependent variable: Concentration Ratios						Dependent variable: Market shares					
	Time deposits		Demand deposits		Saving account		Time deposits		Demand deposits		Saving account	
	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*
Cost to income	0.486	0.000	0.563	0.001	0.437	0.000	0.071	0.000	0.080	0.000	0.061	0.000
Loan to asset ratio	0.003	0.000	0.008	0.000	0.001	0.008	0.000	0.043	0.000	0.744	0.000	0.000
Deposits	-0.060	0.000	-0.103	0.000	-0.032	0.000	0.012	0.000	0.025	0.000	0.018	0.000
Population density	-0.004	0.000	0.001	0.129	0.012	0.000	0.000	0.000	-0.001	0.000	0.000	0.001
Banks per population	0.278	0.000	0.290	0.000	-0.093	0.000	0.002	0.140	0.004	0.094	0.002	0.140
GDP growth	-0.024	0.000	-0.035	0.000	-0.013	0.000	-0.001	0.000	0.000	0.404	-0.001	0.000
Time trend	-0.297	0.000	0.161	0.000	-0.090	0.000	0.000	0.270	-0.001	0.100	0.000	0.239
Constant	6.331	0.000	5.179	0.000	6.196	0.000	-0.024	0.000	-0.131	0.000	-0.094	0.000
R-squared	0.42		0.20		0.14		0.28		0.28		0.40	
Number of obs	5,377		5,377		5,405		5,377		5,377		5,405	

This table presents the results of tests on efficient-structure hypothesis based on equation 3.3 and 3.4. In Model 1, Depedent variable is Concentration ratio. We use CR3 based on deposits. While in Model 2, the dependent variable is market shares. Banks per population is the number of banks in the provinces divided by 100,000 numbers of population. Population density is the number of population divided by area (1000/sq km). GDP growth is the provincial GDP growth annually.

To test whether the efficient-structure hypothesis is held we estimate equation 3.3 and 3.4. In table 3.14, we present the results that the relationship between cost to income ratio with CR3 and market share are positive.

3.6.1.3. Dynamic Panzar and Rosse

Although most previous studies generally employ OLS estimation methodology, this paper applies panel data regression methodology using the

Generalized Method of Moments (GMM)[3] estimator, to allow for departing from assumed product market equilibrium conditions. Table 3.15 presents the results based on different groups of provinces.

Table 3.15
Panzar and Rosse estimation's results using GMM estimator

Variables	All		Metropolitan Area		Java & Sumatra		The Periphery	
	Dependent Variable: Total revenue							
	Coefficient	*P-value*	Coefficient	*P-value*	Coefficient	*P-value*	Coefficient	*P-value*
	(1)		(2)		(3)		(4)	
Lagged total revenue	-0.022	0.000	-0.319	0.000	0.012	0.000	-0.006	0.848
Fixed asset cost	0.050	0.000	0.107	0.002	0.100	0.000	0.030	0.000
Labor cost	0.304	0.000	0.184	0.007	0.180	0.000	0.218	0.000
Wholesale funding cost	0.102	0.000	0.113	0.120	0.336	0.003	0.274	0.042
Total Deposit	0.695	0.000	0.429	0.000	0.706	0.000	0.892	0.000
Time	0.124	0.000	-0.213	0.000	0.155	0.000	-0.019	0.719
Number of obs	4,366		323		1,111		1,172	
Number of banks	132		54		55		41	
H-stat	**0.45**		**0.31**		**0.62**		**0.52**	
F-statistics for H=0	7379.6	0.000	11.91	0.000	31.02	0.000	10.15	0.000
F-statistics for H=1	11430.3	0.000	61.09	0.000	11.27	0.000	8.75	0.000
AR(2) *p-value*	0.655		0.664		0.753		0.542	
Sargan -Hansen, *p-value*	1.0		1.0		1.0		1.0	

This table shows the result of Panzar-Rosse (1987) using Two steps Generalized Method of Moment (Arellano Bond, 1991) with robust standard errors. The dependent variable is total revenue. The set of explanatory variables are fixed asset cost, labor cost, wholesale funding cost, bank's deposit market. All variables are in logarithmic value. AR(2) is the p-value for the test for 2nd-order autocorrelation in the residuals. Sargan is the p-value for the Sargan test for the validity of the over-identifying restrictions. Hansen J the p-value for the Hansen test for the validity of the over-identifying restrictions. Metropolitan area is Jakarta, Banten and West Java that is most populated and active banking market. Java and Sumatra is provinces in Java and Sumatra islands excluding Jakarta, Banten and West Java. The Periphery is other provinces that are less populated and less active banking markets (See section 3.2 for further details).

The estimation results for the total revenue equation using GMM estimation is based on equation (3.2). Using a significant level of 5%, we are able to reject H_0:H=1 in favour of H_1:H<1 or the perfectly competitive banking market for Indonesia over the sample period using the model for metropolitan, Java and Sumatra and the periphery (at 5% level of significance). We also can reject H_0:H=0 using the two-step model. Therefore, based on the GMM estimator using total income as the dependent variable, the Panzar-Rosse H-statistic for

[3] Other estimation using Fixed Effect Model confirm the good fit of the models. The estimated regression equations explain 86%-93% in the total revenue equation and 5-7% of the variability in the ROA equation. H-statistics in the competitive equation for Java and Sumatra (0.47) is larger than The Periphery (0.39). It is also consistent with the study by Claessens and Laeven (2004) on Indonesia and studies on other developing countries that find H-statistics between zero and one and monopolistic competition (Perera et al., 2006,).

the two-step model suggests that the Indonesian banking market as a whole was characterised by monopolistic competition or collusive oligopoly between 2001 and 2008.

The estimated H-statistic lies between zero and one for all groups. H-statistics for all is 0.45. For Metropolitan area, Java and Sumatra and the Periphery, the H-statistics are 0.31, 0.62 and 0.52, respectively. The H statistics suggest that the provincial banking markets were in monopolistic competition. The relatively low values for H-statistics indicate relatively high market power.

There are some differences between the estimation results for the Metropolitan Area, Java and Sumatra and the Periphery provinces. The mean estimated H-statistic is higher for the Java and Sumatra followed by Metropolitan Area and the Periphery. Although monopolistic competition or this is could also be a "collusive oligopoly" appears to be the predominant model in most cases, competitive conditions in the banking sectors of Java and Sumatra lean higher than do those of Metropolitan area and the Periphery provinces.

The estimation results reported in table 3.14 follow a similar pattern to those reported by Claessens and Laeven (2004) who find that the estimated average of H-statistic for the emerging market in their study is 0.67. This attributes to the existence of entry barriers, regulatory restriction and legal impediments

In general the models explain the relationship between input prices and total revenue. Moreover, the regressions specifications fit well and pass diagnostic tests against auto correlation which is applied to the differenced residuals and over identifying instruments at the 5% level of significance. Autocorrelation indicates that the lags of the dependent variable and any other variables used as instruments are strictly exogenous and thus good instruments. In addition to, the results from over-identifying restrictions test find that the instruments, as a group, are appearing exogenous. The Sargan-Hansen J statistic, which is the minimized value of the two-step GMM criterion function, is also robust.

3.6.2. Robustness Checks

To test the robustness of the base results, we re-run regressions for both dynamic Panzar and Rosse model and the efficient-structure hypothesis model.

3.6.2.1. Dynamic Panzar and Rosse

These checks are conducted further to investigate the accuracy of the model and its main empirical result. One concern is to modify our estimation method to quantify the degree of market power in the banking industry by considering other variables in the demand function, as shown in model: (1) population density, since both of them may influence the demand for banking services and (2) the ratio of number of banks per 100, 000 populations. Using this alternative specification does not alter our findings.

Second, to investigate estimation biases, we consider whether there is structural breaks that may influence the results. For this purpose, we use a set of time dummy variables from 2001-08 to check whether there are significant structural break during the period. We employ total revenue as the dependent variable. The results are consistent with the results reported for the combined sample (see table 3.15). The input prices parameters are positive and significant. The time dummies are also significant (see column 2).

Third, to consider the accuracy of the model using alternative dependent variable, the total revenue is changed with total operating income. The result is presented in column 3. Using this specification, our main findings are not altered.

Finally, Model 4 and 5 are the reduced sample based on the implementation of Indonesian Banking Architecture in 2004. A Chow test for parameter stability confirms the suggestion that the banking market has undergone a structural change. In the reduced sample, the results are also consistent with the baseline model. Most of the prices in Model 4 are relatively higher compared to the preferred model. The prices are still positive and significant except for fixed

assets and securities. This is probably because the banks had more investment in the physical capital during 2000-2004. The securities variable is insignificant is because the decrease of securities holdings from 2000 to 2009 (See table 2.5) had caused lower prices to analyse and administer the securities.

The results of robustness checks support the PR model. All coefficients in the models are positive and significant as the baseline model except wholesale funding coefficient in model 2 and model 3. The additional variables are also significant in affecting bank's revenue. Banks that operate in denser area have lower total revenue by 0.6%. However, the increased number of banks will raise banks' revenue by 0.4%.

Table 3.16
The result of robustness checks (Dynamic PR)

	All sample						Sub sample: 2001-04		Sub sample: 2005-08	
	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Variables	Dep Variable: Total revenue				Dep Variable: Total interest		Dep. Var: Total revenue		Dep. Var: Total revenu	
	Coefficient	*P-value*	Coefficient	*P-value*	Coefficient	*P-value*	Coefficient	*P-value*	Coefficient	*P-value*
Lagged total revenue	-0.022	0.000	-0.024	0.000	-0.098	0.000	0.030	0.000	-0.069	0.000
Fixed asset cost	0.048	0.000	0.051	0.000	0.136	0.000	0.074	0.000	0.013	0.000
Labor cost	0.307	0.000	0.286	0.000	0.476	0.000	0.621	0.000	0.289	0.000
Wholesale funding cost	0.079	0.000	-2.650	0.000	-0.141	0.000	0.278	0.000	0.181	0.000
Total Deposit	0.694	0.000	0.706	0.000	0.562	0.000	0.777	0.000	0.624	0.000
Time	0.127	0.000			0.030	0.000	0.333	0.000	0.081	0.000
Population density	-0.006	0.000								
Number of banks per population	0.004	0.000								
Year 2002			-1.701	0.000						
Year 2003			-2.073	0.000						
Year 2004			-1.075	0.000						
Year 2005			0.475	0.000						
Year 2006			-1.625	0.000						
Year 2007			-1.305	0.000						
Number of obs	4,354		4,366		4,359		1573		2566	
Number of banks	132		132		132		128		129	
Chow stability test χ^2 (9)							120,000	0.000		
AR(2) *p-value*	0.691		0.633		0.364		0.142		0.303	
Sargan -Hansen, *p-value*	1.0		1.0		1.0		1.0		1.0	

This table shows the result of Panzar-Rosse (1987) using two-\steps Generalized Method of Moment (Arellano Bond, 1991) with robust standard errors. The dependent variable in Model 1 and 2 is total revenue. While in Model 3, the dependent variable is total interest income. The set of explanatory variables are fixed asset cost, labor cost, wholesale funding cost, bank's deposit market, time dummies, population density and number of banks per 100,000 population. Model 4 and 5 are reduced sample estimations. The cut off period is in 2004 when Indonesian banking architecture was launched. The cut off date is AR(2) is the p-value for the test for 2nd-order autocorrelation in the residuals. Sargan-Hansen test for the validity of the over-identifying restrictions. We use Chow stability test for panel data in model 4 and 5.

3.6.2.2. Efficiency-structure hypothesis

Table 3.17
The result of robustness checks for ES

	Model 1: Cost efficiency						Model 2: Herfindahl-Hirschmann Index					
	Time deposits		Demand deposits		Saving accounts		Time deposits		Demand deposits		Saving accounts	
	Dep. Var: The difference between CBI rate and deposit rates						Dep. Var; The difference between CBI rate and deposit rates					
	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*	Coef.	*p-value*
Concentration indicator	-0.020	0.516	-0.099	0.000	-0.077	0.049	-0.107	0.048	-0.176	0.000	-0.072	0.412
MS	0.176	0.791	-0.384	0.373	0.789	0.265	1.062	0.033	-0.181	0.668	1.129	0.080
Efficiency indicator	3.178	0.000	1.534	0.000	2.411	0.000	-0.702	0.000	1.598	0.000	0.583	0.013
Loan to asset ratio	0.001	0.122	0.013	0.000	0.006	0.000	0.001	0.106	0.015	0.000	0.008	0.000
Size of deposits	-0.068	0.000	-0.082	0.000	-0.013	0.555	-0.125	0.000	-0.052	0.017	0.007	0.750
Population density	0.002	0.059	0.001	0.612	0.005	0.002	0.004	0.000	0.001	0.607	0.005	0.001
Number of banks per population	0.022	0.637	0.227	0.000	0.029	0.633	0.021	0.650	0.171	0.008	0.015	0.801
GDP growth	-0.015	0.000	-0.024	0.000	-0.018	0.000	-0.016	0.000	-0.026	0.000	-0.017	0.000
Time trend	-0.110	0.000	-0.364	0.000	0.054	0.013	-0.176	0.000	-0.418	0.000	0.004	0.842
Constanta	1.307	0.000	8.765	0.000	4.538	0.000	3.211	0.000	8.844	0.000	4.721	0.000
R-squared	0.071		0.100		0.031		0.052		0.105		0.026	
Number of obs	5,366		5,144		5,163		5,609		5,377		5,405	

This table presents the results of robustness checks using two different models. In Model 1, cost to income ratio is replaced with cost efficiency from estimation using SFA approach in Chapter 4. While in Model 2, the concentration indicator is changed from the Concentration Ratio of Top three banks to Herfindahl-Hirschmann Index. MS denotes market share. Size of deposit is the log of deposits. Population density is the number of population divided by area (1000/sq km).

The robustness checks are conducted by changing concentration and efficiency indicator. In the first model, we replace the cost to income ratio that is used in baseline model with cost efficiency (refer to Chapter 4). The cost efficiency is derived from a stochastic cost frontier as developed by Battese and Coelli (1995) which assumes that the error terms are distributed half-normal (for Berger, 1995). The result is relatively similar to the baseline model. The sign of the cost efficiency is different because costs to income ratio measures cost against income while cost efficiency is the efficiency of total assets i.e. an increase of efficiency lowers costs. The other control variables are comparable.

For the second set of robustness checks, the three-bank concentration ratio is changed with the Herfindahl-Hirschman Index (HHI) based on deposits. HHI is defined as the sum of the squared market shares of all banking organizations operating in an area. We calculated the HHI for provincial markets using branch deposits data collected from 20001-2008. The results also show consistent power with the reported results for the baseline model (see table 3.15). The concentration index parameter is negative and significant for time deposits and demand deposits. Other explanatory variables are also consistent.

3.7. Conclusions

This chapter tests the structure-performance hypotheses for banks located in Indonesia's provincial markets. Two hypotheses are specified one is related to the traditional structure-conduct-performance (SCP) and the other is related to efficient-structure hypothesis (ES). We also estimate Panzar and Rosse model to infer the characteristics of provincial markets. Using Indonesian data from, a total of 5,966 observations across 33 Indonesian provincial areas were usable covering the period 2001-2008. The sample was also divided between banks located in Indonesia's provincial areas metropolitan, Java and Sumatra and the periphery.

As has been the case for most previous structure-performance studies, the results using the SCP specification are not very robust. This study does not support SCP hypothesis and find supports for the ES hypothesis for the banks located in the provincial markets. This finding is also consistent to other studies that have examined the structure-performance relationship for emerging markets. Both Mohieldin (2000) and Perera (2007) find evidence that there is no significance relationship between market structure and bank's performance in Egypt and South Asia respectively.

When PR approach is used, as done in other studies, it reveals much evidence of imperfect competition in Indonesian provincial markets. The estimated values of H-statistics for the sample period 2001-2008 are positive ranging between 0.31 - 0.62 which is consistent with the study by Claessens and Laeven (2004). We find that the market in Java and Sumatra is more competitive than metropolitan and the periphery. H-statistic of metropolitan and the periphery are 0.31 and 0.52 respectively while Java and Sumatra is 0.62.

However, the weakness of PR modelling is that it does not tell us much about the sources of imperfect competition, what can be done to change matters. The estimation using ES hypothesis specification does not also reveal significant influence of the geography of Indonesia. There are only few significant results are found. Population density variable is negative and significant in demand deposit markets in metropolitan and the periphery. The other variable is the number of banks per population that is positive and significant in time deposit markets in metropolitan and demand deposit markets in metropolitan and Java and Sumatra.

Although there is a modest impact of the geography of Indonesia on the level of competition, the development that help overcome geographical barriers, e.g. new banking technologies may usefully promote competition in Indonesian deposit markets.

The evidence for the efficiency hypothesis suggests policy makers should not interfere with deposit and loan rate setting in the banking markets. Mergers should be encouraged if they improve relative efficiency, but discouraged if all they do is increase concentration and market power.

Appendix

Main characteristics of Indonesian bank deposits

	Demand deposit	Saving account	Time deposit
Minimum initial deposit	Rp1.000.000 (USD100).	Rp50.000(USD2)	Most banks apply: Rp5.000.000,-(USD500). Some large banks differentiate: Java Island resident Rp10.000.000,-(USD1000) and outside Java islands. Rp5.000.000,-(USD500).
Return	Small interest income called "current account service benefit" paid on credit balances maintained	Interest income is quoted at the discretion of individual banks.	Fixed deposit rates. The rates for fixed deposits for period exceeding 12 months are negotiable.
Withdrawal	At any time by means of a cheque, 'bilyet giro', other payment order, or by transfers	At any time by Debit Card functioning as ATM Card as long as there is amount in the account.	At the end of the fixed term. No interest will be paid on any one month fixed deposit which is uplifted before maturity.
Fee	Service fee of 0.5% per annum for average deposit balance of over Rp1.000.000 a month	Transfer fee Rp5000 (USD0.5) to other accounts in the same banks and Rp10.000 (USD1) in other banks and maintenance fee Rp20.000 (USD2)	No fee
Other feature		Large banks usually launch prize-drawing program with big prizes including luxurious cars and motorbikes etc.	

Chapter 4 Efficiency of Foreign Bank in Indonesia

4.1. Introduction

This chapter examines the efficiency of Indonesian banks in particular the impact of foreign ownership efficiency in Indonesian banking. The translog cost function model is estimated using stochastic frontier method developed by Battese and Coelli (1995) on data for the period from September 2000 from 2009.

The chapter is organized as follows: Section 4.1 provides the introduction. Section 4.2 reviews related literature. Section 3 presents the model that will be used in the estimation. Section 4 describes data. Section 5 presents empirical result and robustness checks. Section 6 concludes the research by providing some recommendations.

4.2. Literature Review

There are many studies on bank efficiency (See e.g. Berger and Humphrey (1997); Goddard et al. (2001); Fethi and Pasiousras (2010)). This section will review some of main articles in this field. It is divided into three sub-sections namely theory of efficiency, efficiency measurement methods, and empirical studies.

4.2.1. Theory of Production and Technical Efficiency

Efficiency can be viewed as consisting of two separate components: technical efficiency, which arises when, given the chosen inputs, output is maximized or minimizing inputs for a given set of outputs; and allocative efficiency, which arises from optimal input choices given prices and output.

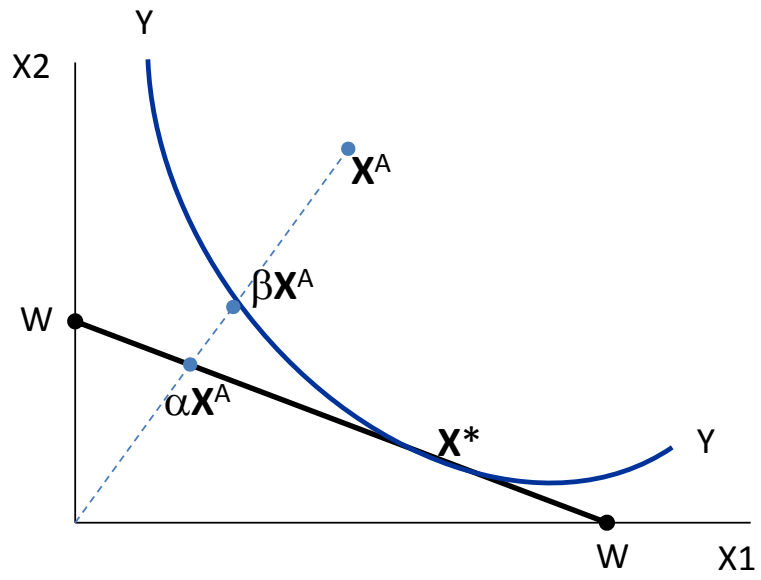
The literature on cost functions and the calculation of efficiency measures begins with Debreu (1951) and Farrell (1957). Farrell suggested that one could usefully analyze technical efficiency as deviations from an idealized frontier isoquant.

This approach leads naturally into an econometric approach in which the inefficiency is identified with disturbances in a regression model. Usually, technical efficiency is measured either as a ratio of observed to maximum potential outputs obtainable from the given inputs, or as a ratio of minimum potential to observed inputs required to produce the given outputs. Cost efficiency is obtained by comparing observed and optimum cost, profit, or any other economic goal, subject to the appropriate constraints on quantities and prices.

Figure 4.1 illustrates the meaning of economic efficiency. In a simple case of two inputs (X1, X2) and a single output (Q). The efficiency isoquant is labelled YY, which shows the minimum potential inputs required to produce the given output by assuming perfect divisibility. A price ratio is represented by the slope of the isocost line, WW. The technically and allocative efficient input point is X*, given output and the observed input price vector.

With the input vector XA normalized to length one, the Debreu-Farrell measure of technical efficiency would be β, but in economic terms, this measure clearly understates the degree of inefficiency. By scaling back both inputs by the proportion β, the producer could reach the isoquant and thus achieve technical efficiency, but by reallocating production more for input X1 and less of X2, the same output could be produced at even lower cost. Thus, producer A is both technically inefficient and allocative inefficient. The overall efficiency or economic efficiency of producer A is only α. Empirically decomposing overall inefficiency, $1 - \alpha$, into its components, technical inefficiency, $(1 - \beta)$, and allocative inefficiency, $(\beta - \alpha)$, is an ongoing issue in the empirical literature on efficiency estimation (Greene, 2008).

Figure 4.1 Technical and allocative efficiency with two factor inputs



Source: Greene (2008).

4.2.2. Review of Efficiency Measurement Methods

This sub section explains the use of stochastic frontier analysis, a parametric estimation technique. First it is useful to distinguish between non parametric and parametric approaches and the reason why we choose to adopt the parametric approach. (See Molyneux et al. (2006) and Lovell et al. (2008) for a comprehensive survey).

4.2.2.1. Non Parametric Approach

The most popular non parametric method is data envelopment analysis (DEA). DEA is a linear programming technique developed by Charnes, Cooper, and Rhodes (1978) and then developed by Banker et al. (1984). A related non parametric method is Free Disposal Hull approach (FDH) that was originally intended for use in the public sector and non-profit institutions where typical economic behavioral objectives such as cost minimization or profit maximization, may not apply.

A potential problem of self identifiers and near-self identifiers may arise when DEA is applied. Under the radial form of DEA, input and output mixes are held constant. This potential problem can be minimized by applying a cost based DEA approach. By applying this method, any input can be compared by combining input prices and quantities and comparing total costs, rather than having to compare firms in every input dimension as in the radial forms of DEA (Bauer et. al, 1998).

The Free Disposal Hull approach (FDH) is a special case of DEA, where, instead of convexity, free disposability of inputs and outputs is assumed. Because the FDH frontier is either congruent with or interior to the DEA frontier, FDH will typically generate larger estimates of average efficiency compared to DEA (Tulkens, 1993). Both approaches permit efficiency to vary over time and make no prior assumption regarding the form of the distribution of inefficiencies across observations (except that the best-practice firms are 100% efficient).

The main advantages of non parametric methods can be summarized: (1) they allow efficiency to vary over time; (2) they do not require explicit specification of a functional form and so impose very little structure on the shape of the efficient frontier. The main drawback of the non parametric method is that they usually do not permit for random error, errors that can arise due to measurement problems associated with inaccurate accounting data, good or bad luck which temporarily raises or lowers inputs or outputs, or specification error such as excluded inputs and outputs and imposing the piecewise linear shape on the frontier. If there is any random error in a bank that is not in the estimated frontier, it will be mistakenly included in that bank's measured efficiency.

4.2.2.2. Parametric Approach

Another widely used technique to measure efficiency is the parametric approach. There are three main parametric methods namely: stochastic frontier approach (SFA), distribution free approach (DFA) and thick frontier approach (TFA). The SFA developed by two main lines of research by Aigner, Lovell, and Schmidt (1977) and Meeusen and van den Broeck (1977), who proposed the stochastic frontier models that applied researchers now use to combine the underlying theoretical propositions with a practical econometric framework. SFA specifies a functional form for the cost relationship among inputs, outputs, and other factors, and allows for random error. In the SFA, the inefficiency and random error components of the composite error term are disentangled by making explicit assumption about their distributions.

The inefficiency term is assumed to follow an asymmetric distribution, usually the half normal, while the random error term is assumed to follow a symmetric distribution, usually the standard normal. The logic behind these assumptions is that the inefficiency cannot reduce costs, and so must be drawn from a truncated distribution, whereas random error can both increase and decrease costs, and so can be drawn from a symmetric distribution. Thus, the inefficiency results depend critically on the skewness of the data. Any inefficiency components that are more or less symmetrically distributed will be measured as random error and vice versa. Moreover, as in other econometric models both the inefficiency and the errors are assumed to be orthogonal to all of the independent variables specified in the estimating equation.

DFA was pioneered by Berger (1993). It requires panel data, and based on a translog system of cost and input cost equations to generate estimates of cost inefficiency for each producers in each time period. The approach assumes the efficiency differences are stable over time, while random error averages out over time.

A disadvantage of DFA is the requirement that cost efficiency is time invariant, and this assumption becomes less tenable as time increases. However, DFA also has two distinct virtues. First, being based on a sequence of time separate cross sectional regressions, it allows the structure of production technology to vary flexibly through time. Second, it does not impose a distributional assumption on the inefficiency term and it does not need to follow any of the specific distributions.

The Thick Frontier Approach (TFA) was introduced by Berger and Humphrey (1991). It also specifies a functional form and like DFA, does not impose distributional assumptions. However, it assumes that inefficiency differs between the highest and lowest performance quartiles and that random error exists within these quartiles. This approach has two disadvantages: (1) the measured inefficiency is sensitive to the assumptions about which fluctuations are random and which represents inefficiency differences. If inefficiency follow a thin-tailed distribution and tend to be small, while random error follows a thick-tailed distribution and tend to large, then TFA may mistake one for the other. (2) TFA gives an estimate of inefficiency differences between the highest and lowest quartile to indicate the general level of overall inefficiency, but does not provide exact point estimates on inefficiency for individual banks (Berger and Humphrey, 1997).

After comparing between non parametric and parametric, the conclusion is that the advantage of parametric methods is that they allow for random error. It makes the measurement or specification error less likely to be misidentified as inefficiency. Moreover, the methods will always rank the efficiencies of the banks in the same order as their cost function residuals, independent of the specific distributional assumptions imposed. Bank with lower costs for a given set of independent variables will always be ranked as more efficient because the conditional mean or mode of the inefficiency term is always increasing in the size of the residual. The disadvantage of this method is that they have to impose more structure on the shape of the frontier by specifying a particular

functional form. If the functional form is misspecified, measured efficiency may be confounded with the specification errors.

Estimating technical efficiency requires only input and output data, while measuring economic efficiency also requires price data. As a result DEA only focused on technical efficiency. On the other hand, all parametric techniques have examined economic efficiency. Among them, SFA is the most popular.

The studies by Bauer et al. (1998), Isik and Hassan (2002) compared estimates using both the non parametric and parametric approaches. The parametric approach was found to yield higher efficiency values than the non parametric approach. Another study by Resti (1997) found little difference between the techniques. This result is consistent with the difference between two methods i.e. the non parametric approach does not allow for a random error owing to luck, data problem, or other measurement errors, while the parametric approach does. Casu et al. (2004) compare productivity growth estimates obtained through parametric and non-parametric approaches. They find that the differences are not as large as in the efficiency studies. Their study does not yield noticeably different results in terms of identifying the components of the productivity growth of EU banks during the period. The studies by Bauer et. al (1993), Allen and Rai (1996), Berger and Mester (1997) and Clark and Siems (2002) compared estimates using two or more of the parametric approaches, but the result were mixed.

A comparison between DEA and SFA in banking has been offered by Ferrier and Lovell (1990), Eisenbeis et al. (1997), Resti (1997), and Huang and Wang (2002). The first three studies reported fairly close average efficiencies generated by the two approaches, while the latter suggests that the congruency between the results of the two methodologies is rather limited. Resti (1997) and Eisenbeis et al. (1997) found very high rank-order correlations between DEA and SFA, whereas Ferrier and Lovell (1990) found rank-order correlation of only 0.02 (not significantly different from zero). Also, Huang and Wang

(2002), using a panel of Taiwanese commercial banks, report that parametric and non-parametric methods are generally contradictory in ranking the sample banks based on their estimated efficiency scores. In contrast, Eisenbeis et al. (1997) found that while the calculated programming inefficiency scores derived from the DEA approach are two to three times larger than those estimated using a stochastic frontier, the correlation of the rankings of banks based on their efficiencies under the two methods is also relatively high. The inconclusive evidence of these studies clearly calls for additional research on this issue.

4.2.3. Review of Empirical Studies

This subsection present surveys and empirical studies in efficiency model. Berger (2007) surveyed 100 bank efficiency studies. Most of the studies on banking efficiency focus on the banks of developed economies. More recently some efficiency studies have been conducted for developing economies (e.g. Lensik et al. 2007).

Table 4.1 summarizes the results of studies from both the developing countries and from the developed countries.

There have been many studies examined the impact of bank ownership on efficiency in emerging markets. However, the results of the empirical studies have been mixed. Nikiel and Opiela (2002), Weill (2003), Fries and Taci (2005) reported that foreign owned banks have higher efficiency than domestic banks in the emerging markets or in cross countries studies.

On the other hand, Green et al. (2002) and Lensik et al. (2007) indicated that the domestic banks are more efficient than foreign banks. They also argue that the negative relationship between foreign ownership and less efficient are less pronounced in the countries with good corporate governance. In addition, Chatapong (2005) found that foreign and domestic banks have similar unit cost of production although operating in different focused area.

Table 4. 1
Summary of foreign bank studies on efficiency

Authors	Country/Period/Obs.	Techniques	Efficiency	Results (%)	Empirical findings
Nikiel and Opiela (2002)	Poland 1997–2000; 301.	SFA	Cost efficiency	Foreign bank: 69.95 Domestic bank: 55.41	Foreign banks are more cost efficient and less profit efficient than other bank
Unite and Sullivan (2003)	Philippines; 1990-1998; 350.	Random Effects Model			Foreign competition compels domestic banks to be more efficient and to become less dependent on relationship-based banking practices.
Weill (2003)	Czech Republic and Poland; 1997; 47 banks.	SUR	Cost efficiency	Foreign bank: 70.4 Domestic bank: 62	Foreign banks are more cost efficient than domestic banks. This advantage does not result from differences in the scale of operations or the structure of activities
Green et al. (2004)	9 CEE; 1995–1999; 1365.	SUR	Economic of scale/scope		Foreign banks are not more efficient than domestic banks. Little evidence of foreign ownership does not significantly reducing banks costs
Bonin et al. (2005)	11 European transition nations, 1996–2000; 435.	SFA	Technical inefficiency	Mean efficiency: 78.6	Foreign-owned banks (branch) are more cost efficient than domestic banks.
Chantapong (2005)	Thailand; 1995-2003 (yearly data); 23 banks.		Cost efficiency	Foreign bank: 17.69 Domestic bank: 12.29	Domestic banks' cost efficiency has improved after foreign acquisition.
Fries and Taci (2005)	15 European transition nations 1994–2001; 1897	SFA	Cost efficiency	Privatised foreign: 79 Privatised domestic: 76.3	Privatised banks with majority foreign ownership are the most efficient and those with domestic ownership are the least
Khumbakar and Wang (2005)	China; 1993-2002	SFA	Technical efficiency	Joint equity banks: 0.90 Wholly state owned banks: 0.47	Joint-equity banks are more efficient than wholly state-owned banks. Both banks are found to be operating slightly below their optimal size
Fu and Heffernan (2007)	China; 1985-2002 (yearly)	SFA	X-efficiency	mean scale inefficiency for the whole sample period is 0.068	X-efficiency declined significantly and the joint stock banks became relatively more X-efficient than domestic banks.
Lensink et.al. (2007)	105 countries; 1998-2003; 7804.	SFA	Cost efficiency		Foreign ownership negatively affects bank efficiency. However in countries with good governance this negative effect is less pronounced.
Tahir etal. (2010)	Malaysia, 2000-2006; 147	SFA	Cost efficiency	Foreign bank: 75.5% Domestic bank: 88.2%	Foreign bank is more cost efficient than domestic bank

Of the studies that have investigated the relationship between efficiency and ownership of banks, some have focused on comparing the differences between foreign-owned banks and domestic-owned banks. There are several possible efficiency disadvantages for foreign-owned banks relative to domestically owned institutions. Foreign-owned banks are sometimes located at significant distances from their organization headquarters, which may be associated with organizational diseconomies to operating or monitoring from a distance. Other possible efficiency disadvantages for foreign-owned banks are differences in the economic environment of the nation of operations from those in the headquarters nation of the foreign-owned bank. Differences in language, culture, currency, and regulatory/supervisory structures, and so forth may increase the costs of management, impede the flow of information, or reduce efficiency in other ways. According to Berger (2007) the efficiency advantages of foreign owned banks relative to domestically owned banks may tend to outweigh the disadvantages on average in many nations.

Chen, Skully, and Brown (2005) find that in China, the big four banks (the Agricultural Bank of China, the Bank of China, the China Construction Bank and the Industrial and Commercial Bank of China) outperformed medium-sized joint-stock banks in terms of cost efficiency. While, Khumbakar and Wang (2005) and Fu and Heffernan (2007) find that the four banks are less cost efficient than the joint-stock bank during the period. Unite and Sullivan (2003) report that foreign banks in the Philippines generated cost efficiency gains but did not produce significant economic benefits.

There are two possible explanations for the differences in efficiency between domestic and foreign banks. One is the multinational presence will allow the foreign banks to serve corporate customers in multiple nations and can still serve domestic customers since they have established the local relationship in the banks. Second, foreign owned banks from developed nations may also have comparative advantages in the use of managerial expertise and experience, access to capital, market power over suppliers etc.

4.3. Data and Methodology

The estimation of bank efficiency implies the explicit definition and measurement of banks' inputs and outputs. Two main approaches are generally used to measure the flow of services provided by banks. Under the production approach banks are treated as firms that employ capital and labour to produce different types of deposit and loan accounts. Thus, their outputs are measured by the number of deposits and loan accounts or by the number of transactions performed on each type of product, whereas total costs are the operating costs used to produce these products. In the intermediation approach, banks are considered as an intermediary between depositors and borrowers, rather than producers of loan and deposit account services. As a result, the values of loans and other assets are defined as bank outputs, while liabilities (deposits, capital and labour) are inputs to the production process. It follows that operating costs and financial expenses (interest on deposits) are the relevant components of total costs. Following Humphrey and Berger (1997), the intermediation approach is adopted in this study.

4.3.1. Data

This study uses quarterly data from September 2000 to 2009 taken from banks' financial statements collected by Bank Indonesia. These data are better than publicly available data because the data have been reviewed by Bank Indonesia, the banking supervisor.[4]

[4] Regulatory data has not been widely used in foreign banks studies. A few studies in the US and Thailand employed annual regulatory data. DeYoung and Nolle (1996) and Chang et al. (1998) use Call Report to study the efficiency of banks in the US. Researchers conducted by Leightner and Lovell (1998) and Chantapong (2005) employing annual aggregate data from the Bank of Thailand and the Stock Exchange of Thailand. This study will be the first using quarterly data from the Bank of Indonesia, the bank's supervisory agency.

In this study, we use domestic banks[5] and joint venture bank's data. We exclude foreign branch banks, three banks that only have one observation and other bank because it is more a trade financing company than a bank.[6] 502 observations (i.e. 12.3%) have been removed from the matched data set to obtain a clean data set for further analysis. Of 502 observations, 205 (5%) is due to error and 297 (7.3%) is foreign branches data that we exclude from the analysis. The cleaned data set is 4,308 observations over the period 2000-2009 based on information of about 119 numbers of banks (92%) in Indonesia.

Table 4.2 Variables used in cost efficiency estimations

Variables	Description	No of observations	Mean	Standard deviation	Min	1st Quartile	2nd Quartile	3rd Quartile	Max
Dependent Variables									
Total costs	Operating and financial cost	4,308	11.46	1.88	6.43	10.17	11.26	12.55	17.62
Input prices (%):									
The price of labor (w1)	Total personnel expenses/total assets	4,308	9.56	1.75	5.05	8.35	9.30	10.55	15.53
The price of physical capital (w2)	Total depreciation and other capital expenses/total fixed assets	4,308	8.03	1.83	1.54	6.77	7.79	9.02	13.75
The price of deposit (w3)	Total interest expenses/total funds(time deposits, demand deposits and saving accounts)	4,308	10.66	1.91	3.90	9.39	10.49	11.77	16.87
Output Quantities (%):									
Total Loans (y1)	The value of aggregate loans/total assets	4,308	51.56	19.57	0.00	37.28	53.10	67.39	99.71
Total Securities (y2)	The value of aggregate securities(short term securities and bonds)/total assets	4,308	7.76	12.04	1.00	1.00	1.50	9.34	78.89
Control variables (%):									
Non-performing loan ratio	The value of aggregate non performing loans/total loans	4,308	5.78	8.52	0.01	1.55	3.11	5.84	91.14
Equity capital ratio	The value of the total aggregate equities/total assets	4,308	13.92	10.81	-1.99	7.90	11.16	16.35	93.33

The table presents the summary statistics of basic variables used in the cost efficiency estimation. In the translog-based estimations of cost efficiency, the dependent variable is total costs. Output variables considered are total loans, and total securities. The input price variables are: price of labor, the price of physical capital, and the price of deposits. The output are normalised by total assets. Control variables are non performing loan ratio and equity capital ratio. All financial values are inflation-adjusted to the base year 2000. Source: Bank Indonesia. Various years. Unpublished.

Table 4.2 gives definitions of all variables specified in the cost function as well as their sample means and standard deviations. The variable input prices (w_1, w_2 and w_3) include the price of labour, the price of physical capital and the price of deposit. Expenditures on these inputs comprise the vast majority of all banking costs. The variable outputs, y, include total loan and total securities.

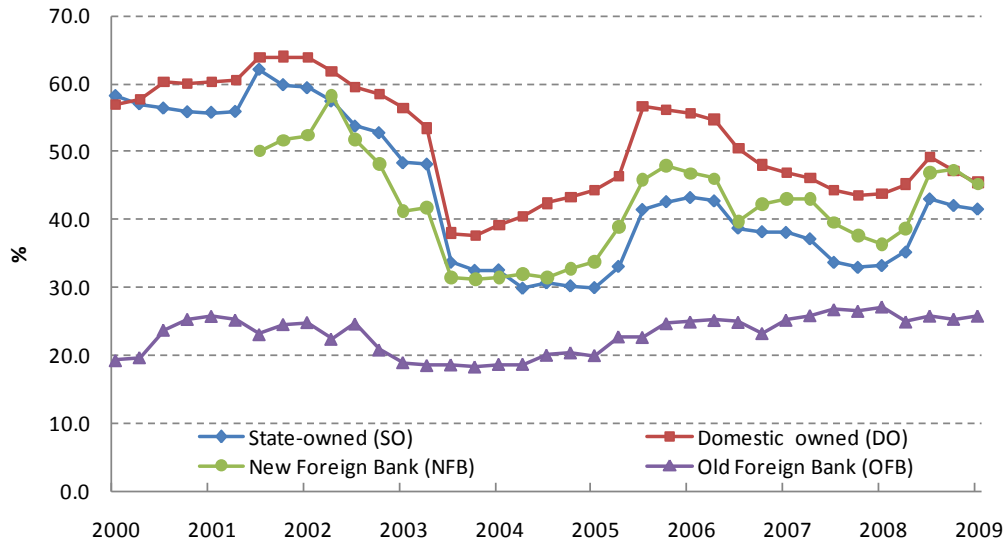
[5] The definition of domestic banks includes banks that are owned 100% by the government of Indonesia, Indonesian citizen or company based on Indonesian legal entity. This also includes banks owned by the local government which are operating in 27 provinces in Indonesia. Now, there are 31 state-owned banks including 26 regional-government-owned banks. While, the foreign bank subsidiaries are the banks owned minimum 51% by foreign investor in cooperation with Indonesian partner. This is including joint stock banks formed before the Asian crisis.

[6] This bank receives fund from the government and provides trade loan for international trade businesses. The distinct asset and liability structure creates incomparable data with other commercial banks.

The reason of including the total securities is that after the crises, holding of securities especially government bond and Bank Indonesia certificate (like T-bills in the US) significantly increased.

The next figures compare average cost, profitability and risk of four groups of banks: state owned banks, private domestic owned banks, old foreign owned banks and new foreign banks. Old foreign banks are banks majority owned by foreigners that were established before the crisis. While the new foreign banks are the banks majority owned by foreign owners and were established after the crisis and as a result of foreign acquisitions.

Figure 4.2
Cost to income ratio



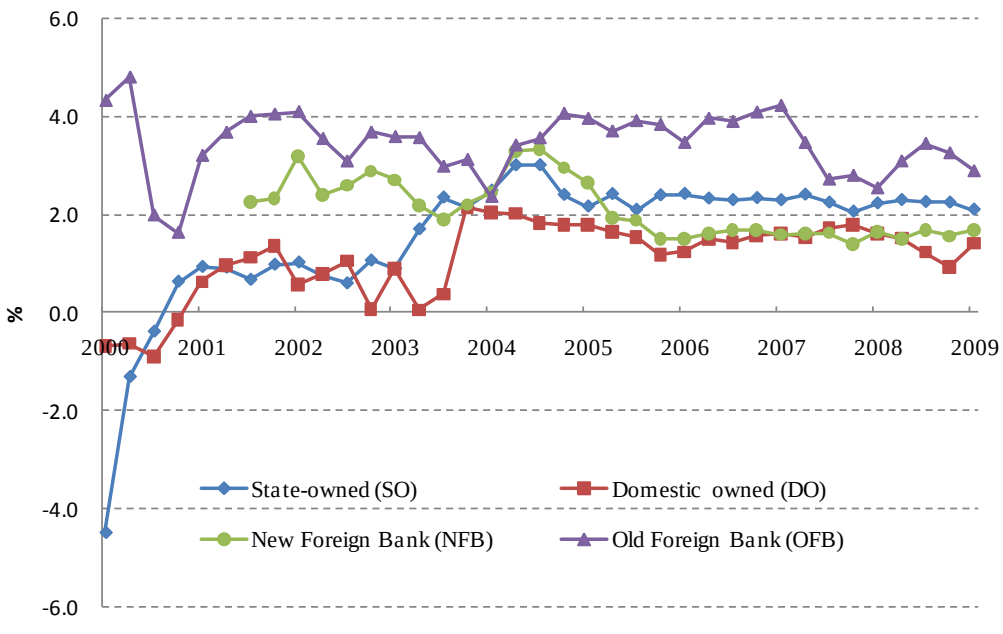
The figure shows cost to income ratio of different type of banks. Cost to income ratio is defined as operating expenses to operating income. Operating expenses are cost of deposits. Operating income are including loan revenue, and securities investment revenues. State-owned banks (SO) refer to banks wholly owned by the Government of Indonesia, Domestic owned banks (DO) refer to the bank whose private domestic ownership is greater than 50% of total ownership, New foreign banks (NFB) refer to new acquired banks (after 2000) by foreign owners and they hold more than 50% of total ownership, Old foreign banks (OFB) refer to bank whose foreign ownership is greater than 50% and established or acquired by foreign investor before 2000. Source: Bank Indonesia. Various years. Indonesian banking statistics.

Figure 4.2 shows that the cost to income ratio of most of banks (except old foreign banks) follows the movement of market interest rates. In general the interest rates have a decreasing trend. The increased interest rates at the end of 2003 and 2005 were due to increase in global and domestic oil prices. It was negatively impact on banks' costs.

During the period, domestic private owned banks have the highest cost to income ratio compared to other types of banks. Its average from September 2009 to September 2009 was 51.4%. However, at the beginning of period, the highest cost to income ratio was state-owned bank with 58.2%. While at the end of September 2009, the lowest cost to income ratio was old foreign banks with 25.8%.

The relatively stable costs to income ratio of old foreign banks are because they have different business models. Those banks were established to conduct correspondent banking especially serving corporate clients for international trading. This makes those banks relatively small and has mean by the cost to income ratio efficient compared to other type of banks.

Figure 4.3
Return on Asset

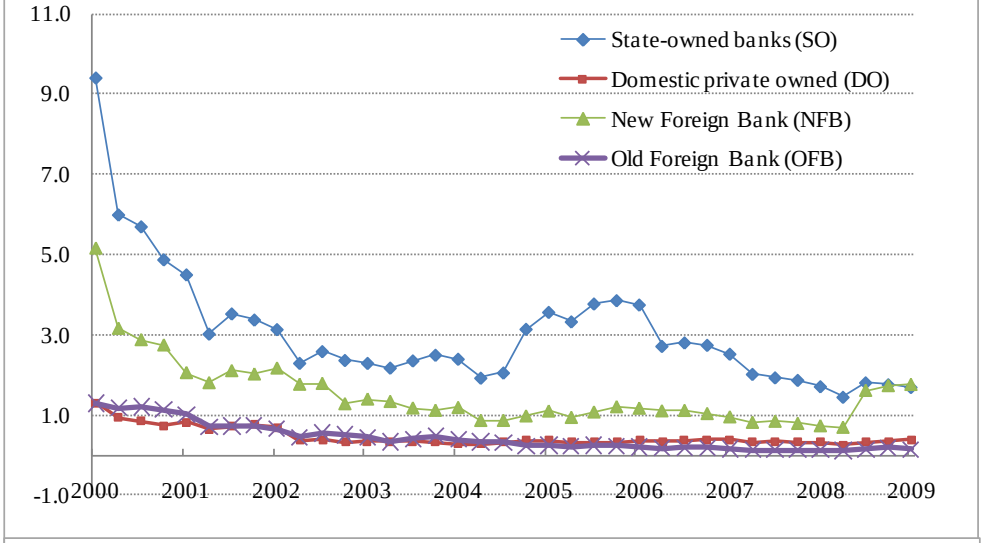


The figure shows Return on Asset ratio of different type of banks. State-owned banks (SO) refer to banks wholly owned by the Government of Indonesia, Domestic owned banks (DO) refer to the banks whose private domestic ownership is greater than 50% of total ownership, New foreign banks (NFB) refer to new acquired banks (after 2000) by foreign owners and they hold more than 50% of total ownership, Old foreign banks refer to banks whose foreign ownership is greater than 50% and established or acquired by foreign investors before 2000. Source: Bank Indonesia. Various years. Indonesian banking statistics.

The profitability ratio, proxied by return on assets (ROA), of banks in Indonesia has been relatively stable over the period in the range of 1-3%. The fluctuations are influenced by the movement of interest rates.

State-owned banks and domestic owned banks have negative ROA immediately after the Indonesian financial crisis in 1997-1998. State-owned banks were affected severely by the default of their corporate loans debtors especially those had unhedged foreign exchange exposures.

Figure 4.4
Non-performing loan ratio



The figure shows non performing loan ratio of different type of banks. Non -performing loan ratio is defined as total non performing loan to total loans. Domestic owned bank refers to the bank whose private domestic ownership is greater than 50% of total ownership, New foreign bank refers to new acquired banks (after Year 2000) by foreign owner and the foreign owner holds more than 50% of total ownership, Old foreign bank refers to bank whose foreign ownership is greater than 50% and established or acquired by foreign investor before Year 2000. Source: Bank Indonesia. Various years. Indonesian banking statistics.

Asset quality condition has been improving. The most improved banks are the old foreign banks mainly because of loans of Japanese banks operating in Indonesia. After series of bank's closures and merger, non performing loan was decreased. In 2008, the NPL ratio of the old foreign banks was 2.3% which was better than domestic banks at 3.8%.

Other banks that still have problem with NPL are state owned banks. The NPL has climbed back up again since 2005. The bank has restructured and written off some loans that caused its banks revenue decreases. Meanwhile the asset quality of new foreign bank was initially the lowest and after acquisition has slightly increased.

Some of the newly acquired banks namely Bank Permata and Bank Niaga that had high NPLs at 45.15% and 27.9% respectively might contribute to the increased of the foreign bank's NPL. In February 2008, NPL of Bank Permata was 4.4% and Bank Niaga was 3.88%.

These summary statistics suggest that in Indonesia domestic and foreign banks indeed responded differently to the current financial and economic situations. The next section explores whether the patterns in evidence in the graphical examination are confirmed by more rigorous econometric analysis.

4.3.2. The implementation of SFA

Efficiency measures the extent to which a bank's costs approximate the costs of the "best practice" or at least cost bank, producing an identical output bundle under the same conditions. In the SFA employed here, the measure is derived from a cost function:

$$C_{it} = C(w_{it}, y_{it}, \varepsilon_{\mathrm{it}}) \qquad (4.1)$$

where C_{it}= total costs; w_{it}=the input prices; y_{it}=the output quantities; ε_{it}=u_{it}+ v_{it}; u_i is an inefficiency factor that may raise costs above the best practice level and v_i is the random error that incorporates measurement error and chance that may give banks high or low costs occasionally

The inefficiency factor u_{it} incorporates both technical inefficiencies from using too much of the inputs to produce the same outputs, y_{it}, and allocative inefficiency from failing to react optimally to relative prices of inputs w_{it}. The standard assumption is that the efficiency and random error terms can be multiplicatively separated from the remainder of the cost function. After taking logs of both sides of equation 4.1, the cost function can be depicted as:

$$lnC_{it} = \beta_{0t} + \sum_n \beta_{it} \ln X_{nit} + v_{it} + u_{it}$$

$$= \beta_{it} + \sum_n \beta_{it} \ln X_{nit} + v_{it}$$

(4.2)

β_{0t} is cost function frontier intercept common to all producers in period t. $\beta_{it} = \beta_{0t} + u_{it}$ is the intercept for bank i in the period t. X denotes the bank's characteristics.

Lee and Schmidt (1993) proposed formulation in which u_{it} in the above equation 4.2 is specified as

$$u_{it} = \beta(t).u_i \qquad (4.3)$$

where the function $\beta(t)$ is specified as a set of time dummy variables β_i. Once β_i and u_i are estimated $\beta_t = \{\exp[-\eta\ (t - T)]\}$, where T is the panel length, u_i are positive firm effects assumed to follow a half-normal distribution, i.e., u_i ~ N(0, σ_u^2), and are independent from v_{it}, and η is a parameter to be estimated. Given the exponential specification of u_{it}, the parameterisation in the above equation implies that the time path of technical efficiency is monotonic, in the sense that technical efficiency increases, is constant and decreases when η is greater, equal and less than zero, respectively. It should be noted that η is assumed to be identical for all banks, leaving u_i to capture efficiency differences.

The maximum likelihood estimation of the cost function (equation 4.1) generates estimates of all parameters of the frontier cost function as well as estimates of the unknown parameters σ, η and γ. After solving the maximum likelihood problem, aggregate residuals ε can be derived by substituting the estimated parameter vector β into the cost function.

Battese and Coelli (1992) show that an estimate of firm-specific efficiency is given by:

$$TE_{it} = E\langle exp(-u_{it})|\varepsilon_i\rangle \qquad (4.4)$$
$$= \frac{\Phi\left(\mu_i^*/\sigma_i^* - \eta_{it}\sigma_i^*\right)}{\Phi(\mu_i^*/\sigma_i^*)} exp\left(-\eta_{it}\mu_i^* + \frac{1}{2}\eta_{it}^2\sigma_i^{*2}\right)$$

where

$$\mu_i^* = \frac{-\eta_i\varepsilon_i\sigma_u^2}{\sigma_v^2 + \eta_i^{'}\eta_i\sigma_u^2} \qquad \text{And} \qquad \sigma_i^{*2} = \frac{\sigma_v^2\sigma_u^2}{\sigma_v^2 + \eta_i^{'}\eta_i\sigma_u^2} \qquad (4.5)$$

$\Phi(.)$denotes the cumulative distribution function of the standard normal distribution. TE_{it} can be interpreted as the cost ratio of a fully efficient bank to the observed unit, i.e. $TE_{it} = (exp(\beta^{'}X_{it})/\exp(\beta^{'}X_{it} + u_{it}))\ \epsilon\ ]0,1]$.

Efficiency theoretically falls in the interval (0,1], and equals one for a best practice bank within the observed data. A value of 0.75, on the other hand, indicates that the bank could reduce its costs by 25 percent, given the output produced operating under the same conditions. The limitation of this definition is that the estimated efficiency is only a relative measure against the best practice bank within the sample; the best practice bank itself may not be efficient when compared to banks outside the sample. Refer back to figure 4.1 TE is same as α.

4.3.3. Model Specification

Consistent with most bank efficiency literature, this study adopts a translog functional form.[7] The model is estimated using panel data. Following Battese

[7] Other method is the Fourier-Flexible (FF) specification. The choice in this chapter was motivated by the fact that the FF specification requires more degree of freedoms. In addition, although formal statistical tests indicated that the coefficients on the Fourier terms are jointly significant, Berger and Mester (1997) argue that the improvement obtained through the use of the FF specification is insignificant from an economic viewpoint. The average improvement in goodness of fit is relatively

and Coelli (1995), Berger and Mester (1997), Khumbakar and Lovell (2000), and Fried, Lovell and Schmidt (2008), we write equation 4.2. as :

$$\ln(C_{it}) = \alpha + \sum_{i=1}^{2} \beta_i \ln(w_i) + \frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{3} \beta_{ij} \ln(\mathrm{w_i}) \ln(\mathrm{w_j}) + \sum_{k=1}^{2} \gamma_k \ln(\mathrm{y_k}) + \frac{1}{2}\sum_{k=1}^{2}\sum_{m=1}^{2} \gamma_{km} \ln(\mathrm{y_k}) \ln(\mathrm{y_m}) + \sum_{i=1}^{2}\sum_{k=1}^{2} \lambda_{ik} \ln(\mathrm{w_i}) \ln(\mathrm{y_k}) + \sum_{l=1}^{L} \tau T + v_{it} + u_{it} \quad (4.6)$$

where,

$\ln(C_{it})$ = natural logarithm of total costs (operating and non operating costs) divided by deposit price (w_3),

$\ln(w_i)$ = natural logarithm of the i_{th} input prices (i.e. labour costs over total assets, fixed asset costs over total fixed assets) divided by deposit price (w_3)

$\ln(y_k)$ = natural logarithm of bank outputs (total loans over total assets and total securities over total assets),

T = time trend from September 2000 to September 2009; T_t = t for t = 1,…, L (L= 37 quarters),

$\alpha, \beta, \gamma, \lambda, and\ \tau$ are coefficients to be estimated with maximum likelihood estimator.

Following common practice, the standard symmetry restrictions apply to this function. In addition, the total cost and input price terms are normalised by the

small, meaning both functional forms yield basically the same average level and dispersion of measured efficiency, and both rank the individual banks in almost the same order.
Wheelock and Wilson (2001) also argue that the FF specification raises several unresolved statistical problems, including whether to augment the underlying translog function with trigonometric terms or orthogonal polynomials, and how many terms should be included for estimations. Furthermore Altunbas and Chakravarty (2001) indicate that the predictive ability of the FF form is worse than the translog form. Finally, several studies use the stochastic frontier approach for both the translog and the Fourier specification of the cost function and reach similar conclusions (Berger and Mester, 1997; Vander Venner, 2002).

last input price, w_3, which imposing linear homogeneity restrictions on the model.

$$\gamma_{km} = \gamma_{mk} \quad k, m = 1,2 \qquad\qquad \beta_{ij} = \beta_{ji} \quad j, k = 1, 2,3$$

$$\sum_{j=1}^{3} \beta_i = 1 \qquad\qquad \sum_{j=1}^{3} \beta_{ij} = 0 \quad k = 1,2,3$$

$$\sum_{i=1}^{3} \lambda_{ik} = 0 \quad i = 1,2,3 \tag{4.7}$$

Many studies normalised the total costs and output quantities relative to the bank's equity capital to control for scale biases in estimations (e.g. Berger and Mester, 1997; DeYoung and Hasan, 1998; Altunbas, Liu, Molyneux, and Seth, 2000; Mertens and Urga, 2001). Since the costs of the largest banks are much larger than those of the smallest banks, large banks would have random errors with much larger variances without the normalization. Furthermore, cost inefficiency term in cost functions is derived from the composite residuals, which might make the variance of the cost efficiencies dependent on bank size without normalization. Similarly, the normalization of the output quantities keeps these variables from being skewed for the large banks, so that all the variables are of nearly the same order magnitude.

However the capitalization and provisioning regulations in Indonesian banks were tightened considerably during the sample period. In particular, state owned banks were severely undercapitalized in the earlier years, and, over time, were required to meet capitalization standard in line with international norms. Thus normalizing by equity capital would conflate these institutional changes with changes with behaviour, and overstate their costs in the early years. For this reason, this thesis follows Hardy and Patti (2001) who normalized these variables using total asset rather than total equity. All of the

output quantities are specified as ratios of the total assets, z, to control for scale biases in the estimation of the cost efficiency in Indonesia's banking sector.

4.4. Empirical Results

4.4.1. Baseline and Preferred Model Results

The estimation results of the cost function for the baseline and preferred model are given in Table 4.3. The different between the models is that the baseline (equation 4.6) includes only outputs and input prices while in the preferred model, we include non performing loans, dummy joint venture (old foreign banks) and time dummies. These variables are significant and they can make the model is more easily interpreted. Non-performing loans is one of important variable since the problem loans can increase bank costs. Dummy joint venture banks in included because joint venture banks have different business model than other commercial banks. They mainly conduct trade finance business for the customers from their home countries.

Both estimations reveal significant parameters. The coefficients for the two models are very similar but total loans now have significant estimate. As the input coefficients given in log form it can be interpreted as input elasticities of the output, the input elasticity of the price of labor of about 0.50%, cost of fixed assets of 0.23% and all of the variables have positive relationship with the total cost. This also indicates that the main contributor for total cost in Indonesian banking market derives from the increased of price of labor.

In the output front, loans have a highly significant and positive coefficient while securities have a positive sign and insignificance. These conditions are true for Indonesian banks since the increase in loans will require banks to enhance monitoring by hiring more resources to perform the job. Meanwhile increased securities reduce the cost of banks. This makes sense, most of the banks invest in government bonds and certificate of Bank Indonesia (bills)

which are safe investment thus demand less monitoring. The ratio of securities to total GDP in Indonesian banks has been decreasing in the last ten years from 32.2% to 14% in 2009 (See table 2.5).

Finally, time trend is significantly negative coefficient showing that the total cost of Indonesian banking is decreasing over time. From 2001 to 2009, the decrease is approximately 8% and the yearly average decrease in total cost is around 2%.

Table 4.3
Stochastic frontier regression results: Baseline and Preferred Models

	Baseline Model		Preferred Model	
	Dep. Var: Total costs			
Independent Variables:	Coeff	*p-value*	Coeff	*p-value*
Price of labor	0.453	0.000	0.504	0.000
Price of physical capitak	0.272	0.000	0.228	0.000
Total loans	0.057	0.080	0.095	0.004
Total securities	0.028	0.282	0.023	0.370
Price of labor*price of labor	0.144	0.000	0.144	0.000
Price of labor*Price of physical capital	0.013	0.289	0.018	0.138
Price of physical capital*Price of physical capital	0.064	0.000	0.058	0.000
Price of labor*total loans	0.013	0.235	0.001	0.928
Price of labor*total securities	0.017	0.003	0.016	0.004
Price of physical capital*total loan	0.005	0.672	0.013	0.305
Price of physical capital*total securities	0.002	0.713	0.002	0.711
Total loans*total loans	-0.003	0.759	-0.009	0.329
Total loans*total securities	-0.002	0.692	-0.003	0.588
Total securities*total securities	0.013	0.034	0.015	0.011
Time trend	-0.003	0.001		
Old foreign banks			0.599	0.000
Non performing loan ratio			0.022	0.000
Year 2001			-0.021	0.083
Year 2002			-0.066	0.000
Year 2003			-0.083	0.000
Year 2004			-0.045	0.021
Year 2005			-0.087	0.000
Year 2006			-0.117	0.000
Year 2007			-0.112	0.000
Year 2008			-0.114	0.000
Year 2009			-0.101	0.003
Constant	3.179	0.000	2.289	0.000
/mu	1.520	0.000	0.868	0.000
/eta	0.000	0.001	0.000	0.000
/lnsigma2	-2.149	0.000	-2.814	0.000
/ilgtgamma	1.381	0.000	0.491	0.001
sigma2	0.117		0.060	
gamma	0.799		0.620	
sigma_u2	0.093		0.037	
sigma_v2	0.023		0.023	
Log likelihood	1,656	0.000	1,769.7	0.000
Test H_0: w1+w2=1	61.6	0.000	59.3	0.000
Test $H_{0:}$ w1w1+w2w2=0	71.0	0.000	69.5	0.000
No of observations	4,304		4,304	
No of banks	129		129	

The table presents the result of translog cost function Indonesian banking during the period of 2000-2009 using stochastic frontier approach. The error term distribution is time varying followed Battese-Coelli (1995). The dependent variable, total costs is the total of operating and financial costs. The regressors are the price of labor is personnel cost over total assets, and the price of physical capital is depreciation costs to total fixed asset. Ouput considered are total loans and total securities. Non performing loan is the ratio of non performing loan over total loans. Dummy old foreign banks is the dummy for banks that are majority owned by foreign investors and established before 2000. Time dummy variable and time trend. The dependent variable and input prices variables are divided by the price of deposit to satisfy linear homogeity in input prices.

4.4.2. Robustness Checks

We further investigate the accuracy of the model and its empirical result by employing additional control variables including capital structure and reduce sample. In the first set of robustness checks, we follow study by Fries and Taci (2005) and Mester (2010) that if a bank were to substitute debt for some of its capital, its accounting (cash flow) costs could rise, making the less-capitalised bank appear to be more costly than a well capitalized bank. To solve this problem, the capital ratio can be included as a control variable in the baseline model. The resulting cost function captures the relationship of cash flow cost to the capital ratio, and the (negative) derivative of cost with respect to capital ratio. The second check is to include the non-performing loans ratio as a risk indicator and the capital structure in preferred model. These variables can play role as control variables. The aim of this test is to ensure the accuracy of the model if we consider other factors may influence the bank's efficiency. The reason to control for capital and non performing loan is because Indonesian banking system is characterized by high credit risk and high capitalised banks. Finally, we divide the sample into two time periods and estimate using preferred model. Group 1 is from September 2000 to December 2004 and the second group is from March 2005 to September 2009. The cut period in December 2004 chosen because this was the year BI began the implementation of a new regulatory framework the Indonesian Banking Architecture (IBA).

Table 4.4 Robustness checks

Dep Var: Total Costs	Model 1 Baseline		Model 2 Preferred		Model 3 Preferred		Model 4 Preferred	
	Capital Structure		Risk and Capital		2000-04		2005-09	
Independent Variables:	Coeff	*p-value*	Coeff	*p-value*	Coeff	*p-value*	Coeff	*p-value*
Price of labor	0.478	0.000	0.522	0.000	0.414	0.000	0.743	0.000
Price of physical capitak	0.265	0.000	0.222	0.000	0.094	0.308	0.006	0.952
Total loans	0.053	0.105	0.087	0.008	0.167	0.004	0.260	0.010
Total securities	0.066	0.014	0.057	0.031	0.060	0.094	0.066	0.168
Price of labor*price of labor	0.137	0.000	0.139	0.000	0.137	0.000	0.277	0.000
Price of labor*Price of physical capital	0.021	0.103	0.024	0.056	-0.015	0.323	-0.062	0.008
Price of physical capital*Price of physical	0.060	0.000	0.055	0.000	0.047	0.015	0.136	0.000
Price of labor*total loans	0.011	0.319	0.000	0.984	-0.002	0.930	-0.086	0.001
Price of labor*total securities	0.017	0.004	0.015	0.009	0.007	0.429	0.033	0.000
Price of physical capital*total loan	0.006	0.642	0.014	0.275	0.037	0.045	0.111	0.000
Price of physical capital*total securities	0.004	0.487	0.005	0.387	-0.013	0.094	0.001	0.882
Total loans*total loans	0.000	0.988	-0.005	0.555	-0.018	0.203	-0.007	0.805
Total loans*total securities	-0.008	0.122	-0.007	0.143	0.007	0.272	0.018	0.079
Total securities*total securities	0.006	0.324	0.009	0.136	0.006	0.547	0.029	0.002
Time trend	-0.003	0.001						
Old foreign banks			0.606	0.000	0.625	0.000	0.447	0.000
Non performing loan ratio			0.019	0.000	0.025	0.000	0.000	0.936
Total capital to total asset ratio	-0.017	0.019	-0.016	0.029				
Year 2001			-0.016	0.198	-0.006	0.606	-0.146	0.000
Year 2002			-0.064	0.000	-0.032	0.033	-0.125	0.000
Year 2003			-0.077	0.000	-0.035	0.053	-0.084	0.000
Year 2004			-0.038	0.052	0.024	0.300	-0.058	0.000
Year 2005			-0.078	0.000				
Year 2006			-0.105	0.000				
Year 2007			-0.099	0.000				
Year 2008			-0.100	0.001				
Year 2009			-0.088	0.010				
Constant	3.212	0.000	2.341	0.000	2.237	0.000	1.820852	0.000
/mu	1.519	0.000	0.889	0.000	1.218	0.000	0.946	0.000
/eta	0.000	0.001	0.000	0.001	0.000	0.920	0.000	0.004
/lnsigma2	-2.138	0.000	-2.797	0.000	-2.551	0.000	-3.076	0.000
/ilgtgamma	1.417	0.000	0.541	0.000	1.022	0.000	0.586	0.000
sigma2	0.118		0.061		0.078		0.046	
gamma	0.805		0.632		0.735		0.642	
sigma_u2	0.095		0.039		0.057		0.030	
sigma_v2	0.023		0.022		0.021		0.017	
Log likelihood	1,667.5	0.000	1,772.0	0.000	892.7	0.000	1,145.1	0.000
Test H_0: w1+w2=1	52.7	0.000	52.8	0.000	68.0	0.000	11.8	0.000
Test $H_{0:}$ w1w1+w2w2=0	61.9	0.000	61.8	0.000	39.1	0.000	83.6	0.000
Chow stability test χ^2 (17)					134.97	0.000		
No of observations	4,244		4,244		2,188		2,116	
No of banks	129		129		129		115	

The table presents the robustness checks using data from 2000Q3-2009Q3 using stochastic frontier approach. Model 1 is the baseline model with capital ratio. Model 2-4 are based on the preferred model. Model 2, capital ratio is added as a control variable. Model 3 uses data from 2000 to 2004. While in Model 4 is from 2005 to 2009. The data split is based on the implementation of Indonesian Banking Architecture in 2004. The dependent variable is total costs. The regressors are the price of labor is personnel cost over total assets and the price of physical capital is depreciation costs of fixed assets to total fixed assets; ouput considered are total loans and total securities. Dummy variable in model 1 is time trend. Dummy variables in model 2-4 are yearly time dummy and old foreign banks. All values are in real term deflated by inflation rate with base year in 2000. We use Chow stability test for panel data in model 3 and 4.

The results in Table 4.4 confirm consistent and stable parameters with the baseline and preferred models. The variables have similar coefficients and they are positively significant to the total costs. The main contributor for cost is the price of labor followed by price of fixed asset. Time trend shows that total costs decrease over the time.

Model 1 shows that capital ratio is negative but not really significant. It shows that the higher the bank's capital the lower the cost. High bank capital means that the bank has fewer portfolios in the form of loans or the bank has mostly performing loans. Model 2 shows that the higher a bank's risk the higher bank cost. The capital ratio also shows negative and not really a significant result. Model 3 and 4 are the reduced sample based on the implementation of Indonesian Banking Architecture in 2004. A Chow test for parameter stability confirms the suggestion that the banking market has undergone a structural change. In the reduced sample, the results are also consistent with the preferred model. Most of the prices in Model 4 are relatively higher compared to the preferred model. The prices are still positive and significant except for fixed assets and securities. This is probably because the banks had more investment in the physical capital during 2000-2004. The securities variable is insignificant is because the decrease of securities holdings from 2000 to 2009 (See table 2.5) had caused lower prices to analyse and administer the securities.

Efficiency Score of Different Ownership

Table 4.5 Cost efficiency estimates

	Year	Mean	Std Deviation	Minimum	Q1	Median	Q3	Maximum	No of obs
State-owned Banks	2000	0.43	0.05	0.35	0.40	0.44	0.47	0.52	11
	2001	0.43	0.05	0.35	0.40	0.44	0.47	0.52	44
	2002	0.45	0.04	0.39	0.42	0.45	0.48	0.53	36
	2003	0.45	0.05	0.39	0.42	0.45	0.49	0.53	28
	2004	0.47	0.05	0.41	0.43	0.46	0.49	0.54	20
	2005	0.48	0.04	0.43	0.44	0.50	0.50	0.54	20
	2006	0.49	0.04	0.44	0.45	0.50	0.50	0.55	20
	2007	0.49	0.04	0.44	0.45	0.51	0.51	0.55	20
	2008	0.50	0.04	0.45	0.46	0.51	0.51	0.56	20
	2009	0.50	0.04	0.45	0.46	0.52	0.52	0.56	15
Domestic private owned banks	2000	0.37	0.08	0.19	0.33	0.35	0.39	0.61	28
	2001	0.38	0.08	0.19	0.34	0.36	0.39	0.61	112
	2002	0.38	0.07	0.20	0.34	0.36	0.40	0.62	116
	2003	0.39	0.08	0.20	0.35	0.37	0.40	0.62	108
	2004	0.39	0.08	0.21	0.35	0.37	0.41	0.62	108
	2005	0.40	0.08	0.21	0.36	0.38	0.41	0.63	88
	2006	0.39	0.07	0.22	0.36	0.38	0.41	0.63	84
	2007	0.40	0.07	0.22	0.37	0.38	0.42	0.64	76
	2008	0.40	0.08	0.23	0.38	0.40	0.43	0.64	64
	2009	0.42	0.07	0.37	0.39	0.40	0.43	0.65	45
New Foreign Banks	2000								
	2001								
	2002	0.41	0.07	0.36	0.38	0.41	0.43	0.45	8
	2003	0.44	0.05	0.36	0.43	0.46	0.46	0.48	16
	2004	0.42	0.04	0.37	0.39	0.41	0.46	0.48	28
	2005	0.45	0.07	0.38	0.41	0.46	0.47	0.60	40
	2006	0.45	0.07	0.36	0.40	0.45	0.48	0.61	44
	2007	0.43	0.07	0.37	0.37	0.42	0.48	0.61	64
	2008	0.44	0.07	0.37	0.39	0.43	0.48	0.62	64
	2009	0.44	0.07	0.38	0.40	0.43	0.49	0.62	48
Old Foreign Banks	2000	0.42	0.22	0.23	0.30	0.34	0.41	0.92	21
	2001	0.43	0.22	0.23	0.31	0.36	0.41	0.92	84
	2002	0.36	0.11	0.24	0.28	0.34	0.40	0.67	72
	2003	0.36	0.10	0.24	0.31	0.35	0.39	0.67	64
	2004	0.37	0.10	0.26	0.31	0.35	0.40	0.68	64
	2005	0.37	0.10	0.26	0.32	0.36	0.40	0.68	64
	2006	0.36	0.06	0.27	0.32	0.36	0.40	0.44	60
	2007	0.36	0.06	0.27	0.32	0.36	0.40	0.45	60
	2008	0.36	0.07	0.23	0.31	0.36	0.41	0.45	60
	2009	0.37	0.07	0.23	0.31	0.38	0.42	0.46	45

This table shows the descriptive statistics of cost efficiency by ownership. State-owned banks refer to the bank wholly owned by the government; Domestic private owned banks refer to those banks whose private domestic ownership is greater than 50% of total ownership. New foreign banks refer to those banks whose foreign ownership is greater than 50% of total ownership since 2000, and old foreign banks refer to those banks whose foreign ownership is greater than 50% of total ownership before 2000. The cost efficiency is estimated using preferred model (translog cost function of two outputs, three inputs, non performing loan ratio, dummy old foreign bank and yearly time dummies).

Table 4.5 reports the descriptive statistics for the cost efficiency estimates of the different type of banks operating in Indonesia's domestic market. The estimation is performed based on the preferred model.

The perfectly cost efficient bank is the old foreign banks that exhibits a cost efficiency estimate equal to 92%. This means that this bank has costs 8.0% higher than the frontier. The lowest cost efficient is domestic private owned banks by 27.5%. In general, the highest cost efficiency score is the state-owned banks, followed by new foreign banks, domestic private owned banks and old foreign banks.

Although state owned banks have higher cost efficiency scores, the average of cost efficiency and the standard deviation of other type of banks are only slightly different. The Kruskal-Wallis test confirms that the cost efficiency of different types of banks is all statistically significant different. The null hypothesis that all five types of banks are equal is rejected at the 1% level (Chi-squared= 514.4 with 3 degrees of freedom).

Table 4.6 Cost efficiency of the new foreign banks

No	Type of banks before acquisition	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	% change
1	State-owned banks	0.46	0.47	0.47	0.48	0.48	0.49	0.49	0.50	0.50	0.51	3.76
2	State-owned banks	0.39	0.39	0.40	0.41	0.41	0.42	0.42	0.43	0.43	0.44	3.35
3	State-owned banks	0.35	0.35	0.36	0.36	0.37	0.38	0.38	0.39	0.39	0.40	4.54
4	State-owned banks	0.44	0.44	0.45	0.45	0.46	0.46	0.47	0.47	0.48	0.48	3.83
5	State-owned banks	0.44	0.45	0.45	0.46	0.46	0.47	0.47	0.48	0.48	0.49	4.29
6	State-owned banks	0.38	0.38	0.39	0.39	0.40	0.40	0.41	0.41	0.42	0.42	2.65
7	Domestic private owned banks	0.33	0.33	0.34	0.34	0.35	0.36	0.36	0.37			0.58
8	Domestic private owned banks	0.36	0.36	0.37	0.37	0.38	0.38	0.39	0.39	0.40	0.40	3.29
9	Domestic private owned banks	0.44	0.45	0.45	0.46	0.47	0.47	0.48	0.48	0.49	0.49	2.69
10	Domestic private owned banks	0.58	0.58	0.59	0.59	0.60	0.60	0.61	0.61	0.62	0.62	1.35
11	Domestic private owned banks	0.40	0.40	0.41	0.41	0.42	0.43	0.43	0.44	0.44	0.45	1.63
12	Domestic private owned banks	0.33	0.33	0.34	0.34	0.35	0.35	0.36	0.37	0.37	0.38	1.66
13	Domestic private owned banks	0.34	0.34	0.35	0.35	0.36	0.36	0.37	0.38	0.38	0.39	1.66
14	Domestic private owned banks	0.35	0.36	0.36	0.37	0.37	0.38	0.38	0.39	0.40	0.40	2.81
15	Domestic private owned banks	0.33	0.33	0.34	0.34	0.35	0.35	0.36	0.37	0.37	0.38	2.23
16	Domestic private owned banks	0.42	0.43	0.43	0.44	0.44	0.45	0.45	0.46	0.47	0.47	2.17
17	Domestic private owned banks	0.33	0.33	0.34	0.34	0.35	0.36	0.36	0.37	0.37	0.38	1.08

The table presents average cost efficiency of seventeen new foreign banks. The banks are distinguished based on types of ownership before foreign acquisitions. State owned bank refers to the banks wholly owned by the government including some banks recapitalised after the crisis in 1998. Domestic private owned bank refers to banks that were owned by domestic private owners before the acquisitions. The grey square indicated the year of the acquisition took place. % change is the change between one year before acquisitions and the year end of period. The bank in number 7 was merged after acquisition in 2007.

Finally, table 4.6 shows the results of individual banks' cost efficiency change from September 2000 to 2009. These scores are calculated based on the results

from the preferred model. The cost efficiency of the banks improves slightly after the acquisitions. The average improvement of the cost efficiency of the seventeen banks one year before and at the end of period is 2.56%. The highest improvement is only 4.5% (See table 4.6). The second lowest improvement is merely 1.08%. The bank with lowest improvement was merged to other bank after acquired by foreign investor.

The banks owned by the government before acquisition seems to have higher improvement than the banks that were previously owned by private domestic. This is mainly because the previously state-owned banks were acquired longer than the other banks were. In the future, the banks that hire more skilled workers and install better working environments will further increased in efficiency.

4.5. Conclusions

The extant research on Indonesian bank efficiency is very limited and background information on the Indonesian banking system is not widely known.

The main goals of this paper are to try to fill in these gaps in the research literature in particular in order to help address issues of efficiency effect on foreign bank during Indonesian banking consolidation period. We analyze efficiency using quarterly panel observations over 2000-2009 on banks operating in Indonesian banking markets. We estimate a translog functional form and analyze the cost efficiency of Indonesian banks.

The analysis suggests several conclusions about banking efficiency in Indonesia. First, the mean efficiency in Indonesia's banking sector was found to be in the range of 40-50%. It also means that, on average, all the sample banks would have increased their efficiency (through lower costs) by about 50-60% had they been operating on the efficiency frontier. Second, foreign

ownership have positive effect on improved cost efficiency of the acquired banks both in terms of the average cost efficiency and its change over time. However, the change in efficiency effect over time is small. Third, it appears that state-owned banks have the best cost efficiency compared to other banks and although old foreign banks are able to maintain comparable efficiency to the new foreign banks, there is some evidence that old foreign banks' efficiency tend to worsen over the studied period.

The major qualification of these conclusions is that efficiency is only a relative measure against the best practice bank within the sample.

Chapter 5 The Role of Banks in Monetary Policy Transmission in Indonesia

5.1. Introduction

This chapter examines the bank lending channel in Indonesia using monthly cross-sectional differences in micro-level data in the period from September 2000 from 2009. Following Erhmann et al. (2003), the investigation concerns the response of bank lending to monetary shocks, together with the influence on this response of bank size, liquidity and capitalisation. This study uses two mean of the monetary policy stance, the one month Certificate of Bank Indonesia's interest rate and a constructed narrative index.

The rest of the chapter is organized as follows. The next section 5.2 presents an overview of Indonesia's monetary development. Section 5.3 discusses literature review about theory of bank lending channel, review of empirical studies in general and emerging markets. Section 5.4 describes the data and estimation methodology. Section 5.5 explains the econometric specification and estimations. Section 5.6 presents the empirical results and robustness checks and Section 5.7 provides conclusion and policy implications.

5.2. Monetary Policy Developments

The major change in the conduct of monetary policy in Indonesia in the aftermath of the 1997–98's Asian crisis was act No 23 Year 1999 that gives Bank Indonesia full autonomy in formulating and implementing monetary policies. First, the objective of the central bank focuses on achieving and maintaining the stability of the Rupiah value. Second, the central bank has been given independence in conducting its monetary policy, while the government in coordination with the central bank will set the inflation target. The act demands Bank Indonesia to set target of inflation rate every year, and directs its

monetary policy to achieve such a target. This becomes the base of the implementation of inflation target framework.

In 2000-2003, Bank Indonesia adopted base money as the operational target as well as an anchor to achieve the ultimate target. It also began monitoring various aggregates as well as interest rates. There were a number of shortcomings in the use of base money as the operating target, such as the difficulties in achieving the target and the poor signal it transmits to the market. Such a poor signal of monetary policy direction and targets fails to meet the need to guide maintain market expectations on future exchange rate and interest rate movements (Goeltom, 2008).

Table 5.1
Selected monetary indicators

Year	CPI (%)		M2	M1	M0	BI-rate (%)	Loan
	Target	Outcome					
2000	5	9.35	747,027	162,185	125,615	14.31	254,730
2001	6	12.55	844,054	177,731	127,795	17.63	294,000
2002	10	10.03	883,908	191,939	138,250	13.12	357,711
2003	9.0 (+/-1%)	5.16	944,366	213,784	728,787	8.31	439,156
2004	5.5 (+/-1%)	6.40	1,033,877	245,946	785,261	7.43	545,511
2005	6.0 (+/-1%)	17.11	1,202,762	271,140	929,343	12.75	692,917
2006	8.0 (+/-1%)	6.60	1,382,493	347,013	1,032,865	9.75	802,796
2007	6.0 (+/-1%)	6.59	1,649,662	450,055	1,196,119	8.00	993,479
2008	5.0 (+/-1%)	11.06	1,895,839	456,787	1,435,772	9.25	1,201,388
2009	4.5 (+/- 1%)	2.78	2,141,384	515,824	402,118	6.5	1,446,808

CPI is consumer price index. Money supply (M2, M1 and M0) and Loan is in billion of Rupiah. M0 is base money. M1 consist of currency and demand deposits. M2 consist of M1 plus time deposit, saving deposit. BI-rate is determined by Bank Indonesia. Source: Bank Indonesia. Various years. Monetary Policy Review.

In 2005, the Inflation Targeting (IT) policy was officially launched as the new monetary policy framework. Under the IT framework, the inflation target represents the overriding monetary objective set by the Indonesian government after coordination with BI. The authorities have initially allowed the headline inflation to fluctuate between the ranges of 9 ± 1% in 2003, before gradually revising the headline inflation target downward to 4.5 ± 1% for 2008 (see table 5.1).

There are two concerns facing Bank Indonesia in its efforts to improve the effectiveness of policy rate transmission to bank lending (Indonesia economic report 2009). The first is the excess liquidity in Indonesian banking. Bank Indonesia's researches showed that if excess banking liquidity is failed to be absorbed by the authority, it will in turn pose a potential pressure on monetary stability, inflation and exchange rate. They also argue that excess banking liquidity poses the potential problem to monetary policy transmission (Indonesia's economic report, 2009).

The second is related to the normal and crisis economic condition. In a normal situation or while the economy is expanding, the sensitivity of monetary policy against aggregate macroeconomic variables seems to work in accordance with a general concept. Meanwhile when opposite condition occurs such as during the global crisis a corrected response manifested in lending rate cut following the drop in BI Rate. The slow response in lending rate cut will later lead to the drop in credit extension while the existence of a financial constraint will further shrink intermediation. Bank's behaviour to hoard their liquidity caused an increase in non-performing loans due to the weakening condition of real sector.

5.3. Literature Review

Over the last decades, there has been a large economic literature on monetary policy transmission mechanisms. This section will discuss theory of bank lending channel, followed by a review of empirical studies in bank lending channel.

There are differing theoretical perspectives on money transmission. Older views such as the basic Keynesian IS-LM framework suggest that policy-makers control or directly influence the stock of bank deposits (broad money) and that this feeds through via "money multiplier" into bank lending. Therefore the changes of bank deposits play a primary role. A variation on this, central

banks influence longer term interest rates and asset prices and this determines holdings of deposits.

5.3.1. Classical interest rate or money view

This view focuses on the liability side of bank balance sheet. The important role played by banks in this transmission mechanism arises from the reserve requirement constraint faced by banks. Thus, shifts in monetary policy that change the quantity of outside money (bank reserves and bank notes) result in a change in inside money in the form of the reservable deposit that can be created in the banking system.

5.3.2. The broad credit channel

The research in this area was motivated by the puzzle that monetary policy shocks that had relatively small effects on long-term real interest rates appeared to have substantial effects on aggregate demand. This literature attributes the amplification of the monetary policy shocks to frictions in the credit markets (See e.g. Bernanke, Gertler and Gilchrist 1996; Bean, Larsen and Nikolov 2002).

It is predicated on credit market imperfections associated with moral hazard problem in principal agent relationship in a debt contract. Because of the information asymmetries between borrowers and lenders, external finance is an imperfect substitute for a firm's internal funds.

The broad credit channel posits that an increase in interest rates associated with a tightening of monetary policy causes deterioration in firm health, in terms of net worth. A firm's net worth is adversely impacted as the lower cash flows emanating from the firm's assets are discounted using the higher interest rates associated with the tightening monetary policy. The deterioration in the collateral value of the firm's assets, in turn cause an increase in the external finance premium paid by the firm to get funding. This increase in the cost of

external funds for borrowers over and above the risk free interest rate then result in a reduction in aggregate demand.

5.3.3. The bank lending channel

The bank lending channel focuses not on borrowers, but on the effect of credit market imperfections on the intermediation function of banks. Bank lending channel is not actually an alternative view to the classical monetary transmission mechanism. It is just a set of features that intensify and extend traditional interest rate effects and is not a truly independent mechanism (Bernanke and Gertler 1995).

In a simple world with three assets -money, bonds and loans- three condition must be satisfied for the bank lending channel to be operational in the transmission of monetary policy (See e.g. Bernanke and Blinder 1988; Kashyap and Stein 1994). First, prices must not adjust fully and instantaneous to a change in the money supply. That is, money is not neutral. Second, open market operations must affect the supply of bank loans. Third, loans and bonds must not be prefect substitutes as a source of credit for at least some borrowers.

Because only the second and third conditions distinguish the bank lending channel from the classical view, and because substantial evidence exists that wages and prices are not perfectly flexible, that the first conditions holds will be assumed for this discussion.

With respect to the second condition, open market operations reduce reserves. However, banks do have choice, and individual banks do differ with respect to how, and to what extent, they respond to this decline in reserves. If reduced reserves constraint their ability to issue deposits, then banks must either raise liabilities to replace the lost deposits, or reduce assets such as securities and loans. To the extent that banks do not regard other sources of funds as perfect substitutes for deposits, they will not fully replace the lost reservable deposits,

and thus must shrink their assets in order to keep total assets in line with their reduced volume of liabilities.

Asymmetric information and credit market frictions will play an important role in determining how an individual bank will respond on the liability side of its balance sheet. Banks primarily use wholesale deposits, as the marginal source of funds during a period of monetary policy tightening.

Given that some shrinkage in bank assets will occur, a bank must then decide on the distribution of that shrinkage across the various assets held in its portfolio. Because securities are relatively liquid, one would certainly expect banks to shrink their holdings of securities. However, to the extent that banks do not consider securities and loans to be perfect substitute in their asset portfolio, one would expect that at least part of the adjustment in assets would be composed of a shrinkage in the volume of their loan portfolio (even though initially the loan portfolio might temporarily grow from distress borrowing as loan customers access credit from previously established loan commitments and lines of credit (Morgan, 1988)).

Asymmetric information and credit market frictions also play an important role in determining the extent to which firms consider bonds and non-bank intermediated loans as perfect substitutes for bank loans. To distinguish the broad credit channel from the bank lending channel, one must address the degree to which borrowers consider non-bank sources of credit as perfect substitutes for bank loans.

Milne and Wood (2009) drop the assumption that reserves constrain the volume of deposits. They argue that as a result constraints on the wholesale funding of bank balance sheets attenuate rather than amplifies the transmission of monetary policy through what is called the ‘bank lending channel’. They show (assuming that policy makers can influence interest rates) that the effect of such bank balance sheet constraints on monetary transmission is theoretically ambiguous, with the prior expectation, based on standard

theoretical models of household and corporate portfolios, that the bank lending channel attenuates monetary policy transmission. To test, they examine macroeconomic data for the G8 countries and find no evidence that banking sector deposits respond negatively and more than lending to tightening of monetary policy, as the accepted view of the bank lending channel requires. A similar analysis is provided by Disyatat 2010.

The main conclusion for this review of the theoretical studies is that the theory is ambiguous about the role of banks in money transmission; the deposit story suggests that constrained banks (low liquidity and capital) will respond more to policy than unconstrained banks. This is because it cannot cover the loss of deposits by obtaining funds from market or wholesale funding. Other view suggest the opposite that constrained banks are unable to respond to interest rate changes and so respond less to policy than unconstrained bank. It becomes a matter for empirical investigation whether the effect is amplifies or attenuates and how large it is.

5.3.4. Review of empirical studies

In this section, we review the relevant empirical papers, measures of monetary policy and studies in developed and developing countries.

5.3.4.1. Empirical studies in developed countries

The earliest studies of the bank lending channel employed aggregate data, comparing the relationship between total bank loans versus total deposits and the economic variables in the context of vector auto regressions (see Bernanke and Blinder, 1992) or the relative forecasting power of the two aggregates with respect to output fluctuations (Ramey, 1993, Kim, 1999, among others). However, it is now widely agreed that testing with aggregate data can generate a misleading conclusion. First, the use of aggregate time series cannot resolve the well-known identification problem, i.e. to distinguish whether the credit

contraction which typically follows the monetary tightening is a result of a reduced supply by banks, as argued by the bank lending channel, or the fall in demand for bank loans stemming from a recession. Second, testing the relative importance of the bank lending versus the money view by comparing the information content of these two aggregates with respect to output would be misleading (Bernanke, 1993). Due to bank balance sheet constraints, aggregate money supply (liability side of banks) and aggregate bank loans (assets side of banks) by construction move together, even though they are not identical. Thus the relative forecasting power of these two aggregate variables provides little information about monetary transmissions.

To identify the channel of monetary policy, recent studies (Kashyap and Stein, 1995, 2000; Dale and Haldane, 1995, Kakes, 2000, for example) have used cross sectional data to determine whether there are distributional effects of monetary policy across lenders and borrowers, as predicted by the bank lending channel argument. On the lenders side, the lending view suggests that a monetary policy shock should constrain bank loan supply since banks cannot frictionless raise non-deposit funds to make up for a shortfall in their deposits. But this will depend on the ability of banks to insulate them from the shock. Small banks which have relatively limited access to non-deposit funds such as securities issues or foreign borrowings are expected to be more affected by the monetary shock and to tend to cut their loan supplies immediately following the shock. On the borrower side, small firms that have limited access to external finance should be more sensitive to a monetary shock (Gertler and Gilchrist, 1994).

Erhmann et al. (2003) use data for banks based in the euro area. They find that factors such as the size or the degree of capitalisation of a bank are generally not important for the way bank adjust its lending to interest rate changes. Their result is opposed to findings for the USA (Kashyap and Stein, 2000 and Kishan and Opiela, 2000) where small and less capitalised banks show a disproportionately strong response to monetary policy.

Table 5.2
Summary of monetary policy transmission studies in developed countries

Author	Data	Country	Econometric technique	Variables	Results
Bernanke and Blinder (1992)	1959:1-1978:12	US	VAR	The funds rate, the unemployment rate, the CPI, deposits, securities, and loans.	Monetary policy works at least in part through bank loans as well as through bank deposits.
Ramey (1993)	1954:1-1991:12	US	IV &VECM	Loans, securities, short-term debt, IPI, Ml, M2, CPI, the Fed Funds rate, Treasury bills rate, CP rate, and Boshen & Mills index.	In most cases, the credit variables play an insignificant role in the impact of monetary policy shocks on output.
Gertler and Glchrist (1994)	1958:4-1986:4	US	VAR	Sales, inventories, and short-term debt, real GNP, inflation, and federal funds rate.	Small firms account for a significantly disproportionate share of the manufacturing decline that follows tightening of monetary policy.
Kashyap and Stein (1995)	1976-1992:Q2	US	OLS and IV	Fed fund rate, core deposit, CPI, and GDP	Loan and security portfolios of large and small banks respond differentially to a contraction in monetary policy.
Dale and Haldane (1995)	1974:6 - 1992:10	UK	VAR	interest and exchange rates, stock prices, money, credit, and prices	The use of sectoral data facilitates the identification of distinct money and credit channels in the transmission of monetary policy.
Kim (1999)	1965:3 1997:5	US, UK, Germany, Japan, France, Italy and Canada	VAR	Call money rate, M2, M1, CPI, industrial production, and the world export commodity price index in terms of domestic currency.	Monetary policy shocks have significant effects on output in the short run.
Kakes (2000)	1979:1-1993:4	Netherlands	VECM	Loans, interest rate on bank loans, long term interest rate, real GDP, bond holdings.	High liquid bank is less responsive to the monetary policy shocks.
Kishan and Opiela (2000)	1980 to 1995	US	Panel data	Loans, the Fed funds rate, Bernanke- Mihov index, securities, time deposit	Small banks and poorly capitalised banks reduce their loan supply more after a monetary contraction
Erhmann et al. (2003)	2000-2008	Euro countries	GMM	Loans, nominal short-term interest rate, GDP, CPI, bank characteristics: asset, liquidity and capital.	Less liquid banks respond more to the change of monetary policy.

5.3.4.2. Empirical studies in developing countries

The macroeconomic environment in emerging economies has been characterised by high risk in banking system, high inflation rate, fixed or managed floating exchange rate regime and the under develop capital markets. Hence transmission channels in emerging economies can be expected to differ from those in industrial countries. Much uncertainty surrounded the impact of monetary policy on prices and output and the channels through which they occurred (Mohanty and Turner, 2008).

There are only a few studies of the role of banks in developing country's monetary transmission. Survey by Mohanty and Turner (2008) show that bank credit appears to have a significant influence on investment in emerging market economies. This finding does not change even after controlling for several demand factors (such as output, exports and the real interest rate), suggesting that the supply of bank credit does play a role in influencing fluctuations in investment spending. In addition, the relative impact of bank credit on investment varies across regions: the impact is stronger in Latin America and central and Eastern Europe than in Asia.

Table 5.3
Summary of monetary policy transmission studies in developing countries

Author	Period	Country	Econometric Technique	Variables	Results
Agung et al. (2002)	1991:01-2000:12	Indonesia	Panel data	Loans, SBI interest rate, interbank rates, dummy capitalisation, deposits, real GDP, and total assets	Low capitalised bank respond more to the shock in monetary policy especially during crisis.
Zulverdi et al. (2006)	1996:01-2004:03	Indonesia	Panel data	Loan, SBI interest rate, deposit rate, NPL, CAR, risk weighted assets on loans (risk perception).	Bank with higher risk perception will decrease bank loans during monetary policy change.
Charoenseang and Manakit (2007)	2000:06-2006:07	Thailand	VAR	Loan, repo rate, private investment index, and core inflation rate	Credit channel through commercial bank lending is a valid monetary policy transmission mechanism.
Matousek and Sarantis (2007)	1994-2003	Czech Rep, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Rep & Slovenia	GMM	Loans, nominal short-term interest rate, GDP, CPI, GDP growth rate, inflation. Bank characteristics: asset, liquidity and capital.	Small and low liquid banks respond more to changes in monetary policy
Goeltom (2008)	1997-1998 and 2000:01-2005:03	Indonesia	Panel data	Loans, SBI interest rate, inter-bank rates, dummy capitalisation, deposits, real GDP, and total assets	In tight monetary policy, private and regional banks reduce lending by rationing credit while state banks and foreign banks by raising the interest rate.
Boughrara, A. and Ghazouani, S. (2009)	Annual data: 1989-2007	Egypt, Jordan, Morocco and Tunisia	GMM	Loan, nominal interest rate, annual growth rate of real GDP, annual inflation rate, growth rate of real GDP, size, liquidity, capitalization.	Characteristics of banks that respond more to monetary policy change are different. In Jordan, small and weak capital banks. In Tunisia, small banks. In Morocco, low liquid banks. In Egypt, high capital banks.
Kassim, S. and Majid MSA (2009)	1989:01-2006:12	Malaysia	ARDL	Loans, deposits, consumer price index, industrial production index and real effective exchange rate.	Bank deposits and loans play crucial roles in the monetary transmission process in the economy.
Bayangos, V.B. (2010)	2001:Q1 to 2009:Q2	The Philippines	GMM	Loan, lending rate, personal consumption, gross domestic capital formation, CPI, wholesale price index , labor force and long-run inflation expectations, CAR & NPL	Bank capital has the most significant effects on bank credit.

GMM=Generalised Method of Moments; ARDL=Autoregressive Distributed Lag.

Table 5.3 summarised literature review of monetary policy transmission in developing countries. It can be divided based on the study uses aggregate data and disaggregate data. The studies using aggregate data is mostly based on Bernanke and Blinder (1992) and employ time series regression e.g. vector auto regression (VAR) or Autoregressive Distributed Lag (ARDL). Meanwhile, disaggregated data estimations are based on the studies of Kashap and Stein (1995 and 2000).

We begin with the studies using aggregate data. Charoenseang and Manakit (2007) use Thailand data from June 2000 to July 2006. The vector auto regression model is estimated for analyzing interest rate channel and credit channel. The dependent variable is 14-day repurchase rates on lending rate, private investment index, private consumption index, commercial bank credit to private sector, private investment index and core inflation rate. They find that the transmission of monetary policy through the interest rates channel is weak. Nonetheless, the credit channel through the commercial bank lending is still a strong channel of monetary transmission in Thailand. Study by Kassim, S. and Majid MSA (2009) using Malaysian data also find that both bank deposits and loans play crucial roles in the monetary transmission process in the economy. Healthy and stable banking system is a pre-condition towards the overall economic stability.

The study using disaggregates data find the existence of the bank lending channel on different bank characteristics. Capital is found to be important indicator for Asian countries, Jordan and Egypt. Meanwhile, size and liquidity are crucial in CEE countries and MENA countries.

Study using Indonesian data finds that the classical interest rate channel works quite well in transmitting monetary policy, even though its magnitude has been affected by conditions in the banking system and overall higher uncertainty and risk factors. The finding is also confirmed the bank lending channel existence.

The estimation using aggregate data show that a monetary shock is able to affect bank lending with a lag due to the ability of banks to insulate the decrease in deposits by liquidating their securities holdings. Different than the result for Thailand, the empirical findings from disaggregated Indonesian data indicate that private domestic banks, banks with low capital, and lending to household are more sensitive to monetary shocks. (Agung, and Warjiyo, 2002; Zulverdi et al. 2006; Goeltom 2008).

In the Philippines, Bayangos, V.B. (2010) uses quarterly data from 2001:Q1 to 2009:Q2 find that bank credit channel matters in Philippine monetary transmission mechanism and bank capital has the most significant effects on bank credit.

Other studies in Central and Eastern Europe using dynamic panel data from 8 CEE countries from 1994 to 2003 also find evidence of a bank lending channel in all countries, through the strength of it varies across countries. Bank size and liquidity seem to play the most significant role in distinguishing banks' reactions to changes in monetary policy. This supports the working hypothesis that liquid and large banks respond less to monetary policy change. The strongest evidence is found for the Czech Republic and the Baltic states while the weakest evidence is found for Hungary. Matousek and Sarantis (2007).

5.4. Data and Methodology

5.4.1. Data

In this study, we compile a monthly balance sheet and income statement data for all reporting Indonesian banks over the period September 2000-2009. Although the original data include 120 financial intermediaries, for most of our analysis we restrict our sample to the 113 commercial banks. The remaining financial intermediaries are excluded because we do not have information on

their changes in liquidity and loans. The sample restriction, however, should not be a big concern for two reasons. First, the excluded financial intermediaries only make up 1% of overall lending. Second, the excluded institutions were not providing loans or taking deposits.

During 2000-2009, there are five mergers events in Indonesia.[8] To mitigate potential problems associated with banks moving between categories due to mergers, we form a bank sample with merger adjustments. Our merger-adjusted data is based on the methodology adopted by Peek and Rosengren (1995) and Kishan and Opiela (2002) in which merged banks are treated as a single bank for the 12-24 months before the merger takes place. This will allow us to implement the estimation using lagged dependent variable as the regressor. This gives us a sample of 12,317 observations and 113 banks.

Table 5.4
Descriptive statistics of variables used

Variables	Description	Obs	Mean	Standard Deviation	Min	Max
Dependent Variables						
Total loans	Investment loans, consumer loans and working capital loans	12,317	13.76	1.97	7.24	19.07
Short term loans	Working capital loans	12,299	12.91	2.12	1.79	18.43
Independent Variables						
Certificate of Bank Indonesia rates	1-month certificate of Bank Indonesia interest rates	12,317	10.80	3.29	6.48	17.67
Narrative monetary policy measure	Index based on the reading on Bank Indonesia's Open Market Policy decisions.	12,317	-0.02	1.03	-2.00	2.00
Loan to asset ratio	Total loans divided by total assets	12,317	0.12	1.81	-5.01	6.05
Liquidity to asset ratio	Total liquidity divided by total assets	12,317	0.32	0.17	0.01	0.95
Capital to asset ratio	Total capital divided by total assets	12,317	0.14	0.11	-0.86	0.94
Real Gross Domestic Product	GDP is inflation adjusted with inflation to the base 2000	12,317	13.43	0.42	12.80	14.19
Prices	Consumer price index	12,317	9.22	3.61	2.71	18.38

This table shows the desriptive statistics of all data and basic variables used in estimation. Most of variables are in percentage except total loan in log forms and narrative measure of monetary policy in index value from -2 (very tight) to 2 (very loose). Liquidity is total liquid assets (cash, reserves and short term securities), Capital is total Tier 1+Tier 2 divided by total assets.
Sources: Bank Indonesia. Various years. CBI rate, GDP, CPI are from Monetary Policy Review. Banking data is unpublished.

[8] The five bank mergers are Bank Century (merger of Bank CIC, Bank Danpac and Bank Pikko), Bank Artha Graha International (merger between Bank Artha Graha and Bank Inter Pacific), Bank CIMB Niaga (merger between Bank Niaga and Bank Lippo), and Bank Windu Kencana Internasional (merger between Bank Windu Kencana and Bank Multicor)

Table 5.4 lists the dependent and independent variables employed in the empirical specifications as well as their descriptive statistics. The dependent variable we feature first is total loans for estimating baseline regression and we also look at total short term loans for robustness checks. As independent variables we include an array of macroeconomic conditions and bank characteristics.

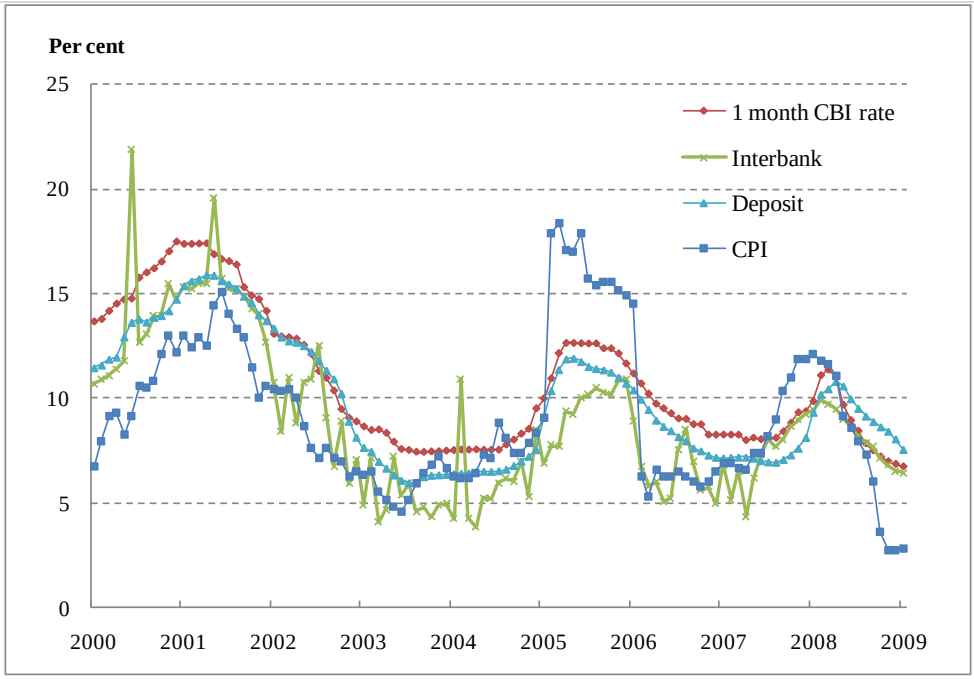
GDP growth, ΔGDP, is available only quarterly, while both the interest rate changes and the inflation rate are measured monthly. Hence, to be consistent with the other macroeconomic measures, we interpolate GDP growth for all intermediary months using cubic-spline.

We use two measures for the changes in monetary conditions: the first is the change in the 1 month Certificate of Bank Indonesia interest rate, and the second is narrative index based on reading from Bank Indonesia's Open Market Committee decision in press release, quarterly review and annual report. The use of variations in the short-term interest rate as a measure that proxies the change in the stance of monetary policy is in line with the literature analyzing the credit channel at the micro level (Agung et al. (2001) also used a 1-month CB interest rate for Indonesian study). The narrative index is constructed similar to the approach used in the study of Boschen-Mills (1995).

We utilize the Certificate Bank Indonesia interest rates as our first measure of monetary policy. That the Bank Indonesia rate might be a good indicator of monetary policy since it has the strong positive correlation with the Bank Indonesia' policy rate. Agung (1998) argues that the money market interest rate (interbank money market) as the monetary policy variable by arguing that Bank Indonesia often indirectly targets the interbank interest rates and SBI rates which have been widely used as the benchmark by the market, in particular since the banks' holding of SBIs increased dramatically. The problem of using the SBI rates are the auction system has been changed few times although since 2000 the auction system has not changed.

The 1-month Certificate Bank Indonesia rate is closely linked to Bank Indonesia's policy rate. 9 It makes the CBI rate a good proxy for monetary policy stance. However since 2008, the CBI rate has been higher than BI Policy rate. This is because the inflation rate has been decreasing but Bank Indonesia wants to absorb excess liquidity in the market. Bank Indonesia employs overnight FASBI to support the money market and to absorb bank's excess liquidity. It reduces the banks opportunity cost of holding deposits. This reflects the traditional view of bank lending channel not working properly since banks can obtain cheaper funds from the money market.

Figure 5.1 The impact of money policy on bank funding



1 month CBI rate is the end-of-period 1-month SBI interest rates published in Weekly Report of Bank Indonesia, Interbank is the overnight Indonesia's money market interest rates. Deposit is bank interest rates on its deposit customers and consumer price index. Source: Bank Indonesia's Monetary Statistics and National Statistic Bureau (various years).

The 1 month CBI rate that is used as a proxy of monetary policy stance has been closely followed by deposit rate. Meanwhile the interbank rate has been

[9] In Indonesian money market, there are five key interest rates namely Bank Indonesia policy rate as the monetary policy operational target, 1 month Certificate of Bank Indonesia rate, Interbank money market rate, Bank Indonesia facility rate and bank deposit rates.

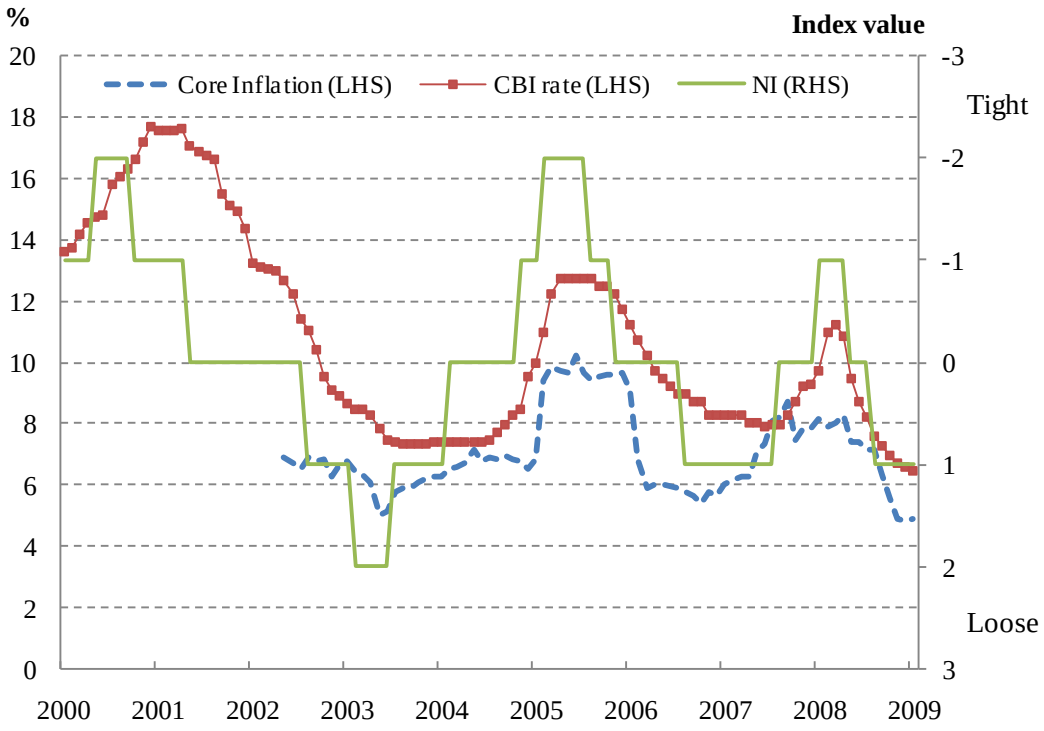
lower than deposit rate. This gives banks an opportunity cost of holding deposits. The changes in monetary policy would significantly change the bank funding to interbank money which is cheaper.

The other measure, the narrative index, measures routine monetary policy condition, relative to the previous month. For example, if interest rates in the previous month was equal or above the world rate, a more than 0.25 percentage rise (fall) in the Indonesian rate would be viewed as a tight (loose) monetary policy condition, and a policy action that does not substantively adjust the bank rate in relation to the world rate is considered neutral or passive. Effectively, we have five discrete scale -2, –1, 0, +1, and +2 corresponding to very tight, tight, neutral, loose and very loose monetary policy stance respectively. This categorisation mitigates the problem of lack of transition that is present in binary policy indices (Romer and Romer, 1989; Huang and Shen, 2001).

Examples of the contractionary policy stance include all open market operations, which act to stimulate increases in short-term interest (or the Bank Indonesia policy rate – the 1 month Certificate Bank Indonesia) rates, increases in reserve requirements, and foreign exchange rationing. High nominal interest rate over and above the CPI inflation rate is considered restrictive; therefore those periods are indexed -2 or –1 depending on the magnitude of the increase. The expansionary policy measures include reduction in the 1 month CBI rates, reduction in the banks' reserve requirements, and the depreciation of the Rupiah per dollar rate. The neutral policy stance includes moral suasion or non reactionary towards the change of macroeconomic disequilibria.

Based on the decision criteria, we can draw the graph of narrative index in Figure 5.2. We can see from the figure that the narrative index has quite similar path to the current benchmark – Certificate Bank Indonesia (CBI) 1 month rate. They have tight monetary policy periods during 2000-2001, 2005-2006 and 2007-2008. It seems that we can use the narrative index for estimation. Finally, for the average inflation rate, we use consumer price index.

Figure 5.2 Measures of Monetary Policy -Narrative Index



NI index is constructed based on selected indicators used in the Board of Governor meeting and published in the press releases documents and other reports (right hand axis). The monetary policy stance that is -2 is contractionary approach and 2 is expansionary approach. Core inflation is inflation rate without considering the impact of administered price inflation and volatile food price. CBI rate is end of 1 month rate of Bank Indonesia Certificate. Both refer to left hand scale.

The composition of the pool of banks may change over time and different banks may have different behaviour in granting the loans to their borrowers. To control for these demand side effects, we include a broad set of bank characteristics in most specifications also bank fixed effects to control for time-invariant unobservable bank characteristics, in robustness replaced by all-encompassing bank -year and loan fixed effects to control for time-variant unobservable bank characteristics. We employ lagged values as economic and monetary conditions may determine the capital and liquidity ratios banks choose.

The key bank balance-sheet variables we are interested are the bank's capital ratio as a measure of the bank's net worth and the liquidity ratio as a measure

of its liquidity position. The capital ratio is defined as the ratio of total Tier 1 and Tier 2 capital over total assets of the bank. The liquidity ratio is the ratio of liquid assets held by the bank (i.e., cash, reserves and short term securities) and the total assets of the bank. Given the skewness of its distribution we employ the natural logarithm of the ratio in all regressions.

5.4.2. Model Specification

In the following empirical approach, we combine size (total assets), liquidity (short term securities i.e certificate of Bank Indonesia) and capital (capital to asset ratio). We test empirically whether bank characteristics will have effect on the way bank respond to the change of monetary policy. The basic regression of full model is thus

$$\begin{aligned}\Delta \ln(L_{i,t}) = {} & \sum_{j=1}^{3} \alpha_j \, \Delta \ln(L_{i,t-j}) + \sum_{j=1}^{3} \beta_j \Delta MPI_{t-j} + \sum_{j=0}^{3} \gamma_j \Delta \ln \text{GDP}_{\text{t-j}} \\ & + \sum_{j=0}^{3} \delta_j \, inf_{t-j} + \zeta x_{i,t-1} + \sum_{j=1}^{3} \varphi_1 x_{i,t-1} \, \Delta MPI_{t-j} \\ & + \sum_{j=1}^{3} \varphi_2 x_{i,t-1} \, \Delta lnGDP_{t-j} + \sum_{j=1}^{3} \varphi_3 x_{i,t-1} \, inf_{t-j} \\ & + \varepsilon_{i,t} \end{aligned} \quad (5.1)$$

where i=1, …, N and t=1, …, T. N denotes the number of banks, T the total number of time periods (monthly); L denotes total loans, MPI denotes monetary policy measures i.e 1-month certificate of Bank Indonesia's interest rates or narrative index, Gross Domestic Product (GDP), *inf* denotes inflation, *x* denotes bank characteristics: size, liquidity and capitalisation. φ_k denotes

interaction between bank's characteristics and monetary policy measures or GDP or inflation, and finally ε_{it} denotes error term.

The specification is in growth rates. The reasons are two-fold: first, we are interested in capturing the differences in the reactions of banks to monetary shocks across bank characteristics, and second, the specification in growth rates is to circumvent unit root problem.

The specification described by equation (5.1), estimated using the Generalized Method of Moments designed by Arellano and Bond (1991) (hereinafter "AB"). We use this methodology because of the inclusion of lagged dependent variable as an explanatory variable[10]. The methodology also accounts for the possible endogeneity of some variables, as is probably the case with the bank characteristics. AB's methodology first differences the autoregressive model in order to eliminate the individual effect and "optimally exploits" the moment conditions using the lagged values dated t-3 and earlier of the dependent variable and lagged values of the predetermined variables as instruments. This ensures efficiency and consistency in the hypothesis of large N and small T, and provided that the model is not subject to serial correlation in it ε and that the set of instrument variables used is valid (which is tested with the Sargan test). Should the disturbances not be serially correlated, it will be evidence of significant negative first-order serial correlation in the differenced residuals and no evidence of second-order serial correlation in the differenced residuals. AB designs both 1-step estimation and a 2-step estimation. The difference between them consists in the specification of an individual specific weighting matrix. The 2-step estimation uses the 1-step's residuals, so it is more efficient.

[10] The presence of a lagged dependent variable among the regressors in a specification considering the individual effect brings about the situation of a right-hand regressor correlated with the error term. In this case, OLS estimation would be biased and inconsistent. The Within estimator would be biased of O(1/T) and its consistency depends on T being large; the random effect GLS estimator in a dynamic panel data model is also biased; the instrumental variable (IV) estimation assures consistency but not necessarily efficiency, since it does not use all the available moment conditions and it does not consider the differenced structure of the residuals. Also, an MLE approach would require strong assumptions on the initial conditions and the distribution of the individual effect. See Baltagi (2008) for a complete analysis.

The bank characteristics (x) are those motivated by the underlying theory of the bank lending channel are defined in the following way:

$$Size_{i,t} = logA_{i,t} - \frac{1}{N_t}\sum_{i} logA_{it} \tag{5.2}$$

$$Liquidity_{i,t} = \frac{L_{i,t}}{A_{i,t}} - \frac{1}{N_t}\sum_{i} \frac{L_{i,t}}{A_{i,t}} \tag{5.3}$$

$$Capitalisation_{i,t} = \frac{C_{i,t}}{A_{i,t}} - \frac{1}{N_t}\sum_{i} \frac{C_{i,t}}{A_{i,t}} \tag{5.4}$$

where $A_{i,t}$ represents total assets, $L_{i,t}$ represents liquid assets, and $C_{i,t}$ represents total capital (Tier1+Tier2), The bank characteristics are normalized with respect to their average across all banks in the respective sample to eliminate possible trends.

The parameters of interest are those in front of narrative indices and CBI rate (β_j), which are meant to capture the direct overall impact of monetary policy changes on the growth in bank lending, and the coefficients in front of the interaction terms (η_j), based on which we assess whether the considered bank characteristic makes any difference in the way banks react to monetary policy changes.

The coefficient in front of the bank characteristic (ζ) has also an illustrative role, describing whether there is a linear relationship between the growth rate of loans and the bank characteristic. Given that there is no prior analysis to address the reaction of bank lending to monetary policy changes at the micro level in Indonesia, for a preliminary insight into whether the growth rate of loans responds to monetary policy shocks and macroeconomic conditions we first estimate a "baseline or benchmark model", which does not include the

bank characteristic (x) and the interaction between the bank characteristic and monetary policy measure.

After conducting the estimation, we then test the null hypothesis of long run coefficients that the sum of the coefficient of the various lags of the indicated variable divided by one minus the sum of the coefficients on the lagged endogenous variable are zero. We also test the null hypothesis that the coefficients are zero. Finally, we calculated the estimated standard error of the long run coefficients using the delta method.

5.5. Empirical Results

5.5.1. Baseline Model

In this section we present regression result in table 5.5 and 5.6. The difference between the tables is in the choice of monetary policy measures. We report result using 1-month certificate Bank Indonesia rate in table 5.5 and using the narrative index in table 5.6. In the tables, each column shows the results from one of the specifications-first models with one of the bank characteristics each, and then one model with all three characteristics simultaneously. We also present the long run coefficients of bank characteristics.

In our model, the bank lending channel operates via the banks' characteristics, and our results show that there is a statistical significant relation between the banks' characteristics and loans in the interaction terms. Table 5.5 presents a complete list of coefficient estimates, standard error and associated p-values.

Table 5.5
Monetary policy transmission, 3 lags GMM estimates and long run coefficients
(1 month CBI rate)

Variable	Dependent variable: log loan											
	Size			**Liquidity**			**Capital**			**All**		
Explanatory variables	Coeff	Std error	*p-value*	Coeff	Std error	*p-value*	Coeff	Std error	*p-value*	Coeff	Std error	*p-value*
Lagged 1 loans	-0.677	0.001	0.000	-0.519	0.001	0.000	-0.674	0.001	0.000	-0.509	0.002	0.000
Lagged 2 loans	-0.451	0.001	0.000	-0.531	0.001	0.000	-0.442	0.001	0.000	-0.515	0.002	0.000
Lagged 3 loans	-0.416	0.001	0.000	-0.476	0.001	0.000	-0.408	0.001	0.000	-0.452	0.003	0.000
Lagged 1 certificate BI int rate (CBI)	0.520	0.008	0.000	1.330	0.042	0.000	-0.093	0.014	0.000	-0.285	0.097	0.003
Lagged 2 certificate BI int rate CBI)	0.217	0.007	0.000	-0.434	0.034	0.000	-0.043	0.010	0.000	-0.058	0.057	0.307
Lagged 3 certificate BI int rate (CBI)	0.147	0.005	0.000	0.790	0.038	0.000	-0.039	0.009	0.000	-0.029	0.069	0.678
Long run coefficient CBI	**0.347**	**0.005**	**0.000**	**0.667**	**0.028**	**0.000**	**-0.069**	**-0.008**	**0.000**	**-0.150**	**-0.070**	**0.031**
Lagged 1 GDP	0.795	0.015	0.000	1.904	0.121	0.000	0.202	0.078	0.010	0.558	0.395	0.157
Lagged 2 GDP	0.438	0.021	0.000	-1.228	0.062	0.000	0.423	0.093	0.000	0.444	0.303	0.142
Lagged 3 GDP	-0.099	0.017	0.000	0.406	0.193	0.000	0.427	0.060	0.000	0.826	0.458	0.071
Long run coefficient GDP	**0.446**	**0.016**	**0.000**	**0.428**	**0.074**	**0.000**	**0.417**	**0.042**	**0.000**	**0.738**	**0.252**	**0.003**
Lagged 1 CPI	-0.423	0.012	0.000	-1.611	0.039	0.000	-0.056	0.028	0.046	0.364	0.423	0.388
Lagged 2 CPI	-0.221	0.012	0.000	0.066	0.030	0.000	0.320	0.034	0.000	0.509	0.510	0.319
Lagged 3 CPI	0.100	0.015	0.000	0.338	0.045	0.000	-0.013	0.041	0.749	0.325	0.423	0.443
Long run coefficient CPI	**-0.214**	**-0.010**	**0.000**	**-0.478**	**-0.021**	**0.000**	**0.099**	**0.013**	**0.000**	**0.484**	**0.152**	**0.002**
Lagged 1 GDP*lagged 1 asset	-0.167	0.008	0.000							-0.749	0.058	0.000
Lagged 2 GDP*lagged 1 asset	-0.127	0.010	0.000							0.030	0.035	0.402
Lagged 3 GDP*lagged 1 asset	0.063	0.011	0.000							0.452	0.036	0.000
Lagged 1 GDP*lagged 1 liquidity				-3.719	0.358	0.000				1.980	0.967	0.041
Lagged 2 GDP*lagged 1 liquidity				3.785	0.169	0.000				0.061	0.633	0.923
Lagged 3 GDP*lagged 1 liquidity				-0.079	0.598	0.000				-1.863	1.172	0.112
Lagged 1 GDP*lagged 1 capital							0.167	0.546	0.760	-5.892	2.298	0.010
Lagged 2 GDP*lagged 1 capital							-0.079	0.675	0.907	-0.897	1.617	0.579
Lagged 3 GDP*lagged 1 capital							-1.335	0.345	0.000	1.682	1.290	0.192
Lagged 1 CPI*lagged 1 asset	0.196	0.011	0.000							0.118	0.022	0.000
Lagged 2 CPI*lagged 1 asset	0.092	0.008	0.000							0.020	0.021	0.346
Lagged 3 CPI*lagged 1 asset	0.196	0.015	0.000							-0.098	0.031	0.002
Lagged 1 CPI*lagged 1 liquidity				3.326	0.101	0.000				-0.103	1.060	0.923
Lagged 2 CPI*lagged 1 liquidity				0.111	0.078	0.000				-1.515	1.463	0.300
Lagged 3 CPI*lagged 1 liquidity				-1.076	0.127	0.000				0.614	1.169	0.599
Lagged 1 CPI*lagged 1 capital							-0.915	0.196	0.000	-4.517	1.069	0.000
Lagged 2 CPI*lagged 1 capital							-2.191	0.294	0.000	-1.524	1.184	0.198
Lagged 3 CPI*lagged 1 capital							0.059	0.304	0.846	-2.459	1.257	0.050
Lagged 1 Assets (Size)	-0.057	0.004	0.000							-0.062	0.003	0.000
Lagged 1 CBI*lagged 1 asset	-0.044	0.006	0.000							-0.432	0.036	0.000
Lagged 2 CBI*lagged 1 asset	-0.039	0.003	0.000							-0.126	0.012	0.000
Lagged 3 CBI*lagged 1 asset	-0.007	0.003	0.012							-0.055	0.008	0.000
Long run coefficient assets	**-0.035**	**-0.004**	**0.000**							**-0.248**	**-0.022**	**0.000**
Lagged 1 Liquidity				0.153	0.013	0.000				0.483	0.122	0.000
Lagged 1 CBI*lagged 1 liquidity				-3.224	0.117	0.000				1.128	0.205	0.000
Lagged 2 CBI*lagged 1 liquidity				1.031	0.092	0.000				0.135	0.178	0.448
Lagged 3 CBI*lagged 1 liquidity				-1.876	0.096	0.000				-0.226	0.157	0.151
Long run coefficient liquidity				**-1.611**	**-0.068**	**0.000**				**0.419**	**0.173**	**0.016**
Lagged 1 Capitalisation							0.277	0.022	0.000	1.143	0.077	0.000
Lagged 1 CBI* lagged 1 capital							0.773	0.090	0.000	-0.047	0.338	0.890
Lagged 2 CBI* lagged 1 capital							-0.032	0.069	0.644	-0.408	0.205	0.046
Lagged 3 CBI*lagged 1 capital							0.332	0.044	0.000	0.635	0.155	0.000
Long run coefficient capital							**0.425**	**0.046**	**0.000**	**0.073**	**0.202**	**0.719**
p-value Sargan-Hansen	0.326			0.356			0.347			0.598		
p-value MA2	0.086			0.414			0.084			0.956		
p-value MA3	0.101			0.073			0.079			0.093		
No of banks	113			113			113			113		
No of observations	11752			11752			11752			11752		

This table shows the result of loan equation with three period of lags of independent variables using two steps Generalised Method of Moment (Arellano Bond, 1991) with robust standard errors. The dependent variable is loan growth. The set of explanatory variables are 1 month certificate Bank Indonesia rate (CBI), real GDP, prices (consumer price index-CPI), and some interactions between bank characteristics with CBI, GDP and CPI. Bank characteristics are log total asset (size), ratio of total liquid assets to total assets (liquidity), and capitalisation (ratio of total capital over total assets). Standard error and p-value are presented next to each coefficients.

We present the results of interactions term in the first three columns in which size, liquidity and capital are estimated separately. The coefficient for the size and the liquidity are negative and for the capital is positive. Most of the impacts of the bank characteristics are transmitted to bank loans since the first month. Nevertheless, during the last three months periods, the impact of monetary policy shock has been lessening. For example, the negative impact for the assets has reduced from 0.044% to 0.007%. The liquidity contraction has dropped from 3.22% to 1.87%. In the capital equation, the elasticity of loan growth has decreased from 0.77% to 0.33%.

The final column of table 5.5 presents estimates that include a comprehensive set of bank characteristics in which size, liquidity and capital are combined in one estimation. The estimated coefficients on GDP growth and the change in the interest rate are positive and smaller than the one characteristic model. These variables absorb changes in loan demand quality over the business cycle, i.e., changes in the loan from different banks. Meanwhile, the coefficients of the interaction terms have similar signs with that of each bank characteristic models. The only different is that the coefficients are slightly larger for assets and capitalisation.

The long run effects of monetary policy on loans of an average bank vary. It is a negative effect for size and liquidity i.e. larger and illiquid banks respond less than small and liquid banks. There is a positive effect for capitalisation i.e. better capitalised banks respond more in the long run. The estimated coefficients on the bank characteristics are overall and across all specifications statistically significant, economically relevant, and stable. The average banks reduce lending after a monetary contraction by 0.035% in size equation, 1.61% in liquidity equation following a contractionary monetary policy stance. Meanwhile, high capital banks are less responsive to the tight monetary policy with an increase in loans by 0.43%.

As we have seen, bank characteristics do emerge as a useful indicator for distributional effects of monetary policy. The only different is liquidity that gives negative effect in the specification with liquidity only but positive effect in all characteristics. In all bank characteristics specification, the effect of monetary change is more on large and highly liquid banks. Following tight monetary policy, those types of banks reduce their loan growth by 0.5% and 0.4% respectively while high capital bank increase their lending by 2.7%. This could, however, be caused by liquidity segmentation in Indonesian banks where there are 13 banks are very liquid with average liquidity to asset ratio is 62.4%.

Table 5.6
Monetary policy transmission, 3 lags, GMM estimates and long run coefficients (narrative index)

Variable	Dependent variable: log loan											
Explanatory variables	**Size**			**Liquidity**			**Capital**			**All**		
	Coeff	Std error	p-value	Coeff	Std error	p-value	Coeff	Std error	p-value	Coeff	Std error	p-value
Lagged 1 loans	-0.120	0.001	0.000	-0.515	0.001	0.000	-0.177	0.002	0.000	-0.481	0.008	0.000
Lagged 2 loans	-0.160	0.001	0.000	-0.529	0.001	0.000	-0.217	0.001	0.000	-0.462	0.009	0.000
Lagged 3 loans	-0.123	0.001	0.000	-0.476	0.001	0.000	-0.130	0.001	0.000	-0.415	0.008	0.000
Lagged 1 narrative index (NI)	-0.246	0.013	0.000	-0.181	0.008	0.000	-0.124	0.015	0.000	-0.147	0.084	0.000
Lagged 2 narrative index (NI)	-0.168	0.014	0.000	-0.141	0.009	0.000	-0.340	0.023	0.000	-0.172	0.128	0.000
Lagged 3 narrative index (NI)	-0.020	0.015	0.207	-0.036	0.009	0.000	-0.237	0.016	0.000	-0.163	0.112	0.000
Long run coefficient NI	-0.309	-0.028	0.000	-0.142	-0.008	0.000	-0.460	-0.034	0.000	-1.026	-0.141	0.000
Lagged 1 GDP	0.493	0.053	0.000	0.053	0.095	0.574	7.103	0.116	0.000	4.997	0.882	0.000
Lagged 2 GDP	0.355	0.018	0.000	0.338	0.053	0.000	4.855	0.116	0.000	0.200	1.282	0.000
Lagged 3 GDP	0.102	0.019	0.000	0.177	0.109	0.104	-0.849	0.089	0.000	3.591	1.574	0.052
Long run coefficient GDP	0.677	0.033	0.000	0.226	0.072	0.002	7.290	0.116	0.000	7.278	0.968	0.000
Lagged 1 CPI	2.893	0.083	0.000	-0.363	0.064	0.000	0.941	0.119	0.000	7.056	1.035	0.000
Lagged 2 CPI	-0.501	0.033	0.000	-0.103	0.029	0.000	3.386	0.063	0.000	-6.700	1.078	0.000
Lagged 3 CPI	0.068	0.019	0.000	-0.033	0.020	0.096	4.310	0.115	0.000	-1.774	0.982	0.000
Long run coefficient CPI	1.752	0.047	0.000	-0.198	-0.016	0.000	5.668	0.086	0.000	13.390	0.507	0.000
Lagged 1 GDP*lagged 1 asset	0.608	0.033	0.000							-6.275	0.208	0.000
Lagged 2 GDP*lagged 1 asset	-0.189	0.012	0.000							-0.300	0.115	0.019
Lagged 3 GDP*lagged 1 asset	0.279	0.013	0.000							0.656	0.104	0.571
Lagged 1 GDP*lagged 1 liquidity				0.673	0.320	0.036				4.533	1.603	0.000
Lagged 2 GDP*lagged 1 liquidity				0.025	0.136	0.854				-1.364	2.079	0.000
Lagged 3 GDP*lagged 1 liquidity				0.101	0.345	0.770				-3.743	3.576	0.484
Lagged 1 GDP*lagged 1 capital							-50.295	0.783	0.000	-34.980	5.777	0.000
Lagged 2 GDP*lagged 1 capital							-32.191	0.790	0.000	6.078	5.399	0.115
Lagged 3 GDP*lagged 1 capital							3.419	0.564	0.000	9.941	4.121	0.000
Lagged 1 CPI*lagged 1 asset	-2.780	0.030	0.000							-9.545	0.241	0.000
Lagged 2 CPI*lagged 1 asset	0.943	0.023	0.000							6.095	0.168	0.000
Lagged 3 CPI*lagged 1 asset	0.327	0.023	0.000							5.057	0.222	0.000
Lagged 1 CPI*lagged 1 liquidity				0.422	0.211	0.046				6.881	2.176	0.000
Lagged 2 CPI*lagged 1 liquidity				0.376	0.091	0.000				-6.215	3.548	0.005
Lagged 3 CPI*lagged 1 liquidity				0.069	0.068	0.306				-1.500	2.268	0.000
Lagged 1 CPI*lagged 1 capital							8.124	0.789	0.000	-64.501	5.835	0.000
Lagged 2 CPI*lagged 1 capital							-27.323	0.695	0.000	39.995	3.091	0.000
Lagged 3 CPI*lagged 1 capital							-30.431	0.730	0.000	26.222	4.234	0.000
Lagged 1 assets	0.044	0.004	0.000							0.965	0.051	0.000
Lagged 1 NI*lagged 1 asset	0.357	0.015	0.000							0.064	0.011	0.000
Lagged 2 NI*lagged 1 asset	0.376	0.011	0.000							0.452	0.020	0.000
Lagged 3 NI*lagged 1 asset	0.302	0.009	0.000							0.564	0.022	0.000
Long run coefficient assets	**0.737**	**0.024**	**0.000**							**0.204**	**0.022**	**0.000**
Lagged 1 liquidity				0.301	0.012	0.000				0.852	0.353	0.000
Lagged 1 NI*lagged 1 liquidity				0.286	0.017	0.000				0.391	0.111	0.000
Lagged 2 NI*lagged 1 liquidity				0.265	0.025	0.000				0.369	0.152	0.000
Lagged 3 NI*lagged 1 liquidity				0.049	0.028	0.077				-0.055	0.163	0.000
Long run coefficient liquidity				**0.238**	**0.024**	**0.000**				**1.653**	**0.152**	**0.000**
Lagged 1 capitalisation							5.125	0.058	0.000	-0.053	0.465	0.000
Lagged 1 NI* lagged 1 capital							0.081	0.088	0.359	-2.309	0.418	0.000
Lagged 2 NI* lagged 1 capital							1.474	0.146	0.000	0.653	0.653	0.000
Lagged 3 NI*lagged 1 capital							0.819	0.111	0.000	1.034	0.480	0.000
Long run coefficient capital							**1.558**	**0.216**	**0.000**	**3.311**	**0.682**	**0.000**
p-value Sargan-Hansen	0.276			0.445			0.180			0.860		
p-value MA2	0.122			0.717			0.082			0.871		
p-value MA3	0.065			0.051			0.922			0.310		
No of banks	113			113			113			113		
No of observations	11,752			11,752			11,752			11,752		

This table presents the result of loan equation with three period of lags of independent variables using two steps Generalised Method of Moment (Arellano Bond, 1991) with robust standard errors. The dependent variable is loan growth. The set of explanatory variables are narrative index as monetary policy measure (NI), real GDP, prices (consumer price index-CPI), and some interactions between bank characteristics with CBI, GDP and CPI. Bank characteristics are log total asset (size), ratio of total liquid assets to total assets (liquidity), and capitalisation (ratio of total capital over total assets). Standard error and p-value are presented next to each coefficients.

In table 5.6 we present the result from GMM estimation using narrative index as monetary policy measure. Unlike the previous measure, higher narrative index means expansionary monetary policy.

All type of banks responds more to the change of the index. The coefficients of each bank's characteristics are positive and significant. The more relax monetary policy the more banks to expand their lending. Furthermore, the impacts of the bank characteristics seem to be transmitted to bank loans since the first month and lessening in the next two months. For example, the positive impact for the assets has decreased from 0.357% to 0.302%.

In the combined model, the coefficients are mixed. Size and capitalisation have negative coefficients in the beginning and become positive toward the end of third month. Meanwhile, liquidity has different pattern that the coefficient is initially positive. These results suggest that both large and high capitalised banks respond more and the high liquid banks respond less during the early months to a more relax monetary policy stance.

In the long run, the interaction variables between monetary policy change and bank characteristics show that relax monetary policy stance is responded positively by banks with different characteristics. There is an increase of loans by 0.2% in size equation, 1.7% in liquidity equation and 3.3% in capitalization equation.

While results are significant, there are some inconsistencies between table 5.5 and 5.6, especially in the model in which all interaction of bank characteristics are used.

In general the models are robust and explain that bank characteristics are important in monetary policy transmission in Indonesia. Moreover, the regressions specifications fit well and pass diagnostic tests against auto correlation which is applied to the differenced residuals and over identifying instruments at the 5% level of significance. Autocorrelation indicates that the

three lags of the dependent variable and any other variables used as instruments are strictly exogenous and thus good instruments. In addition to, the results from over-identifying restrictions test find that the instruments, as a group, are appearing exogenous. The Sargan-Hansen J statistic, which is the minimized value of the two-step GMM criterion function, is also robust.

5.5.2. Robustness Checks

To check the robustness of the results, we change the monetary policy measure using money market interest rates (MM rates), broad money as monetary measure and also alter the dependent variable to working capital loan (See table 5.7). These alternative measures of monetary policy can be motivated by arguing that Bank Indonesia often indirectly targets the broad money and interbank interest rates (Agung et al., 2001).

The model using interbank money market interest rates shows similar result with the baseline model using CBI interest rate. The coefficients of size and capitalisation are negative and of liquidity are mostly negative and significant. Large banks respond more to the tight monetary policy stance. As a response, those banks on average decrease lending by 0.03% after a monetary contraction

In model 2 using broad money, the results for the effect of monetary policy change to bank characteristics shows similar and significant result with baseline model using CBI interest rate. The tight monetary policy caused large banks to reduce more lending by 0.025%. Meanwhile, high liquidity and highly capitalised banks manage to increase lending by 0.3% and 1.1% respectively.

Finally in model 3, in order to ascertain whether or not there is a distributional effect of size, liquidity and capitalisation to the maturity structure of bank's loan portfolio, the dependent variable is replaced with short term loan. This exercise will provide information if there is a different response between different bank characteristics to the change of short term loan which is

uncollateralised. We find similar results that the contractionary monetary policy caused a reduction of lending by 3.7%. Furthermore, it seems that large banks' response was stronger than that of small banks as a result of monetary policy shock. Low liquid and low capitalised banks have significant positive effects. The tight in monetary policy increase their loan growth by 0.4% and 1.1%.

Table 5.7 Robustness Checks

Models:	1			2			3		
Dependent variables:	Log total loans			Log total loans			Log Working capital loans		
Monetary policy measures:	MM rates			Log broad money (M1)			1 month CBI rates		
Explanatory variables	Coeff	Std error	p-value	Coeff	Std error	p-value	Coeff	Std error	p-value
Lagged 1 loans	-0.506	0.002	0.000	-0.508	0.002	0.000	-0.516	0.002	0.000
Lagged 2 loans	-0.521	0.002	0.000	-0.521	0.002	0.000	-0.522	0.003	0.000
Lagged 3 loans	-0.456	0.003	0.000	-0.456	0.003	0.000	-0.460	0.004	0.000
Lagged 1 certificate BI int rate (CBI)	0.065	0.076	0.391	-0.036	0.045	0.420	-3.712	0.230	0.000
Lagged 2 certificate BI int rate CBI)	-0.062	0.108	0.564	0.003	0.042	0.949	-1.147	0.094	0.000
Lagged 3 certificate BI int rate (CBI)	0.076	0.070	0.274	0.050	0.020	0.015	-0.828	0.074	0.000
Lagged 1 GDP	0.877	0.418	0.036	0.444	0.414	0.284	1.491	0.495	0.003
Lagged 2 GDP	0.479	0.168	0.004	0.471	0.203	0.020	0.162	0.387	0.675
Lagged 3 GDP	0.247	0.341	0.469	0.407	0.406	0.316	0.224	0.406	0.581
Lagged 1 CPI	0.008	0.266	0.977	0.372	0.178	0.037	0.341	0.385	0.377
Lagged 2 CPI	0.843	0.348	0.016	-0.066	0.380	0.863	-0.460	0.343	0.181
Lagged 3 CPI	-0.023	0.393	0.953	0.338	0.518	0.514	0.957	0.510	0.061
Lagged 1 GDP*lagged 1 asset	-0.237	0.051	0.000	-0.251	0.065	0.000	-0.818	0.078	0.000
Lagged 2 GDP*lagged 1 asset	-0.069	0.029	0.018	-0.042	0.034	0.221	0.098	0.036	0.007
Lagged 3 GDP*lagged 1 asset	0.052	0.028	0.062	0.059	0.035	0.092	0.488	0.030	0.000
Lagged 1 GDP*lagged 1 liquidity	0.989	0.762	0.194	1.622	0.967	0.093	-0.796	1.222	0.514
Lagged 2 GDP*lagged 1 liquidity	-0.302	0.396	0.445	-0.493	0.515	0.339	-0.246	0.620	0.692
Lagged 3 GDP*lagged 1 liquidity	0.305	0.851	0.720	-0.151	1.004	0.880	-0.523	1.069	0.625
Lagged 1 GDP*lagged 1 capital	-6.484	2.182	0.003	-4.844	2.615	0.064	-5.920	2.426	0.015
Lagged 2 GDP*lagged 1 capital	0.083	1.086	0.939	0.567	1.371	0.679	1.159	1.827	0.526
Lagged 3 GDP*lagged 1 capital	0.507	0.896	0.571	-0.054	1.161	0.963	1.993	0.996	0.045
Lagged 1 CPI*lagged 1 asset	-0.034	0.021	0.104	-0.065	0.019	0.001	0.133	0.025	0.000
Lagged 2 CPI*lagged 1 asset	-0.194	0.019	0.000	-0.123	0.038	0.001	0.009	0.034	0.778
Lagged 3 CPI*lagged 1 asset	0.087	0.024	0.000	0.051	0.030	0.082	-0.078	0.038	0.038
Lagged 1 CPI*lagged 1 liquidity	0.674	0.499	0.177	0.018	0.367	0.960	-0.066	1.084	0.952
Lagged 2 CPI*lagged 1 liquidity	-1.375	1.097	0.210	0.319	0.539	0.554	1.185	0.578	0.040
Lagged 3 CPI*lagged 1 liquidity	1.220	1.105	0.270	0.466	1.107	0.674	-1.290	1.327	0.331
Lagged 1 CPI*lagged 1 capital	-3.343	1.159	0.004	-4.723	0.972	0.000	-4.586	1.086	0.000
Lagged 2 CPI*lagged 1 capital	-4.504	0.602	0.000	-1.343	2.037	0.510	-0.843	1.891	0.656
Lagged 3 CPI*lagged 1 capital	-1.219	1.301	0.349	-2.330	1.815	0.199	-2.545	1.962	0.195
Lagged 1 assets	**-0.030**	**0.003**	**0.000**	**-0.025**	**0.004**	**0.000**	**-0.041**	**0.005**	**0.000**
Lagged 1 CBI*lagged 1 asset	-0.093	0.011	0.000	-0.009	0.005	0.069	4.223	0.272	0.000
Lagged 2 CBI*lagged 1 asset	-0.063	0.014	0.000	0.013	0.005	0.012	1.201	0.075	0.000
Lagged 3 CBI*lagged 1 asset	-0.024	0.009	0.006	0.003	0.004	0.370	0.935	0.070	0.000
Lagged 1 liquidity	**0.334**	**0.073**	**0.000**	**0.306**	**0.060**	**0.000**	**0.406**	**0.074**	**0.000**
Lagged 1 CBI*lagged 1 liquidity	-0.228	0.186	0.221	0.043	0.125	0.732	-0.043	0.066	0.518
Lagged 2 CBI*lagged 1 liquidity	0.208	0.178	0.244	-0.053	0.128	0.679	0.079	0.033	0.016
Lagged 3 CBI*lagged 1 liquidity	-0.144	0.121	0.237	-0.183	0.057	0.001	0.002	0.029	0.950
Lagged 1 capitalisation	**1.195**	**0.075**	**0.000**	**1.107**	**0.114**	**0.000**	**1.108**	**0.142**	**0.000**
Lagged 1 CBI* lagged 1 capital	-0.604	0.548	0.271	0.431	0.166	0.010	0.142	0.072	0.049
Lagged 2 CBI* lagged 1 capital	-0.166	0.842	0.844	0.398	0.169	0.018	0.014	0.031	0.662
Lagged 3 CBI*lagged 1 capital	-0.626	0.469	0.182	0.264	0.088	0.003	0.022	0.022	0.321
p-value Sargant-Hansen	0.589			0.659			0.621		
p-value MA2	0.898			0.906			0.884		
p-value MA3	0.069			0.070			0.156		
No of banks	113			113			113		
No of observations	11,752			11,752			11,712		

This table shows 3 models estimated using two steps Generalised Method of Moment (Arellano Bond, 1991) with robust standard errors. Model 1 and 2 use total loan growth as the dependent variable, while Model 3 uses working capital loan's growth. For the monetary measure: money market interest rates (MM) in model 1, log of broad money in model 2, and CBI interest rate in model 3. The set of explanatory variables are real GDP, prices (consumer price index-CPI), and interactions between bank characteristics and CBI, GDP, and CPI. Bank characteristics are log total asset (size), ratio of total liquid assets to total assets (liquidity), and capitalisation (ratio of total capital over total assets). Standard error and p-value are presented next to each coefficients.

In general the models have similar results and support the baseline model using 1 month Certificate of Bank Indonesia. The regressions specifications fit well and pass diagnostic tests against serial correlation and over identifying instruments at the 5% level of significance.

5.5.3. Economic significance of the results

Following the example of Kashyap and Stein (2000), we analyze the economic significance of our estimation results. From table 5.5 the estimate of the long run effect of bank size is 0.035% using 1 month certificate of Bank Indonesia as monetary policy measure. We use the distribution data in September 2009 (in Appendix 2) and find that the large bank has βj = Rp130.2 trillion and a small bank has βj =Rp3.6 trillion. These numbers correspond to the 90th and 10th percentile of the distribution in September 2009. This implies that, one month after a 100 basis point rise in CBI funds rate, the level of loans of the small bank will be roughly 0.19% lower than that of the large bank. That is if both banks started with a level of loans equal to Rp1000 then purely on the basis of asset differences, we would predict a Rp0.19 gap between the two banks a month after the CBI rate shock.

5.6. Conclusions

This chapter is an empirical examination of the lending channel in Indonesia. The analysis focuses on the differential response of the loan supply to monetary policy across bank characteristics. The categorisation device is used in this chapter based on banks' financial strength measured by size, liquidity and capitalisation. This study use monthly dataset on all Indonesian banks from September 2000 to September 2009 and apply 1 month Certificate Bank Indonesia rate and narrative index based on Boschen and Mills index as the monetary policy measures.

The result from loan supply suggests that a lending channel is operative in Indonesia. We find clear evidence that in the short run large banks are more responsive (and some evidence high liquidity and high capitalisation banks are less responsive to the change of monetary policy). These bank characteristics are matter for the transmission process in Indonesia.

We find that all factors are generally important for the way bank adjusts its lending to interest rate or monetary policy stance changes. This is similar to other developing countries results where large banks show stronger response to monetary policy.

Liquidity is important to shape the response of a bank to monetary policy. Banks with a relatively low share of liquid assets reduce loan supply by more than more liquid banks on average. It appears that banks with liquid assets draw on their liquid assets to maintain their loan portfolio. A reason for doing this could be the existence of relationship lending in Indonesia, where bank customers are shielded to some extent from monetary policy effects.

Following van den Heuvel (2001), the supply of credit is likely to be influence by the health of the banking system as well as the shocks hitting it at any point in time. Hence, to the extent that policymakers do not have precise knowledge of the state of the banking system, they will face considerable uncertainty when trying to evaluate the likely response of the economy to changes in monetary policy. This research may provide information about the behaviour of bank lending to the policymakers so they could apply the most appropriate monetary policy. Indonesian policy makers need to take account of how the response to monetary policy change varies with bank characteristics and especially with bank size.

Appendices

Appendix 1. The construction of narrative index

In order to construct narrative index, the episodes are first identified, followed by an assessment of the policy developments immediately before and after the source of each episode. The financial policy stance following each episode is then classified as "tight", "neutral", or "loose" depending on the behaviour of a combination of policy instruments including the growth of money supply, Bank Indonesia Policy rate, Certificate of Bank Indonesia rate, the change of the Rupiah's exchange rate, and loan to deposit ratio. We assign each of the policy instruments the expected impact on economic activity.

The growth in money supply shows a downward pressure on the interest rate structure and encourages banks to reduce lending rates and increase the demand for lending. This type of policy action is an example of expansionary monetary policy whose expansionary impact is index 1 for moderate growth and 2 for significant growth of money supply.

A high interest rate policy (Bank Indonesia rate) exerts an upward pressure on the interest rate structure, thus forcing banks to raise their deposit and lending rates, which in turn may discourage the demand for funds for expenditure by the consumers and investors. Such policy action is an example of tight monetary policy whose contractionary impact is index -1 for moderate impact and -2 for significant impact.

Higher liquid assets or loan to deposit ratio will reduce the quantity of loanable funds available for intermediation hence has a potential of inducing an increase in the overall interest rate structure and in the end inducing a fall in the supply of and the demand for money and credit. A fall in the demand for liquidity shifts the aggregate demand curve inwards, and thus inducing a fall in the level national output. Again, such policy is classified as tight and contractionary and is indexed -1 for moderate change and -2 for significant change.

The change of Rupiah exchange rate has became the concern of the central bank. This is because most Indonesian manufacturing industries use imported material for example raw material and capital goods. The central bank sometimes intervenes to stabilize the market since high volatility and large Rupiah depreciation will have significant impact on the inflation increases. Therefore the realized Rupiah depreciation has been indexed as -1.

Appendix 2: Banks' characteristics for economic significance calculation

Table Indonesian Banking– September 2009

	Large	Small	Liquid	Low Liquid	Well cap	Poorly cap
	(1)	(2)	(3)	(4)	(5)	(6)
Number of banks	12	104	13	103	12	104
Mean Asset (trillion Rp)	130.2	6.8	5.5	21.3	3.4	21.4
Fraction of total asset	**5.7**	**0.3**	0.2	0.9	0.2	0.9
Mean deposit (trillion Rp)	69.2	4.3	3.7	12.0	1.5	12.1
Fraction of tot deposit	5.4	0.3	0.3	0.9	0.1	0.9
Mean lending (trillion Rp)	71.3	4.0	2.0	12.1	2.4	11.9
Fraction of total lending	0.06	0.00	0.16	0.95	0.19	0.94
Liquid asset to total asset ratio	26.8	30.2	**62.4**	**25.7**	41.6	28.5
Loan to asset ratio	55.0	57.6	30.8	60.7	40.1	59.3
Deposit to asset ratio	53.2	63.8	67.7	56.1	42.8	56.7
Deposit to loan ratio	97.1	97.1	186.1	99.1	61.9	101.7
Core deposit to total deposits ratio	36.3	37.9	42.1	36.6	54.6	36.6
Capital to asset ratio	11.9	19.3	33.6	16.6	**59.1**	**13.9**
Interbank lending/Total loan ratio	20.7	16.7	26.2	19.2	19.5	19.4

Core deposits are give by current accounts and demand deposits. A small bank has the average size of the banks below 90the percentile, while large bank has the average size of the banks above 90th percentile. A low liquid bank has the average liquidity ratio of the banks below the 10th percentile, a liquid bank has the average liquidity ratio of the banks above the 90th percentile. A poorly capitalized bank has a capital to asset ratio equal to the average equity ratio below the 10th percentile, a well capitalised bank has the average capitalization of the banks above 90th percentile. Source: Bank Indonesia. September 2009. Unpublished.

Column 1 and 2 in the above table shows that small banks are slightly more liquid and better capitalized. This result fits with the standard idea that smaller banks need buffer stocks of securities to compensate their limited ability to raise external finance on the capital market. This interpretation is confirmed on the liability side, where the percentage of core deposits (demand deposit and saving accounts) is greater among small banks, while their securities issues are more limited than the ones of large banks. It is worth noting that the ratio of deposit to loans for small banks is on average greater than one. In fact, small banks have a relatively high capacity in local deposit markets and fund-raising

represents often their main business. In summary, high liquidity and capitalization ratios and specific institutional characteristics of the Indonesian system may counterbalance the traditional asymmetric information problems faced by small banks.

The following columns in the table present that liquid banks are smaller and better capitalized than average. Banks with low holdings of liquid assets have more deposits and make fewer loans. They have also a higher percentage of short-term loans, which should increase the speed of the bank lending channel transmission.

In the column 5 and 6, low capitalized banks make more loans, particularly long-term loans, and hold fewer liquid assets. On the liability side, they raise more deposits especially time deposits.

Chapter 6 Conclusions

6.1. Introduction

The objective of this thesis was to investigate bank competition issues, cost-efficiency, and the role of banks in monetary policy transmission in Indonesia. It began with an overview of Indonesia's geographical location, the evolution of the banking sector and monetary policy over ten years, and included reviews of the related theoretical and empirical studies of competition, efficiency, and monetary policy transmission. Using a comprehensive and supervisory data set of Indonesian banks, the thesis concentrated on:

- Assessing how competitive the Indonesian provincial market is by testing whether there is support for the market power or for efficient-structure hypothesis.
- Obtaining measures of cost-efficiency, with a view to assessing how the foreign acquisition influenced cost-efficiency and whether there are any differences in cost-efficiency between the new foreign banks, and private or state owned domestic banks.
- Analyzing the role of banks in monetary policy transmission in Indonesia. The aim is to provide empirical evidences on the working mechanism of bank lending channel—in transmitting the monetary policy into banking loans.

Chapter 2 reviewed Indonesia's banking sector from 2000-2009 providing the background for more detailed empirical analysis in subsequent chapters. The banking sector underwent significant changes after 2002, when the Indonesian government introduced a government divestment program, and a series of reforms in 2004.[11]

[11] Employing a gradual approach, from 2002 to 2004, the Indonesian government sold controlling stakes in some major private banks nationalized during the crisis to foreign investor including Bank Central Asia, Bank Danamon, Bank Permata, Bank International Indonesia, Bank Niaga, and Bank

The long term reform program was initiated with the objective of developing an effective, competitive and stable banking sector. To achieve this aim, BI introduced a package of financial reforms in the framework of Indonesian Banking Architecture (IBA), involving a mix of deregulation and new regulations. For example, regulation on merger and acquisition were relaxed, the introduction of single presence policy to shape large banks ownership etc.

Chapter 3 examines the relationship between the bank performance with concentration ratio, and several banking variables including efficiency ratio, risk indicator, deposit market and geographical variables in provincial market. We utilize banking datasets of provincial banks in Indonesia to examine the issue. We compare market power hypothesis models (traditional SCP), efficient-structure hypothesis and the New Empirical Industrial Organization (NEIO) model by employing the data of all Indonesian banks during 2001-2008.

As has been the case for most previous structure-performance studies, the results using the SCP specification are not very robust. This study does not support SCP hypothesis and find modest supports for the ES hypothesis for the banks located in the provincial markets. This finding is also consistent to other studies that have examined the structure-performance relationship for emerging markets. Both Mohieldin (2000) and Perera (2007) find evidence that there is no significance relationship between market structure and bank's performance in Egypt and South Asia respectively.

When PR approach is used, as done in other studies, it reveals much evidence of imperfect competition in Indonesian provincial markets. The estimated

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Lippo. Foreign institutions' investments continued in 2005-08, mostly acquiring smaller commercial banks focused on retail loans. These foreigners brought better risk management practices and operating procedures, as well as financial backing.
The government also divested a portion of shares in state owned banks, such as Bank Mandiri, Bank Rakyat Indonesia and Bank Negara Indonesia, through public listings. Another noteworthy transformation of the banking landscape was the drop in the number of banks. Technological progress has also boosted competition by eliminating geographical barrier for foreign banks and facilitating product innovations. This development will make Indonesian banking sounder and better able to provide services to their customers.

values of H-statistics for the sample period 2001-2008 are positive ranging between 0.31 - 0.62 which is consistent with the study by Claessens and Laeven (2004). We find that the market in Java and Sumatra is more competitive than metropolitan and the periphery. H-*statistic* of metropolitan and the periphery are 0.31 and 0.52 respectively while Java and Sumatra is 0.62.

However, the weakness of PR modelling is that it does not tell us much about the sources of imperfect competition, what can be done to change matters. The estimation using ES hypothesis specification does not also reveal significant influence of the geography of Indonesia. There are only few significant results are found. Population density variable is negative and significant in demand deposit markets in metropolitan and the periphery. The other variable is the number of banks per population that is positive and significant in time deposit markets in metropolitan and demand deposit markets in metropolitan and Java and Sumatra.

Although there is a modest impact of the geography of Indonesia on the level of competition, the development that help overcome geographical barriers, e.g. new banking technologies can usefully promote competition in Indonesian deposit markets.

Chapter 4 investigates cost-efficiency using a translog cost function within banking system from 2000Q3 to 2009Q3. The results show that the mean of cost-efficiency was in the range of 40%-50%. State-owned banks were found to be relatively more cost-efficient than foreign banks. The analysis suggests several conclusions about banking efficiency in Indonesia. Firstly, foreign ownership has positive effect on improved cost efficiency of the banks. However, the changing effect is small. Secondly, it appears that although old foreign banks are able to maintain comparable efficiency to the new acquired foreign banks, old foreign banks' efficiency tend to worsen. They need to hire more skilled workers and install better working environments.

Chapter 5 investigates the response of banks to a monetary policy shift. We study whether the central bank's monetary policy stance affects banks' lending behavior. Based on monthly datasets on all Indonesian banks from September 2000 to September 2009, we use the 1 month Certificate Bank Indonesia interest rates and narrative indices based on Boschen-Mills index, and we find that the result from loan supply suggests that there is an operative lending channel in Indonesia. We also find evidence that large banks are more responsive, while high liquidity and high capitalisation banks are less responsive to the changes in monetary policy.

This is similar to other developing countries' results, where large banks show stronger responses to monetary policy. The absent effects of liquidity and capitalisation are caused by informational asymmetries. To reduce informational frictions: the role of government is needed to improve transparency, increase efficiency, etc; banking networks should be expanded; and the number of bank failure in Indonesia should be decreased.

The findings from various chapters are consistent with each other, and suggest that: (1) the geography of Indonesia has a modest impact on competition in some deposit markets. The developments which help overcome geographical barriers, e.g. new banking technologies, can usefully promote competition in Indonesian deposit markets. (2) The gradual reform strategy did improve the competitive structure of Indonesia's banking sector to some extent. However, policy should be directed to enabling the more efficient banks to gain more market shares. Given that the foreign banks were more efficient than domestic banks in the sample, the policy implication is to encourage the expansion of the foreign/joint venture banks to further improve competitive structure. (3) Cost-efficiency is a critical issue that should receive more attention from researchers, bank regulators and managers. (4) Converting private owned banks to foreign owned or joint venture banks could improve their cost-efficiency.(5) The response to monetary policy varies according to bank characteristics, especially bank size.

6.2. Limitation of this Thesis

As with other studies on bank competition and efficiency, this thesis has some drawbacks. The first issue concerns the limited number of observations, because of the relatively small number and short history of these banks. This rules out the use of some more sophisticated estimation methods, for example cost efficiency estimation, the data limitation will limit the possibility of employing some more advanced techniques, such as the Flexible Fourier functional form.

A similar point can be made about the investigation of provincial banking competition. It will be beneficial to employ other techniques, based on panel data that can give accurate measures of competition over time. One example is techniques that do not require any information on the market structure of each bank or a market equilibrium assumption, and allows us to determine the degree of market power endogenously like the NEIO model developed by Uchida and Tsutsui (2005).

In terms of the methodology, as indicated by Berger and Humphrey (1997), one problem with frontier analysis is that rankings of banks by their measured cost-efficiency can differ, although central tendency of average cost-efficiency values for banks is generally similar across frontier techniques. To make this ex-post regression informative, cost-efficiency estimates should be obtained from other frontier techniques. However, this thesis only used one parametric technique, the stochastic frontier approach, to estimate cost-efficiency. More frontier techniques are needed to cross check the result.[12]

Another issue is that cost-efficiency is only a relative measure against the best practice bank within the sample. The best practice bank itself may or may not be really efficient in the real economic sense. The latter could cause the

[12] There is a study on Indonesia using a non parametric DEA Slack Based Model (Hadad et al. 2008) find similar result that the average bank efficiency was reasonably stable during the sample period, ranging between 70% and 82%, with 92 of the 130 banks in existence at that time having efficiency scores of over 70%, including 10 with (super) efficiency scores above unity.

inaccurate measurement of the real efficiency level of Indonesia's banking sector.

Berger, Hanweck and Humphrey (1987) argue that the cost function only captures the cost, or supplies side benefits to the banks from joint production (spreading fixed costs and information production). Yet, it ignores the revenue, or demands side benefits, as in the last two resources (risk reduction and customer cost economies). Therefore, total economies from joint production may be understated in the empirical estimates here and in other studies.

Finally, as discussed by Mester (2008), since inefficiency is derived from the regression residual, selection of the characteristics of the banks and the environmental variables to include in the frontier estimation is particularly important. The variable defines the peer group that determines the best practice performance against which a particular bank's performance is judged. She argues that estimates of bank cost efficiency can be biased if bank heterogeneity is ignored.

6.3. Avenues for Future Research

Several suggestions for future research may be derived from this thesis. First, the study of other endogeneity factors that may affect bank's cost and profitability such as debt maturity, resources allocated to risk management etc.

While the thesis has made a contribution to estimating the structure-performance relationship within Indonesia's banking sector, none of the theories are completely consistent with the observed relationship among profits, market structure and efficiency for banks. Further research is needed along those lines.

Third, a larger data set should produce more reliable results by enabling more advanced techniques to address the efficiency and competition issues. Fourth, while this thesis is concentrated on the efficiency of cost in bank operations,

further work is needed to estimate the profit efficiency, which also takes the revenue of bank operations into account.

Finally, there is a possibility for the bank lending channel to be enhanced through support from the government, as found from the recent crisis, and credit provision, so the current financial crisis should be a particularly fruitful period for investigation by researchers. The continuing efforts of researchers will hopefully find answers to these questions and shed more light on the factors that influence efficiency and competition in the banking sector and the role of banks in monetary policy transmission.

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