

**Essays on Monetary Policy Transmission:  
Panel Data Evidence from Korea**

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# **Essays on Monetary Policy Transmission: Panel Data Evidence from Korea**

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## **ABSTRACT**

The thesis consists of four distinct essays examining different aspects of monetary transmission using firm and bank level data for Korea.

The first essay examines the determinants of firms' capital structure using comprehensive Korean firm-level panel data. The empirical results show that small, less collateralised, riskier firms are more dependent on short-term bank finance. Particularly after the currency crisis period, banks have more concerns about firms' profitability and the level of debt in their lending practices, and firms with higher profits or lower leverage have easier access to short-term bank borrowing. When examining the impact of tight monetary policy on firms' external finance, firm size, profitability, and indebtedness have significant role in bank lending channel during the post-crisis period.

The second essay examines firms' foreign currency exposure and real exchange rate balance sheet effects on firms' investments using Korean firm-level data. The findings in this paper have helped uncover the elusive real exchange rate balance sheet effect in limited open economy literature.

The third essay examines the impact of foreign banks on the monetary policy transmission mechanism in the Korean economy with a specific focus on the lending behavior of banks with different types of ownership. Using bank-level panel data of the banking system in Korea, we present consistent evidence on the buffering impact of the foreign banks, especially foreign bank branches including U.S. bank branches, on the effectiveness of the monetary policy transmission mechanism in Korea from the bank-lending channel perspective during the global financial crisis of 2008-2009.

Finally, the fourth essay empirically analyses availability of credit for small and medium firms (SMEs) based on bank-firm level data, with a particular focus on the credit policy of the central bank of Korea. Its findings can serve as a useful reference for implementing credit policy, which is being increasingly adopted by central banks since the global financial crisis.

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## DECLARATION

Another version of Chapter 3 entitled “Foreign Currency Exposure and Exchange Rate Balance Sheet Effect on Firm’s Investment: Korean Firm-level Analysis” has been accepted for presentation at BIS (Bank for International Settlements) 6<sup>th</sup> Annual Workshop of the Asian Research Networks on Monetary Policy and Exchange Rates, held in Manila, Philippines, March 2013.

Chapter 4 entitled “The Impact of Foreign Banks on Monetary Policy Transmission during the Global Financial Crisis of 2008-2009: Evidence from Korea” is a joint work with Bang Nam Jeon and Ji Wu. I contributed to managing panel dataset, formulating testable hypotheses, designing modelling framework and analysing estimation results.

Another version of Chapter 4 has been accepted for presentation at BIS (Bank for International Settlements) 7<sup>th</sup> Annual Workshop of the Asian Research Networks on Monetary Policy and Exchange Rates, held in Tokyo, Japan, March 2014.

Another version of Chapter 4 has been also accepted for publication in *Emerging Markets Finance and Trade*. Full publication details are given as below.

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Chapter 5 entitled “The Impact of Credit Policy on Bank Loans to SMEs: Focusing on the Aggregate Credit Ceiling System of the BOK” is a joint work with Hosung Jung. I contributed to formulating testable hypotheses, designing modelling framework, testing empirically and analysing estimation results.

Another version of Chapter 5 written in Korean has been presented as a Working Paper of the Bank of Korea. Full details of the Working Paper are given as below.

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## **Chapter 1. Introduction**

The thesis consists of four distinct essays examining different aspects of monetary policy transmission mechanism and its effectiveness using firm-level, bank level, and bank-firm level panel data for Korea. The first essay, chapter 2, deals firm's capital structure and a broad bank lending channel which is one of credit channels. In the second essay, chapter 3, open economy credit channel is considered focusing on exchange rate balance sheet effect on firms' investment using data of foreign currency denominated debt of firms. The third essay, chapter 4, examines the impact of foreign banks on the monetary policy transmission mechanism focusing on the lending behavior of banks with different types of ownership. Lastly, the fourth essay examines the impact of a credit policy on bank loans to small and medium-sized enterprises. Credit policy can play a supplementary role for main monetary policy. The thesis deals with important issues of monetary policy using micro-level data of Korea. The analysis of this thesis can give some useful policy implications especially to countries which are in the similar development stage with Korea as well as Korea itself. More specific contents of each essay are as follows.

The first essay, chapter 1, examines the determinants of firms' capital structure using comprehensive Korean firm-level panel data between the periods 1991-2006 and the sub-periods of the Korean pre-crisis and post-crisis eras. Although a lot of studies have examined the capital structure determinants of large and listed firms in Korea, the number of capital structure studies including many unlisted small and medium firms has been limited. According to Small and Medium Business Administration of Korea, Korean small and medium-sized enterprises (SMEs) account for nearly 80% of all employees and around a half of production of the manufacturing sector. In spite of SMEs' pivotal role in the national economy, it has been difficult to examine the determinants of firms' capital structure due to the lack of comprehensive firm-level data on small and medium-sized firms. To fill this gap, the most comprehensive firm-level panel data of Korean statutory audited firms was used. It is beneficial to take a sample of statutory audited firms because they would include much smaller firms than large listed firms and reflect small firms' behaviour more closely in capital structure choices. The determinants of firms' capital structure

are analysed not only for the whole period but also for the sub-periods of the pre-crisis and post-crisis eras to see whether there were changes in the determinants of firms' capital structure between the two periods. This essay also examines the impact of firm-specific characteristics on external finance interacted with monetary policy stance to find the existence of a credit channel in the Korean context and to show that the effects of firm-specific characteristics on access to external finance differs along with the changes of monetary policy stance.

The second essay, chapter 3, investigates firms' foreign currency exposure and real exchange rate balance sheet effects on firms' investments using Korean firm-level data. Currency mismatch in the debt structure of firms is an important issue in the open economy. When there is a significant currency mismatch in the economy, a large real depreciation undermines the net worth of firms with high foreign currency debt and makes credit more expensive and restricted for these firms, leading to a decrease in the firm's investment and production activities. However, a real depreciation can have expansionary effects through increasing the operating profits in the export sector as well as increasing the cost of imported goods, favouring tradable activities in the economy. When there is a large balance sheet effect, a rapid increase in the exchange rate induces economic shrinkage by decreasing investment, in contrast with an economic expansion experienced by an increase of exports during an increase in the exchange rate in general. However, previous literatures show quite a mixed exchange rate balance sheet effect on a firm's performance such as investments and sales growth. This essay investigates firms' foreign currency exposure and a real exchange rate balance sheet effect on the firm's investment using Korean firm-level data. The followings are considered in the analysis to clarify the elusive real exchange rate balance sheet effect: the level of depreciation; the ratio between foreign currency borrowing vs. export; and short-term foreign currency borrowing ratio. The findings of this paper help uncover the elusive real exchange rate balance sheet effect on firm-level activities in an open economy.

In the third essay, chapter 4, we examine the impact of foreign banks on the monetary policy transmission mechanism in the Korean economy with a specific focus on the lending behavior of banks with different types of ownership, especially during the global financial crisis of 2008-2009. It is investigated that how different

types and country-origin of foreign banks affect the effectiveness of monetary policy transmission in Korea in the midst of the increasing presence of foreign banks in the Korean banking market. The event of global financial crisis provides a case for the first significant test for evaluating the stabilizing or destabilizing role of foreign banks, especially foreign bank branches, in an emerging Asian economy, Korea, after experiencing a steady increase in foreign ownership in its banking sector. The accurate assessment of the impact of the increased foreign bank penetration into host emerging Asian economies has been an important issue. This essay examines the issue for the case of Korea. Foreign banks have increased steadily in Korea since the 1997 Asian currency crisis. Therefore, Korean banking sector provides a unique opportunity to investigate the role of foreign banks in monetary policy transmission. The aim of this essay is to investigate the impact of increased foreign bank penetration on the monetary policy transmission mechanism in an emerging Asian economy, Korea, during the period from 2000 to 2012. We put a specific focus on loan growth by foreign banks (subsidiaries and branches), compared to domestic banks, during the recent global financial crisis of 2008-2009.

Finally, the fourth essay, chapter 5, empirically analyses availability of credit for small and medium firms (SMEs) based on bank-firm level data, with a particular focus on the credit policy of the central bank of Korea. The credit policy of central banks, which affects credit allocation to SMEs and households, has been the object of much attention since the global financial crisis. Prior to the financial crisis, central banks generally sought to stabilize prices and secure financial stability by altering the amount of liquidity in the entire economy through interest rate adjustments. After the onset of the global financial crisis, however, financial markets suffered from a credit crunch and households and enterprises had difficulties accessing credit even though there was ample liquidity in the market. In response, the central banks of major countries have conducted credit policy so as to affect the flow of funds and credit allocation in the private sector. The Bank of Korea (BOK) has been operating the Aggregate Credit Ceiling System (ACCS), the primary tool of the BOK's credit policy operations on bank loans to SMEs. The BOK provides loans to financial institutions within a certain ceiling set by the Monetary Policy Committee considering commercial banks' individual lending performance to SMEs. The BOK

sets a ceiling on its overall refinancing for banks, and individual banks can borrow funds from the BOK within the allotted limit. This paper examines empirically how the ACCS helps improve banks' intermediation function based on their loan data and the financial statements of banks and enterprises. We examine whether banks increase their lending to ACCS-eligible SMEs and reduce lending rates to them, and we also investigate whether SMEs newly included in the ACCS are able to access credit from a greater number of banks after being accepted into the system. We analyse the effects of the ACCS on bank loans to SMEs using bank-firm level panel data which are set up by linking four kinds of data from different sources.

## **Chapter 2. The Impact of Firm-Specific Characteristics on Access to External Finance: Evidence from a Panel of Korean Firms**

### **Abstract**

This paper examines the determinants of firms' capital structure to see the changes of determinants of firms' capital structure between the periods 1991-2006 and the sub-periods of the Korean pre-crisis and post-crisis eras. The most comprehensive firm-level panel data of Korean statutory audited firms for those periods was used. The empirical results suggest that small, less collateralized, riskier firms are more dependent on short-term bank finance. Meanwhile, lower leveraged firms or firms with higher profits have had easier access to short-term bank borrowing in the post-crisis period because banks have had more concerns about firms' profitability and the level of debt in banks' lending practices, especially after the Korean currency crisis in late November 1997. The impact of firm-specific characteristics on external finance together with the Bank of Korea's monetary policy stance shows that the effects of firm-specific characteristics on access to external finance differ with the change in monetary policy stance. The effects of firm size, profitability and indebtedness are especially noticeable when there was a tight monetary policy during the post-crisis period.

### **2.1. Introduction**

Firms' finance of their business and investment activities generally depends on not only internal funds such as retained earnings, but also external funds such as bank loans, commercial papers, and bonds. In spite of the Modigliani and Miller theorem showing that firms' market value is independent of firms' leverage, firms choose their optimal capital structure to maximise their market value by considering their specific characteristics and market environment with the existence of asymmetric information and an incomplete, real-world market.

Since the aftermath of the currency crisis in Korea in late 1997, firms' capital structure has been an important issue for the Korean economy because of the high debt ratio of firms, especially short-term debt, which was regarded as one of the main causes of the currency crisis. Firms' access to external finance was sometimes treated without much consideration of factors such as profitability, financial stability, and default risk, in the pre-crisis period. As a result, the sudden outflow of foreign capital, causing a liquidity crisis in the financial sector, led to a currency crisis. Since the aftermath of the currency crisis, severe restructuring of corporate finance has been required to increase firms' financial stability.

However, in spite of the economic importance of firms' capital structure in the Korean economy, there have been few systematic studies on heterogeneous firms' access to external finance where debt maturity and the characteristics of the debt source are differentiated. There have also been few analyses using a large panel of Korean statutory audited firms, including listed firms, in the extensive period around the currency crisis.

This paper examines the determinants of firms' capital structure using the most comprehensive firm-level panel data of Korean statutory audited firms, including listed firms, over the period from 1991 to 2006, fully covering the period before and after the currency crisis. Although a lot of studies have examined the capital structure determinants of large and listed firms in Korea, the number of capital structure studies including many unlisted small and medium firms has been limited. According to Small and Medium Business Administration of Korea, Korean small and medium sized enterprises (SMEs) account for 76.8% of all employees and 47.6% of production of the manufacturing sector in 2009. In spite of SMEs' pivotal role in the national economy, it has been difficult to examine the determinants of firms' capital structure due to the lack of comprehensive firm-level data on small and medium-sized firms. To fill this gap, I drew financial statement data of statutory audited firms from a large dataset compiled by Korea Information Service (KIS). It is beneficial to take a sample of statutory audited firms because they would include much smaller sized firms than listed firms and reflect small firms' behaviour more closely in capital structure choices.

The determinants of firms' capital structure are analysed not only for the whole period but also for the sub-periods of the pre-crisis and post-crisis eras to see whether there were changes in the determinants of firms' capital structure between the two periods.

This paper also examines the impact of firm-specific characteristics on external finance together with monetary policy stance to find the existence of a credit channel in the Korean context and to show that the effects of firm-specific characteristics on access to external finance differs with the change of monetary policy stance.

The remainder of this paper is organised as follows: Section 2.2 presents the theoretical background and a brief literature review of determinants of capital structure; Section 2.3 contains the overview of firms' external finance in Korea; Section 2.4 develops the hypotheses; Section 2.5 presents the description of the dataset and estimation methodology; Section 2.6 analyses the empirical results; and Section 2.7 concludes.

## **2.2. Determinants of Capital Structure**

Modigliani and Miller (1958) present a theorem about capital structure called the Capital Structure Irrelevance Principle. It shows that in an efficient market the market value of a firm does not alter with the firm's leverage and the method of the firm's finance in the absence of taxes, bankruptcy costs, and asymmetric information. However, considering bankruptcy costs, agency costs, asymmetric information, and the incompleteness of the real market, the optimal capital structure can exist. The representative theories related to this opinion are the Static Trade-off theory and the Pecking Order theory.

According to the Static Trade-off theory, the optimal capital structure can be suggested when bankruptcy costs, agency costs, and a non-debt tax shield are considered. For example, when a firm's debt increases, its value can increase from a reduction in tax. However, it can be offset by the increase in bankruptcy costs and agency costs. Thus, this implies that the optimal capital structure can be found due to

the existence of such trade-offs. Studies related to this theory include Jensen and Meckling (1976), Scott (1977), Myers (1977), and Long and Malitz (1985).

In the Pecking Order theory, firms tend to draw on the cheapest sources of finance first by considering financing costs. The optimal capital structure suggested by the Static Trade-off theory is not considered. Therefore, firms depend on internal funds first and then draw on external financing by issuing bonds or stocks when the internal fund is not sufficient for them. According to Myers (1984) and Myers and Majluf (1984), this financing behaviour is motivated by information asymmetry between the company and its external investors. Grinblatt and Titman (1998) suggest profitable firms can accumulate retained earnings, and firms with large retained earnings maintain a low leverage.

In addition, according to Market Timing theory suggested by Baker and Wurgler (2002), past variation in the market-to-book ratio of a firm has close relationship with current capital structure of that firm, meaning that equity market timing affects capital structure largely and persistently. When a firm needs new financing, it chooses the type of financing such as debt and equity which is most favourable at that time. A firm's leverage is quite negatively related to the firm's historical market valuations. This theory suggests that debt market conditions and stock returns are important when deciding capital structure.

Rajan and Zingales (1995) explore the determinants of the capital structure of listed firms in G-7 countries. They find that tangibility of assets and firms' size, which can be proxies for the inverse probability of default, are positively correlated with leverage, while the market-to-book ratio, which is regarded as investment opportunities, and profitability are negatively correlated with leverage.

Johnson (1997) examines the relationship between ownership structure of firms' debt and some firms' specific characteristics. He divides external finance into three categories according to debt ownership structure: debt held publicly; debt held by non-bank private lenders; and debt held by banks. Among these debts, bank debt use is negatively related to firm size, age, and the market-to-book ratio, and positively related to leverage and the fixed asset ratio. Private non-bank debt use is negatively related to leverage and the fixed asset ratio, and positively related to the market-to-book ratio.

Demirgüç-Kunt and Maksimovic (1999) explore firms' debt maturity in 30 countries during the period from 1980 to 1991. The 30 countries are composed of 19 developed countries and 11 developing countries. It appears that large firms have more long-term debt in countries with active stock markets, while small firms have less short-term debt and their debt is of longer maturity in countries with a large banking sector.

Lee et al. (2000) examine the changes in the leverage and debt structure of non-financial Korean firms listed in the Korea Stock Exchange using an unbalanced panel from 1981 to 1997. The empirical result indicated that firm size and growth rate have a significant positive relationship with leverage while tangible fixed assets and profitability have a significant negative relationship with leverage. It appears that there are major differences in the capital structure choices between Chaebol<sup>1</sup> and non-Chaebol firms even when controlling for determinants such as firm size, growth rate, tangible fixed assets, and profitability. Lee et al.'s study shows that Chaebol-affiliated firms have a higher leverage than non-Chaebol firms.

Booth et al. (2001) estimate the extended Rajan and Zingales' (1995) model by adding an average tax rate and business risk variables. They explore the capital structure choices of firms in ten developing countries including Korea, and explain that the decisions in developing countries are affected by the same variables as in developed countries even though there are persistent differences across countries. According to their study, return on asset, average tax rate, asset tangibility, and business risk are negatively related with leverage while the market-to-book ratio is positively related with leverage in many countries. Profitability, which is expressed by the variable of return on assets, has the largest negative effect on leverage in many countries.

Borensztein and Lee (2002) examine the nature of the credit crunch in the aftermath of the currency crisis in Korea. They analyse changes in the allocation of credit in the post-crisis period across different types of firms using Korean listed

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<sup>1</sup> Chaebol is the term used for a large business group in Korea. The scope of business groups is defined in the Enforcement Decree of the Monopoly Regulation and Fair Trade Act as a corporation wherein a single person owns thirty per cent (30%) or more either solely or together with any of the closely-related persons and corporations. Thirty of the largest business groups based on the scale of total assets are identified and announced to the public by the Korea Fair Trade Commission (KFTC) every year.

firm-level data for the period from 1996 to 1998. They find that profitability is an important factor for accessing credit in the aftermath of the currency crisis, and that Chaebol-affiliated firms lost their easy access to credit which they had used to before the currency crisis.

Nagano (2003) examines the determinants of firms' capital structure in the five East Asian countries of Indonesia, Korea, Malaysia, the Philippines, and Thailand after the 1997 Asian financial crisis using the model of Rajan and Zingales (1995). Nagano shows that profitability and the ratio of debt-to-equity have a significant negative relationship in all five countries, and firm size has a positive relationship in many countries. However, he obtains few statistically significant empirical results in the case of asset tangibility and market-to-book ratio, a proxy variable for a firm's growth opportunity.

Bougheas et al. (2006) present a theoretical model to explore the influence of firm-specific characteristics such as size, risk, and debt on the variation in the composition of external finance as a consequence of contractions and expansions in monetary policy. Based on this theoretical model, they predict that new investment will be financed through short-term bank loans rather than through long-term debt from the markets when the level of existing debt is high, the level of collateral is low, the level of risk is high, the level of future profitability is low, and the level of economic activity is low. They also predict that smaller firms are more likely to use bank loans to finance their business. They test the above predictions using UK manufacturing firm-level data. They find that firm-specific characteristics such as size, collateral, riskiness, age, and profitability are important determinants of access to short-term and long-term debt, and also demonstrate that smaller, more risky, and younger firms are more affected by monetary tightening than larger, secure, or older firms.

Daskalakis and Psillaki (2008) estimate the determinants of capital structure using a sample of Greek and French SMEs. They suggest that the determinants of the capital structure of SMEs are not driven by country-specific factors but driven by firm-specific factors. They show that profitability has a negative relationship with the debt to assets ratio while firm size is positively related to the ratio in both countries irrespective of their country-specific factors.

Leary (2009) and Voutsinas and Werner (2011) examine the capital market supply

frictions and its impact on firms' capital structure. Leary (2009) find that leverage ratios of bank-dependent firms decrease relative to firms having bond market access when there is a contraction in the availability of bank loans focusing on the US market. Voutsinas and Werner (2011) apply the method of Leary (2009) to the Japanese market and they find that changes in monetary conditions and fluctuations in the supply of credit have a significant impact on firms' capital structure. They show that bank-dependent firms' leverage levels are severely reduced during credit crunch period, and they point out the importance of accounting for credit supply factors in firms' capital structure.

Judge and Korzhenskaya (2012) consider the role of credit ratings in firms' capital structure choice during the period of adverse loan supply shock. They examine the question whether contraction in bank credit has affected each firm equally or whether firms having alternative external debt finance can relieve the adverse effect of contractionary bank credit, using a sample of UK listed firms. They use credit ratings as an indicator of access to alternative debt market. They suggest that the impact of access to bond markets measured by having a credit rating on leverage is greater during the period of credit market tightening.

Kremp and Sevestre (2013) and Farinha and Felix (2015) estimate the determinants of credit supply and credit demand for small and medium sized enterprises (SMEs) assuming that the credit market is in disequilibrium where interest rate does not guarantee that credit demand equals credit supply. Kremp and Sevestre (2013) conclude that French small and medium-sized enterprises are not strongly affected by credit rationing stemming from banks' cautious behavior even during the crisis. On the contrary, credit demand factors such as firms' activity and investment projects have a greater impact on observed loans outstanding. This result is in line with Rottmann and Wollmershauser (2013) regarding German SMEs. Farinha and Felix (2015) examine credit demand and supply factors which affect Portuguese SMEs. They suggest that credit supply depends on firms' cash flows and collateral assets while credit demand for bank loans depends on interest rates.

### **2.3. Overview of Firms' External Finance in Korea**

In Table 2.1, according to the account of flow of funds in Korea, the total funds supplied to non-financial corporation sectors by the financial sector decreased drastically just after the currency crisis in November 1997 and has increased again gradually. The increasing growth rate of funds supplied to non-financial corporation sectors by the financial sector has been less than the growth rate of nominal GDP. Therefore, the ratio of funds supplied to non-financial firms to nominal GDP has decreased from 34.6% just before the currency crisis to 26.2% in 2005.

The decrease of the flow of funds supplied to non-financial firms has been mainly due to the decrease of external funds. The ratio of external funds to total funds has decreased from 69.5% before the currency crisis to 46.3% in 2005 while the ratio of internal funds to total funds has increased from 30.5% to 53.7% in the same period.

Meanwhile, indirect funding through financial firms, such as bank loans, among the external funds has decreased and has also shown bigger volatility after the currency crisis, as shown in Figure 2.1, while direct funding through the capital market, such as securities, has recovered.

The decrease of the ratio of the external funds to total funds in non-financial firms has improved the firms' financial stability, as shown in Table 2.2. Through the restructuring of firms after the currency crisis, firms' profitability and growth have increased significantly, and firms have lowered their dependence on external funds. The debt ratio of manufacturing firms has drastically decreased from 396.3% in 1997, the year of the occurrence of the currency crisis, to 98.9% in 2005.

External finance to firms has decreased after the currency crisis. In particular, indirect funding to firms has contracted much more than direct funding, and indirect funding to the manufacturing sector has contracted more than to other industrial sectors. While indirect funds to firms have significantly decreased, loans to households from the banking sector have increased greatly because of an increase in mortgage loans after the currency crisis, as shown in Table 2.3. Financial firms have preferred to fund households because the firms can easily secure collateral and housing prices have also highly increased in this period.

## 2.4. Hypotheses Development

This paper examines the determinants of firms' capital structure using the most comprehensive firm-level panel data of Korean statutory audited firms including listed firms over the period from 1991 to 2006, which fully covers the period before and after the currency crisis and also considers debt maturity. This paper analyses not only the whole period but also the sub-periods of the pre-crisis and post-crisis eras to see whether there were changes to determinants of firms' capital structure between the two periods.

The firm-specific explanatory variables' expected effect on access to credit can be suggested as follows:

Firms' size and the level of collateral are expected to be positively related to long-term debt from the market and negatively related to short-term bank loans. Large firms can obtain long-term debt more easily because usually their default risks are lower and they have more collateral assets than smaller firms. Moreover, large firms can easily access external funds through capital markets because the possibility of asymmetric information between investors and borrowing firms is less than small firms. High collateral can reduce agency costs between investors and borrowing firms and thus it can make access to long-term marketable debt easier. Meanwhile, tangible assets, which are used as collateral assets, are usually long-term assets. Therefore, firms with high collateral would like to access long-term debt more than short-term debt to balance the maturities of assets and debts.

When firms' level of profitability is low or firms' level of risk is high, firms are expected to depend more on short-term bank finance. Firms with high profitability can accumulate internal funds when they have excess profit and can decrease external finance because firms tend to draw on the cheapest sources of finance first on the basis of financing cost. Firms with abundant internal funds depend on internal funds first and then draw on external financing when the internal funds are not sufficient. Firms with good credit ratings use a high amount of non-debt finance while firms with high risk have difficulty in accessing external finance.

Firms with high leverage are expected to depend more on short-term bank loans. Firms with a high level of debt have difficulty accessing further credit, especially long-term debt, while borrowing more in short-term bank loans. However, if the level of debt is not a determinant of firms' capital structure but just the result of firms' borrowing performance, the expected result can be changed. If firms take on high external debt because they are healthy, high external debt should be positively related to total debt.

This study focuses on Korean firms' context and will set forth the following hypotheses: when the size of firms is smaller; the value of collateral is lower; the level of firms' profitability is lower; the level of risk is higher, the firms' debt level is higher; it is more probable that external funds are financed through short-term bank loans rather than long-term debt from the markets.

## **2.5. Data and Estimation Methodology**

The relationship between access to external finance and firm-specific characteristics was tested using Korean firm-level data<sup>2</sup>. External finance was separated into short-term bank finance and long-term market finance, and firm-specific characteristics were specified by firm size, credit risk, collateral asset, leverage, profitability, and firm age. These relationships were also reviewed by dividing the analysis period into pre- and post-currency crisis periods to see whether there had been changes in the effect of the firm specific characteristics on external finance between the two periods.

A panel dataset was used to measure the impact of firm-specific characteristics on external finance. The dataset was constructed from the KIS-Value Database containing firms' financial statement data kept by the Korea Information Service.

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<sup>2</sup> Korean firm-level data is obtained from financial statements data provided by the Korea Information Service, Inc. (KIS). The main dataset of KIS contains only surviving firms which are those that exist as of the date when we obtain data after its entry into markets. Therefore, this research limits its analysis to only surviving firms because data on liquidated firms is not available from the KIS database. Meanwhile, the liquidation rate of statutory audited firms in Korea is only around two to three per cent in the sample period. Therefore, it is probable that the effect of inclusion of liquidated firms to this paper may not make a significant difference from the estimation results of this paper using surviving firms.

The panel dataset consists of Korean statutory audited firms<sup>3</sup> excluding financial firms for the period from 1991 to 2006. Most of the firms in the sample were not listed firms on the stock markets. Therefore, the sample includes many small and medium sized firms.

Each firm-specific variable was measured as follows:

‘SIZE’ is made by taking the logarithm of real total assets. It is calculated by deflating nominal total assets by the producer price index. ‘KIS SCORE’ is used for measuring firms’ failure probability. KIS SCORE is calculated by using the KIS credit rating model of Korea Information Service Ltd. This score reflects not only firms’ financial ratios but also non-financial factors, such as the choice of organizational forms of firms, the industrial sector, and affiliated group. This score is calculated based on indicators for stability, liquidity, profitability, growth, and activity of firms, and has been tested statistically using previous default firms’ data. The scores range from 0 to 100 and are classified as five categories according to credit estimates.<sup>4</sup> Most firms in the sample are given a KIS SCORE while bond ratings are given to limited firms. The ratio of tangible assets to total assets is used to measure ‘COLLATERAL’, which supports firms’ borrowing. ‘LEVERAGE’ is the ratio of total liability to the shareholders’ fund, which indicates the indebtedness of firms in relation to their equity. ‘PROFIT’ is made by calculating the ratio of ordinary income, which is net profit before tax plus net extraordinary gains, to total assets. ‘AGE’ is calculated by using the difference between the analytic financial year and the firm’s established year.

In addition, non-firm-specific variables are also considered. ‘RATE’ is the uncollateralized overnight call rate, which is the policy interest rate set by the Bank of Korea and which can be compared with the Repo rate set by the Bank of England

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<sup>3</sup> According to “The Enforcement Degree of the Act on External Audit of Stock Companies” revised 10 March 2006, the scope of companies subject to an accounting audit by an external auditor includes stock companies whose total values of assets are not less than seven billion Korean Won as of the end of the immediately preceding fiscal year. It also includes not only all companies whose shares are listed for trading on the KSE (Korea Stock Exchange) and the KOSDAQ (Korea Securities Dealers Automated Quotation) Market, but also unlisted stock companies intending to initially offer shares to the public on KSE or KOSDAQ in the immediately following fiscal year irrespective of the size of total assets.

<sup>4</sup> The range of the KIS SCORE is as follows: 100~81 (Strong), 80~71 (Good), 70~56 (Adequate), 55~46 (Less Vulnerable), 45~0 (More/Highly Vulnerable).

and the Federal Funds rate in the US. ‘GDP’, standing for GDP growth rate here, is also used to control for cyclical effects.

Two kinds of dependent variables, which are ‘the ratio of short-term debt to total debt’ and ‘the ratio of total debt to total liabilities’, are constructed. The former mainly stands for the access to short-term bank finance, and the latter stands for the overall availability of external debt. Short-term debt is made up of the sum of bank overdrafts, short-term borrowings in foreign currency, short-term borrowings-notes, and short-term borrowings-other. Short-term debt is mostly composed of bank finance. Total debt is composed of short-term debt, the current portion of long-term liabilities, and long-term borrowing including bonds. Total liabilities are made up of short-term debt, trade credit, and the total of other current liabilities, which include some forms of finance resembling commercial paper or bonds, long-term debt, and other long-term liabilities.

We followed the method of Kashyap et al. (1993) to construct the dependent variables using the ratio of each debt. They used a mix variable defined as the ratio of bank loans to the sum of bank loans and commercial paper. They showed that the mix variable is reduced in periods of recession and tight monetary policy.

The summary statistics of concerned variables for the manufacturing sector are presented in Table 2.4. Firms with less than three years of observations were dropped and the observations in the one percent tails for each regression variable were eliminated to control for the effect of outliers.

The relationship between the financial choices of firms and firm-specific characteristics was estimated using a standard panel model which makes it possible to control for firm-specific unobservable effects and to account for firm heterogeneity. The fixed effect model was used for this estimation.

$$y_{it} = \beta_1 * SIZE_{it} + \beta_2 * KISSCORE_{it} + \beta_3 * COLLATERAL_{it} + \beta_4 * LEVERAGE_{it} \\ + \beta_5 * PROFIT_{it} + \beta_6 * AGE_{it} + \alpha_i + YearDummies + \varepsilon_{it}$$

Where  $i$  indicates a cross-section unit and  $t$  indicates time period:  $y_{it}$  is the dependent variable;

$\alpha_i$  is a firm-specific intercept; and  $\varepsilon_{it}$  is the idiosyncratic error term.

The ratio of short-term debt to total debt and the ratio of total debt to total liabilities are both used as dependent variables. The former mainly represents the access to bank finance and the latter represents the overall availability of external debt.

If  $\alpha_i$  only contains a constant term and no unobserved effects, Pooled Ordinary Least Squares estimates are consistent and efficient. However, if  $\alpha_i$  contains an unobserved effect, then OLS estimates are biased and inconsistent due to omitted variables. The existence of unobservable individual specific effects will be tested by using Breusch-Pagan Test.

If  $\alpha_i$  contains unobserved individual specific effects and is correlated with explanatory variables, fixed effects should be used. It was tested by using Hausman test to determine whether there was a systematic difference between coefficients from both the Fixed Effects model and the Random Effects model.<sup>5</sup>

## 2.6. Empirical Results

In this section, the relationship between firm-specific characteristics and firms' access to external finance was estimated using a fixed effect model. In particular, differences in maturity structures of debt were considered by classifying the debt into short-term and total debt. In our sample, short-term debt mainly represented bank borrowing while total debt, which includes short-term and long-term debt, represented overall access to external finance. The sample was also divided into two sub-periods to examine whether there was a structural change in the determinants of firms' debt structure between the periods before and after the currency crisis in late 1997: the pre-crisis period (1991~1997) and the post-crisis period (1999~2006).

Table 2.5 presents the empirical results for the relationship between firm-specific characteristics and firms' access to external finance in the manufacturing sector of

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<sup>5</sup> Dynamic panel GMM estimates produces consistent and more efficient estimates for models that have a dynamic structure, and endogenous variables. However, the GMM method requires lagged dependent variables for a dynamic structure and often lagged variables as instruments. When we analysed the interaction effect of firm specific characteristics and monetary policy stance during the pre-crisis period and the post-crisis period, the beginning period of each period of our sample, which are critically needed for our analysis would have been lost if we had relied on GMM for the estimation. Therefore, we employed Fixed Effects for this estimation.

Korea. In equations (1) and (3) for the sample of manufacturing firms, time dummies were included to control for time effects and demand-side effects. In equations (2) and (4) for the sample of manufacturing firms, macroeconomic variables, such as GDP growth rate and interest rate, were included instead of time dummies to control for cyclical effects as well as time effects.

In most firm-specific variables, the empirical results showed strong evidence for the hypotheses presented in section 1.4 of this paper. Consider first firm size, measured by the logarithm of real assets, as a determinant of debt structure. Larger firms are highly liable to gain access to long-term debt while reducing short-term debt. The results show that firms' size has a significant negative relationship with the ratio of short-term debt to total debt while it has a significant positive relationship with the ratio of total debt to total liabilities. Generally high accessibility to information on large firms reduces the problem of information asymmetry. Thus large firms can get financing easily in capital markets. They can replace the short-term debt, mainly financed by bank borrowing, with equity finance such as bond issuing. Smaller firms are more dependent on short-term bank finance (Oliner and Rudebusch, 1996). Size is an important determinant of firms' access to external finance and is consistent with the findings of Titman and Wesels (1988), Gertler and Gilchrist (1994), and Chittenden et al. (1996).

High collateral firms access long-term debt more than short-term debt, as predicted. Collateral assets are measured by the ratio of tangible assets to total assets. High collateral can reduce moral hazards like the principal-agency problem between investors and firms, hence increasing firms' ability to access external funds. The collateral effect can play a role of increasing long-term debt compared with short-term debt because monitoring long-term debt is more difficult for investors than short-term debt. Fixed assets can play the role of good collateral, especially for long-term debt. Firms with high fixed assets can also easily match the maturity between fixed assets and long-term debt because fixed assets are usually long-term assets. According to Demirgüç-Kunt and Maksimovic (1999), a high ratio of net fixed assets to total assets is related to a higher ratio of long-term debt to total assets and lower levels of short-term borrowing.

The result shows that risky firms are more dependent on short-term bank finance, as predicted. The KIS Score is used as a proxy variable of firms' default risk: it ranges from zero to one hundred. A high KIS Score means a low possibility of firms' default. In many previous research papers, such as Whited (1992) and Kashyap and Stein (1994), bond ratings were used as a proxy of firms' default risk. However, the number of firms with bond ratings in this sample was very limited, and firms with bond ratings are generally quite large. Therefore, in this paper, the KIS Score was used for capturing firms' default risk instead of bond ratings. Most firms in the sample have a KIS Score irrespective of their size. The coefficients of the KIS Scores on both the ratio of short-term debt to total debt and the ratio of total debt to total liabilities are significantly negative. This implies that firms with a low default risk can reduce both short-term and long-term debt finance because they can easily use other non-debt finance like internal funds. Therefore, the KIS Score, a proxy variable of firms' default risk, also can be said to play an important role in firms' access to external finance.

The positive coefficients of age on the ratio of short-term debt to total debt in our estimates support the existence of relationship banking in Korea. Firms' age can be used as a proxy variable of relationship banking. Relationship banking can mitigate the adverse selection and moral hazard problem caused by information asymmetry between borrowers and lenders because relationship building between banks and firms makes monitoring activities more effective. According to Boot (2000), relationship banking is defined as the provision of financial services by financial intermediaries which invest to obtain customer-specific information and evaluate the profitability of the investment through multiple interactions with the same customer over time. Petersen and Rajan (1994), Harhoff and Korting (1998), and Machauer and Weber (2000) show that relationship banking has a positive linkage with the high availability of funds. Our estimates also show that relationship banking plays a positive role in obtaining more short-term debt which mainly is composed of bank borrowings. Firms' age can be used to test for a relationship banking proposition.

Though firms with more debt are expected to depend more on short-term bank loans rather than long-term debt, empirical results show differently in Table 2.5. Leverage is measured by the ratio of total liability to shareholders' funds. In the

estimation, leverage has a significant negative relationship with the ratio of short-term debt to total debt but a significant positive relationship with the ratio of total debt to total liabilities. A probable reason for the increase in the long-term debt of the firms with high leverage is that the greater debt cannot be the result of vulnerability but, rather, the result of the success in obtaining external funds in the past. The coefficient of leverage on the ratio of short-term debt changed from positive in the pre-crisis period to negative in the post-crisis period as shown in Table 2.6. Even though a positive sign in the pre-crisis period is statistically insignificant, it has some meaning: It implies that firms' debt ratio has been a key concern for short-term bank lending in the post-crisis period while the debt ratio was not seriously considered in the pre-crisis period. These implications are consistent with the findings of Borensztein and Lee (2002) which show that the level of debt and profitability were not seriously considered in bank lending before the currency crisis in Korea, but they have been more seriously dealt with in the post-crisis period through the banking sector's restructuring.

It is expected that firms are financed by short-term bank loans rather than long-term debt when the level of firms' profitability is low. However, the results in Table 2.5 show that firms' profitability has a significant positive relationships with the ratio of short-term debt to total debt and a significant negative relationships with the ratio of total debt to total liabilities. Profitability has a positive relationships with short-term debt for the whole sample period. However, when the sample period is divided into two periods as in Table 2.6, such as the pre- and the post-crisis periods, there is a change in the relationship between profitability and short-term bank loans. The coefficient of profit variable on the ratio of short-term debt changed from negative in the pre-crisis period to positive in the post-crisis period, as shown in Table 6. This means that the banking sector put more emphasis on the profitability of firms in their lending practices after the currency crisis. Borensztein and Lee (2002) also show that profitability has been a significant determinant of firms' access to bank credit in the post-crisis period even though profitability did not play a significant role in the pre-crisis period. Because profitable firms can accumulate internal funds and do not prefer to use external funds which are generally more expensive than internal funds,

profitability has a negative relationship with long-term debt. This finding is consistent with Myers and Majluf (1984).

In equations (2) and (4) in Table 2.5, macroeconomic variables are added to the estimations. Rate stands for interest rate, and GDP stands for GDP growth rate. Year dummies are excluded from these estimations since macroeconomic variables can also play the role of time dummies. The interest rate variable, which is an important determinant of credit supply, is included in order to see the monetary policy effect on firms' debt structure, and the variable of GDP growth rate is included to control the cyclical effects. In this estimation, the uncollateralized overnight call rate is used as an interest rate variable. This interest rate is the policy interest rate set by the Bank of Korea, which is comparable to the repo rate in the UK and the Federal Funds rate in the US.

When the sample period is divided into two periods such as the pre-crisis and the post-crisis eras in Table 2.6, the coefficients of rate on the ratio of short-term debt to total debt show different aspects in sign and significance between the two sub-periods.

Firms' profitability and the level of debt have been more important in accessing short-term bank finance in the post-crisis period. This means that banks have been more likely to lend to high profit firms and low leveraged firms after the currency crisis compared with the period before the currency crisis. Relationship banking also shows a great importance in accessing short-term bank loans.

When considering the estimation results based on the three major capital structure theories, Pecking Order theory is closely related to the estimation results using data of Korean statutory audited firms. It is said that a firm follows pecking order if it prefers internal funds to external finance, and also prefers debt to equity. Since the analysis of this chapter covers quite many small and medium sized firms, small firms' funding behaviour can be more closely examined than the analysis using mostly large or listed firms. Smaller, riskier, and less collateralized firms depend on short-term bank finance during both pre-crisis and post-crisis period because they do not have much internal cash flow like retained earnings which are regarded cheapest funding and they have difficulties in accessing capital markets. It is regarded that those smaller, riskier, and less collateralized firms are heavily dependent on short-

term bank finance because it is relatively cheap. Especially, profitable firms do not much depend on capital market after crisis. It might be because profitable firms accumulate retained earnings and they resort on their cheap internal funding rather than capital market funding. In addition, it is difficult to evaluating Market Timing theory through the estimation results of this chapter because sample firms of this chapter are mostly small firms and rarely depend on equity markets.

The empirical results of this paper suggest that smaller, less collateralized, riskier firms are more dependent on short-term bank finance. Meanwhile, firms with higher profits or lower leveraged firms have easier access to short-term bank borrowing than other firms because banks have more concerns about firms' profitability and the level of debt in their lending practices, especially after the currency crisis period.

It was also found that when monetary policy is tightening, indicated by the level of higher policy interest rates, bank loans are significantly reduced. This can be interpreted to mean that variations in the bank loans can affect the economy significantly because some firms have a high dependence on bank loans and have a lot of difficulty accessing other funds depending on their specific characteristics.

Table 2.7 shows the impact of firm-specific characteristics on external finance together with monetary policy stances. Interaction between the explanatory variables and the dummy variable (TMP), which stands for tight monetary policy period, has been constructed. TMP dummy variable has value one when the first difference between uncollateralized overnight call rate at time  $t$  and  $t-1$  is greater than 0 which is assumed to be a time of tight monetary policy.

Since the currency crisis in Korea in November 1997, inflation has been reduced from around 5%-7% in the pre-crisis period to around 3% in the post-crisis period.<sup>6</sup> The Bank of Korea officially adopted inflation targeting in 1998 and has used the call rate as a policy instrument. There was a change in the monetary policy regime during the currency crisis. Therefore, it might be better to examine the effect of monetary policy with firm-specific characteristics focusing on the post-crisis period when using the call rate to detect the monetary policy stance. Even though there was a difference in the monetary policy instrument at the monetary policy regime change,

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<sup>6</sup> Call rate has been greatly reduced from around 12%-17% in pre-crisis period to around 3%-5% in post-crisis period.

the call rate has been used for both the pre-crisis period and the post-crisis period to compare both periods. It is acceptable to use the call rate even in the pre-crisis period because the interest rate is regarded to be related, to some extent, to the money supply.

While the effects of SIZE on short-term debt ratio were less with monetary tightness in the pre-crisis period, SIZE has been desirable in the post-crisis period by reducing the ratio of short-term debt to total debt with tight monetary policy. It also means that smaller firms are more dependent on short-term bank debt in a tight monetary policy period. However, the total debt to total liability ratio had also been reduced in the post-crisis period when SIZE increased with tight monetary policy, but this is not statistically significant.

KIS SCORE and COLLATERAL with tight monetary policy mostly do not show significant effects. However, more COLLATERAL brings more total debt in a tight monetary policy period during the post-crisis period. Thus, the effect of COLLATERAL is more desirable during that time.

After the currency crisis, financial intermediaries seem to have been more concerned about firms' profitability and leverage because of the strict restructuring of financial institutions after the currency crisis. During the period, profitable firms have had more access to bank finance, and the effect of PROFIT increased more with tight monetary policy during the post-crisis. On the contrary, highly leveraged firms have had difficulty in accessing bank finance after the currency crisis while the effect lessened with tight monetary policy.

The effects of SIZE with a tight monetary policy are more important during the post-crisis period while less influential during the pre-crisis period. The effects of PROFIT are more important during the post-crisis period, but those of LEVERAGE are less influential.

The estimation results show that the effects of firm-specific characteristics on access to external finance differ with a change in the monetary policy stance. In particular, in the Korean context, SIZE, PROFIT, and LEVERAGE show significance in a broad bank lending channel after the currency crisis while SIZE only shows significance in the channel during the pre-crisis period.

## 2.7. Conclusions

In this paper, we examined the determinants of firms' capital structure using firm-level panel data of Korean statutory audited firms over the period from 1991 to 2006. We also analysed not only the whole period but also the sub-periods of the pre-crisis and the post-crisis eras to see the changes in the determinants of firms' capital structure between the two periods. The differences in maturity structures of debt were considered by classifying the debt as short-term and total debt. In our sample, short-term debt mainly represented bank borrowing while total debt represented overall access to external finance. The relationship between the financial choices of firms and firm-specific characteristics such as size, riskiness, collateral assets, the level of debt, profitability, and age was estimated using a standard panel model which makes it possible to control for firm-specific unobservable effects and to account for firm heterogeneity.

The empirical results show that firm-specific characteristics such as size, riskiness, collateral assets, the level of debt, profitability, and age were significant in determining firms' capital structure in Korea for the whole sample period from 1991 to 2006. The results suggest that smaller, less collateralized, riskier firms are more dependent on short-term bank finance. Meanwhile, firms with higher profits or lower leveraged firms have easier access to short-term bank borrowing because banks have more concerns about firms' profitability and the level of debt in their lending practices, especially after the currency crisis period.

The impact of firm-specific characteristics on external finance together with monetary policy stance has been examined using a tight monetary policy dummy variable calculated by the first differencing of the call rate. This shows that the effects of firm-specific characteristics on access to external finance differ with the change of monetary policy stance. In particular, firm size, profitability, and indebtedness have a significant role in a broad bank lending channel during the post-crisis period.

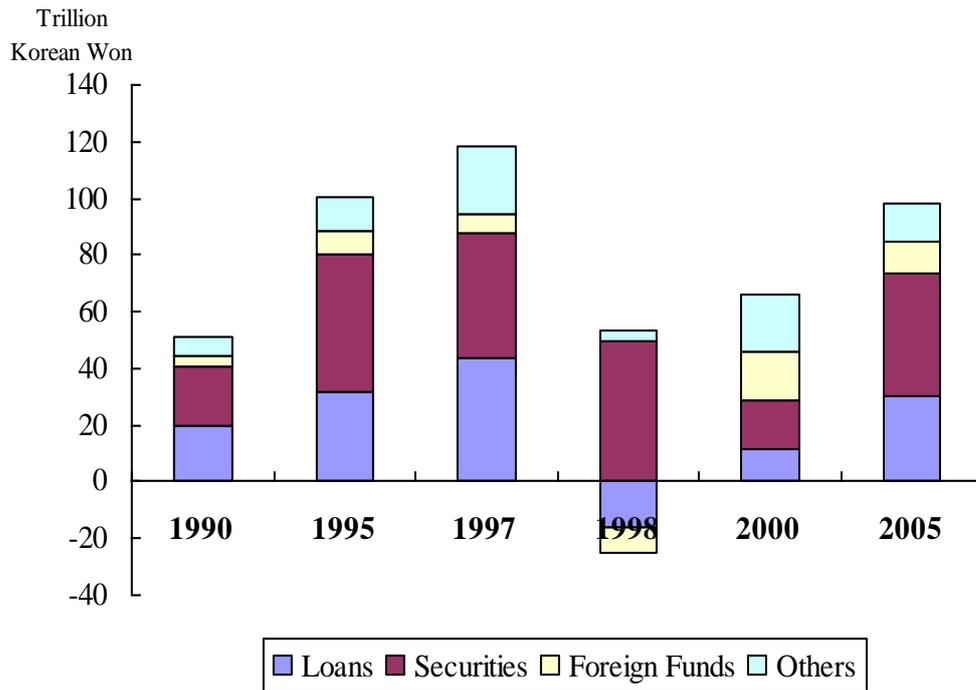


Figure 2.1. Volume of external funds supplied to non-financial corporation sectors by the financial sector<sup>1)</sup>

Note: 1) Excluding the Bank of Korea

Source: The Bank of Korea, *Flow of Funds*, Each year.

Table 2.1. Volume of funds supplied to non-financial corporation sectors by the financial sector<sup>1)</sup> (Changes in the amount)

(Unit: Trillion Korean Won, %)

	1990	1995	1997	1998	2000	2005
Funds supplied (A)	71.6	146.3	169.8	60.5	130.2	212.0
(Internal Fund) <sup>2)</sup>	(29.1)	(31.5)	(30.5)	(53.7)	(49.5)	(53.7)
(External Fund) <sup>2)</sup>	(70.9)	(68.5)	(69.5)	(46.3)	(50.5)	(46.3)
External Fund	50.8	100.3	118.0	28.0	65.8	98.2
Loans	19.5	31.9	43.4	-15.9	11.8	30.0
Depository Corporations	8.0	14.9	15.2	0.3	23.3	17.0
Other Financial Firms	11.5	17.0	28.2	-16.1	-11.5	13.0
Securities	21.5	48.1	44.1	49.5	17.2	43.4
Commercial Paper	1.9	16.1	4.4	-11.7	-4.8	3.1
Corporate Bonds	10.9	15.4	27.5	45.9	-2.1	7.6
Stocks	6.0	14.4	9.0	13.5	20.8	19.4
Foreign Funds	3.3	8.6	6.6	-9.5	16.8	11.3
Others	6.5	11.7	24.0	3.8	20.0	13.4
Nominal GDP (B)	186.7	398.8	491.1	484.1	578.7	810.5
Ratio (A/B) <sup>4)</sup>	38.4	36.7	34.6	12.5	22.5	26.2

Notes: <sup>1)</sup> Excluding the Bank of Korea

<sup>2)</sup> Figures in parentheses represent weight in the total volume of funds supplied (%).

<sup>3)</sup> The statistics of flow of funds for the years 1975~2005 is measured on the basis of the 1968 SNA (United Nations System of National Account) and for that of from 2006 on the basis of the 1993 SNA.

<sup>4)</sup> Ratio is A/B x 100 (%).

Source: The Bank of Korea, *Flow of Funds*, Each year.

Table 2.2. Indicators of financial stability

(Unit: %)

	1990	1995	1997	1998	2000	2005	2006
Debt Ratio <sup>1)</sup>							
All Industry	n/a	n/a	424.6	336.4	221.1	110.9	105.3
Manufacturing	285.5	286.8	396.3	303.0	210.6	100.9	98.9
Large Enterprises	273.8	268.3	390.0	295.4	224.6	86.1	85.5
SMEs	338.6	380.6	418.4	334.4	179.7	140.9	132.6
Ratio of Total Borrowings and Bonds Payable to Total Assets <sup>2)</sup>							
All Industry	n/a	n/a	50.0	48.5	40.3	24.1	23.1
Manufacturing	44.6	44.8	54.2	50.8	41.2	22.9	22.4
Large Enterprises	45.2	46.0	56.5	52.9	43.6	19.1	18.1
SMEs	42.3	40.0	46.8	43.0	35.0	30.8	30.9
Stockholders' Equity to Total Assets <sup>3)</sup>							
All Industry	n/a	n/a	19.1	22.9	31.1	47.4	48.7
Manufacturing	25.9	25.9	20.2	24.8	32.2	49.8	50.3
Large Enterprises	26.8	27.2	20.4	25.3	32.4	53.7	53.9
SMEs	22.8	20.8	19.3	23.0	35.8	41.5	43.0

Notes: 1)  $(\text{Debt} / \text{Stockholders' Equity}) \times 100$  2)  $[(\text{Borrowings} + \text{Bonds Payable}) / \text{Total Assets}] \times 100$ 3)  $(\text{Stockholders' Equity} / \text{Total Assets}) \times 100$ Source: The Bank of Korea, *Financial Statement Analysis*, Each year.

Table 2.3. Loans and discounts of commercial banks and saving banks (End of period)

(Unit: Billion Korean Won, %)

	1992	1995	1997	1998	2000	2005	2006
Total	102,797.0	152,477.7	200,401.1	200,289.1	310,804.1	613,922.8	699,430.3
Firms	79,948.7	111,027.2	141,875.4	144,767.5	201,859.1	308,408.9	353,208.0
	(77.8)	(72.8)	(70.8)	(72.3)	(64.9)	(50.2)	(50.5)
Manufacturing	45,048.3	62,389.7	74,288.7	70,688.8	89,720.4	120,443.3	130,412.1
	(43.8)	(40.9)	(37.1)	(35.3)	(28.9)	(19.6)	(18.6)
Households	22,848.3	41,450.5	58,525.7	55,521.6	108,945.0	305,513.9	346,222.3
	(22.2)	(27.2)	(29.2)	(27.7)	(35.1)	(49.8)	(49.5)

Note: Figures in parentheses represent weight in the total volume.

Source: The Bank of Korea, *Money & Banking*, Each year.

Table 2.4. Descriptive statistics

	WHOLE PERIOD		PRE-CRISIS PERIOD		POST-CRISIS PERIOD	
	(1991-2006; incl. 1998)		(1991-1997)		(1999-2006)	
	Number of Observations	Mean (Std. dev.)	Number of Observations	Mean (Std. dev.)	Number of Observations	Mean (Std. dev.)
Total debt/Total liabilities (%)	65,247	54.34 (21.66)	16,600	53.29 (20.17)	44,720	54.70 (22.22)
Short-term debt/Total debt (%)	59,023	58.14 (29.35)	15,782	50.58 (26.52)	39,689	61.68 (29.82)
SIZE	69,909	16.66 (1.25)	17,051	16.84 (1.30)	48,781	16.62 (1.21)
KIS SCORE	64,654	61.15 (12.12)	14,860	64.08 (11.16)	46,197	60.13 (12.27)
COLLATERAL	69,851	0.36 (0.18)	17,043	0.35 (0.17)	48,736	0.36 (0.19)
LEVERAGE	65,247	1.72 (2.12)	16,600	2.32 (2.59)	44,720	1.49 (1.87)
PROFIT	69,860	0.05 (0.08)	17,021	0.04 (0.06)	48,766	0.05 (0.09)
AGE	69,909	14.96 (11.09)	17,051	15.50 (10.93)	48,781	14.84 (11.16)
RATE	16	6.86 (4.29)	7	13.13 (1.35)	8	4.21 (0.58)
GDP	16	5.21 (3.65)	7	7.10 (1.73)	8	5.57 (2.09)

Note: 'SIZE' is made by taking the logarithm of real total assets. It is calculated by deflating nominal total assets by the producer price index. 'KIS SCORE' is used for measuring firms' failure probability. The scores range from 0 to 100. The range of the KIS SCORE is as follows: 100~81 (Strong), 80~71 (Good), 70~56 (Adequate), 55~46 (Less Vulnerable), 45~0 (More/Highly Vulnerable). The ratio of tangible assets to total assets is used to measure 'COLLATERAL'. 'LEVERAGE' is the ratio of total liability to the shareholders' fund. 'PROFIT' is made by calculating the ratio of ordinary income, which is net profit before tax plus net extraordinary gains, to total assets. 'AGE' is calculated by using the difference between the analytic financial year and the firm's established year. 'RATE' is the uncollateralised overnight call rate, which is the policy interest rate set by the Bank of Korea. 'GDP', standing for GDP growth rate here, is used to control for cyclical effects.

Table 2.5. The impact of firm-specific characteristics on the external finance  
(Fixed Effect, Manufacturing Sector, Whole Period: 1991~2006)

Dependent var.	Short-term debt/Total debt (%)		Total debt/Total liabilities (%)	
	(1)	(2)	(3)	(4)
SIZE	-6.216*** (-26.52)	-5.770*** (-24.71)	5.511*** (40.48)	5.672*** (42.04)
KIS SCORE	-0.189*** (-12.65)	-0.201*** (-13.45)	-0.663*** (-74.93)	-0.666*** (-75.54)
COLLATERAL	-46.699*** (-51.50)	-46.343*** (-50.95)	21.037*** (39.50)	20.901*** (39.27)
LEVERAGE	-0.362*** (-6.06)	-0.367*** (-6.14)	1.215*** (33.71)	1.219*** (33.89)
PROFIT	5.305*** (3.08)	6.202*** (3.60)	-0.846 (-0.85)	-0.666 (-0.67)
AGE	1.887*** (43.23)	1.720*** (26.35)	-0.516*** (-19.59)	-0.298*** (-7.70)
RATE	-	-0.418*** (-7.16)	-	0.218*** (6.30)
GDP	-	0.033 (0.97)	-	-0.182*** (-8.83)
CONSTANT	159.626*** (42.94)	160.427*** (41.71)	2.386 (1.11)	-5.860*** (-2.65)
Year dummy	included	-	included	-
Observations	55,207	55,207	60,717	60,717
Number of firm	7,005	7,005	7,167	7,167
Breusch-Pagan	38,454.50	764.78	585.84	612.02
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman	395.35	764.78	585.84	612.02
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)
R-squared	0.05	0.06	0.28	0.30

Notes: 1. Fixed Effect is used for this estimation. The figures reported in parentheses are t-statistics.

2. \*, \*\*, \*\*\* indicate significance at the 10%, 5%, 1% levels, respectively.

Table 2.6. The impact of firm-specific characteristics on the external finance  
(Fixed Effect, Manufacturing Sector, Pre-Crisis and Post-Crisis Period)

Dependent var.	Short-term debt/Total debt (%)				Total debt/Total liabilities (%)			
	Pre-Crisis (1991-1997)		Post-Crisis (1999-2006)		Pre-Crisis (1991-1997)		Post-Crisis (1999-2006)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SIZE	-7.565*** (-12.11)	-7.598*** (-12.16)	-7.144*** (-22.35)	-6.946*** (-21.68)	5.998*** (16.57)	5.965*** (16.48)	5.372*** (29.83)	5.391*** (29.98)
KIS SCORE	-0.154*** (-5.57)	-0.143*** (-5.19)	-0.209*** (-11.27)	-0.211*** (-11.36)	-0.507*** (-31.35)	-0.502*** (-31.13)	-0.575*** (-53.93)	-0.573*** (-53.99)
COLLATERAL	-39.940*** (-20.18)	-39.817*** (-20.12)	-50.891*** (-42.96)	-49.839*** (-41.98)	15.020*** (13.09)	15.083*** (13.15)	23.584*** (34.92)	23.548*** (34.93)
LEVERAGE	0.080 (0.93)	0.092 (1.06)	-0.476*** (-5.56)	-0.496*** (-5.78)	0.912*** (17.76)	0.917*** (17.86)	1.406*** (28.10)	1.413*** (28.27)
PROFIT	-3.856 (-1.04)	-4.770 (-1.29)	6.477*** (3.24)	6.641*** (3.31)	-14.812*** (-6.90)	-15.306*** (-7.14)	-3.099*** (-2.73)	-3.193*** (-2.82)
AGE	1.192*** (7.94)	0.977*** (8.11)	2.029*** (26.74)	1.692*** (19.67)	-0.956*** (-10.89)	-0.753*** (-10.72)	-0.198*** (-4.50)	-0.210*** (-4.20)
RATE	-	0.050 (-0.45)	-	-1.607*** (-5.25)	-	0.278*** (4.23)	-	-0.055 (-0.31)
GDP	-	0.328*** (4.01)	-	-0.476*** (-7.11)	-	-0.463*** (-9.66)	-	-0.213*** (-5.51)
Constant	178.862*** (9.90)	185.128*** (18.85)	184.880*** (36.89)	192.7*** (36.06)	-2.857 (-0.50)	-10.294* (-1.81)	-7.515*** (-2.67)	-7.348** (-2.44)
Year dummy	included	-	included	-	included	-	included	-
Observations	14,018	14,018	38,001	38,001	14,592	14,592	42,630	42,630
Number of firm	3,174	3,174	6,840	6,840	3,299	3,299	7,076	7,076
Breusch-Pagan (p-value)	11,045.77 (0.00)	11028.27 (0.00)	24,012.08 (0.00)	23,728.22 (0.00)	13,410.38 (0.00)	13,365.03 (0.00)	34,512.34 (0.00)	34,469.83 (0.00)
Hausman (p-value)	60.21 (0.00)	66.50 (0.00)	391.21 (0.00)	467.77 (0.00)	208.08 (0.00)	258.13 (0.00)	635.26 (0.00)	715.75 (0.00)
R-squared	0.07	0.08	0.06	0.07	0.19	0.24	0.27	0.27

Notes: 1. Fixed Effect is used for this estimation. The figures reported in parentheses are t-statistics.

2. Total period is divided into two sub-periods such as pre-Crisis period and Post-Crisis period to see whether there are changes in firm's access to finance between two periods.

3. \*, \*\*, \*\*\* indicate significance at the 10%, 5%, 1% levels, respectively.

Table 2.7. The impact of firm-specific characteristics and monetary policy stance on external finance

(Fixed Effect, Manufacturing Sector, Pre-Crisis and Post-Crisis Period)

Dependent var.	Short-term debt/Total debt (%)		Total debt/Total liabilities (%)	
	Pre-Crisis (1991-1997)	Post-Crisis (1999-2006)	Pre-Crisis (1991-1997)	Post-Crisis (1999-2006)
Period	(1)	(2)	(3)	(4)
SIZE	-7.917*** (-12.28)	-6.744*** (-20.52)	5.921*** (15.84)	5.291*** (28.66)
SIZE*TMP	0.621** (2.48)	-0.408** (-2.23)	0.109 (0.75)	-0.192 (-1.89)
KIS SCORE	-0.135*** (-3.94)	-0.215*** (-10.30)	-0.509*** (-25.38)	-0.587*** (-49.10)
KIS SCORE*TMP	-0.029 (-0.91)	0.007 (0.25)	0.006 (0.29)	0.037* (2.40)
COLLATERAL	-39.151*** (-17.85)	-50.251*** (-39.80)	14.269*** (11.21)	22.753*** (31.65)
COLLATERAL*TMP	-1.456 (-0.88)	0.961 (0.77)	1.273 (1.33)	2.347** (3.25)
LEVERAGE	0.061 (0.52)	-0.639*** (-5.96)	0.816*** (11.82)	1.661*** (26.29)
LEVERAGE*TMP	0.043 (0.34)	0.288** (2.12)	0.158** (2.16)	-0.443*** (-5.62)
PROFIT	-6.927 (-1.33)	4.192* (1.82)	-18.814*** (-6.22)	-2.411 (-1.84)
PROFIT*TMP	4.782 (0.87)	6.732** (1.97)	5.813* (1.83)	-0.664 (-0.35)
AGE	1.237*** (7.03)	1.627*** (9.20)	-0.655*** (-6.37)	0.322** (3.29)
AGE*TMP	0.026 (0.93)	-0.043* (-1.87)	0.021 (1.32)	0.031* (2.31)
RATE	0.904*** (3.86)	-2.216*** (-3.73)	0.637*** (4.62)	1.933*** (5.84)

Dependent var.	Short-term debt/Total debt (%)		Total debt/Total liabilities (%)	
	Pre-Crisis (1991-1997)	Post-Crisis (1999-2006)	Pre-Crisis (1991-1997)	Post-Crisis (1999-2006)
Period	(1)	(2)	(3)	(4)
RATE*TMP	-0.854*** (-4.39)	1.603* (1.87)	-0.295** (-2.58)	-0.569 (-1.22)
GDP	0.479 (1.10)	-0.549*** (-7.48)	-0.302 (-1.19)	-0.091* (-2.16)
GDP*TMP	0.117 (0.23)	-0.071 (-0.25)	-0.066 (-0.22)	0.129 (0.82)
Constant	172.862*** (16.65)	193.736*** (27.99)	-15.450** (-2.57)	-21.524*** (-5.60)
Observations	14,018	38,001	14,592	42,630
Number of firms	3,174	6,840	3,299	7,076
Breusch-Pagan	11,048	23,840	13,412	34,451
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman	76.77	402.20	245.79	462.75
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)
R-squared	0.07	0.07	0.28	0.19

Notes: 1. The figures reported in parentheses are t-statistics..

2. Total period is divided into two sub-periods such as pre-Crisis period and Post-Crisis period to see whether there are changes in firm's access to finance between two periods.

3. TMP is a dummy variable which stands for tight monetary policy period.

4. \*, \*\*, \*\*\* indicate significance at the 10%, 5%, 1% levels, respectively.

## **Chapter 3. Foreign Currency Exposure and Exchange Rate Balance Sheet Effect on Firm's Investment: Korean Firm-level Analysis**

### **Abstract**

This paper examines firms' foreign currency exposure and real exchange rate balance sheet effects on firms' investments using Korean firm-level data. The findings in this paper have helped uncover the elusive real exchange rate balance sheet effect in the limited open economy literature. Firstly, a contractionary balance sheet effect mostly occurs in the presence of a large real exchange rate depreciation. Secondly, real exchange rate depreciations lead to lower investments for the firms with high foreign currency borrowing and low exports which are highly vulnerable to exchange rate shock. Thirdly, the firms with a low short-term foreign currency borrowing ratio tend to increase investment even when there is a real exchange rate depreciation, while firms with an extremely high short-term foreign currency borrowing ratio experience no significant effects.

### **3.1. Introduction**

Currency mismatch in the debt structure of firms is an important issue in the open economy. When there is a significant currency mismatch in the economy, a large real depreciation undermines the net worth of firms with high foreign currency debt and makes credit more expensive and restricted for these firms, leading to a decrease in the firm's investment and production activities. However, a real depreciation can have expansionary effects through increasing the operating profits in the export sector as well as increasing the cost of imported goods, favouring tradable activities in the economy. A currency mismatch means that a large fraction of a firm's debt is foreign currency denominated, whilst the flow of income and assets are mostly denominated in the domestic currency.

When there is a large balance sheet effect, a rapid increase in the exchange rate induces economic shrinkage by decreasing investment, in contrast with an economic expansion experienced by an increase of exports during an increase in the exchange rate in general. For example, during the currency crisis period, firms' financial conditions and net worth worsened due to the high interest rate and rapid depreciation of the Korean currency. The subsequent credit crunch made the real economy shrink as shown in Figure 4.1.

Aghion et al. (2001) present a model of the currency crisis driven by the interplay between the credit constraints of private domestic firms and the existence of nominal price rigidities. According to Aghion et al., if nominal prices are sticky, a currency depreciation leads to an increase in the foreign currency debt repayment obligations of firms, thus leading to a fall in their profits. This reduces the firms' borrowing capacity, investment, and output in a credit-constrained economy. Moreover, the currency depreciation reduces the demand for the domestic currency and leads to a further currency depreciation. In particular, developing countries' inability to borrow abroad using their local currency tends to result in a currency mismatch on their balance sheets. This phenomenon is referred to as "original sin" by Eichengreen et al. (2003)

Allayanis et al. (2003) find that firms with higher dollar debt invest less during a depreciation period as in the case of large listed companies in Asian countries. Using large listed firms in Mexico, Aguiar (2005) describes that there is a balance sheet effect mechanism. Aguiar finds that there is a significant negative correlation between dollar debts and firms' investments, which signifies that firms with higher dollar debt have smaller investments due to a currency depreciation. Kesriyeli et al. (2011) also find that devaluations are contractionary for sectors with higher liability dollarization in terms of investments and profits, using a sample of Turkish firms. Carranza et al. (2011) claim that the negative balance sheet effect of exchange rate depreciation is observable only if the magnitude of the depreciation is large enough, using country-level data. Endresz and Harasztosi (2014) show that investment rate of firms with foreign currency loans falls further during the currency crisis due to the balance sheet effects by the depreciation, while investment rate of firms with foreign currency loans rises before the crisis, using a sample of Hungarian firms. Carranza et

al. (2003), Galiani et al. (2003), Cowan et al. (2005) also find a negative balance sheet effect of the interaction between exchange rate depreciation and foreign currency debt on firms' investments.

However, Bleakley and Cowan (2008) inversely find that the correlation is positive and significant in the case of Latin American countries. They explain that currency depreciation does not reduce investments of the firms with dollar denominated debt. In the case of Asian countries, Luengnaruemitchai (2003) finds that the relationship between dollar debt and the firms' investments is not significant. Bonomo et al. (2003), Benavente et al. (2003) also identify that there is no negative significant effect of exchange rate depreciation on firms' investments. Echeverry et al. (2003) also cannot identify a negative exchange rate balance sheet effect on investments but identified one on profitability.

On the other hand, Bougheas et al. (2007) present a model of an open economy credit channel including currency mismatch. Assuming that exporting firms are capable of accessing international credit while non-exporting firms are not, smaller firms are less likely to obtain credit than larger, exporting firms. Sales growth is also positively influenced by the size of the firm. However, Bougheas et al. do not directly show the exchange rate balance sheet effect using foreign currency denominated debt. Guariglia and Mateut (2010) examine the relationship between firms' access to global markets and their financial health using a sample of UK firms. They present that non-exporting firms which are not globally engaged face a higher degree of financial constraints than exporting firms, by showing that the sensitivity of inventory investment to financial composition variable exhibits higher sensitivities for non-exporting firms. However, they do not consider the effect of exchange rate variation in their estimation model. Bougheas et al. (2015) explore crisis effects on different types of firms focusing on Brazil which experienced a currency crisis in 1999 that affected foreign capital flows and the exchange rate market. They present results showing that the total sales growth of exporting firms shows less sensitivity to the currency crisis than that of non-exporting firms because exporting firms can offset a loss in domestic sales with greater export sales after a currency crisis with an improvement in their competitiveness. However, they do not separate domestic and export sales growth in their model.

These empirical analyses show quite a mixed exchange rate balance sheet effect on a firm's performance such as investments and sales growth. This paper investigates firms' foreign currency exposure and a real exchange rate balance sheet effect on the firm's investment using Korean firm-level data. The followings are considered to clarify the elusive real exchange rate balance sheet effect: the level of depreciation; the ratio between foreign currency borrowing vs. export; and short-term foreign currency borrowing ratio.

The findings of this paper help uncover the elusive real exchange rate balance sheet effect by documenting firm-level activities in an open economy. The impact of an exchange rate balance sheet effect on firms' investments will be estimated through currency mismatch, using data on foreign currency denominated borrowings. This paper fills the gap in limited evidence on firm-level activities in an open economy.

### **3.2. Balance Sheet Channel: One of Main Credit Channels**

The credit channel of the monetary transmission mechanism is made up of two sub-channels: the bank lending channel and the balance sheet channel. According to the bank lending channel, the tightening of monetary policy leads to a reduction in reserves, a larger reduction in deposits, and hence a reduction in loans supply. Thus, the firms which are dependent on banks - younger and smaller firms for example – need to cut their investments, which leads to a drop in economic growth. According to the balance sheet channel, the tightening of monetary policy is associated with a rise in the interest rate and a drop in the firms' cash flow and net worth. This translates into a rise in the problems of moral hazard and adverse selection, and in turn, leads to less lending to the firms, lower investments, and lower GDP.

The credit channel is not an independent channel, but it amplifies and propagates the traditional interest rate channel. The interest rate increases due to tight money but remains high only for a short period. Nonetheless, what is puzzling is that many factors like investments and house purchases start to react after the interest rate returns to the trend. Small changes in interest rates have large effects on the real economy. Monetary policy affects short-run interest rates, but factors like investment

in durables or house purchases mostly react to monetary policy. These puzzles can be solved by looking at the credit channel.

Bernanke and Gertler (1995) have shown that the balance sheet channel is useful in explaining the puzzles and characterizing the interest rate channel. These puzzles are: the timing, whereby the economy often reacts to a tight monetary policy once the interest rate returns to the trend; magnitude, whereby small changes in the interest rate have large effects on the economy; and composition, whereby a tight monetary policy, which affects short-term interest rates, affects long-lived assets more than short-lived ones. The balance sheet channel provides solutions to these puzzles. Specifically, small changes in the interest rate can lead to large changes in output through the accelerator effect, as they are accompanied by the large changes in balance sheet situations of the firms and by reductions in the supply of bank loans. Moreover, the effects of monetary policy may last for a long time after the interest rate returns to normal because a weak balance sheet lasts at least until the following year, when new accounts are published. In addition, firms can be viewed as risky even after they return to normal status. Finally, long-lived assets are affected by monetary policy not through the actual changes in the short-run interest rate, but through factors like the change in the coverage ratio or the mortgage burden.

The balance sheet channel has also been empirically tested by Gertler and Gilchrist (1994) who have shown that small firms shrink more than large firms following the tightening of monetary policy. Specifically, Gertler and Gilchrist (1994) showed that in periods of recession and a tight monetary policy, small firms reduce their sales, inventory investment, and short-term debt much more than large firms. This is due to the fact that they are much more affected by the problems of adverse selection and moral hazard. These findings support the balance sheet channel of transmission of the monetary policy.

A firm's net worth is defined by its liquid assets and marketable collateral and includes cash, equities, and cash flow. A high net worth is associated with a lower external finance premium. If a firm has a low net worth, lenders are likely to think that the firm has a low net worth because it undertook poor investment projects in the past and is therefore a high-risk firm. Consequently, lenders reduce lending to this firm.

The role of the micro sector in financial fragility and macroeconomic vulnerability should be included in analysis used in the studies of financial crisis. The balance sheet channel approach considers the micro factors to be important sources of macroeconomic turbulence. Therefore, it is crucial to link micro sectors and macroeconomy in analysing financial crises.

A balance sheet effect occurs when the firms and financial institutions face a significant increase in the cost of debt which significantly weakens their balance sheets during currency crises. This paper looks at the balance sheet effect through currency mismatches using Korean firm-level data. Specifically, it examines whether firms with high foreign currency denominated debt have difficulty investing during exchange rate depreciation. Furthermore, this paper examines the balance sheet effect more broadly by differentiating the size of depreciation, the comparative ratio between foreign currency borrowing and export, and the level of the short-term foreign currency borrowing ratio.

### **3.3. Main Features of the Data**

#### **3.3.1. The Data Set and Summary Statistics**

The data set was constructed from the balance sheet and cash flow statements gathered by the KIS (Korea Information Service). This data set includes statutory audited firms. Thus, it includes the majority of the firms which do not trade on the stock market as well as those that do.<sup>7</sup>

This paper only considers the manufacturing sector of statutory audited firms. The firms' data were selected only if the information on their balance sheets are reported as of the end of December (financial year-end) and the accounting year-end is not changed. Therefore, the data refer to a 12-month accounting period.

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<sup>7</sup> Even though the data set covers statutory audited firms, firms with data on foreign currency denominated debt and export sales are mostly large firms. This can create a size bias in the sample as the largest firms tend to be less credit constrained than smaller firms. This constrains ostensibly affects their debt structures and real activities such as investments and sales growth

To control for the potential influence of outliers, observations beyond the 1st and 99th percentiles for each of the regression variables are removed.<sup>8</sup> Observations that showed export sales being greater than total sales are excluded, and observations reporting total debt being greater than total assets are also excluded. The firm-years that do not have complete records of the variables of foreign currency denominated borrowings and export sales are dropped, and the firm-year observations without a time gap are kept. Moreover, when GMM is used, equations are estimated in first-differences, and the values of the regressors that lagged twice or more are used as instruments. For this reason, at least three consecutive observations are needed for each firm to allow the first-differencing process and the construction of the instruments. Thus, only the firms with a minimum of three consecutive observations remain in the sample. This leaves us with a sample of 4,381 observations for 737 firms over the period 1991-2006.

Definitions of the variables used in this paper and summary statistics are presented at Table 3.1 and Table 3.2, respectively.

### **3.3.2. The Determinants of Foreign Currency Borrowing**

The determinants of foreign currency denominated borrowing, a main variable of the analysis, are also examined. The ratio of foreign currency denominated borrowing to total borrowing is calculated. The result is presented in Table 3.3.

In identifying which types of firms raise foreign debt using firm-level data, credit score (KIS Score), collateral assets, profitability, and the ratio of export sales play key roles in accessing foreign currency borrowing. These variables show highly significant positive coefficients. This signifies that firms which are financially healthier, the firms which have larger collateral assets, and firms which have more foreign currency income are more likely to borrow in a foreign currency.

A firm's leverage ratio and size show a negative relationship with its foreign currency borrowing. This means that firms with heavier debt cannot easily obtain foreign currency borrowing. However, the size effect may be different from expectation. It might be because, after the currency crisis in Korea, large firms have

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<sup>8</sup> When winsorizing the data instead of truncating observations above 99% or below 1%, it did not make any significant difference to the estimation results reported in this chapter.

had many alternative finance sources and have also been trying to reduce their debt ratio to gain greater financial stability. In particular, after the currency crisis, large exporting firms earned high foreign currency income from their business through the exchange rate depreciation.

Real exchange rate depreciation, which is not a firm-specific characteristic variable but a macroeconomic variable, has a highly significant negative effect on obtaining foreign currency debt. It reflects the fact that when there is a depreciation in the value of the domestic currency, the burden of foreign currency denominated debt will go up, so demand for foreign currency denominated debt will decrease.

### **3.3.3. Correlations between Foreign Currency Borrowing and Export in Korea**

Figure 4.2 shows the plots of FCB (foreign currency borrowing ratio) and EXPORTS (export ratio) of each firm. Following Echeverry et al. (2003), each firm was identified as belonging to one of the three zones: Zone 1 (hell), Zone 2 (heaven), and Zone 3 (hedge). The upper and lower bounds of the hedge area are set as  $FCB=(3/2)*EXPORTS$  and  $FCB=(2/3)*EXPORTS$ , respectively.

The firms with high FCB and low EXPORTS are classified as being in hell as they are more vulnerable to the balance sheet effect of a real exchange rate depreciation. The firms in heaven export a large proportion of their output and have a low level of FCB. The firms in the hedge zone hedge their high FCB with higher EXPORTS. 45% of Korean sample firms belong to hell zone, 41% to heaven zone, and 14% to hedge zone. For comparison, 4%, 17%, 79% of Colombian firms belong to hell, heaven and hedge zone, respectively (Echeverry et al., 2003), and majority of the sectors in Turkey belong to the hell zone (Kesriyeli et al., 2011).

## **3.4. Model Specification and Estimation Methodology**

### **3.4.1. Empirical Model Specification**

A dynamic panel data framework is used to explain the effects of the interaction between foreign currency denominated borrowing and real exchange rate

depreciation on firms' investments. To account for some dynamics in the behavior of the investment, a lagged dependent variable is used.

Following Bleakley and Cowan (2008) and Carranza et al. (2011), the balance sheet effect of a real exchange rate depreciation through foreign currency denominated borrowing has been investigated, starting from equation (1).

$$\Delta INV_{it} = \alpha + \beta_0 \Delta INV_{it-1} + \beta_1 \Delta RER_t + \beta_2 FCB_{it} + \beta_3 (FCB_{it} \times \Delta RER_t) + v_i + v_t + e_{it} \quad (1)$$

$\Delta INV_{it}$  is the net investment of the firm<sub>it</sub>, which are the ratio of net purchase of tangible, intangible, and leased assets normalized by total assets.  $\Delta RER_t$  is the variation of the real exchange rate in log terms in year t. Increase in  $\Delta RER_t$  means depreciation of the local currency.  $FCB_{it}$  is the ratio of foreign currency denominated borrowing to total borrowing in year t. The error term in Equation (1) is made up of the following components:  $v_i$  which denotes a firm-specific component;  $v_t$  which represents a time-specific component; and  $e_{it}$  which is an idiosyncratic component.

$\beta_1$  is a common effect for every firm. It reflects the impact of the exchange rate on the firm's investment decision and depends on the relative strength of the competitiveness effect and the balance sheet effect.  $\beta_1$  captures not only exchange rate movements but also other macroeconomic effects. By using time dummies,  $v_t$ , macro-variables will be controlled.

The interaction effect of foreign currency borrowing with a real exchange rate depreciation is measured by  $\beta_3$ . If balance sheet effect is captured, it should have a negative sign. However, recent analyses have found only weak evidence for this balance sheet effect.

$$\Delta INV_{it} = \alpha + \beta_0 \Delta INV_{it-1} + \beta_1 \Delta RER_t + \beta_2 FCB_{it} + \beta_3 (FCB_{it} \times \Delta RER_t) + \beta_4 (FCB_{it} \times \Delta RER_t \times \mathbf{D}_{it}^a) + v_i + v_t + e_{it} \quad (2)$$

$$\Delta INV_{it} = \alpha + \beta_0 \Delta INV_{it-1} + \beta_1 \Delta RER_t + \beta_2 FCB_{it} + \beta_3 (FCB_{it} \times \Delta RER_t) + \beta_4 (FCB_{it} \times \Delta RER_t \times \mathbf{D}_{it}^b) + v_i + v_t + e_{it} \quad (3)$$

$$\Delta INV_{it} = \alpha + \beta_0 \Delta INV_{it-1} + \beta_1 \Delta RER_t + \beta_2 FCB_{it} + \beta_3 (FCB_{it} \times \Delta RER_t) + \beta_4 (FCB_{it} \times \Delta RER_t \times \mathbf{D}_{it}^y) + v_i + v_t + e_{it} \quad (4)$$

The estimation model of this paper introduces three kinds of dummy variables, not only for the level of depreciation ( $\mathbf{D}^a_t$ ), but also for comparative ratio between foreign currency borrowing and export ( $\mathbf{D}^b_{it}$ ) and for the level of the ratio of short-term foreign currency borrowing ( $\mathbf{D}^y_{it}$ ). Focusing on  $\beta_4$  in the equation (2), (3), and (4), this paper investigates in which circumstances the exchange rate balance sheet effect works significantly.

### 3.4.2. Estimation Methodology<sup>9</sup>

The first-difference GMM (Generalized Method of Moments) estimator, which Arellano and Bond (1991) developed, is used to estimate the above specifications. Arellano and Bond proposed a dynamic panel data estimator based on General Method of Moments methodology which optimally exploits the linear restrictions implied by the dynamic panel model proposed in this study. This method takes unobserved firm heterogeneity into account by estimating the equation in the first differences, and it controls any possible endogeneity problems by using as instruments the model variables lagged by two or more periods. The Generalised Method of Moments (GMM) provides a framework for estimating equations with such endogenous variables. Instrumental variables that are related to the explanatory variable but not to the error can be used to isolate the variation that is not correlated with the error. Such instruments are relatively easy to obtain in the panel context as deeper lags of the dependent variable can be used.

The GMM estimator treats the model as a set of equations, one for each time period. The predetermined and endogenous variables in the first differences are instrumented with suitable lags at their own levels. Allowing for the heteroscedasticity of the disturbances across the firms and their possible correlation over time, the GMM method of estimation takes the two biases caused by firm-specific effects and endogenous regressors simultaneously into account. This technique eliminates firm-specific effects by taking the first difference of the

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<sup>9</sup> The empirical models are estimated by both one-step first-difference GMM and two-step first-difference GMM. The estimation results are similar, but there are some differences in statistical significance. In the main text, the estimation results of one-way first-difference GMM are presented, and the results of two-way first-difference GMM are reported in the Appendix. The two-step estimates of the difference GMM standard errors may have a downward bias. Therefore Windmeijer correction is applied to these standard errors. When error term is not iid, one-step estimators cannot be efficient but are still consistent.

equations and controlling for possible endogeneity problems, using the model variables lagged by two or more periods as instruments. The GMM results reported are one-step estimates. All standard errors are asymptotically robust to heteroscedasticity.

Both the Sargan test for instrument validity and the test for second-order serial correlation of the residuals in the differences equations, AR(2), are used to evaluate whether the estimation models are correctly specified. If the models are correctly specified, the variables in the instrument set should be uncorrelated with the error term. Under the null hypothesis of instrument validity in the Sargan test, it is asymptotically distributed as a chi-square with degrees of freedom equal to the number of instruments less the number of parameters. Sargan's statistic is a special case of Hansen's J under the assumption of homoscedasticity, and for robust GMM the Sargan test statistic is inconsistent. (Roodman, 2006) Therefore, Hansen's J test is used for the analysis of this paper.

The AR(2) test is asymptotically distributed as a standard normal under the null hypothesis of no second-order serial correlation of the differenced residuals. It provides a further check on the specification of the model and on the legitimacy of variables dated  $t-2$  as instruments in the equation. The consistency of the estimates is premised on the assumption of a lack of autocorrelation of the error terms. Specifically, there should be rejection of the null hypothesis of first order serial correlation and non-rejection of the second order. Thus, this paper tests the existence of the first and second order serial correlation.

First-difference GMM is likely to suffer from the finite, small sample biases, which is often the case in autoregressive models with persistent series and a high ratio of the variance of fixed-effects to the variance of transitory shocks. (Blundell and Bond, 1998) To check this, it is necessary to compare the Ordinary Least Squares (OLS) estimates and the Fixed Effects or Within Groups estimates of lagged dependent variable. The OLS estimate is upward biased and the fixed-effects estimate is downward biased. If the coefficient on the lagged dependent variable from the first-difference GMM lies between the corresponding estimation coefficients obtained by OLS and fixed-effects methods, this suggests that the first-

difference GMM estimator is unlikely to suffer from a weak instrument bias (Bond et al, 2001).<sup>10</sup>

### 3.5. Empirical Results

As mentioned in the model specification and estimation methodology section, the first-difference GMM (Generalized Method of Moments) estimator, developed by Arellano and Bond (1991), was used for the dynamic panel data model specification.

An investment variable was used as a dependent variable in our estimation because investment is most commonly used for measuring firm's performance when investigating the balance sheet effect. The investment rate is measured as the annual change in tangible, intangible, and leased assets and normalized by total assets.

The instruments for GMM specifications include  $\Delta INV_{it}$ ,  $FCB_{it}$ ,  $FCB_{it} \times \Delta RER_t$ , and  $FCB_{it} \times \Delta RER_t \times D^a_t$  (or  $FCB_{it} \times \Delta RER_t \times D^b_{it}$ ;  $FCB_{it} \times \Delta RER_t \times D^y_{it}$ ) all lagged twice. Time dummies and  $\Delta RER_t$  are also included in the instrument set. Hansen's J-statistics suggests that the instruments are valid tests to support our choice of the instrument sets for the estimations. According to the m1 and m2 test, the null hypothesis of the absence of first order serial correlation is rejected and the null of the absence of second order serial correlation is not rejected. In addition, the estimated coefficients by first-differenced GMM on the lagged dependent variable lie between the corresponding estimates obtained using pooled OLS and the Fixed Effects estimators. This suggests that the GMM estimator is not likely to suffer from bias due to a weak instrument set. Therefore, the empirical validity of the GMM specification is secure.

The coefficient,  $\beta_3$  in the equation (2), of the interaction term of foreign currency borrowing) with exchange rate depreciation is the key explanatory variables in most literatures as it represents the balance sheet effect of foreign currency borrowing. However, its effects are yet unclear.

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<sup>10</sup> The first-difference GMM coefficients of lagged dependent variable in the estimations are between OLS and fixed-effect coefficient. Hence, first-difference GMM method can be applied to the analysis.

Therefore, to reveal this elusive balance sheet effect, three kinds of dummy variables are introduced to the estimations. Main interest in the specification is the parameter  $\beta_4$  in the equation (2), (3), and (4) i.e. parameters attached to the interaction terms of foreign currency borrowing and real exchange rate depreciation with dummy variables such as  $D_t^\alpha$ ,  $D_{it}^\beta$ , and  $D_{it}^\gamma$ . In these estimations,  $D_t^\alpha$  is a dummy variable for identifying the size of depreciation,  $D_{it}^\beta$  is for identifying a comparative ratio between foreign currency borrowing and exports, and  $D_{it}^\gamma$  is for identifying the level of the ratio of short-term foreign currency borrowing.

Table 3.4 shows a negative impact of large depreciations on investment.  $D_{it}^\alpha$ , a dummy variable for identifying the level of depreciation, is introduced in this estimation. The size of depreciation is separated into appreciation ( $\alpha \leq 0\%$ ), depreciation ( $\alpha > 0\%$ ), and large depreciation ( $\alpha > 15\%$ ). The coefficient of the interaction term of ( $FCB_{it} \times \Delta RER_t$ ) of column (1) and (2) in Table 3.4 has a positive and significant effect, whereas it has a positive but insignificant effect in column (3).

However, when there is depreciation ( $\alpha > 0\%$ ), especially large depreciation ( $\alpha > 15\%$ ), the exchange rate balance sheet effect becomes significantly negative. The coefficient of the interaction term of ( $FCB_{it} \times \Delta RER_t \times D_t^\alpha$ ) of column (1) and (2) in Table 3.4 has a negative and significant effect. It means large real exchange rate depreciations, even in the case of depreciation, lead to less investment for firms with relatively high foreign currency borrowing. However, the effect is not significant when there is appreciation ( $\alpha \leq 0\%$ ). Consequently, large real exchange rate depreciations tend to be contractionary in terms of a firm's investment.

This result supports the findings of Carranza et al. (2011) which show that the negative balance sheet effect of exchange rate depreciation may be observable only if the magnitude of the depreciation is large enough.

Table 3.5 shows that real exchange rate depreciations lead to lower investment for firms highly vulnerable to the exchange rate shock because they have a high level of foreign currency borrowing and low exports.  $D_{it}^\beta$  is introduced for identifying the comparative ratio between foreign currency borrowing and export sales.

As seen in Figure 4.2, following Echeverry et al. (2003), each firm belongs to one of three zones: Zone 1 (hell), Zone 2 (heaven) and Zone 3 (hedge). The upper and lower bounds of the hedge area are set as  $FCB = (3/2) * EXPORTS$  and

$FCB=(2/3)*EXPORTS$ , respectively. Firms in Zone 1 (hell zone) represent the firms with high foreign currency borrowing ratio and low export sales ratio, and firms in Zone 2 (heaven zone) represents the firms with low foreign currency borrowing ratio and low export sales ratio. Firms in Zone 3 (hedge zone) lie between Zone 1 and Zone 2.

According to Table 3.5, the firms which can be most vulnerable to the real exchange rate depreciation are the firms in Zone 1 (hell zone) with high foreign currency borrowing and low export. Even though the statistical significance is low, these firms show great negative sensitivity of investment to the balance sheet effect while firms in Zone 2 (heaven zone), with low foreign currency borrowing and high export, show great positive sensitivity of investment to the balance sheet effect.

The coefficient of interaction term of  $(FCB_{it} \times \Delta RER_t)$  of both column (4) and (5) in Table 3.5 has a positive effect. However, while the coefficient of interaction term  $(FCB_{it} \times \Delta RER_t \times D_{it}^{\beta})$  of column (4) has a negative effect, the coefficient of interaction term of  $(FCB_{it} \times \Delta RER_t \times D_{it}^{\beta})$  of column (5) has a positive effect.

This result is consistent with Gilchrist and Sim (2007) who showed that a devaluation depresses the investments of firms whose financial position is most exposed to exchange rate shock. Gilchrist and Sim showed this by dividing their sample into four sub-groups based on whether they are high vs. low export firms and whether they have high vs. low foreign denominated debt firms. They also used Korean firm-level data over the period of 1993 to 2002, and they constructed the investment data using a net increase in tangible assets. However, there are some differences from this paper in the way the sub-groups are separated and the way investment is calculated.

Table 3.6 shows that firms with a low short-term foreign currency borrowing ratio tend to increase investment even when there are real exchange rate depreciations, while there is no significant effect on firms with a high short-term foreign currency borrowing ratio.

The short-term foreign currency borrowing ratio is the ratio of short-term foreign currency borrowing due in less than one year to total foreign currency borrowing. A dummy variable,  $D_{it}^{\gamma}$ , has been introduced in this estimation for the purpose of identifying the level of short term foreign currency borrowing.

The coefficients of the interaction term of  $(FCB_{it} \times \Delta RER_t)$  of columns (7), (8) and (9) in Table 3.6 do not show statistically significant effects. However, while the coefficient of the interaction term of  $(FCB_{it} \times \Delta RER_t \times D^y_{it})$  of column (7) and (8) has a significant positive effect, the coefficient of the interaction term of  $(FCB_{it} \times \Delta RER_t \times D^y_{it})$  of estimation (9), which is the case of a large short-term foreign currency borrowing ratio, does not show any further significant effect.

As seen in Table 3.3, foreign currency borrowing is closely related to financially healthier and more profitable firms and positively related to export sales. Moreover, foreign currency borrowing can be another source of finance for firms' investments in addition to their domestic borrowing. Therefore, firms with foreign currency borrowing tend to increase their investment even during a real exchange rate depreciation. However, if the short-term foreign currency borrowing ratio is extremely high, over 90%, for example, and there is real exchange rate depreciation, the firms with foreign currency borrowing do not show a significant relationship with their investment.

### 3.6. Conclusions

This paper investigates firms' foreign currency exposure and the real exchange rate balance sheet effect on firms' investments using Korean firm-level data. It considers the size of depreciation, the ratio between foreign currency borrowing vs. exports, and the short-term foreign currency borrowing ratio, using the dummy variables in our estimation model to clarify the elusive real exchange rate balance sheet effect.

First-differenced GMM method was used to estimate our dynamic panel model because this method takes unobserved firm heterogeneity into account by estimating the equation in the first differences. The model also controls for possible endogeneity problems by using the model variables lagged by two or more periods as instruments.

From this analysis using Korean firm-level data, this paper shows that a contractionary balance sheet effect occurs in the presence of a large real exchange rate depreciation.

Secondly, real exchange rate depreciations lead to lower investments for firms that are highly vulnerable to the exchange rate shock because they have high foreign currency borrowing and low exports.

Thirdly, firms with a low short-term foreign currency borrowing ratio tend to increase investments even during real exchange rate depreciations, whilst there is no significant effect on firms with an extremely high short-term foreign currency borrowing ratio.

In the presence of limited evidence documenting firm-level activities in the open economy, this paper's finding contributes to uncovering the elusive real exchange rate balance sheet effect on firms' investments.

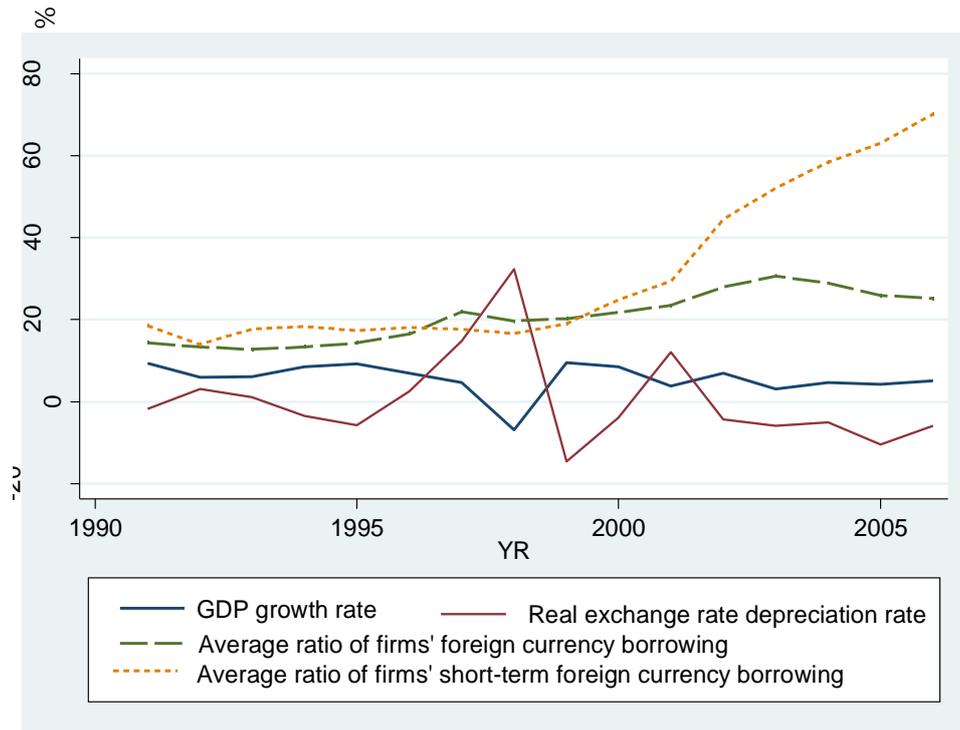


Figure 3.1. GDP growth rate, Real exchange rate, Foreign currency borrowing

Notes: average ratio of (short-term) foreign currency borrowing is authors' calculation using firms' balance sheet data.

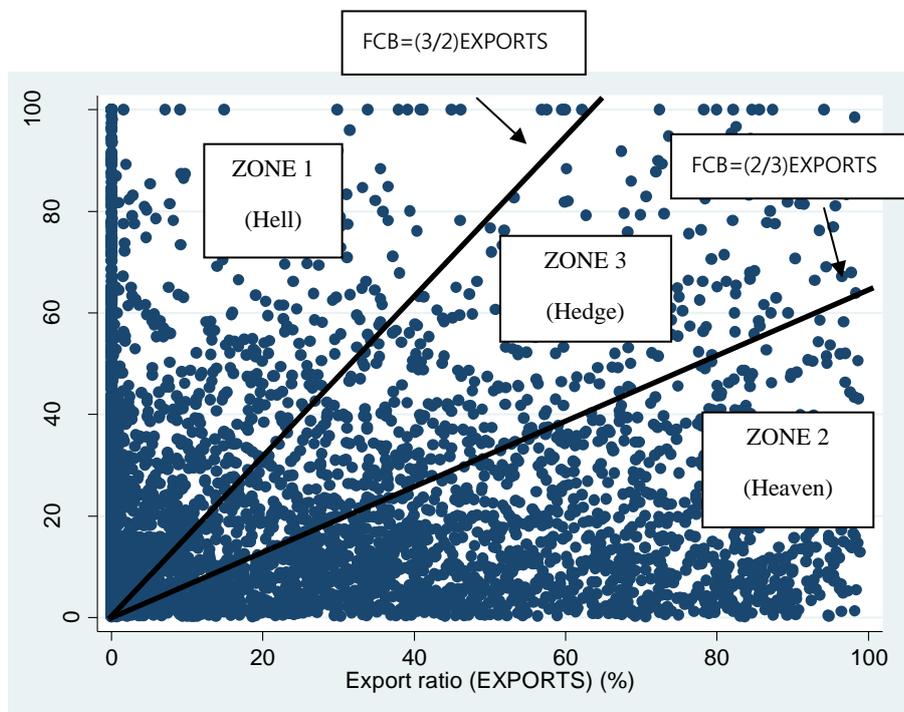


Figure 3.2. Foreign currency borrowing and exports

Table 3.1. Definitions of the variables

Variable name	Description
SIZE	The log of real total assets deflated by PPI (Producer Price Index)
KISSCORE	Firm's credit rating score by KIS (Korea Information service Ltd.) The score is calculated as a number in the range 0 – 100. 81-100: Strong, 71-80: Good, 56-70: Adequate, 46-55: Less Vulnerable, 0-45: More/Highly Vulnerable
COLLATERAL	(The ratio of tangible assets to total assets) * 100
LEVERAGE	(The ratio of total debt to total assets)*100
PROFIT	(The ratio of profit before tax to total assets) *100
EXPORTS	(The ratio of export sales to total sales) * 100
FCB	(The ratio of short-term and long-term foreign currency denominated borrowing to total borrowing) *100
ST_FCB	(The ratio of short-term foreign currency denominated borrowing due in less than one year to total foreign currency denominated borrowing) * 100
INVESTMENT	(The ratio of Net purchase of tangible, intangible, leased assets from cash flow data to total assets of the previous year) *100
$\Delta$ RER	Depreciation of bilateral real exchange rate, which is the real exchange rate between South Korean Won and US Dollar adjusted for the inflation differential between South Korea and USA. Annual average index with 1991=100 is used.

Table 3.2. Summary statistics

Variable	N	Mean	SD	Min	Max
SIZE	4,381	17.63	1.27	13.56	21.01
KISSCORE	4,325	62.84	10.64	27.00	87.00
COLLATERAL	4,381	39.04	16.83	1.23	85.02
LEVERAGE	4,381	39.12	17.01	0.71	84.72
PROFIT	4,381	4.43	7.85	-36.42	37.05
EXPORTS	4,381	27.09	29.18	0.00	98.89
FCB	4,381	23.09	21.95	0.23	100.00
ST_FCB	4,381	35.54	43.02	0.00	100.00
INVESTMENT	3,238	1127.46	1452.25	-2269.68	11110.75
$\Delta$ RER	4,321	-0.43	10.99	-14.67	64.93

Table 3.3. Determinants of foreign currency denominated borrowing

Dependent Variable: the ratio of foreign currency borrowing to total borrowing

	(1)	(2)
SIZE	-3.044 <sup>***</sup> (0.273)	-2.540 <sup>***</sup> (0.301)
KISSCORE	0.146 <sup>***</sup> (0.0458)	0.116 <sup>***</sup> (0.050)
COLLATERAL	0.044 <sup>**</sup> (0.0212)	0.0432 <sup>**</sup> (0.024)
LEVERAGE	-0.219 <sup>***</sup> (0.0261)	-0.181 <sup>***</sup> (0.028)
PROFIT	0.157 <sup>***</sup> (0.0603)	0.350 <sup>***</sup> (0.071)
EXPORTS	0.0437 <sup>***</sup> (0.0118)	0.052 <sup>***</sup> (0.013)
$\Delta$ RER	-0.083 <sup>***</sup> (0.028)	-0.037 <sup>***</sup> (0.031)
CONSTANT	72.464 <sup>***</sup> (4.762)	62.360 <sup>***</sup> (5.166)
N	4,320	3,583
R <sup>2</sup>	0.090	0.089

Notes: Estimation (2) uses one-time lagged explanatory variables. The figures reported in parentheses are standard errors. Standard errors and test statistics are asymptotically robust to heteroskedasticity. \* indicates significance at the 10% level. \*\* indicates significance at the 5% level. \*\*\* indicates significance at the 1% level.

Table 3.4. Effect of exchange rate depreciations and foreign currency borrowing on investments (One-step Difference GMM Estimation)

Dependent Variable: Investment( $\Delta INV_{it}$ )			
$D_{it}^{\alpha}$ : Dummy for			
Value of depreciation ( $\alpha$ )	$\alpha > 15\%$	$\alpha > 0\%$	$\alpha \leq 0\%$
	(1)	(2)	(3)
$\Delta INV_{it-1}$	0.178*** (4.64)	0.177*** (4.60)	0.178*** (4.62)
$FCB_{it} * \Delta RER_t$	0.993** (1.81)	0.883** (1.72)	0.048 (0.21)
$FCB_{it} * \Delta RER_t * D_{it}^{\alpha}$	-1.293** (-1.70)	-1.132* (-1.62)	-0.024 (-0.07)
$\Delta RER_t$	-9.546*** (-3.51)	15.377** (2.50)	12.469** (2.16)
$FCB_{it}$	-4.353 (-0.59)	-5.282 (-0.71)	-6.102 (-0.83)
Time Dummy	Included	Included	Included
Observations	1,805	1,805	1,805
Firms	509	509	509
m1	-5.91 (0.000)	-5.91 (0.000)	-5.93 (0.000)
(p-value)			
m2	-0.45 (0.651)	-0.46 (0.644)	-0.50 (0.620)
(p-value)			
Hansen	21.83 (0.293)	21.45 (0.313)	23.66 (0.210)
(p-value)			

Notes: Lagged dependent variable is used to account for some dynamics in the behaviour of investment. All Specifications were estimated using one-step first-difference GMM specifications, where the instruments are all right-hand side firm-specific variables lagged twice. Exchange rate depreciation and time dummies are also included in the instrument set. The figures reported in parentheses are t-statistics. Standard errors and test statistics are asymptotically robust to heteroskedasticity. Time dummies are included in all specifications to control for all macroeconomic variables. m2 is a test for second-order serial correlation in the first-differenced residuals of the GMM specification, asymptotically distributed as  $N(0,1)$  under the null of no serial correlation. The Hansen's J-test is used for check instrument validity. \* indicates significance at the 10% level. \*\* indicates significance at the 5% level. \*\*\* indicates significance at the 1% level.

Table 3.5. Effect of foreign borrowing-exports zone dummy and foreign currency borrowing on investments (One-step Difference GMM Estimation)

Dependent Variable: Investment( $\Delta INV_{it}$ )			
$D_{it}^{\beta}$ : Dummy for ZONE	ZONE A	ZONE B	ZONE C
	High foreign borrowing	Low foreign borrowing	Area between
	Low Export	High Export	ZONE A and B
	(4)	(5)	(6)
$\Delta INV_{it-1}$	0.171*** (4.49)	0.175*** (4.66)	0.173*** (4.48)
$FCB_{it} * \Delta RER_t$	0.172 (1.32)	0.009 (0.08)	-0.019 (-0.11)
$FCB_{it} * \Delta RER_t * D_{it}^{\beta}$	-0.252 (-1.32)	0.360 (1.16)	0.098 (0.36)
$\Delta RER_t$	11.429** (2.08)	9.580** (2.50)	12.903** (2.24)
$FCB_{it-1}$	-9.378 (-1.34)	-4.413 (-0.62)	-6.884 (-1.00)
Time Dummy	Included	Included	Included
Observations	1,805	1,805	1,805
Firms	509	509	509
m1	-5.95 (0.000)	-6.15 (0.000)	-6.03 (0.000)
(p-value)			
m2	-0.45 (0.649)	-0.73 (0.466)	-0.47 (0.641)
(p-value)			
Hansen	35.48 (0.226)	36.50 (0.192)	30.87 (0.422)
(p-value)			

Notes: Lagged dependent variable is used to account for some dynamics in the behaviour of investment. All Specifications were estimated using one-step first-difference GMM specifications, where the instruments are all right-hand side firm-specific variables lagged twice. Exchange rate depreciation and time dummies are also included in the instrument set. The figures reported in parentheses are t-statistics. Standard errors and test statistics are asymptotically robust to heteroskedasticity. Time dummies are included in all specifications to control for all macroeconomic variables. m2 is a test for second-order serial correlation in the first-differenced residuals of the GMM specification, asymptotically distributed as  $N(0,1)$  under the null of no serial correlation. The Hansen's J-test is used for check instrument validity. \* indicates significance at the 10% level. \*\* indicates significance at the 5% level. \*\*\* indicates significance at the 1% level.

Table 3.6. Effect of short-term foreign currency borrowing ratio on investments (One-step Difference GMM Estimation)

Dependent Variable: Investment( $\Delta INV_{it}$ )			
$D_{it}^{\gamma}$ : Dummy for	$\gamma > 30\%$	$\gamma > 60\%$	$\gamma > 90\%$
Short-term foreign currency borrowing ratio( $\gamma$ )	(7)	(8)	(9)
$\Delta INV_{it-1}$	0.169*** (4.51)	0.168*** (4.38)	0.175*** (4.54)
$FCB_{it} * \Delta RER_t$	0.079 (-0.61)	-0.079 (-0.63)	-0.021 (0.21)
$FCB_{it} * \Delta RER_t * D_{it}^{\gamma}$	0.296* (1.83)	0.302* (1.86)	0.199 (1.26)
$\Delta RER_t$	12.631** (2.28)	12.129** (2.18)	13.392** (2.38)
$FCB_{it}$	-6.690 (-0.94)	-3.290 (-0.50)	-7.613 (-1.17)
Time Dummy	Included	Included	Included
Observations	1,805	1,805	1,805
Firms	509	509	509
m1	-5.96 (0.000)	-5.89 (0.000)	-5.95 (0.000)
(p-value)			
m2	-0.54 (0.590)	-0.63 (0.525)	-0.47 (0.640)
(p-value)			
Hansen	38.28 (0.143)	46.38 (0.029)	37.76 (0.156)
(p-value)			

*Notes.* Lagged dependent variable is used to account for some dynamics in the behaviour of investment. All Specifications were estimated using one-step first-difference GMM specifications, where the instruments are all right-hand side firm-specific variables lagged twice. Exchange rate depreciation and time dummies are also included in the instrument set. The figures reported in parentheses are t-statistics. Standard errors and test statistics are asymptotically robust to heteroskedasticity. Time dummies are included in all specifications to control for all macroeconomic variables. m2 is a test for second-order serial correlation in the first-differenced residuals of the GMM specification, asymptotically distributed as  $N(0,1)$  under the null of no serial correlation. The Hansen's J-test is used for check instrument validity. \* indicates significance at the 10% level. \*\* indicates significance at the 5% level. \*\*\* indicates significance at the 1% level.

## Appendix: Two-step GMM Estimations

A-1: Effect of exchange rate depreciations and foreign currency borrowing on investments (Two-step Difference GMM Estimation)

Dependent Variable: Investment( $\Delta INV_{it}$ )			
$D_{it}^{\alpha}$ : Dummy for			
Value of depreciation ( $\alpha$ )	$\alpha > 15\%$	$\alpha > 0\%$	$\alpha \leq 0\%$
	(1)	(2)	(3)
$\Delta INV_{it-1}$	0.177*** (5.50)	0.175*** (5.47)	0.168*** (4.97)
$FCB_{it} * \Delta RER_t$	0.902* (1.67)	0.905* (1.82)	-0.000 (-0.00)
$FCB_{it} * \Delta RER_t * D_{it}^{\alpha}$	-1.035 (-1.36)	-1.028 (-1.48)	0.244 (0.80)
$\Delta RER_t$	-11.311*** (-4.24)	11.738* (1.92)	7.008 (1.21)
$FCB_{it}$	-8.295 (-1.06)	-9.091 (-1.16)	-7.400 (-1.02)
Time Dummy	Included	Included	Included
Observations	1,805	1,805	1,805
Firms	509	509	509
m1	-5.83 (0.000)	-5.84 (0.000)	-5.73 (0.000)
(p-value)			
m2	-0.33 (0.745)	-0.33 (0.740)	-0.51 (0.607)
(p-value)			
Hansen	21.83	21.45	23.66
(p-value)	(0.293)	(0.313)	(0.210)

Notes: Lagged dependent variable is used to account for some dynamics in the behaviour of investment. All Specifications were estimated using two-step first-difference GMM specifications, where the instruments are all right-hand side firm-specific variables lagged twice. Exchange rate depreciation and time dummies are also included in the instrument set. The figures reported in parentheses are t-statistics. Standard errors and test statistics are asymptotically robust to heteroskedasticity. Time dummies are included in all specifications to control for all macroeconomic variables. m2 is a test for second-order serial correlation in the first-differenced residuals of the GMM specification, asymptotically distributed as  $N(0,1)$  under the null of no serial correlation. The Hansen's J-test is used for check instrument validity. \* indicates significance at the 10% level. \*\* indicates significance at the 5% level. \*\*\* indicates significance at the 1% level.

A-2: Effect of foreign borrowing-exports zone dummy and foreign currency borrowing on investments (Two-step Difference GMM Estimation)

Dependent Variable: Investment( $\Delta INV_{it}$ )			
$D_{it}^{\beta}$ : Dummy for ZONE	ZONE A	ZONE B	ZONE C
	High foreign borrowing	Low foreign borrowing	Area between
	Low Export	High Export	ZONE A and B
	(4)	(5)	(6)
$\Delta INV_{it-1}$	0.169*** (5.21)	0.161*** (4.83)	0.174*** (5.45)
$FCB_{it} * \Delta RER_t$	0.246* (1.84)	0.128 (1.18)	0.198 (1.36)
$FCB_{it} * \Delta RER_t * D_{it}^{\beta}$	-0.136 (-0.75)	0.310 (1.20)	-0.124 (-0.46)
$\Delta RER_t$	5.333 (0.95)	4.993 (0.88)	7.202 (1.28)
$FCB_{it-1}$	-9.285 (-1.42)	-7.482 (-1.11)	-6.357 (-0.92)
Time Dummy	Included	Included	Included
Observations	1,805	1,805	1,805
Firms	509	509	509
m1	-5.70 (0.000)	-5.66 (0.000)	-5.78 (0.000)
(p-value)			
m2	-0.40 (0.686)	-0.66 (0.510)	-0.49 (0.624)
(p-value)			
Hansen	35.48 (0.226)	36.50 (0.192)	30.87 (0.422)
(p-value)			

Notes: Lagged dependent variable is used to account for some dynamics in the behaviour of investment. All Specifications were estimated using two-step first-difference GMM specifications, where the instruments are all right-hand side firm-specific variables lagged twice. Exchange rate depreciation and time dummies are also included in the instrument set. The figures reported in parentheses are t-statistics. Standard errors and test statistics are asymptotically robust to heteroskedasticity. Time dummies are included in all specifications to control for all macroeconomic variables. m2 is a test for second-order serial correlation in the first-differenced residuals of the GMM specification, asymptotically distributed as  $N(0,1)$  under the null of no serial correlation. The Hansen's J-test is used for check instrument validity. \* indicates significance at the 10% level. \*\* indicates significance at the 5% level. \*\*\* indicates significance at the 1% level.

A-3: Effect of short-term foreign currency borrowing ratio on investments  
(Two-step Difference GMM Estimation)

Dependent Variable: Investment( $\Delta INV_{it}$ )			
$D_{it}^{\gamma}$ : Dummy for	$\gamma > 30\%$	$\gamma > 60\%$	$\gamma > 90\%$
Short-term foreign currency borrowing ratio( $\gamma$ )	(7)	(8)	(9)
$\Delta INV_{it-1}$	0.164*** (5.13)	0.164*** (4.78)	0.173*** (5.37)
$FCB_{it} * \Delta RER_t$	0.078 (0.66)	0.072 (0.61)	0.123 (1.08)
$FCB_{it} * \Delta RER_t * D_{it}^{\gamma}$	0.294* (1.93)	0.281* (1.86)	0.162 (1.57)
$\Delta RER_t$	6.947 (1.25)	7.584 (1.32)	8.818 (1.57)
$FCB_{it}$	-11.275* (-1.72)	-9.483 (-1.43)	-11.048* (-1.95)
Time Dummy	Included	Included	Included
Observations	1,805	1,805	1,805
Firms	509	509	509
m1	-5.87 (0.000)	-5.71 (0.000)	-5.83 (0.000)
(p-value)			
m2	-0.41 (0.682)	-0.48 (0.629)	-0.35 (0.726)
(p-value)			
Hansen	38.28 (0.143)	46.38 (0.029)	37.76 (0.156)
(p-value)			

*Notes.* Lagged dependent variable is used to account for some dynamics in the behaviour of investment. All Specifications were estimated using two-step first-difference GMM specifications, where the instruments are all right-hand side firm-specific variables lagged twice. Exchange rate depreciation and time dummies are also included in the instrument set. The figures reported in parentheses are t-statistics. Standard errors and test statistics are asymptotically robust to heteroskedasticity. Time dummies are included in all specifications to control for all macroeconomic variables. m2 is a test for second-order serial correlation in the first-differenced residuals of the GMM specification, asymptotically distributed as  $N(0,1)$  under the null of no serial correlation. The Hansen's J-test is used for check instrument validity. \* indicates significance at the 10% level. \*\* indicates significance at the 5% level. \*\*\* indicates significance at the 1% level.

## **Chapter 4. The Impact of Foreign Banks on Monetary Policy Transmission during the Global Financial Crisis of 2008-2009: Evidence from Korea**

### **Abstract**

This paper examines the impact of foreign banks on the monetary policy transmission mechanism in the Korean economy during the period from 2000 to 2012, with a specific focus on the lending behavior of banks with different types of ownership. Using the bank-level panel data of the banking system in Korea, we present consistent evidence on the buffering impact of the foreign banks, especially foreign bank branches including U.S. bank branches, on the effectiveness of the monetary policy transmission mechanism in Korea from the bank-lending channel perspective during the global financial crisis of 2008-2009. One of the underlying reasons for the buffering effect by foreign bank branches is the existence of internal capital markets operated by multinational banks to overcome capital market frictions faced when the foreign banks finance their loans.

### **4.1. Introduction**

This paper examines the impact of foreign banks on the monetary policy transmission mechanism in the Korean economy during the period from 2000 to 2012, with a specific focus on the global financial crisis of 2008-2009. We specifically focus on the bank lending channel as the monetary policy transmission mechanism in Korea. We also investigate how different types and country-origin of foreign banks affect the effectiveness of monetary policy transmission in Korea in the midst of the increasing presence of foreign banks in the Korean banking market.

The recent global financial crisis of 2008-2009 provides a case for the first significant test for evaluating the stabilizing/destabilizing role of foreign banks in an emerging Asian economy, Korea, after experiencing a steady increase in foreign

ownership in its banking sector. During the recent global financial crisis, we have observed that many local subsidiaries of foreign banks in Asia reduced their credit by a larger extent than their domestic counterparts. The accurate assessment of the impact of the increased foreign bank penetration into host emerging Asian economies has been an important issue and has been called for by academicians as well as policymakers. This paper examines these issues for the case of Korea.

Using the data in the Korean banking sector provides a unique opportunity for us to investigate the role of foreign banks in monetary policy transmission in an environment where the presence of foreign banks has increased steadily since the 1997 Asian financial crisis. Banks play an important role in transmitting monetary policy to the Korean economy and facilitating project financing and economic growth. In contrast to emerging Asia, the banking sector in Eastern Europe is dominated by foreign banks over the weak presence of domestic banks, and in Latin America foreign banks have not been affected significantly, compared to other regions, by the recent global financial crisis of 2008-2009.<sup>11</sup>

The main contribution of this paper is to provide consistent evidence on the buffering impact of foreign banks on the effectiveness of the monetary policy transmission mechanism from the bank-lending channel perspective in an emerging Asian economy, Korea, during the period of the global financial crisis of 2008-2009. We expect that the main findings of this paper will have useful policy implications for monetary authorities and bank regulators to minimize the adverse effects of the increasing presence of foreign banks on the effectiveness of monetary policy in the Korean economy.

The remainder of this paper is organized as follows. Section 3.2 reviews the related literature on the role of foreign banks in emerging economies. Section 3.3 describes the model, data, and methodology used in the study. Section 3.4 reports and discusses the empirical results, followed by robustness checks in section 3.5. Section 3.6 concludes.

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<sup>11</sup> For the differences in the bank ownership structure between banks in the Asia-Pacific region and those in other regions including North America, Europe, Latin America and Africa, see Hossain et al. (2013).

## 4.2. The Related Literature

Various concerns on the role of foreign banks in host countries have been raised and discussed in the literature. For example, foreign banks lack information on the credit worthiness of smaller-size borrowers in local markets, tend to have higher interest margins and profitability than domestic banks in developing countries, and lead domestic banking markets to a less competitive environment (see Claessens et al. (2001), Mian (2003), and Yeyeti and Micco (2007)). Other additional concerns posited in recent years include a sudden stop or reversal of capital and credits during difficult times, especially when the parent banks in home countries suffer from the credit crunch or capital loss. The researchers have presented evidence that foreign banks are a major channel of the financial shock transmission or contagion, and pose a significant challenge to the effectiveness of monetary policy in host economies (see, for example, Cetorelli and Goldberg (2012a, 2012b) and Jeon *et al.* (2013)).<sup>12</sup>

There is a growing literature that documents the behavioral difference between domestic and foreign banks, in particular on banks' credit provision when shocks arise, suggesting the significant role of multinational banks in either stabilizing or destabilizing host-country financial markets. Many works find that, when host countries were in economic crisis, foreign banks de facto buffered the detrimental impact of the crisis by maintaining or increasing credit in comparison with the domestic banks which had to curtail lending greatly (see Demirgüç-Kunt et al. (1998), Dages et al. (2000), Goldberg (2001), Martinez Peria et al. (2005), De Haas and van Lelyveld (2006), and Haselmann (2006))<sup>13</sup>.

However, in contrast to the earlier crisis episodes usually originated in emerging and developing countries (Laeven and Valencia (2013)), the recent global financial turmoil in 2008-09 that commenced in the advanced economies poses

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<sup>12</sup> For a counter-example, see Jain-Chandra *et al.* (2013).

<sup>13</sup> A number of works indicate that foreign banks may also amplify domestic business cycle shocks in some particular scenarios. For example, Morgan and Strahan (2003) find that foreign banks respond to the collateral shocks in host countries by reallocating their portfolio when the expected risk/return is changed. Galindo et al. (2003) document that when foreign banks are exposed to a shock on expected returns in the host country, they may cut back on local operations at a faster pace than less diversified domestic banks.

questions about the stabilizing role of multinational banks.<sup>14</sup> Many recent works find that if foreign bank subsidiaries' operation is reliant on the access to their parent banks' funding, they would be forced to rein in their credit in host markets more greatly than domestic banks when the parent banks' supportive strength is weakened by shocks, thus playing as a propagating channel of the global financial contagion (Aiyar (2012), Cull and Martinez Peria (2012), Allen et al. (2013, 2014) and De Haas and van Lelyveld (2010, 2014))<sup>15</sup>. Nevertheless, the results of some research indicate regional differences in foreign banks' behavior during crisis periods. The impact of the crisis is found much muted in the foreign banks in Latin American countries because of the local deposits used as their major funding source (Kamil and Rai (2010), Vogel and Winkler (2011), and Cull and Martinez Peria (2012)).

Regarding the role of foreign banks in host countries' monetary policy transmission mechanism, extant literature reports only scarce (and even mixed) empirical evidence on the impact of foreign banks on the effectiveness of the monetary policy transmission in host economies. Wu *et al.* (2011) find evidence that foreign banks, compared to domestic counterparts, are less sensitive to changes in the host monetary policy in adjusting their loans and interest rate, even after controlling for the heterogeneity in liquidity, capitalization, size, and cost efficiency at the individual bank level. Arena *et al.* (2007) also find difference between domestic and foreign banks in the loan growth rate and the lending interest rate in response to changes in monetary policy, but only as significant among lower liquid and capitalized banks. In addition, the research on the impact of foreign bank presence on the monetary policy transmission is concentrated on Central and Eastern Europe and Latin America, but is still scanty for emerging Asian economies.

A few recent papers have ascribed the insensitivity of foreign bank subsidiaries to host country monetary policies, relative to domestic banks, to their parent banks'

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<sup>14</sup> Before the outbreak of the global financial crisis, some papers examined foreign banks' destabilizing role in introducing shocks from abroad to host markets. For instance, Peek and Rosengren (1997, 2000) examine how the collapse of stock and property price in Japan in the 1990s was translated into a significant decline in the loans of Japanese bank subsidiaries in the U.S.

<sup>15</sup> These papers' comparison bases are different: Aiyar (2012) concentrates his analysis on the UK-resident banks, Cull and Martinez Peria (2012) use bank data from both Latin America and East Europe, Allen et al. (2013, 2014) focus on the banks in Central and Eastern European countries, while De Haas and van Lelyveld (2010, 2014) observe banks in 53 developed and developing countries in the world.

global-wide liquidity and assets management. This is especially so when the global banks are hit by various forms of financial stress such as the global financial crisis in 2008-09 and results in redirected internal capital flows from subsidiaries to headquarters (De Haas and van Lelyveld (2014)). For example, the intra-group capital flows from U.S. banks' affiliates abroad to their head offices increased (or flows from head offices to their foreign affiliates decreased) when the liquidity condition is tightened in the U.S., as shown by Cetorelli and Goldberg (2010, 2011a, 2012b). Mihaljek (2010) documents that some parent banks increased their borrowing from subsidiaries in host countries such as Mexico, Czech Republic, and Slovakia after the failure of Lehman Brothers in 2008.

It was also reported that in 2008 and 2009, the U.S. branches of foreign banks used the Fed discount window actively to raise funds and channeled them back to their parent banks, thus alleviating the degree to which parent banks had to be engaged in "fire-sale" of assets to meet their liquidity demand. As a matter of fact, these reversed capital flows (from subsidiaries to parents) were not rare at the time of home crisis when head offices' uncertainty regarding their ability to meet capital requirement and maintain liquidity increased substantially.

Besides intragroup deposits and loans, foreign bank affiliates transfer assets back to their parent banks through various means, including off-balance sheet transactions, income flow (such as dividend), and internal transactions of other financial instruments, as reported by Vogel and Winkler (2011), Allen et al. (2011, 2013), and Giannetti and Laeven (2012). This upstream capital flow raises a question regarding the potency of host monetary policy, particularly generally adopted expansionary policy in the context of the 2008-09 financial turbulence. If multinational banks had reallocated, on a global basis, their liquidity and assets more concentratively toward their headquarters and reduced credit in host markets, the expansion in host money supply would have generated only less pronounced outcomes.<sup>16</sup>

Our paper aims to fill the gap in the literature by using bank-level panel data and investigating the impact of increased foreign bank penetration on the monetary

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<sup>16</sup> Consistent with this intuition, Jain-Chandra and Unsal (2012), using SVAR analysis, find that large capital inflow weakens the transmission of short-term policy interest rate to longer-term lending interest rate in emerging Asian economies.

policy transmission mechanism in an emerging Asian economy, Korea, during the period from 2000 to 2012. We put a specific focus on loan growth by foreign banks (subsidiaries and branches), compared to domestic banks, during the recent global financial crisis.

### 4.3. Model, Data and Estimation Methodology

#### 4.3.1. The Model

Our empirical model examines the major determinants of loan growth by banks with different types of ownership. Our model is similar to the models used by Kashyap and Stein (1995), Kishan and Opiela (2000) and Gambacorta (2005):

$$\begin{aligned}
y_{i,t} = & c + \sum_{j=1}^4 \alpha_j y_{i,t-j} + \sum_{j=0}^4 \beta_j MP_{t-j} + \sum_{q=1}^5 \chi_q char_{q,i,t-1} + \sum_{q=1}^5 \sum_{j=0}^4 \phi_{qj} char_{q,i,t-1} MP_{t-j} \\
& + \sum_{n=1}^2 \delta_n foreign_{n,i,t} + \varphi crisis_t + \sum_{n=1}^2 \gamma_n foreign_{n,i,t} crisis_t + \sum_{j=0}^4 \kappa_j crisis_t MP_{t-j} \\
& + \sum_{n=1}^2 \sum_{j=0}^4 \eta_{nj} foreign_{n,i,t} MP_{t-j} + \sum_{n=1}^2 \sum_{j=0}^4 \theta_{nj} foreign_{n,i,t} crisis_t MP_{t-j} \\
& + \sum_{q=1}^5 \sum_{j=0}^4 \rho_{qj} char_{q,i,t-1} crisis_t MP_{t-j} + \sum_{n=1}^2 \sum_{j=0}^4 \sigma_{nj} macro_{n,t-j} + dummies + f_i + \varepsilon_{it}
\end{aligned}$$

with  $i=1, \dots, N$  and  $t=1, \dots, T$  and where the dependent variable  $y_{it}$  is the growth rate of net loans (in real term), calculated as the first order difference of the log of the loans of bank  $i$  in quarter  $t$ .  $MP$  represents the monetary policy shock (described below).  $foreign$  is a vector of two dummies to represent the different types of foreign ownership of international banks, respectively *subsidiary* and *branch*.<sup>17</sup>  $crisis$  is the

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<sup>17</sup> We split foreign banks in two different groups by ownership type—foreign banks subsidiaries and foreign bank branches. Foreign bank subsidiaries in Korea are subject to local laws and regulations, while foreign bank branches are subject to those in their home countries. In addition, the former depends primarily on domestic deposits and investment for sources of funding, while the latter depends more on funding from its headquarters in home countries. For lending, foreign bank subsidiaries are also observed to behave in a similar way to domestic banks in Korea, while foreign bank branches behave differently from domestic banks.

dummy for the recent global financial crisis. *char* is a vector of bank individual characteristics, including liquidity, capitalization, size, riskiness, and profitability. *macro* is a vector of two macroeconomic variables, the growth rate of real GDP and the change in the unemployment rate. Other *dummies* include the seasonal and annual dummies, and  $f_i$  is the bank-specific fixed effect.

The growth rate of loans, adjusted by using GDP deflator, is regressed on 4 lags of itself, as a standard practice in extant literature. *MP* is the first order difference of BOK's base rate relative to last quarter, hence a positive (negative) *MP* suggests a contractionary (expansionary) monetary adjustment by the Korean monetary authority, and a zero in *MP* suggests that the central bank has left monetary policy unchanged. The sum of the coefficients,  $\beta_j$ , which indicates the cumulative response of bank loans to monetary policy shock, is expected to be negative. Given the lags of the dependent variable, the long-run elasticity of bank loans to monetary policy shock is calculated as:  $\sum_{j=0}^4 \beta_j / (1 - \sum_{j=1}^4 \alpha_j)$ .

The dummy, *crisis*, is equal to 1 for the period 2008Q3 – 2009Q4. *crisis* is interacted with *MP* to distinguish the effects of monetary policy in tranquil periods and the recent global financial turmoil. In order to detect the heterogeneous response of domestic and foreign banks, *MP* is interacted with the dummy *subsidiary* and *branch*, which is respectively equal to 1 for subsidiary and branch. The coefficient,  $\eta$ , suggests foreign banks' different monetary policy responses in non-crisis periods. The 3-way interaction terms,  $foreign \times crisis \times MP$ , detects foreign banks' (different) sensitivity to Korean monetary policy shock in 2008-2009 global financial crisis. If foreign banks are less responsive to host monetary shock, the cumulative sum of  $\theta$  will be positive.

The vector of bank characteristics, *char*, includes *liquidity*, *capitalization*, *size*, *riskiness* and *profitability*. Liquidity is measured by using the ratio of cash and due from other banks to total assets. We exclude securities from the composition of bank's liquid assets because the data on securities are only available after 2004. Capitalization is proxied by the ratio of equity to total assets. Size is defined the log of bank's total assets. Riskiness is measured by bank's net charge-off over net loans, and profitability is proxied by return on equity. In order to avoid the problem of endogeneity, we use one quarter lag of the bank characteristic variables.

The above five bank characteristics are all normalized with respect to the mean across all banks, in order to get indicators that sum to zero over all observations. Following the literature on bank lending channel, banks with heterogeneous characteristics have a different ability to be shielded from the impact of monetary shock, so we interact *char* with *MP*. Since all *char* are normalized, the average of the 2-way interaction terms (namely, *liquidity*×*MP*, *capitalization*×*MP*, *size*×*MP*, *riskiness*×*MP* and *profitability*×*MP*) are also equal to zero, hence the coefficient  $\beta$  can be directly interpreted as the effect of monetary policy shocks on the average bank.

The variables in *char* are also 3-way interacted with *MP* and the dummy *crisis* to detect how heterogeneous banks react to *MP* differently in the recent global financial crisis. If we observe foreign banks having different degrees of sensitivity to host monetary policy during a crisis, we can safely conclude that it is not driven by banks' heterogeneous characteristics but by the foreign ownership of the banks.

Two macroeconomic variables, the growth rate of real GDP and the change in the unemployment rate, are included in the regression to control for the demand effect on bank lending.

#### **4.3.2. Data**

We construct an unbalanced panel dataset using both bank-level data and macroeconomic data. We obtain the bank-level data set on balance sheet data from commercial banks in Korea (domestic banks and branches and subsidiaries of foreign banks doing business in Korea, for the period 2000Q1- 2012Q4) which are available at Financial Analysis Information Retrieval System at the Bank of Korea (BOK). We also retrieve the macroeconomic data from the Economic Statistics System of the BOK.

- (1) Before we proceed to estimate the econometric model, it is worthwhile to conduct a simple analysis on the difference between foreign and domestic banks in the Korean economy (Table 4.1.). Domestic banks are observed to provide loans at a higher growth rate than foreign banks

in terms of both mean and median. However, foreign banks, although smaller in their market size, have higher liquidity and capitalization ratios, but earn lower profits than their domestic counterparts. The identified distinction between foreign banks and domestic banks in their bank characteristics confirms the necessity to control for these factors in order to isolate foreign banks' different behavior caused by their foreign ownership.

- (2) Since some of the bank characteristics variables may be correlated with each other, they may generate the problem of multicollinearity if included in the model simultaneously. Accordingly, we examine the pair-wise correlation between the bank characteristics variables and do not observe substantially high correlation coefficients between these variables, which indicates little evidence on multicollinearity. (See Table 4.1.)

#### **4.3.3. Econometric Methodology**

We estimate our empirical model using the system GMM estimator, following the methodology developed by Arellano and Bover (1995) and Blundell and Bond (1998), to address a possible concern on the endogeneity issue in determining loan growth. The system GMM estimator uses both level and differenced equations and instrumented the lagged dependent variable by using lagged differences for the level equation and lagged level for the differenced equation.

In all estimations, we control for a full set of year-specific effects and also control for the bank-specific effects. We obtain robust standard errors to correct for the heteroskedasticity across banks in the panel. We add four-quarter lags of the dependent variable in the system-GMM estimation whose results are discussed and reported in the next section.

#### **4.4. Estimation Results**

#### 4.4.1. The Baseline Estimations

The baseline regression results are reported in Table 4.2. The baseline estimations of the loan growth equation fit the data relatively well and the estimation results overall are reasonable. The coefficients on control variables, including bank characteristics and host country macroeconomic conditions, are not statistically significant during tranquil periods, while they turn to be statistically significant during the crisis period of 2008-2009. To save space, we only report the long-run elasticity, respectively in tranquil periods and the global financial crisis period. We also report the differences between the coefficients in non-crisis periods vs. crisis periods.

First, the coefficient on the long-run effect of monetary policy on lending (the stand-alone *mp*) is negative as expected and statistically significant, suggesting that banks will increase (reduce) their loans when the BOK adopts a more expansionary (contractionary) monetary policy. Quantitatively, the coefficient is 9.993, which implies that a typical 25 basis point downward adjustment in the monetary policy base rate during tranquil periods will cause domestic banks to increase their lending growth rate by around 2.5% ( $= 9.993 \times 0.25\%$ ) in the long run.

Second, we find that the effect of monetary policy becomes more salient during the period of the global financial crisis of 2008-2009. Domestic banks will increase their lending growth rate by more than 14% with a 100 basis point downward adjustment in the Korean monetary policy, although the difference between the coefficient during tranquil periods (-9.993) and crisis periods (-14.578) is not detected to be statistically significant.<sup>18</sup> This finding suggests that domestic banks are increasingly sensitive to the unusually aggressive monetary expansion by the BOK during the crisis period.

Third, the Korean monetary policy also works effectively among foreign bank subsidiaries. A 100 basis point adjustment on the BOK base rate will cause foreign subsidiaries to change their credit growth rate by 12 percentage points in an expected direction during tranquil periods. This pattern of responses to changes in monetary policy by foreign banks subsidiaries is almost same as that of the period during the 2008-2009 global financial crisis. This result suggests a similarity in the

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<sup>18</sup> The difference is calculated as  $\sum_{j=0}^4 \kappa_j / (1 - \sum_{j=1}^4 \alpha_j)$ .

lending behavior between foreign subsidiaries and domestic banks. However, we find significant evidence that foreign bank branches are much less sensitive to changes in the Korean monetary policy during the crisis period. The effect of monetary policy on lending by foreign branches in crisis is positive, instead of negative, and the difference from their responses during tranquil periods is statistically significant.<sup>19</sup>

This finding suggests that foreign bank branches actually reduced their lending when the BOK lowered its base rate substantially to conduct aggressively expansionary monetary policy during the crisis period in Korea. However, the relatively low statistical significance (only 10 percent) could be caused by the inclusion of numerous interaction terms, which increase the correlation across regressors and the standard error of estimations. We investigate further on this finding in the following sub-sections.

#### **4.4.2. Foreign Bank Branches: US Bank Branches vs. Non-US Bank Branches**

We next divide the branches of foreign banks in Korea into two groups, those established by banks headquartered in the U.S. and those established by parent banks in other countries. The reasons why we are interested in the comparison between US bank branches and non-US bank branches include: first, the global financial crisis of 2008-2009 started from the U.S. after it suffered from housing market bubble burst and the outbreak of the sub-prime mortgage crisis, and second, foreign banks from the U.S. have the largest market share in the Korean banking sector and show largest inter-office transactions of funds between parent banks and their foreign subsidiaries or branches among those inter-office transactions by all US and non-US foreign banks. The estimation results are reported in Table 4.3.

The results suggest that the inertia in foreign branches to the Korean monetary policy is mainly driven by American branches. They reduced their lending growth rate substantially when BOK lowered the base rate, indicated by the reported highly significant coefficient of 19.67. We find that both groups of foreign branches

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<sup>19</sup> Our paper also complements the recent research by Chen and Wu (2014) who examine the impact of foreign ownership and host (expansionary) monetary policy on bank credit in emerging economies in the global financial crisis, but they do not address the heterogeneous policy responses of banks with different ownership.

show very different responses to monetary policy shocks, especially during the global financial crisis of 2008-2009 than their domestic peers. The effect of changes in monetary policy on lending by foreign branches is negative during tranquil periods although not statistically significant. But the effect turns to be positive during the crisis period, implying that both groups cut their lending albeit under a substantially lowered BOK base rate. However, we find statistically significant evidence only for American bank branches. The difference between their monetary policy responses in tranquil periods vs. crisis periods is notably statistically significant, while that of non-American bank branches is only marginally not significant.<sup>20</sup>

In sum, the buffering effects of foreign banks on the monetary policy transmission mechanism in Korea are most conspicuous in foreign bank branches whose parent banks are located in the U.S. among foreign banks from different country of origin.

#### **4.4.3. Global vs. Regional Foreign Bank Branches**

In this section, we test if foreign bank branches would have different responses to changes in monetary policy in the host country, Korea, given the different geographic scope of the conglomerates' operation. A global foreign bank is defined as a multinational financial institution whose headquarter or the majority of affiliates are located outside Asia. By contrast, a regional foreign bank is the one with both headquarters and main affiliates located in Asia. The global foreign banks are expected to be more exposed to the recent global financial crisis, and hence they probably would ship more funds toward their crisis-hit headquarters, leading to the foreign branches' more sluggish responses to host monetary policy.

The results of estimation are reported in Table 4.4. In the estimation, we replace the dummy, *branch*, by two alternative dummies, representing the branches of global foreign banks and the regional foreign banks, respectively. For simplicity,

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<sup>20</sup> How the specific parent origin may potentially impact foreign banks' credit during the crisis of 2008-09 has been underexplored so far. In addition, even the few papers that identify foreign banks' home country provide only mixed results. Dekle and Lee (2015) find that the foreign banks from the US cut more of their lending in Latin American markets than other banks, whereas Choi et al. (2013) find no significant evidence that the foreign banks from the US and Europe even reduced their credit in 2008-09.

we only report the long-term effect of monetary policy shocks on lending by different groups of banks in Korea.

The transmission of Korean monetary policy to domestic banks and foreign subsidiaries is found to be still effective in both tranquil and global financial crisis periods. The impact of Korean monetary policy is seemingly more pronounced during the global financial crisis period, although the difference between the tranquil and the crisis periods are not statistically significant. Foreign subsidiaries are found to have no variation in their sensitivity to domestic monetary policy between the two periods. By contrast, both global and regional foreign banks' branches show reversed responses to changes in Korean monetary policy in 2008-2009 by reducing the growth rate of their credit. As expected, the branches of *global* foreign banks reversed their lending more substantially than their counterparts of *regional* foreign banks, indicated by statistically significant differences between the sensitivity of their lending to monetary policy changes in non-crisis as well as crisis periods. Given the fact that the headquarters of regional foreign banks are located in the same area as the host markets, our finding is consistent with De Haas and van Horen (2013) who show that international banks maintain their lending to geographically close countries.<sup>21</sup>

Compared with Table 4.3, it is observed that the reversed reaction of global foreign bank branches to Korean monetary policy is milder than that of American bank branches. This is because the global crisis of 2008-2009 started in the U.S., and accordingly the global multinational banks originated from Europe and Japan were less severely affected by the financial crisis, compared to U.S. banks, thus demanding less amount of capital flows from their branches in Korea.

#### **4.4.4. Robustness Tests**

In this section we conduct a number of robustness tests. We first widen the window of financial crisis from 2008Q3-2009Q4 to 2007Q3-2009Q4 to include the period of the subprime mortgage crisis in the U.S. The results are reported in the first

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<sup>21</sup> Choi et al. (2013) also expect that regional foreign banks may be more willing to maintain the credit growth of their affiliates than global ones, as the former are closer to the countries where they operate and may be more reliant on them due to lower diversification, but they find no supportive evidence.

panel of Table 4.5. Foreign bank branches' buffering force to host monetary policy is found more salient in the widened crisis period. During 2007-2009, a 100 basis point cut of base rate by BOK causes foreign branches to increase their lending by 8.711 percent, suggesting a credit growth rate reversion by 20.920 percent and this variation is highly statistically significant. The result seems to imply that foreign banks actually transfer their funds back to their headquarters before the global turmoil was triggered off by the failure of Lehman Brothers.

It can be argued that the estimates of the effects of branches' financial characteristics on their lending may be overstated since they may not be relevant. For example, since branches are not independent entities, there is no specific capital sufficiency requirement imposed independently on them, and thus foreign bank branches' capital may not affect their lending decisions. Accordingly, in our second robustness test, we try to rule out the potentially biased effects of branches' capitalization by dropping the variable of capital from the estimation equation. Meanwhile, we also assume the profitability of branches, proxied by ROE, is not much relevant as a bank characteristic either. The results, as reported in Table 4.5, test 2, do not change our baseline findings qualitatively. Foreign branches are still found to cut down their credit growth when BOK lowered policy rates in the 2008-2009 financial crisis, and the difference from their behavior in the tranquil period is only marginally insignificant.

Finally, we try to increase the variation in our monetary policy indicator by substituting the first-order difference of the Korean money market rate for the change in BOK's policy rate. As reported in Table 4.5, test 3, the results are not much different from our previous findings.

#### **4.5. Conclusions**

We examine the impact of foreign banks on the monetary policy transmission mechanism from the bank-lending channel perspective in the Korean economy during the period from 2000 to 2012, with a specific focus on the lending behavior of banks with different types of ownership. Using the bank-level panel data of the banking system in Korea, we find that there exist heterogeneous responses of loan growth by domestic banks and foreign-owned banks to changes in monetary policy

in Korea during the recent global financial crisis of 2008-2009. In particular, during crisis periods, foreign banks play a buffering or even hampering role in affecting the monetary policy transmission mechanism by adjusting loan growth in a way opposite to domestic banks.

We present consistent evidence on the buffering impact of foreign banks on the effectiveness of the monetary policy transmission mechanism in Korea. This is more conspicuous for foreign bank branches than for foreign bank subsidiaries during the period of the global financial crisis of 2008-2009. Our further analyses show that this buffering effect is mostly driven by foreign bank branches whose parent banks are located in the U.S. One of the underlying reasons for the buffering effect by foreign branches is the existence of internal capital markets operated by multinational banks to overcome capital market frictions faced when the foreign banks finance their loans. Multinational banks establish internal capital markets and allocate their funds on global scale across their foreign subsidiaries and branches, which may affect the efficacy of monetary policy in host countries.<sup>22</sup>

Our findings suggest an important policy implication for both policy makers and banking regulators in Korea that, when the Bank of Korea conducts monetary policies—expansionary or contractionary--during crisis periods to bail them out from the credit crunch and spillover effects of financial shocks from abroad, it must take into account the buffering or hampering effects of foreign banks on the effectiveness of the monetary policy transmission mechanism. This paper presents evidence that this buffering effect is most likely created by foreign bank branches, among foreign banks with different types of ownership, operating banking activities in Korea.

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<sup>22</sup> For empirical evidence that internal capital markets do exist between multinational banks and their subsidiaries in emerging and developing economies, see Jeon and Wu (2013). Our bank-specific data on foreign banks' inter-office transactions show that the average net inter-office borrowing, i.e., inter-office borrowing minus inter-office lending, by foreign bank branches in Korea dropped significantly in 2008 and 2009 from the pre-crisis period, and rebounded significantly immediately after the crisis periods.

Table 4.1. Descriptive summary statistics

Panel A:				Panel B: correlation					
<i>Domestic banks</i>									
	Mean	Std. dev.	Median	Growth rate of	Liquidity	Capitalization	Size	Riskiness	Profitabilit
Growth rate of loans	2.104	4.744	1.926	1					
Liquidity	5.150	2.972	4.595	.009	1				
Capitalization	6.698	4.959	5.633	-.003	-.294***	1			
Size	17.360	1.309	17.311	-.085**	-.254***	-.002	1		
Riskiness	.745	.959	.435	.049	.192***	-.097***	-.018	1	
Profitability	10.036	41.573	7.01	.104***	-.078**	-.123**	.171***	-.144***	1
<i>Foreign banks</i>									
	Mean	Std. dev.	Median	Growth rate of	Liquidity	Capitalization	Size	Riskiness	Profitabilit
Growth rate of loans	.451	20.835	.808	1					
Liquidity	7.756	10.621	3.848	.001	1				
Capitalization	10.213	11.401	6.278	-.007	.710***	1			
Size	14.499	1.987	14.658	.030	-.590***	-.698***	1		
Riskiness	.250	.552	.068	.023	.003	.020	.030	1	
Profitability	7.654	8.827	5.73	.052*	-.154***	-.245***	.185***	.016	1
<i>Macroeconomic variables</i>									
	Mean	Std. dev.	Median	Monetary policy	GDP growth rate	$\Delta$ unemployment			
Monetary policy	-.047	.407	.000	1					
GDP growth rate	1.388	6.227	1.966	.119***	1				
$\Delta$ unemployment	-.056	.575	-.067	-.089***	.789***			1	

Note: This table shows the summary statistics and pair-wise correlation of bank characteristics variables. \*\*\*, \*\*, \* represent statistical significance at the 1%, 5% and 10% level, respectively.

Table 4.2. Baseline estimation results

Dependent variable: Quarterly growth rate of real loans							
The effect of monetary policy on banks							
	Tranquil period		Global crisis of 2008-09			Differences	
	Coeff.	p-value	Coeff.	p-value		Coeff.	p-value
Domestic banks	-9.993*	.073	-14.578**	.034	$\sum mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	-4.584	.553
Foreign subsidiaries	-12.308*	.086	-11.870	.103	$\sum sub \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	.437	.924
Foreign branches	-8.625	.272	6.237	.303	$\sum branch \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	14.862*	.095
The effect of bank characteristics on monetary policy							
	Tranquil period		Global crisis of 2008-09			Differences	
	Coeff.	p-value	Coeff.	p-value		Coeff.	p-value
Liquidity	5.739	.238	8.669***	.009	$\sum liquidity_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	2.929	.618
Capitalization	-2.187	.671	-2.825	.455	$\sum capitalization_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	-.638	.912
Size	-1.702	.728	8.936***	.007	$\sum size_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	10.639	.113
Riskiness	1.193	.710	-1.787	.756	$\sum riskiness_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	-2.980	.633
Profitability	1.573	.801	-20.450***	.000	$\sum profitability_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	-22.023**	.017
Observations (banks): 1616 (64)	AR(1)/AR(2) test: .000/.689		Hansen's J statistic: 1.000				

Notes: The regression is estimated using the system GMM estimation method. We use unbalanced bank-level panel data for the period 2000Q1-2012Q4. Global financial crisis period is defined as the period of 2008Q3-2009Q4. We control for a full set of time-specific effects and also for the bank specific effects. We only report the long-term effect of monetary policy shocks on the loan growth rate by different groups of banks in Korea. We obtain robust standard errors to correct for the heteroskedasticity across banks in the panel. AR(1)/AR(2) test reports the Arellano-Bond test for autocorrelation. \*\*\*, \*\*, \* represent statistical significance at the 1%, 5% and 10% level, respectively.

Table 4.3. Estimation results: US branches vs. non-US branches

Dependent variable: Quarterly growth rate of real loans							
The effect of monetary policy on banks							
	Tranquil period		Global crisis of 2008-09			Differences	
	Coeff.	<i>p</i> -value	Coeff.	<i>p</i> -value		Coeff.	<i>p</i> -value
Domestic banks	-9.892*	.074	-14.624**	.035	$\sum mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	-4.732	.542
Foreign subsidiaries	-12.354*	.080	-11.928*	.096	$\sum sub \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	.425	.923
US branches	-6.626	.552	19.670***	.008	$\sum US\ branch \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	26.297**	.043
Non-US branches	-8.483	.302	5.571	.379	$\sum non-US\ branch \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	14.055	.128
The effect of bank characteristics on monetary policy							
	Tranquil period		Global crisis of 2008-09			Differences	
	Coeff.	<i>p</i> -value	Coeff.	<i>p</i> -value		Coeff.	<i>p</i> -value
Liquidity	6.337	.196	8.983***	.007	$\sum liquidity_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	2.645	.644
Capitalization	-2.401	.644	-3.230	.396	$\sum capitalization_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	-.829	.886
Size	-1.344	.776	8.482***	.010	$\sum size_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	9.826	.136
Riskiness	.883	.784	-1.337	.819	$\sum riskiness_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	-2.221	.724
Profitability	.870	.878	-21.419***	.000	$\sum profitability_{t-1} \times mp_{t-j} \times crisis / (1 - \sum y_{t-j})$	-22.289**	.011
Observations (banks): 1616 (64)	AR(1)/AR(2) test:.000/.852		Hansen's <i>J</i> statistic: 1.000				

Notes: The regression is estimated using the system GMM estimation method. We use unbalanced bank-level panel data for the period 2000Q1-2012Q4. Global financial crisis period is defined as the period of 2008Q3-2009Q4. We control for a full set of time-specific effects and also for the bank specific effects. We only report the long-term effect of monetary policy shocks on loan growth rate by different groups of banks in Korea. We obtain robust standard errors to correct for the heteroskedasticity across banks in the panel. AR(1)/AR(2) test reports the Arellano-Bond test for autocorrelation. \*\*\*, \*\*, \* represent statistical significance at the 1%, 5% and 10% level, respectively.

Table 4.4. Global vs. Regional foreign branches

Dependent variable: Quarterly growth rate of real loans							
The effect of monetary policy on banks							
	Tranquil period		Global crisis of 2008-09			Differences	
	Coeff.	<i>p</i> -value	Coeff.	<i>p</i> -value		Coeff.	<i>p</i> -value
Domestic banks	-10.368*	.058	-14.944**	.028	$\sum mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	-4.575	.563
Foreign subsidiaries	-12.697*	.068	-12.286*	.082	$\sum sub \times mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	.411	.930
Global branches	-9.009	.294	7.369	.203	$\sum global\ branch \times mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	16.378*	.075
Regional branches	-7.347	.408	3.887	.635	$\sum regional\ branch \times mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	11.234	.358
Observations (banks): 1616 (64)	AR(1)/AR(2) test:.000/.830		Hansen's <i>J</i> statistic: 1.000				

Notes: The regression is estimated using the system GMM estimation method. We use unbalanced bank-level panel data for the period 2000Q1-2012Q4. Global financial crisis period is defined as the period of 2008Q3-2009Q4. We control for a full set of time-specific effects and also for the bank specific effects. We only report the long-term effect of monetary policy shocks on loan growth rate by different groups of banks in Korea. We obtain robust standard errors to correct for the heteroskedasticity across banks in the panel. AR(1)/AR(2) test reports the Arellano-Bond test for autocorrelation. \*\*\*, \*\*, \* represent statistical significance at the 1%, 5% and 10% level, respectively.

Table 4.5. Robustness tests

Dependent variable: Quarterly growth rate of real loans							
The effect of monetary policy on banks							
<i>Test 1: An extended crisis period to 2007Q3-2009Q4</i>							
	Tranquil period		Global crisis of 2007-09			Differences	
	Coeff.	p-value	Coeff.	p-value		Coeff.	p-value
Domestic banks	-7.312	.221	-16.995	.529	$\sum mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	-9.682	.728
Foreign subsidiaries	-9.521	.199	-11.039	.124	$\sum sub \times mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	-1.518	.744
Foreign branches	-12.208	.143	8.711	.135	$\sum branch \times mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	20.920***	.004
<i>Test 2: Removing capital and profitability from foreign bank branches' bank characteristics in loan growth estimations</i>							
	Tranquil period		Global crisis of 2008-09			Differences	
	Coeff.	p-value	Coeff.	p-value		Coeff.	p-value
Domestic banks	-9.653	.117	-14.184**	.022	$\sum mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	-4.530	.591
Foreign subsidiaries	-11.117	.146	-12.271	.119	$\sum sub \times mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	-1.154	.806
Foreign branches	-8.488	.286	8.158	.412	$\sum branch \times mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	16.646	.148
<i>Test 3: Using an alternative measure of changes in monetary policy – money market rates</i>							
	Tranquil period		Global crisis of 2008-09			Differences	
	Coeff.	p-value	Coeff.	p-value		Coeff.	p-value
Domestic banks	-7.322	.155	-12.758	.522	$\sum mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	-5.435	.806
Foreign subsidiaries	-10.297	.135	-7.680	.425	$\sum sub \times mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	2.616	.703
Foreign branches	-6.447	.292	16.500	.295	$\sum branch \times mp_{t,j} \times crisis / (1 - \sum y_{t,j})$	22.948	.167

Notes: For robustness tests, we first widen the window of global financial crisis from 2008Q3-2009Q4 to 2007Q3-2009Q4 to include the period of the subprime mortgage crisis in the U.S. In the second robustness test, we drop two bank-specific characteristic control variables, capitalization and profitability, to rule out the potentially biased effects of foreign bank branches. In the third robustness test, we try to increase the variation in our monetary policy indicator by substituting the first-order difference of the Korean money market rate for the change in BOK's base rate. \*\*\*, \*\*, \* represent statistical significance at the 1%, 5% and 10% level, respectively.

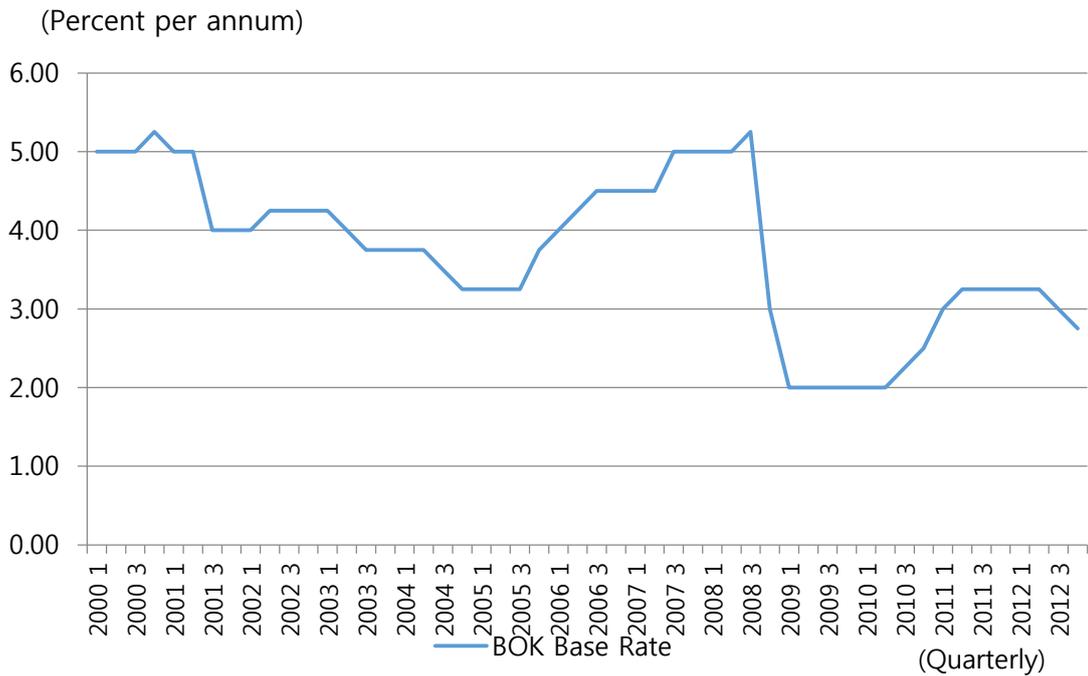


Figure 4.1. The BOK base rate, 2000Q1-2012Q4

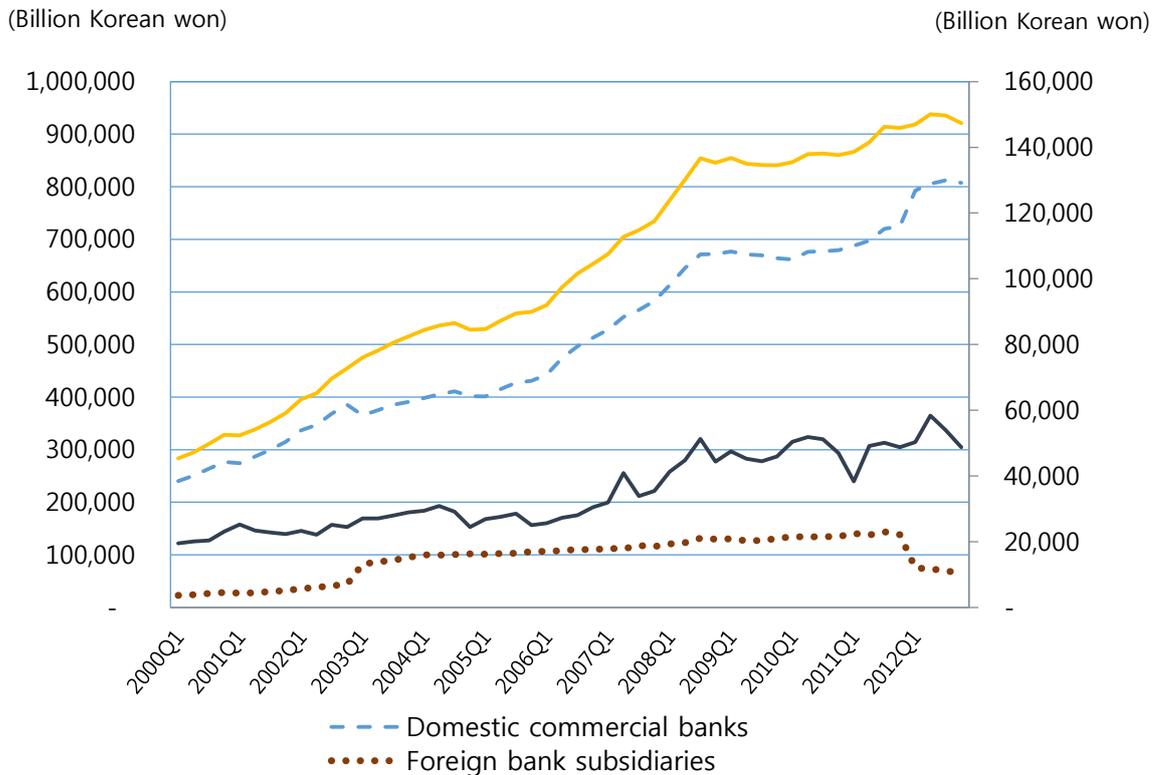


Figure 4.2. Bank loans by domestic banks and foreign banks in Korea, 2000Q1-2012Q4

## Appendix: List of banks by type of ownership in Korea, 2000-2012

### (a) Domestic commercial banks in Korea, 2000-2005

2000	2001	2002	2003	2004	2005
Woori Bank	Woori Bank	Woori Bank	Woori Bank	Woori Bank	Woori Bank
Chohung Bank	Chohung Bank	Chohung Bank	Chohung Bank	Chohung Bank	Chohung Bank
Seoul Bank	Seoul Bank	Seoul Bank	Shinhan Bank(old)	Shinhan Bank(old)	Shinhan Bank(old)
Shinhan Bank(old)	Shinhan Bank(old)	Shinhan Bank(old)	Kookmin Bank	Kookmin Bank	Kookmin Bank
Hana Bank(old)	Hana Bank(old)	Hana Bank(old)	Hana Bank	Hana Bank	Hana Bank
Peace Bank of Korea	Peace Bank of Korea	Kookmin Bank	Daegu Bank	Daegu Bank	Daegu Bank
Kookmin Bank(old)	Kookmin Bank(old)	Hana Bank	Busan Bank	Busan Bank	Busan Bank
Housing & Commercial Bank	Housing & Commercial Bank	Daegu Bank	Kwangju Bank	Kwangju Bank	Kwangju Bank
Daegu Bank	Kookmin Bank	Busan Bank	Jeju Bank	Jeju Bank	Jeju Bank
Busan Bank	Daegu Bank	Kwangju Bank	Jeonbuk Bank	Jeonbuk Bank	Jeonbuk Bank
Kwangju Bank	Busan Bank	Jeju Bank	Kyongnam Bank	Kyongnam Bank	Kyongnam Bank
Jeju Bank	Kwangju Bank	Jeonbuk Bank			
Jeonbuk Bank	Jeju Bank	Kyongnam Bank			
Kyongnam Bank	Jeonbuk Bank	Korea Exchange Bank			
Korea Exchange Bank	Kyongnam Bank				
	Korea Exchange Bank				
Total: 15	16	14	11	11	11

**(b) Domestic commercial banks in Korea, 2006-2012**

2006	2007	2008	2009	2010	2011	2012
Woori Bank	Woori Bank	Woori Bank	Woori Bank	Woori Bank	Woori Bank	Woori Bank
Chohung Bank	Kookmin Bank	Kookmin Bank	Kookmin Bank	Kookmin Bank	Kookmin Bank	Kookmin Bank
Shinhan Bank(old)	Hana Bank					
Kookmin Bank	Shinhan Bank	Shinhan Bank	Shinhan Bank	Shinhan Bank	Shinhan Bank	Shinhan Bank
Hana Bank	Daegu Bank	Daegu Bank	Daegu Bank	Daegu Bank	Daegu Bank	Daegu Bank
Shinhan Bank	Busan Bank	Busan Bank	Busan Bank	Busan Bank	Busan Bank	Busan Bank
Daegu Bank	Kwangju Bank	Kwangju Bank	Kwangju Bank	Kwangju Bank	Kwangju Bank	Kwangju Bank
Busan Bank	Jeju Bank	Jeju Bank	Jeju Bank	Jeju Bank	Jeju Bank	Jeju Bank
Kwangju Bank	Jeonbuk Bank	Jeonbuk Bank	Jeonbuk Bank	Jeonbuk Bank	Jeonbuk Bank	Jeonbuk Bank
Jeju Bank	Kyongnam Bank	Kyongnam Bank	Kyongnam Bank	Kyongnam Bank	Kyongnam Bank	Kyongnam Bank
Jeonbuk Bank						Korea Exchange Bank
Kyongnam Bank						
Total: 12	10	10	10	10	10	11

Note: Korea Exchange Bank was acquired in 2003 by Lone Star Funds, a private U.S. equity fund, and it was incorporated into Hana Financial Group, a domestic financial holding company, in 2012.

**(c) Foreign bank branches in Korea, 2000-2005**

2000	2001	2002	2003	2004	2005
Standard Chartered					
Credit Agricole Corporate And Investment Bank					
Arab Bank	Arab Bank	Arab Bank	Arab Bank	BNP Paribas	BNP Paribas
BNP Paribas	BNP Paribas	BNP Paribas	BNP Paribas	ING Bank	ING Bank
ING Bank	ING Bank	ING Bank	ING Bank	Credit Lyonnais	UBAF
Credit Lyonnais	Credit Lyonnais	Credit Lyonnais	Credit Lyonnais	UBAF	DBS Bank
UBAF	UBAF	UBAF	UBAF	DBS Bank	UFJ
DBS Bank	DBS Bank	DBS Bank	DBS Bank	UFJ	Societe Generale
UFJ	UFJ	UFJ	UFJ	Societe Generale	Union Bank of California
Societe Generale	Societe Generale	Societe Generale	Societe Generale	Union Bank of California	Australia and New Zealand Bank(ANZ)
Union Bank of California	Australia and New Zealand Bank(ANZ)	Oversea-Chinese Banking Corporation			
Australia and New Zealand Bank(ANZ)	Oversea-Chinese Banking Corporation	Bank of China			
Oversea-Chinese Banking Corporation	Oversea-Chinese Banking Corporation	Oversea-Chinese Banking Corporation	Oversea-Chinese Banking Corporation	Bank of China	Credit Suisse
Bank of China	Bank of China	Bank of China	Bank of China	Credit Suisse	American Express Bank
Morgan	Morgan	Credit Suisse	Credit Suisse	American Express Bank	State Street
Credit Suisse	Credit Suisse	American Express Bank	American Express Bank	State Street	National Australia Bank (NAB)
American Express Bank	American Express Bank	State Street	State Street	National Australia Bank (NAB)	Bank of Novascotia
National Bank of Canada	State Street	National Australia Bank (NAB)	National Australia Bank (NAB)	Bank of Novascotia	Bank of NY Mellon (BNY Mellon)
National Australia Bank (NAB)	National Australia Bank (NAB)	Bank of Novascotia	Bank of Novascotia	Bank of NY Mellon (BNY Mellon)	Mizuho Corporate Bank
Bank of Novascotia	Bank of Novascotia	Bank of NY Mellon (BNY Mellon)	Bank of NY Mellon (BNY Mellon)	Mizuho Corporate Bank	United Overseas Bank
Bank of NY Mellon (BNY Mellon)	Bank of NY Mellon (BNY Mellon)	Mizuho Corporate Bank	Mizuho Corporate Bank	United Overseas Bank	Deutsche Bank
Mizuho Corporate Bank	Mizuho Corporate Bank	United Overseas Bank	United Overseas Bank	Deutsche Bank	Bank of Tokyo-Mitsubishi UFJ
United Overseas Bank	United Overseas Bank	Deutsche Bank	Deutsche Bank	Bank of Tokyo-Mitsubishi UFJ	Metrobank

2000	2001	2002	2003	2004	2005
Deutsche Bank	Deutsche Bank	Bank of Tokyo-Mitsubishi UFJ	Bank of Tokyo-Mitsubishi UFJ	Metrobank	Bank Mellat
Bank of Tokyo-Mitsubishi UFJ	Bank of Tokyo-Mitsubishi UFJ	Metrobank	Metrobank	Bank Mellat	Sumitomo Mitsui Bank Ltd.
Metrobank	Metrobank	Bank Mellat	Bank Mellat	Sumitomo Mitsui Bank Ltd.	Barclays
Sumitomo Mitsui Bank Ltd.	Bank Mellat	Sumitomo Mitsui Bank Ltd.	Sumitomo Mitsui Bank Ltd.	Barclays	Bank of America Corporation
Bank of America Corporation	Sumitomo Mitsui Bank Ltd.	Barclays	Barclays	Bank of America Corporation	Yamaguchi Bank
Bank One Corporation	Bank of America Corporation	Bank of America Corporation	Bank of America Corporation	Bank One Corporation	RBS
Citibank	Bank One Corporation	Bank One Corporation	Bank One Corporation	Citibank	Indian Overseas Bank
Asahi Bank	Citibank	Citibank	Citibank	Yamaguchi Bank	Industrial and Commercial Bank of China Limited
Yamaguchi Bank	Asahi Bank	Yamaguchi Bank	Yamaguchi Bank	RBS	China Construction Bank
RBS	Yamaguchi Bank	RBS	RBS	Indian Overseas Bank	J.P. Morgan Chase and Corporation
Indian Overseas Bank	RBS	Indian Overseas Bank	Indian Overseas Bank	Industrial and Commercial Bank of China Limited	National Bank of Pakistan
Industrial and Commercial Bank of China Limited	Indian Overseas Bank	Industrial and Commercial Bank of China Limited	Industrial and Commercial Bank of China Limited	China Construction Bank	Wells Fargo
J.P. Morgan Chase and Corporation	Industrial and Commercial Bank of China Limited	J.P. Morgan Chase and Corporation	J.P. Morgan Chase and Corporation	J.P. Morgan Chase and Corporation	HSBC
Paribas	J.P. Morgan Chase and Corporation	National Bank of Pakistan	National Bank of Pakistan	National Bank of Pakistan	UBS Bank
National Bank of Pakistan	National Bank of Pakistan	Wells Fargo	Wells Fargo	Wells Fargo	Bank Of Communications
Wells Fargo	Wells Fargo	Fleet National Bank	HSBC	HSBC	Morgan Stanley
Fleet National Bank	Fleet National Bank	HSBC	UBS Bank	UBS Bank	
Bank of Hawaii	Bank of Hawaii	Fuji Bank			
HSBC	HSBC	UBS Bank			
Overseas Union Bank Limited	Overseas Union Bank Limited				
Fuji Bank	Fuji Bank				
UBS Bank	UBS Bank				
Total: 45	45	42	40	40	39

**(d) Foreign bank branches in Korea, 2006-2012**

2006	2007	2008	2009	2010	2011	2012
Credit Agricole Corporate And Investment Bank						
BNP Paribas						
ING Bank						
UBAF						
DBS Bank						
Societe Generale						
Union Bank of California	Australia and New Zealand Bank(ANZ)					
Australia and New Zealand Bank(ANZ)	Oversea-Chinese Banking Corporation					
Oversea-Chinese Banking Corporation	Bank of China					
Bank of China	Credit Suisse					
Credit Suisse	American Express Bank	American Express Bank	State Street	State Street	State Street	State Street
American Express Bank	State Street	State Street	Bank of Novascotia	Bank of Novascotia	Bank of Novascotia	Bank of Novascotia
State Street	Bank of Novascotia	Bank of Novascotia	Bank of NY Mellon (BNY Mellon)			
Bank of Novascotia	Bank of NY Mellon (BNY Mellon)	Bank of NY Mellon (BNY Mellon)	Mizuho Corporate Bank	Mizuho Corporate Bank	Mizuho Corporate Bank	Mizuho Corporate Bank
Bank of NY Mellon (BNY Mellon)	Mizuho Corporate Bank	Mizuho Corporate Bank	United Overseas Bank	United Overseas Bank	United Overseas Bank	United Overseas Bank
Mizuho Corporate Bank	United Overseas Bank	United Overseas Bank	Deutsche Bank	Deutsche Bank	Deutsche Bank	Deutsche Bank
United Overseas Bank	Deutsche Bank	Deutsche Bank	Bank of Tokyo-Mitsubishi UFJ			
Deutsche Bank	Bank of Tokyo-Mitsubishi UFJ	Bank of Tokyo-Mitsubishi UFJ	Metrobank	Metrobank	Metrobank	Metrobank
Bank of Tokyo-Mitsubishi UFJ	Metrobank	Metrobank	Bank Mellat	Bank Mellat	Bank Mellat	Bank Mellat
Metrobank	Bank Mellat	Bank Mellat	Sumitomo Mitsui Bank Ltd.			
Bank Mellat	Sumitomo Mitsui Bank Ltd.	Sumitomo Mitsui Bank Ltd.	Barclays	Barclays	Barclays	Barclays
Sumitomo Mitsui Bank Ltd.	Barclays	Barclays	Bank of America Corporation			

2006	2007	2008	2009	2010	2011	2012
Barclays	Bank of America Corporation	Bank of America Corporation	Yamaguchi Bank	Yamaguchi Bank	Yamaguchi Bank	Yamaguchi Bank
Bank of America Corporation	Yamaguchi Bank	Yamaguchi Bank	RBS	RBS	RBS	RBS
Yamaguchi Bank	RBS	RBS	Indian Overseas Bank	Indian Overseas Bank	Indian Overseas Bank	Indian Overseas Bank
RBS	Indian Overseas Bank	Indian Overseas Bank	Industrial and Commercial Bank of China Limited			
Indian Overseas Bank	Industrial and Commercial Bank of China Limited	Industrial and Commercial Bank of China Limited	China Construction Bank	China Construction Bank	China Construction Bank	China Construction Bank
Industrial and Commercial Bank of China Limited	China Construction Bank	China Construction Bank	J.P. Morgan Chase and Corporation			
China Construction Bank	J.P. Morgan Chase and Corporation	J.P. Morgan Chase and Corporation	National Bank of Pakistan			
J.P. Morgan Chase and Corporation	National Bank of Pakistan	National Bank of Pakistan	Wells Fargo	Wells Fargo	Wells Fargo	Wells Fargo
National Bank of Pakistan	Wells Fargo	Wells Fargo	HSBC	HSBC	HSBC	HSBC
Wells Fargo	HSBC	HSBC	UBS Bank	UBS Bank	UBS Bank	UBS Bank
HSBC	UBS Bank	UBS Bank	Bank Of Communications	Bank Of Communications	Bank Of Communications	Bank Of Communications
UBS Bank	Bank Of Communications	Bank Of Communications	Morgan Stanley	Morgan Stanley	Morgan Stanley	Morgan Stanley
Bank Of Communications	Morgan Stanley	Morgan Stanley	Goldman Sachs	Goldman Sachs	Goldman Sachs	Goldman Sachs
Morgan Stanley	Goldman Sachs	Goldman Sachs	Merrill Lynch International Bank Limited	Landesbank Baden-Wurttemberg	Landesbank Baden-Wurttemberg	Landesbank Baden-Wurttemberg
Goldman Sachs		Merrill Lynch International Bank Limited	Landesbank Baden-Wurttemberg	Macquarie Bank	Macquarie Bank	Macquarie Bank
		Lehman Brothers Bankhaus	Macquarie Bank		Banco Bilbao Vizcaya Argentaria	Banco Bilbao Vizcaya Argentaria
		Landesbank Baden-Wurttemberg				Agricultural Bank of China
Total: 37	36	39	38	37	38	39

**(e) Foreign bank subsidiaries in Korea, 2000-2012**

2000	2001	2002	2003	2004	2005
Standard Chartered Bank Korea Limited					
Citibank Korea					
			Korea Exchange Bank	Korea Exchange Bank	Korea Exchange Bank
Total: 2	2	2	3	3	3

2006	2007	2008	2009	2010	2011	2012
Standard Chartered Bank Korea Limited						
Citibank Korea						
Korea Exchange Bank						
Total: 3	3	3	3	3	3	2

## **Chapter 5. The Impact of Credit Policy on Bank Loans to SMEs: Focusing on the Aggregate Credit Ceiling System of the BOK**

### **Abstract**

This paper examines the impact of the Aggregate Credit Ceiling System (ACCS), the primary tool of the Bank of Korea (BOK)'s credit policy operations on bank loans to small and medium-sized enterprises (SMEs). Measuring the influence of the ACCS on SMEs' credit availability is important for evaluating and improving the system. Bank-firm level data from 2009 to 2011 are used for this analysis.

The results show that the ACCS helps increase bank loans to SMEs and decrease lending rates. These effects are particularly prominent for enterprises with medium-credit scores, start-ups, and enterprises newly eligible for the ACCS. Enterprises tend to access loans from a greater number of banks after being included in the system, implying that it does influence banks' decisions by reducing information asymmetry between banks and enterprises.

This research empirically analyses availability of credit for SMEs based on bank-firm level data, with a particular focus on the BOK's credit policy. Its findings can serve as a useful reference for implementing credit policy, which is being increasingly adopted by central banks since the global financial crisis.

### **5.1. Introduction**

The credit policy of central banks, which affects credit allocation to small and medium-sized enterprises (SMEs) and households, has been the object of much attention since the global financial crisis. Prior to the financial crisis, central banks generally sought to stabilize prices and secure financial stability by altering the amount of liquidity in the entire economy through interest rate adjustments. After the onset of the global financial crisis, however, financial markets suffered from a credit

crunch and households and enterprises had difficulties accessing credit even though there was ample liquidity in the market. In response, the central banks of major countries have conducted credit policy so as to effect the flow of funds and credit allocation in the private sector.

The Bank of Korea (BOK) has been operating the Aggregate Credit Ceiling System (ACCS)<sup>23</sup>, the primary tool of the BOK's credit policy operations on bank loans to (SMEs), since before the global financial crisis. In this scheme, the BOK provides loans to financial institutions within a certain ceiling set by the Monetary Policy Committee, in consideration of their individual lending performance to SMEs. It then sets a ceiling on its overall refinancing for banks, and individual banks can borrow funds from the BOK within the allotted limit. In particular, the BOK sought to adjust the aggregate credit ceiling (ACC) flexibly to ease the effects of external and internal economic shocks to SME loans, such as the Asian foreign currency crisis in 1997, the events of September 11 in 2001, and the global financial crisis in 2008. It also completely revamped the ACCS in April 2013, including, for example, the addition of 'Technology SMEs' to those enterprises eligible for the lending scheme.

This paper examines empirically how the ACCS helps improve banks' intermediation function based on their loan data and the financial statements of banks and enterprises. It analyzes whether banks increase their lending to ACCS-eligible SMEs and reduce lending rates to them. Additionally, we analyze whether the eligibility of the ACCS reduces the information asymmetry between banks and enterprises by identifying whether SMEs newly included in the ACCS are able to access credit from a greater number of banks after being accepted into the system.

Bank-firm level loan data from 2009 to 2011 are used for this study. We analyze the effects of the ACCS by controlling various factors affecting bank loans to SMEs using bank-firm level panel data.

The results of this study are summarized as follows. First, the ACCS helps increase bank loans to SMEs and decrease borrowing rates for them. These effects are particularly prominent for enterprises with medium-credit scores (ratings 5-6),

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<sup>23</sup> This has been renamed the Bank Intermediated Lending Support Facility since August 2013 in a bid to emphasize its function of encouraging banks' active intermediation of funds in support of business activity. Because this facility was known as the Aggregate Credit Ceiling System (ACCS) during the 1990s and 2000s, the period covered by the study, this term is retained throughout this paper.

start-ups, and enterprises that have newly become eligible for the ACCS. Second, enterprises tend to access loans from a greater number of banks after being accepted into the system, implying that it does influence banks' decisions by reducing the information asymmetry between banks and enterprises.

The rest of this paper is structured as follows. Section 4.2 provides a review of the ACCS and previous studies related to credit policy. In section 4.3, data and summary statistics for the analysis are explained in detail. In section 4.4, an empirical model is established and its findings set out. Finally, section 4.5 concludes.

## **5.2. BOK's Credit Policy for SMEs**

In this chapter, we introduce the ACCS, the BOK's primary credit policy instrumentality for SMEs, and review previous studies related to credit policy.

### **5.2.1. ACCS and Bank Loans to SMEs**

The BOK's lending facilities available to financial institutions include Aggregate Credit Ceiling Loans (ACCL), Liquidity Adjustment Loans and Deposits, Intraday Overdrafts, and special loans<sup>24</sup>. Among them, the ACCL was adopted in March 1994 to reform its long-standing lending facilities characterized by automatic rediscounts. The ACCL is aimed at providing loans to financial institutions within a ceiling set by the Monetary Policy Committee, based on their particular SME lending performance. The loans are supplied within a pre-determined Aggregate Credit Ceiling of refinancing credits, under which a quota is assigned to individual banks in accordance with the prescribed criteria. Individual banks can borrow funds from the BOK within their quota.

ACCL should be conducted in an indirect manner by providing incentives to commercial banks because the direct supply of funds by the central bank itself could

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<sup>24</sup> Liquidity Adjustment Loan and Deposit constrains the excessive volatility of money market interest rates by enabling financial institutions to borrow from the BOK to meet shortages or deposit surplus funds at an interest rate level within a certain margin above or below the monetary policy Base Rate. Intraday Overdrafts support banks facing temporary shortages of funds for payment and settlement in the course of a day. Special loans help the BOK perform its lender of last resort function.

make problems such as the distortion of funds allocation in bank loan market. BOK encourages commercial banks to expand their supply of funds to SMEs lacking credit supply by assigning additional capital that they have raised themselves, taking on the credit risk on the basis of the central bank's support from low interest rate funds. BOK finances commercial banks at a low interest rate, below market interest rate, in accordance with banks' lending performance to SMEs to increase bank loans to SMEs. Banks can reduce their funding cost by receiving the ACCL from the BOK with low interest rate, and the reduced funding cost can compensate the extra risk exposure by lending more to SMEs. BOK cut the interest rate of ACCL paid by banks to strengthen their incentive for lending to SMEs. Specific support ceiling for each bank is determined in consideration of its lending performance to SMEs, and then a certain ratio of the amount of loans handled by the bank concerned is supported with low interest rate which can reduce bank's funding cost.

One of criteria for the eligibility for Aggregate Credit Ceiling Loans is firm size. Only SMEs can be eligible for ACCL. BOK needs to consider SMEs which experience bigger difficulties to access external finance than large enterprises, especially during economic downturns and financial crisis. The ACCL is operated focusing on expanding funds availability for SMEs which experience difficulties in obtaining credit supply. The other criteria are the suitability of firm's business operation for BOK's support programmes such as programmes for trade financing, small-scale business owners, high tech start-ups, and regional enterprises. However, the ultimate decision for lending loans to these kinds of firms is made by commercial banks themselves reflecting their lending practice and considering BOK's incentive scheme of ACCL for SMEs.

Figure 5.1 shows the changes in the Aggregate Credit Ceiling and its interest rate. The BOK lowered the ceiling steeply from 8.8 trillion Korean won in March 1994, when the system was introduced, to 3.6 trillion Korean won in February 1997, greatly reducing its credit supply through this channel. However, the Aggregate Credit Ceiling was raised on a large scale and its span was extended in order to address liquidity issues and credit crunch situations caused by financial and economic shocks in Korea and abroad such as the Asian foreign currency crisis in 1997, the September 11 events in the US in 2001, and the global financial crisis in

2008.

The BOK has made active use of the ACCL as one of its primary credit policy instruments, against the backdrop of the increasing demand of SMEs and the self-employed for strategic funding since the global financial crisis. To encourage financial institutions to supply credit loans to SMEs with little in the way of assets eligible as collateral, a “Special Support Ceiling linked to SME Credit Loans” was established in April 2012<sup>25</sup>. The BOK reorganized the scheme's operations, setting a specific lending cap for each regional branch to improve the effectiveness of the BOK's financial support for SMEs in areas with less favorable access to financing<sup>26</sup>. In line with financial inclusion, an initiative supported in the most nations, ‘special support limit for loans to self-employed business owners’ was incorporated into the system in October 2012<sup>27</sup>. In April 2013, the ACCS was fully reformed,<sup>28</sup> with a focus on the improvement of growth potential and job creation capacity.<sup>29</sup> Table 5.1 shows the ACCL programme as it stands today, as of the end of June 2013.

The BOK has sought to mitigate shocks from the reduction of bank loans to SMEs by expanding the ACCL. Figure 5.2 shows the trend of bank loans to SMEs. As of the end of 2012, the loans of domestic banks (including special-purpose banks) to SMEs stood at 464.25 trillion won. SME loans increased rapidly after 2007, but they then have decreased from 2012.

Table 5.2 shows the ratio of the ACCL to SME loans extended by major domestic banks. This table shows total bank lending to SMEs, SME loans eligible for the ACCS, and the amount of the ACCL supported by the BOK. As of the end of 2011, the total amount of SME loans by major banks reached 52.5 trillion won on average. Among them, SME loans eligible for the ACCS amounted to 6.20 trillion won. The BOK provides an average of 0.67 trillion won to individual banks based on

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<sup>25</sup> BOK press release, “Support for SME credit loans through the ACCL,” 13 February 2012.

<sup>26</sup> BOK press release, “Reorganization of quarterly regional limits of ACCL,” 18 April 2012.

<sup>27</sup> BOK press release, “Support for small self-employed business owners through ACCL,” 13 September 2012.

<sup>28</sup> ‘Programme for high technology start-ups’ was newly included in the ACCS to support enterprises, which have been in business for up to seven years and have outstanding technology. Enterprise Procurement Loans and Electronically Processed Secured Receivables Loans were excluded in April 2013 because they were regarded as having successfully fulfilled their aim of improving payment and settlement practice among enterprises.

<sup>29</sup> BOK press release, “Reorganization of ACCL system to nurture ‘Creative SMEs’ in the early stage of incubation,” 11 April 2013.

their SME loan performance.

### **5.2.2. Previous Studies Related to Credit Policy on SMEs**

Extensive research has been conducted to learn the effects of policy interest rate adjustments by central banks on bank loans to enterprises, developing the “analysis of bank lending channel of monetary policy”. However, there has been very little research on the operation of central banks’ credit policy for SMEs<sup>30</sup> since the global financial crisis<sup>31</sup>. Accordingly, this section focuses on theoretical studies on the need for credit policy for SMEs and the effects of support funding for them.

Credit rationing to enterprises caused by information asymmetry between banks and enterprises has been frequently discussed in justification for the argument that the government or the central bank should financially support SMEs. Financial institutions make lending decisions with the help of screening devices because they do not have enough information on enterprises. Once a lending rate exceeds a certain point, the risk to the borrower increases<sup>32</sup> and the profit of the bank decreases. Accordingly, banks unable to control the full panoply of enterprises' behavior set loan interest rates lower than the point where loan supply and loan demand meet in order to attract low-risk borrowers (credit rationing) (Stiglitz and Weiss 1981, Jaffe and Stiglitz 1990).

Credit rationing makes financial institutions allot fewer loans to SMEs, which are considered to be less transparent and disclose less information than large enterprises, resulting in market failures (Kim 2005). To resolve this issue, the governments and central banks of developing economies put in place direct and

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<sup>30</sup> Since the global financial crisis, some countries have supported SMEs in unconventional monetary policy operations by making available ABS purchase funds and long-term low interest funds based on bank loans to households and non-financial enterprises. For example, the Fed introduced TALF (Term ABS Loan Facility) to support the ABS market for school funds, automobile funds, credit card funds, small business loan funds and CMBS markets in November 2008. The Bank of England introduced FLS (Funding for Lending Scheme) to provide long-term low interest rate funds based on bank loans to households and non-financial enterprises in July 2012. Also the Bank of Japan in December 2012 launched a loan support programme with an unlimited credit line in order to lend an amount equivalent to the rise in a participating institution's loans at the call rate as of the date of the loan.

<sup>31</sup> Dagva (2005) described central banks' funding support programmes for SMEs in the SEACEN countries.

<sup>32</sup> When loan interest rates increase, the profitability of banks decreases, as it discourages safe potential borrowers from the loan market (adverse selection effects) and encouraging borrowers to seek high-risk projects (adverse incentive effects). (Stiglitz and Weiss 1981, Jaffe and Stiglitz 1990)

(guarantee-based) indirect funding support <sup>33</sup>(Beck et al. 2008).

Various conflicting results have been reported regarding the effects of governments' financial support for SMEs. In Australia, financial support for SMEs helps increase their income and profitability and expand loans by mitigating information asymmetry between financial institutions and enterprises (Xiang and Worthington 2013). In Canada, enterprises that had received governmental support showed a faster increase in salary, employment, and revenue than non-supported enterprises from 2004 to 2006 (Chandler 2012). However, a study on the SME loan programmes of the Croatian government suggests that SMEs did not have adequate access to bank loans if banks participating in the programme did not have consistent lending criteria, regardless of the government's interest rate subsidy and sufficient fund supply (Cziraky et al., 2005).

Empirical studies on the impact of policy finance on Korea's SMEs include those of Kim (2005), Kang and Jeong (2006), and Jeong et al. (2007). Kim (2005), using SMEs database, examines whether government's subsidies contribute to the improvement of the profitability of SMEs. His findings indicate that it is highly likely to help enterprises with a short operational history, although there is no significant difference in the improvement of profitability between the subsidized and the non-subsidized. Kang and Jeong (2006) analyze the effects of government's financial support on the profitability and growth of SMEs based on SMEs' management indexes for enterprises subject to external audit. They find that government's financial support contributes to the profitability and growth of innovative SMEs, although it usually did not make a difference to the business performance of SMEs. Jeong et al. (2007) investigate the performance of enterprises with and without guarantees from the government and conclude that credit guarantees help improve their return on assets.

To date, there have been few empirical studies on the effects of lending

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<sup>33</sup>Generally, government financial support for SMEs is provided either directly (lending) or indirectly (through credit guarantees). Credit guarantees have been perceived as a more market-oriented strategy compared to direct governmental support in improving SMEs' funding conditions (Chandler 2012, Riding et al. 2007, Boocock et al. 2005). However, with the introduction of a credit guarantee system, some banks encourage the conversion of general loans to credit loans to improve their profitability (Vogel and Adams 1997) or oblige enterprises to take out a credit loan instead of a general loan when they apply to borrow (De Ruyg 2007). Therefore, there are serious doubts about the system's effectiveness.

facilities for SMEs operated by the BOK. Accordingly, this paper tries to contribute to this area of study by analyzing the effects of the ACCL on bank loans to SMEs in terms of the loan amount and interest rate based on bank-firm level loan data.

### **5.3. Data and Summary Statistics**

#### **5.3.1. Data**

The sample of this paper consists of the total outstanding balance of loans from seven major banks in Korea to incorporated SMEs, excluding self-employed business owners, at the end of each year from 2009 to 2011.

The data set used in this analysis connects four databases containing yearly information on balance sheet items for banks and small and medium sized enterprises, and also information showing loan relationship between banks and SMEs. We set up bank-firm level data using these four databases to analyse the impact of credit policy on bank loans to SMEs focusing on the Aggregate Credit Ceiling System which is one of primary tools of BOK's credit policy.

First, we collected seven major banks' loan data to SMEs compiled by the Office of Bank Examination & Analysis, Macroprudential Analysis Department of the BOK, during the period of bank supervision. These data contain loan information from each bank to respective SMEs. The seven major banks are Woori, Hana, KB, IBK, KEB, SC, and Shinhan. SME loans extended by the seven banks accounted for 76.2% of the total bank loans to SMEs as of the end of March 2012. These data has not been compiled regularly but were compiled temporarily when there was bank supervision for special purpose for examining commercial banks' loan behaviour. This covers the SME loan information from 2009 to 2011. That's the reason why we limit our analysis only for the three year period. Second, we gathered bank-firm data on loans eligible for Aggregate Credit Ceiling Loan from Payment & Settlement Systems Department of the BOK which collected the data from commercial banks. Next, we collected financial statement data to control for the heterogeneity of banks and firms. Firms' financial statement data were obtained from Korea Enterprise Data Co. Ltd., and banks' financial statement data were available at Financial Analysis

Information Retrieval System of the BOK. We linked these data set using registered number of each enterprise, and set up bank-firm level data for the analysis. As far as we know, these bank-firm level data were firstly used for analysing the impact of credit policy of a central bank, the BOK, on bank loans to SMEs.

Table 5.3 shows information on the loans to the individual enterprises used in this analysis. The number of SMEs included in the analysis was 22,697, and the loan balance was 75.47 trillion won as of the end of December 2011. The ACCL eligible SMEs numbered 8,081 and the total amount of the loans to such SMEs from the seven major banks was 35.95 trillion won. In contrast, the enterprises not eligible for the ACCL numbered 14,616, and the total amount of the loans from the seven major banks to these firms ineligible for the ACCL amounted to 39.51 trillion won.

### 5.3.2. Summary Statistics

Dependent variables used for the analysis are the log value of the loan amount of individual enterprises<sup>34</sup> and the weighted- average loan interest rate<sup>35</sup>. Figure 5.3 shows the loan distribution between ACCL eligible enterprises and ineligible enterprises. It shows the loans to ACCL eligible enterprises are biased to the right compared to those to ineligible enterprises. To control the outlier effect, we exclude bank loans to individual enterprises which represent less than 0.1% of their total assets.<sup>36</sup>

Figure 5.4 shows the distribution of loan interest rates for the ACCL eligible enterprises and ineligible enterprises. It shows that loan interest rates for the eligible enterprises are distributed near the median compared to those for the ineligible.

Table 5.4 shows the summary statistics of the variables used for this analysis. Panel A shows the summary statistics of loans, and Panels B and C show those of the financial statement variables of the enterprises and banks, respectively. As shown in Table 5.4, Panel A, the average amount of the loans from banks to individual

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<sup>34</sup> The loan amount includes domestic currency loan, foreign currency loan, advances for customers, and acceptances and guarantees outstanding.

<sup>35</sup> The weighted average loan interest rate was calculated using the formula, {[loan amount per account of the corresponding borrower × loan interest rate per account]/total loan amount}.

<sup>36</sup> For example, in case an enterprise has 10 billion won worth assets and has the loan balance of less than 10 million won, the loan is excluded from the analysis.

enterprises<sup>37</sup> is 1.82 billion won, the average loan interest rate is 6.1%, and the ratio of mortgage loans is 19.7%. Table 5.4, Panel B presents the summary statistics of enterprise variables. The median number of transacting banks of each enterprise is two, and some enterprises use all seven major banks. We use log assets, business history, credit rating, profitability, and total loans to total assets, leverage ratio, and coverage ratio to control the characteristics of individual enterprises<sup>38</sup>. To control the effects of outliers, data falling under 1% or over 99% of each enterprise-related explanatory variable are excluded.<sup>39</sup> The financial statement data of enterprises are obtained through Korea Enterprise Data (KED). Table 5.4, Panel C shows the summary statistics of financial statement variables of banks. Log assets of banks, profitability, leverage ratio, Non-Performing Loan Ratio data are used<sup>40</sup> as variables to control the characteristics of individual banks. As for bank-level data, we use the business reports of the seven major banks submitted to the BOK.

On the other hand, Figure 5.5 shows the distribution of the business history, the length of life since establishment, of the targeted enterprises. It does not show any major difference between the ACCL eligible enterprises and ineligible enterprises.

Table 5.5 shows the correlation between the variables used in this analysis. The log value of the loans shows a negative (-) correlation with the loan interest rate and enterprise leverage ratio and a positive (+) correlation with the ACCL ratio, mortgage loan ratio, log value of enterprise assets, and business history. The loan interest rate shows a positive (+) correlation with the enterprise leverage ratio and a negative (-) correlation with the ACCL ratio, mortgage loan ratio, the log value of an enterprise's assets, and its coverage ratio.

When focusing on the correlation between ACCL ratio and two major

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<sup>37</sup> Considering that the minimum amount of loans from banks to individual enterprises is one million won and the maximum amount is 433.89 billion won, the selection bias is confirmed to be relatively small.

<sup>38</sup> As for business history, the number obtained by subtracting the year of establishment from the year of data is used. Credit rating is classified from grade 1 to grade 10, and grade 1 is the highest grade. Profitability (ROA) is defined as the ratio of net income to total assets. The leverage ratio is defined as the ratio of assets to capital, and the coverage ratio is defined as the ratio of operating income to interest expense.

<sup>39</sup> When winsorizing the data instead of truncating observations above 99% or below 1%, it did not make any significant difference to the estimation results reported in this chapter.

<sup>40</sup> The bank leverage ratio is defined as the ratio of assets to capital. For bank profitability, ROA index is used. For the non-performing loan ratio, a non-accrual loan ratio is used.

variables regarding the log value of the loan and the loan interest rate, it shows that an increase of ACCL ratio has strongly positive relationship with an increase total loan while an increase ACCL has not statistical significant relationship with an decrease of loan interest rate. It gives some hints that an increase of ACCL helps to enlarge funding availability of SMEs even though it does not show much strong relationship with interest rate. However, it has to be empirically examined controlling other heterogeneous factors of firms and banks.

Some of bank characteristics such as profitability and log value of assets are strongly correlated with each other, and it may cause multicollinearity problem if included in the model simultaneously. Therefore, we include some bank characteristics and firm characteristics in the model to control for the heterogeneity of banks and firms, which do not show high correlation between variables of banks and firms respectively.

## **5.4. Model Specification and Empirical Results**

### **5.4.1. Model Specification**

A panel data model is set up to confirm whether the ACCS increases loans to SMEs and reduces lending rates, in which low interest rates are offered for a part of the SME loans that banks have already extended<sup>41</sup>. We use a bank-firm level panel data model, considering that the amount and interest rate of the loan to each enterprise depend on its business relationship with banks. Additionally, we control (i) the effects on the demand and supply of loans by using various financial statement variables of enterprises and banks and (ii) changes in the macro-economic situation by using time dummies.

Estimation model (1) is set up to see if the ACCS increases total loans to

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<sup>41</sup>We adopt Hausman Test to decide whether to use a fixed effect or a random effect in the Panel analysis. Given the characteristics of the firm-bank disaggregated data set used for this analysis, it seems that a fixed effect model, which assumes that unobserved individual heterogeneity and other explanatory variables are related, is more realistic than a random effect model, which assumes that unobserved individual heterogeneity and other explanatory variables are independent. However, a random effect model is also used based on the argument that the model would be more efficient in case that panel data have short time series and unobserved individual heterogeneity of panel is independent of explanatory variables to compare the results using fixed effects. Both models are found to have generated the same results.

SMEs, while estimation model (2) is to confirm whether it reduces interest rates for total loans<sup>42</sup>.

$$\text{LnLoan}_{i,k,t} = \text{const} + a_{i,k} + \delta \text{CAH}_{i,k,t} + \gamma L_{k,t} + \theta Z_{k,t-1} + \beta X_{i,t} + v_t + \epsilon_{i,k,t} \quad (1)$$

$$\text{INTR}_{i,k,t} = \text{const} + a_{i,k} + \delta \text{CAH}_{i,k,t} + \gamma L_{k,t} + \theta Z_{k,t-1} + \beta X_{i,t} + v_t + \epsilon_{i,k,t} \quad (2)$$

The subscript  $i$  of each variable denotes bank,  $k$  enterprise, and  $t$  year of 2009, 2010, and 2011 respectively. For dependent variables, the log loan of a bank to an individual enterprise ( $\text{LnLOAN}_{i,k,t}$ ) and the loan interest rate ( $\text{INTR}_{i,k,t}$ ) are used. The total amount of the loans from individual banks to individual enterprises includes domestic currency loans, foreign currency loans, advances for customers, and acceptances and guarantees outstanding. The loan interest rate means the weighted average interest rate calculated by [(loan amount per account of the borrower  $\times$  loan interest rate per account) / total loan amount of the borrower].

$\alpha_{i,k}$  is a fixed term to capture bank-firm fixed effects, and  $v_t$  is another term to capture the time fixed effect.  $\text{CAH}_{i,k,t}$  shows the ratio of the ACCL eligible loans to individual enterprises at a specified time (ACCL eligible loans / total loans). We set the ratio of the ACCL eligible loan as a major independent variable to see if favorable loan conditions (amount and lending rate) are offered to a company with a higher percentage of ACCL eligible loans, with other conditions being the same.

On the other hand, we can also identify a substitution relationship between ACCL eligible loans and non-ACCL eligible loans by examining the effects of an increase in the ACCL eligible loan ratio on LnLOAN. To check mathematically whether there is a substitution relationship between ACCL eligible loans and non-ACCL eligible loans, we assume ‘a’ is ACCL eligible loans, ‘b’ is the non-ACCL eligible loans, and the total loans are ‘a+b’. The effects of an increase in the ACCL eligible loan ratio on log total loans (k) can be calculated using the following formula:

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<sup>42</sup> The samples used for the analysis are the entire sample of SME loan performance of individual banks. As ACCL eligibility is determined for each loan type, the possibility of sample selection bias is very low.

$$\frac{d \log(a+b)}{d \left[ \frac{a}{a+b} \right]} = \frac{\frac{da+db}{a+b}}{\frac{(a+b)da - (da+db)a}{(a+b)^2}} = \frac{(a+b)(da+db)}{bda - adb} = k$$

If an increase in ACCL eligible loans leads to an increase in the total loans in spite of the substitution effects between the ACCL eligible loan (a) and non-ACCL eligible loan (b),  $db/da$  should be over -1.

When  $\frac{db}{da} > -1$ , the range of k can be defined as follows:

$$k = \frac{(a+b)(da+db)}{bda - adb} = \frac{(a+b)(1 + \frac{db}{da})}{b - a \frac{db}{da}}$$

$$(a+b) \left(1 + \frac{db}{da}\right) = k \left(b - a \frac{db}{da}\right)$$

$$\text{For } \frac{db}{da} = \frac{kb - a - b}{ka + a + b} = \frac{kb - (a+b)}{ka + (a+b)} > -1, k \text{ should be over } 0.$$

In other words, if k is over 0, an increase in ACCL eligible loans does not fully offset non-ACCL eligible loans, resulting in an increase in total bank loans. Therefore, we can say that the substitution relationship between ACCL eligible loans and non-ACCL eligible loans does not offset the increase in ACCL eligible loans.

To control the demand and supply of loans, we use enterprise characteristic variables and bank characteristic variables.  $L_{k,t}$  is a set of those control variables of enterprise k at time t, such as its credit rating, weight of bank transaction, mortgage loan ratio, loan interest rate, and loan amount, which directly affect bank lending taken from the characteristics of individual enterprises. Enterprise credit ratings are divided into ten tiers, from Grades 1 to 10 in the rank order from the highest rating to the lowest. We use the weight of bank transaction as a proxy for “relationship banking” between enterprises and banks. The weight of bank transaction is the ratio of bank i’s loans to enterprise k to the total bank loans to enterprise k. It is assumed that the larger the weight of bank transaction the stronger is this relationship banking.  $Z_{k,t-1}$  is a set of control variables of enterprise k at time t-1, such as business history, log assets, profitability (ROA), leverage ratio, coverage ratio, and debt to financial asset ratio. Notably, the debt to financial asset ratio, is used as a proxy for the

enterprise's demand for loans. It is assumed that a higher debt to financial asset ratio means a stronger loan demand. Another assumption is that banks could use financial variables of the previous year when deciding whether to make a loan to an enterprise.  $X_{i,t}$  is a set of control variables which show the characteristics of bank I at time t, such as log assets and leverage ratio.<sup>43</sup>

We also compare entry into the ACCS and an increase in the existing ACCL ratio and investigate which of the two has a bigger impact on the total amount and lending rate. In order to identify the effects of the above two cases on the amount, estimation model (3) is established, and to identify the effects on lending rates, estimation model (4) is set up.

$$\begin{aligned} \text{LnLoan}_{i,k,t} = & \text{const} + a_{i,k} + \delta_1 \text{NCAH}_{i,k,t} + \delta_2 \text{ICAH}_{i,k,t} + \gamma L_{k,t} + \theta Z_{k,t-1} \\ & + \beta X_{i,t} + v_t + \epsilon_{i,k,t} \end{aligned} \quad (3)$$

$$\begin{aligned} \text{INTR}_{i,k,t} = & \text{const} + a_{i,k} + \delta_1 \text{NCAH}_{i,k,t} + \delta_2 \text{ICAH}_{i,k,t} + \gamma L_{k,t} + \theta Z_{k,t-1} \\ & + \beta X_{i,t} + v_t + \epsilon_{i,k,t} \end{aligned} \quad (4)$$

For  $\text{NCAH}_{i,k,t}$ , dummy variable, a value of one is given when an enterprise was not eligible for the ACCL at the end of the previous year (t-1) but is eligible at the end of this year (t). For  $\text{ICAH}_{i,k,t}$  dummy variable, a value of one is given when an enterprise have a higher ACCL ratio at the end of year (t) compared to the end of the previous year (t-1).

In addition, to identify whether new eligibility for the ACCL and an increase in the ACCL ratio affect banks' decision to do business with the enterprise, estimated model (5) is set up.

$$\begin{aligned} \Delta \text{Banks}_{k,t} = & \text{const} + a_k + \delta_1 \text{NCAH}_{k,t} + \delta_2 \text{ICAH}_{k,t} + \gamma L_{k,t} + \theta Z_{k,t-1} \\ & + \beta X_{i,t} + vt + \epsilon_{k,t} \end{aligned} \quad (5)$$

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<sup>43</sup> We initially considered bank profitability (ROA), and non-performing loan ratio (NPL) as controlling variables for bank characteristics. However, bank profitability and bank leverage ratio were finally excluded from the variable analysis since bank profitability and bank assets (LN\_BASS) show a high correlation (0.9471), and so does bank non-performing loan ratio and bank leverage ratio (0.641) in the case of the loans to SMEs with high credit scores ( ratings 1 and 2).

Changes in the number of transacting banks of an individual enterprise compared to the end of the previous year ( $\Delta Banks$ ) are used as a dependent variable. As the number of transacting banks is calculated at the end of every year, we get the data from bank-firm level loan data. The characteristics of individual enterprises are obtained using the weighted average of the loan amount. Control variables for individual enterprise characteristics ( $L, Z$ ) and those for transacting banks ( $X$ ) are same as in estimation models (1) and (2).

#### **5.4.2. Empirical Results**

##### **A. Ratio of ACCL and SME Loans**

This section presents the empirical results of the models set up in this paper. Table 5.6 shows the effects of the ACCL on the amount of the loans to SMEs. Here, the log value of bank loans to individual enterprises (LnLOAN) is used as a dependent variable. A fixed effect model is used for this panel data analysis based on Hausman Test. Column 1 of Table 5.6, Panel A displays the analysis results for all enterprises, and columns (2) to (6) show the analysis results according to the credit rating of individual enterprises. Columns (1) to (6) all include year dummies. The analysis focuses on enterprises' credit rating and business history. We try to identify whether the ACCS has any effects on low credit or start-up SMEs that have difficulty obtaining funds from financial institutions because of information asymmetry.

As shown in column (1) of Table 5.6, Panel A, when the ratio of the ACCL of an individual enterprise is higher, the total loans to the enterprise increase significantly. In other words, when the ratio of the ACCL increases 10%p (in other words, 0.1 unit of the ACCL ratio), total loans increase by 1.93%. When broken down by credit rating, the loan increase is found to be the most prominent for enterprises with credit ratings 3 to 6. Considering that loans to enterprises with credit ratings 3 to 6 account for 92.7% of the bank loans to SMEs, it would be safe to say that a rise in the ACCL ratio helps boost bank lending to SMEs.

This result confirms that banks increase loans to enterprises when their ACCL ratio has increased. On the other hand, it is shown that an increase of the ACCL does not have significant effects on an increase in bank loans to SMEs in the case of

financially healthier SMEs (credit ratings 1 and 2), and middle-to-low (credit ratings 7 and 8) or the lowest-grade enterprises (credit ratings 9 and 10). It is attributable that SMEs with good credit have already had enough support, while SMEs with low credit scores have less success with their loan applications.

Also, to investigate how much the ACCS can compensate for market failures caused by information asymmetry between banks and SMEs in the early stage, we classify enterprises into those of less than 5 years old, 6 to 10 years, 11 to 15 years, 16 to 20 years, and over 21 years and review the effects of the ratio of the ACCL on the loan amount and banks' lending rates for SMEs.

Table 5.6, Panel B shows the analysis result of the effects of the ACCL ratio on SMEs according to their business history. The dependent variable is the log value of the loan (Ln LOAN). Column (1) indicates the results of all enterprises, and columns 2 to 6 show the analysis results according to the business history of enterprises. Columns 1 to 6 all include year dummies. As seen in Columns 2 to 6 of Table 5.6, Panel B, the total loans of the enterprises with a higher ratio of ACCL take on a non-linear pattern depending on their business history. Specifically, enterprises with five or fewer years of business history show the biggest increase in the loan amount when the ratio of ACCL increases.

Among the variables controlling the characteristics of enterprises, the higher the credit risk of an enterprise, the smaller bank loans to the enterprise and the more assets an enterprise holds, the larger bank loans to the enterprise. In addition, the higher the debt to financial asset ratio, which is assumed to reflect an enterprise's demand for loans, the greater bank loans to SMEs.

Table 5.7 shows the effects of the ACCL on loan interest rates applied to SMEs. Loan interest rates of banks to a specific enterprise are used as a dependent variable. Here, the loan interest rate is the weighted average of the interest rates on loans in the company's individual accounts. Column (1) of Table 5.7, Panel A indicates the results of all enterprises, and columns (2) to (6) show the analysis results according to enterprise credit rating. Columns (1) to (6) all include year dummies. In Column (1) of Table 5.7, Panel A, which deals with all enterprises, the lending rates for the enterprise decrease significantly, as the enterprise has a higher ACCL ratio to total bank loans. In other words, when the ratio of the ACCL increases

10%p (or 0.1 unit of the ACCL ratio), the average lending rate decreases by 0.00435%p (0.435bp), implying that a cut in the lending rate is much smaller than an increase in the ACCL ratio. This is attributable to the fact that the BOK's ACCL account for a small portion of banks' loans to SMEs<sup>44</sup>, and that it is not easy for enterprises to ask for a rate cut because the ACCL is provided indirectly, through banks. Also, banks are expected to bear the responsibility for non-performing loans in the case of the ACCL, unlike loans from government funds which are extended through the direct support or payment guarantee of the government. Thus banks perceive the interest loss associated with the ACCL as a risk premium on additional loans to enterprises.

When breaking it by credit rating, it is found that the rate reduction effect is statistically significant in enterprises with the credit ratings of 5 to 6, the main business partners of banks, while enterprises with the credit ratings of 9 to 10 face an increase in total lending rates in spite of the higher ACCL ratio.

Table 5.7, Panel B shows the effects of the ACCL ratio on lending rates based on business history. The dependent variables are the lending rate (INTEREST) applied to individual enterprises. Enterprises with 11 to 15 years of business history show a decrease in lending rates as the ACCL ratio increases, as seen in Columns (1) to (6) of Table 5.7, Panel B. The same effect is also found in other enterprises, but it is not statistically significant.

On the other hand, among the variables controlling enterprise characteristics, loan interest rate increases when credit risk increases. It is also found that the bigger (enterprise log asset) and the more profitable an enterprise (enterprise profitability and enterprise coverage ratio), the lower the lending rate. As the debt to financial asset ratio, assumed to reflect an enterprise's demand for loans, goes up, the lending rate increases. As for the variables controlling characteristics of banks, the bigger a bank and the higher its coverage ratio, the lower the lending rate.

To sum up, when an enterprise's ACCL ratio is higher, banks increase loans to the enterprise and offer lower rates. However, the rate cut is found to be very small.

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<sup>44</sup> As shown in Table 4.2, the ACCL supplied by the BOK take up averagely 1.28% of the total amount of the loans to SMEs as of the end of 2011.

## **B. New Eligibility for ACCS and Bank Loans to SMEs**

In this section, we review the effects of an increase of the ACCL ratio on the amount and interest rate of the loans to enterprises newly eligible for the ACCL and those already in the system.

Table 5.8, Panel A shows a transition matrix between ACCL eligible enterprises and ineligible enterprises. According to the results, 25.06% of the enterprises which were eligible for the system at the end of the previous year maintained their eligibility at the end of the year under review, while 9.24% became eligible from ineligible for the ACCL during the year. Table 5.8, Panel B describes a transition matrix between an increase in the ratio of the ACCL eligible loans and a decrease in the ratio. Upon analysis, 54.83% of the enterprises that suffered a decrease in the ratio at the end of the previous year had another year of decrease, while 9.43% experienced a switch to an increase during the year under review.

Table 5.9 shows empirical analysis of formulas (3) and (4), intended to investigate the effects of new eligibility or an increase in the ratio of the ACCL on the total loan amount and interest rate for total loans. A fixed effect model based on Hausman Test's results is used for this panel analysis. According to the empirical analysis, when SMEs become eligible for the ACCL, the loan amount increases as shown in columns (1) to (3) of Table 5.9 and the interest rate decreases as shown in columns (4) to (6). However, an additional increase in the ACCL ratio is not found to have any significant effects on the increase of the loan amount or reduction of lending rates.

## **C. New Eligibility for ACCS and Changes in the Number of Transacting Banks**

In this section, we review changes in the number of transacting banks after enterprises become eligible for the ACCS or there are changes in the ACCL ratio of already eligible enterprises. If the number of transacting banks increases after such addition or change, it means that these two factors contribute to mitigating information asymmetry between banks and enterprises. A fixed effect model based on the Hausman Test is used for this panel analysis.

Table 5.10 shows the empirical analysis of estimation model (5). An increase or decrease in transacting banks compared to the end of the previous year is set as a

dependent variable. As shown in Column (3) in Table 5.10, the number of transacting banks increases significantly as enterprises become eligible for the ACCS. In other words, enterprises newly eligible for the ACCS in the year do business with 0.19 more banks, which is statistically significant at the 1% level. The result confirms that inclusion into the system helps mitigate information asymmetry and serves as a criterion for banks to determine whether to do business with enterprises.

### 5.4.3. Robustness Analyses : Excluding Subsidy from the BOK

This section investigates whether banks increase loans in addition to the amount supported by the BOK when the ratio of the ACCL rises, by excluding the BOK's support from the loan amount to be analyzed.

As the ACCL is provided to banks in its entirety, we estimate the loan amount excluding the BOK's support from the total loans to an individual enterprise (total loans excluding the ACCL) as follows:

$$\begin{aligned} & \text{Total loans excluding the ACCL} \\ & = \text{Total loans} - (\text{ACCL eligible loan} \times \text{support ratio}^{45}) \end{aligned} \quad (6)$$

Reflecting that there is a considerable difference between the ACCL for general fund and the ACCL for regional SMEs in terms of support ratio, different ratios are respectively applied to general fund loans (Corporate Procurement Loans, Electronically Secured Receivables Loans, and trade finance) and regional SME supporting funds. Table 5.11 shows the effects of the ACCL ratio on the loan amount excluding the ACCL. A fixed effect based on Hausman Test is used for this panel analysis.

As shown in column (1) of Table 5.11, Panel A, as the ACCL ratio of an individual enterprise gets higher, the loan amount excluding the ACCL increases significantly. It is found that when the ACCL ratio goes up by 10%p (in other words, 0.1 unit of the ACCL ratio), the loan amount excluding the BOK's support increases by 0.00715%. Effects on enterprises with different credit ratings and business history

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<sup>45</sup> Support ratio means the ratio of the BOK's funding support with low interest rate to banks' loan performance regarding ACCL eligible loan. The support ratios are differentiated according to the entitled funds of the Aggregate Credit Ceiling Loan Programmes.

are similar to those confirmed in Table 5.6, Panel A. Table 5.11, Panel B shows the results based on the business history of enterprises. The effect of a higher ACCL ratio on the increase of loans is the most prominent for enterprises with no more than five years of business history.

## **5.5. Conclusions**

This paper examines the impact of the ACCS, the primary tool of the BOK's credit policy operations, on bank loans to SMEs. This analysis is meaningful in that it provides judgment criteria for the sustainability and improvement of credit policy of central banks and that it may have important implications for the policy authorities in major countries that have intended to implement credit policy for SMEs since the global financial crisis.

The following summarizes the major findings of this paper based on bank-firm level loan data from 2009 to 2011. First, the ACCL leads to an increase in SME loans and a decrease in interest rates. Its effect on the loan amount is particularly clear in SMEs with medium credit scores (Grades 3 to 6), the main customers of banks, while its effect on interest rates is most noticeable in SMEs with the credit ratings of 5 and 6. Additionally, the loan increase is mostly found in enterprises with five or fewer years of business history.

Second, it is mostly the enterprises newly accepted into the ACCS that see an increase in the loan amount and a decrease in lending rates. Their inclusion also results in a significant increase in the number of transacting banks, suggesting that ACCL eligibility have positive signal effects to other banks.

This paper is the first to investigate the effects of credit policy of the BOK, Korea's central bank, on the loan amount and lending rates for SMEs after controlling for other characteristics of enterprises and banks that could influence banks' lending decisions based on a bank-firm disaggregated data set. Its findings are also expected to serve as a useful reference for researching credit policy which is being increasingly adopted by central banks following the global financial crisis.

Table 5.1. Details of Aggregate Credit Ceiling Loan Programmes  
(as of the end of June 2013)

Entitled funds	Time of Introduction	Quota [Trillion Korean Won]
Programme for Trade Financing	March 1994	1.5
Programme for Credit Loans	April 2012	1.0
Programme for Small-Scale Sole Traders	October 2012	1.5
Programme for High Technology Start-ups	April 2013	3.0
Programme for Local SMEs	March 1994	4.9

Source: The Bank of Korea

Table 5.2. Bank loans to SMEs and Aggregate Credit Ceiling Loans to each bank

(based on individual banks)

Unit: trillion Korean Won

		Minimum	Median	Average	Maximum
	Total bank loans to SMEs	9.197	61.078	52.128	93.865
End of 2009	Bank loans eligible for ACCL	0.376	6.279	5.411	9.559
	ACCL by the BOK	0.045	0.859	0.870	2.081
	Total bank loans to SMEs	9.370	59.369	51.724	99.683
End of 2010	Bank loans eligible for ACCL	0.519	6.155	5.619	9.400
	ACCL by the BOK	0.027	0.596	0.677	1.830
	Total bank loans to SMEs	9.100	59.188	52.502	105.73
End of 2011	Bank loans eligible for ACCL	0.725	5.873	6.198	13.05
	ACCL by the BOK	0.031	0.571	0.670	1.936

Note: Calculated based on the individual institutional limit of seven major banks [Woori, Hana, KB, IBK, KEB, SC, and Shinhan]

Source: The Bank of Korea

Table 5.3. Number of SMEs and loan amount<sup>1)</sup>

(Unit : trillion Korean Won)

Year	ACCL eligible SMEs		ACCL ineligible SMEs		Total SMEs <sup>2)</sup>	
	Number of enterprises	Loan amount <sup>3)</sup>	Number of enterprises	Loan amount	Number of enterprises	Loan amount
End of 2009	6,953	32.78	14,448	37.71	21,401	70.50
End of 2010	7,130	33.64	15,185	39.44	22,315	73.08
End of 2011	8,081	35.95	14,616	39.51	22,697	75.47

Notes: 1) Based on the balance of the loans from seven major banks (Woori, Hana, KB, IBK, KEB, SC, and Shinhan) in Korea to incorporated SMEs. SMEs are limited to enterprises having credit ratings and the financial variables necessary for the analysis.

2) SMEs are limited to incorporated SMEs and exclude large enterprises and self-employed business owners.

3) The loan amount includes domestic currency loans, foreign currency loans, advances for customers, and acceptances and guarantees outstanding.

Source: The Bank of Korea

Table 5.4. Basic statistics

## &lt;Panel A: Loans&gt;

Name of variables	Minimum	P1	Median	Average	Standard Deviation	P99	Maximum
Loans [billion Korean Won]	0.001	0.014	0.732	1.817	3.828	15.499	433.890
Ln(Loans)	0.000	2.628	6.596	6.522	1.505	9.649	12.981
Loan interest rate[%]	1.950	2.778	6.010	6.115	1.527	11.000	14.650
Ratio of mortgage loans	0.000	0.000	0.000	0.197	0.290	1.000	1.000

**<Panel B: Enterprises >**

Name of variables	Minimum	P1	Median	Average	Standard Deviation	P99	Maximum
Ln( Assets)	9.851	12.445	15.155	15.219	1.311	18.649	21.879
Business history	0.000	1.000	10.000	12.281	8.700	42.000	100.00
Number of transacting banks	1.000	1.000	2.000	1.816	1.009	5.000	7.000
Credit rating	1.000	2.000	5.000	4.883	1.200	8.000	10.000
Profitability [ROA]	-0.400	-0.152	0.041	0.049	0.064	0.240	0.306
Ratio of total loans to total assets	0.000	0.000	0.415	0.405	0.187	0.789	0.885
Leverage ratio	-6.820	1.215	3.000	3.672	2.675	15.693	29.894
Coverage ratio	-12.342	-5.000	2.215	4.356	7.851	43.459	86.059

**<Panel C: Banks>**

Name of variables	Minimum	P1	Median	Average	Standard Deviation	P99	Maximum
Ln (Assets)	18.068	18.068	18.974	18.936	0.463	19.442	19.442
Profitability [ROA,%]	0.004	0.004	0.638	0.589	0.295	1.335	1.335
Leverage ratio[%]	7.550	7.550	9.430	9.520	0.961	11.170	11.170
Non-performing loan ratio[%]	0.934	0.934	1.298	1.430	0.530	3.400	3.400

Notes: 1) The loan amount includes domestic currency loans, foreign currency loans, advances for customers, and acceptances and guarantees outstanding.

2) Loan interest rate means weighted average interest calculated as {[Loan amount per account of the borrower × Loan interest rate per account] / Total loan amount of the borrower}.

3) Mortgage loans include guaranteed loans.

4) Credit rating is classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

5) The ratio of total loans to total assets is defined as the ratio of total borrowings to total asset of the enterprise.

6) Enterprise leverage ratio is defined as the ratio of total assets to total capital.

7) Enterprise coverage ratio is defined as the ratio of operating income to interest expense.

8) Bank leverage ratio is defined as the ratio of total asset to total capital.

9) Bank non-performing loan ratio is defined as non-accrual loan ratio.

Sources: The Bank of Korea (for loan and bank level data)

Korea Enterprise Data (for enterprise level data)

Table 5.5. Correlation coefficient

	Ln(Loans)	Loan interest rate	Ratio of ACCL	Ratio of mortgage loans	Enterprise Ln(Assets)	Enterprise leverage ratio	Enterprise coverage ratio	Ratio of total loans to total assets	Enterprise credit rating	Enterprise Profitability	Enterprise Business History	Bank Ln(Assets)	Bank leverage ratio	non-performing loan ratio	Bank Profitability
Ln(Loans)	1.000														
Loan interest rate	-0.209 [0.000]	1.000													
Ratio of ACCL	0.231 [0.000]	-0.011 [0.642]	1.000												
Ratio of mortgage loans	0.089 [0.000]	-0.076 [0.001]	0.012 [0.616]	1.000											
Enterprise Ln(Assets)	0.642 [0.000]	-0.283 [0.000]	0.190 [0.000]	0.068 [0.004]	1.000										
Enterprise leverage ratio	-0.149 [0.000]	0.178 [0.000]	-0.041 [0.082]	-0.095 [0.000]	-0.328 [0.000]	1.000									
Enterprise coverage ratio	-0.033 [0.161]	-0.157 [0.000]	-0.030 [0.212]	0.030 [0.208]	0.143 [0.000]	-0.181 [0.000]	1.000								
Ratio of total loans to total assets	0.111 [0.000]	0.104 [0.000]	0.016 [0.489]	-0.074 [0.002]	-0.210 [0.000]	0.362 [0.000]	-0.336 [0.000]	1.000							
Enterprise credit rating	0.195 [0.000]	-0.133 [0.000]	0.036 [0.127]	0.089 [0.000]	0.260 [0.000]	-0.191 [0.000]	0.040 [0.089]	0.048 [0.044]	1.000						
Enterprise profitability	0.003 [0.911]	-0.022 [0.361]	-0.022 [0.352]	-0.016 [0.492]	-0.049 [0.037]	-0.123 [0.000]	0.390 [0.000]	-0.023 [0.335]	-0.002 [0.935]	1.000					

	Ln(Loans)	Loan interest rate	Ratio of ACCL	Ratio of mortgage loans	Enterprise Ln(Assets)	Enterprise leverage ratio	Enterprise coverage ratio	Ratio of total loans to total assets	Enterprise credit rating	Enterprise Profitability	Enterprise Business History	Bank Ln(Assets)	Bank leverage ratio	non-performing loan ratio	Bank Profitability
Enterprise business history	0.265	-0.116	0.111	0.099	0.498	-0.213	-0.033	-0.160	0.126	-0.230	1.000				
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.160]	[0.000]	[0.000]	[0.000]					
Bank Ln(Assets)	-0.023	-0.026	0.015	-0.032	0.039	0.042	0.061	-0.038	-0.035	0.027	-0.004	1.000			
	[0.334]	[0.279]	[0.526]	[0.177]	[0.096]	[0.077]	[0.010]	[0.107]	[0.140]	[0.255]	[0.855]				
Bank leverage ratio	0.030	-0.101	0.021	0.058	0.088	-0.042	0.090	-0.056	0.013	0.048	0.083	-0.090	1.000		
	[0.207]	[0.000]	[0.381]	[0.015]	[0.000]	[0.076]	[0.000]	[0.017]	[0.577]	[0.045]	[0.000]	[0.000]			
Non-performing loan ratio	-0.072	-0.041	-0.010	0.007	-0.095	0.168	0.044	0.052	-0.032	0.028	-0.068	0.064	0.641	1.000	
	[0.002]	[0.084]	[0.686]	[0.757]	[0.000]	[0.000]	[0.064]	[0.027]	[0.174]	[0.239]	[0.004]	[0.006]	[0.000]		
Bank Profitability	0.016	-0.083	0.015	-0.050	0.032	-0.071	0.100	0.015	0.041	0.066	0.002	0.703	0.078	0.260	1.000
	[0.494]	[0.000]	[0.523]	[0.036]	[0.183]	[0.003]	[0.000]	[0.532]	[0.081]	[0.005]	[0.947]	[0.000]	[0.001]	[0.000]	

Notes: 1) The loan amount includes domestic currency loans, foreign currency loans, advances for customers, and acceptances and guarantees outstanding.

2) Loan interest rate means weighted average interest calculated as  $\{[\text{Loan amount per account of the borrower} \times \text{Loan interest rate per account}] / \text{Total loan amount of the borrower}\}$ .

3) Mortgage loans include guaranteed loans.

4) Credit rating is classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

5) The ratio of total loans to total assets is defined as the ratio of total borrowings to total asset of the enterprise.

6) Enterprise leverage ratio is defined as the ratio of total assets to total capital.

7) Enterprise coverage ratio is defined as the ratio of operating income to interest expense.

8) Bank leverage ratio is defined as the ratio of total asset to total capital.

9) Bank non-performing loan ratio is defined as non-accrual loan ratio.

10) The sample period is 2009 to 2011.

11) Numbers in brackets are p-values.

Sources: The Bank of Korea (for loan and bank level data)

Korea Enterprise Data (for enterprise level data)

Table 5.6. The effects of ACCL eligible loans on bank loans to SMEs

**Panel A: Focusing on credit rating**

VARIABLES	LN LOAN (Total Enterprises)	LN LOAN credit rating (1~2)	LN LOAN credit rating (3~4)	LN LOAN credit rating (5~6)	LN LOAN credit rating (7~8)	LN LOAN credit rating (9~10)
Ratio of ACCL	0.1934*** (9.35)	-0.0053 (-0.03)	0.2819*** (7.00)	0.1750*** (6.86)	0.1048 (0.41)	-0.0932 (-0.78)
Enterprise credit rating	-0.0577*** (-13.95)	0.2323 (1.05)	0.0016 (0.14)	-0.0567*** (-7.95)	0.0437 (1.08)	-0.0059 (-0.07)
Weight of bank transaction	1.8774*** (71.57)	1.3920*** (5.67)	1.7540*** (31.77)	1.8850*** (57.18)	1.3254*** (5.90)	3.1700*** (8.47)
Mortgage ratio	0.3203*** (12.22)	-0.1257 (-0.46)	0.2087*** (3.66)	0.3464*** (11.08)	0.9900** (2.26)	-0.6147* (-1.69)
Loan interest rate	-0.0257*** (-6.73)	-0.0255 (-0.36)	-0.0353*** (-3.49)	-0.0264*** (-5.68)	-0.0339 (-1.11)	0.0445 (1.26)
Business history <sub>t-1</sub>	0.0722*** (3.86)	-0.7288 (-1.37)	0.0674** (2.12)	0.0282 (0.60)	0.0185 (0.32)	0.0239 (0.23)
Business history <sup>2</sup> <sub>t-1</sub>	-0.0008*** (-6.89)	0.0003 (0.22)	-0.0008*** (-3.31)	-0.0010*** (-6.75)	-0.0020 (-1.43)	-0.0003 (-0.26)
Enterprise Ln(Assets) <sub>t-1</sub>	0.3554*** (26.35)	0.3876* (1.68)	0.3603*** (11.77)	0.3217*** (18.97)	0.1776** (2.26)	0.1753 (1.25)
Enterprise Profitability <sub>t-1</sub>	-0.0922* (-1.88)	-0.3179 (-0.46)	-0.2402** (-2.06)	-0.0051 (-0.08)	0.2509 (0.76)	-0.7119 (-1.51)
Enterprise leverage ratio <sub>t-1</sub>	-0.0067*** (-4.80)	-0.0869 (-0.89)	-0.0114* (-1.85)	-0.0065*** (-4.22)	0.0125 (0.88)	-0.0006 (-0.04)
Enterprise coverage ratio <sub>t-1</sub>	0.0012** (2.14)	-0.0003 (-0.11)	0.0013 (1.38)	0.0014* (1.70)	0.0020 (0.43)	0.0047 (0.47)
Ratio of total loans to total assets <sub>t-1</sub>	0.1447*** (5.94)	-0.1742 (-0.43)	0.0702 (1.25)	0.1466*** (4.90)	-0.0531 (-0.31)	-0.1823 (-0.71)
Bank Ln(Assets) <sub>t</sub>	0.2462*** (3.77)	7.8911 (1.50)	0.0833 (0.26)	-0.4076*** (-4.56)	-0.7556 (-1.07)	1.4616 (0.63)

VARIABLES	LN LOAN (Total Enterprises)	LN LOAN credit rating (1~2)	LN LOAN credit rating (3~4)	LN LOAN credit rating (5~6)	LN LOAN credit rating (7~8)	LN LOAN credit rating (9~10)
Bank leverage ratio <sub>t</sub>	0.0146*** (2.83)	0.5594 (0.53)	-0.0241 (-0.84)	0.0254*** (4.61)	0.0524 (1.12)	0.1024 (1.24)
Constant <sub>t</sub>	-5.1975*** (-4.17)	-141.9319 (-1.62)	-1.7745 (-0.30)	8.3082*** (4.66)	16.2403 (1.28)	-28.0063 (-0.65)
Time dummy	YES	YES	YES	YES	YES	YES
Hausman Test Statistics	7,068.70	140.68	2,195.31	4,410.03	190.44	73.91
Hausman Test p-value	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
R-squared(within)	0.278	0.134	0.269	0.284	0.217	0.235
Observations	120,773	1,783	30,082	81,882	3,229	3,797
Number of Firm-Bank	54,476	1,204	15,897	40,655	2,488	2,618

Notes: 1) Dependent variable is Ln (Loans) of each bank to each enterprise. The loan amount includes domestic currency loans, foreign currency loans, advances for customers, and acceptances and guarantees outstanding.

2) Fixed effects are used for this panel analysis, and the sample period is 2009 to 2011.

3) Enterprise credit ratings are classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

4) Numbers in parentheses indicate t-statistics. \*, \*\*, and \*\*\* refer to 10%, 5%, and 1% statistical significance, respectively.

Table 5.6. The effects of ACCL eligible loans on bank loans to SMEs

**Panel B: Focusing on business history**

VARIABLES	LN LOAN (Total Enterprises)	LN LOAN business history (0~5)	LN LOAN business history (6~10)	LN LOAN business history (11~15)	LN LOAN business history (16~20)	LN LOAN business history (Over 21)
Ratio of ACCL	0.1934*** (9.35)	0.3280*** (5.12)	0.1761*** (3.42)	0.1114** (2.32)	0.0846 (1.47)	0.2411*** (6.40)
Enterprise credit rating	-0.0577*** (-13.95)	-0.0490*** (-4.34)	-0.0689*** (-8.21)	-0.0542*** (-6.08)	-0.0408*** (-3.47)	-0.0394*** (-3.97)
Weight of bank transaction	1.8774*** (71.57)	1.3708*** (25.07)	1.8058*** (32.86)	2.0023*** (30.81)	2.1792*** (22.62)	2.1653*** (29.66)
Mortgage ratio	0.3203*** (12.22)	0.5932*** (7.66)	0.3101*** (5.63)	0.2975*** (5.15)	0.3160*** (3.88)	0.0772 (1.29)
Loan interest rate	-0.0257*** (-6.73)	-0.0647*** (-6.48)	-0.0338*** (-4.55)	-0.0135 (-1.42)	-0.0262** (-2.17)	0.0105 (1.10)
Business history <sub>t-1</sub>	0.0722*** (3.86)	0.1402*** (4.64)	0.2577 (1.01)	0.6961*** (9.35)	-0.0447 (-0.41)	-0.0152 (-0.36)
Business history <sup>2</sup> <sub>t-1</sub>	-0.0008*** (-6.89)	-0.0167*** (-4.93)	-0.0012 (-0.56)	0.0063*** (2.77)	0.0009 (0.30)	-0.0006** (-1.99)
Enterprise Ln(Assets) <sub>t-1</sub>	0.3554*** (26.35)	0.2645*** (8.60)	0.3067*** (12.12)	0.2973*** (8.72)	0.2502*** (6.01)	0.3696*** (7.01)
Enterprise Profitability <sub>t-1</sub>	-0.0922* (-1.88)	0.2382** (1.96)	-0.3205*** (-3.14)	-0.3408*** (-2.87)	-0.2088 (-1.20)	0.0729 (0.67)
Enterprise leverage ratio <sub>t-1</sub>	-0.0067*** (-4.80)	-0.0032 (-1.08)	-0.0056** (-2.27)	-0.0042 (-1.12)	-0.0017 (-0.29)	-0.0032 (-1.00)
Enterprise coverage ratio <sub>t-1</sub>	0.0012** (2.14)	0.0015 (1.62)	0.0040*** (3.31)	0.0019 (1.32)	-0.0038* (-1.93)	-0.0030** (-2.08)
Ratio of total loans to total assets <sub>t-1</sub>	0.1447***	0.0249	0.1030**	0.0666	0.0444	0.2641***

VARIABLES	LN LOAN (Total Enterprises)	LN LOAN business history (0~5)	LN LOAN business history (6~10)	LN LOAN business history (11~15)	LN LOAN business history (16~20)	LN LOAN business history (Over 21)
		(5.94)	(0.53)	(2.07)	(1.05)	(0.51)
Bank Ln(Assets) <sub>t</sub>	0.2462*** (3.77)	1.0148*** (4.95)	0.1312 (1.00)	0.2292 (1.46)	0.4606** (2.13)	0.3326** (2.13)
Bank leverage ratio <sub>t</sub>	0.0146*** (2.83)	0.0085 (0.54)	0.0281*** (2.67)	0.0129 (1.05)	-0.0129 (-0.79)	0.0174 (1.54)
Constant <sub>t</sub>	-5.1975*** (-4.17)	-17.977*** (-4.74)	-3.481 (-1.13)	-12.226*** (-4.11)	-6.1349 (-1.52)	-5.4199* (-1.71)
Time dummy	YES	YES	YES	YES	YES	YES
Hausman Test Statistics	7,068.70	1,185.66	2,039.62	1,541.71	794.68	1,233.18
Hausman Test p-value	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
R-squared(within)	0.278	0.281	0.267	0.278	0.293	0.277
Observations	120,773	20,225	36,534	27,708	14,959	21,347
Number of Firm-Bank	54,476	11,611	20,560	15,916	8,388	10,135

Notes: 1) Dependent variable is Ln(Loans) of each bank to each enterprise. The loan amount includes domestic currency loans, foreign currency loans, advances for customers, and acceptances and guarantees outstanding.

2) Fixed effects are used for this panel analysis, and the sample period is 2009 to 2011.

3) Enterprise credit ratings are classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

4) Numbers in parentheses indicate t-statistics. \*, \*\*, and \*\*\* refer to 10%, 5%, and 1% statistical significance, respectively.

Table 5.7. The effects of ACCL eligible loans on the interest rate of bank loans to SMEs

**Panel A: Focusing on credit rating**

VARIABLES	INTEREST (Total Enterprises)	INTEREST credit rating (1~2)	INTEREST credit rating (3~4)	INTEREST credit rating (5~6)	INTEREST credit rating (7~8)	INTEREST credit rating (9~10)
Ratio of ACCL	-0.0435* (-1.68)	0.1031 (0.62)	0.0952** (2.04)	-0.1207*** (-3.78)	0.1627 (0.39)	0.2138*** (3.18)
Enterprise credit rating	0.1640*** (23.11)	-0.5464** (-2.28)	0.1481*** (10.51)	0.2768*** (22.71)	0.2164 (1.46)	-0.4658 (-0.53)
Weight of bank transaction	-0.1434*** (-4.53)	0.1599 (0.92)	-0.2276*** (-3.85)	-0.1282*** (-3.18)	0.0243 (0.06)	0.1340 (0.94)
Mortgage ratio	-0.3503*** (-10.60)	-0.3135 (-1.58)	-0.2853*** (-4.68)	-0.3713*** (-8.94)	-0.9652 (-1.31)	-0.1708 (-0.32)
Ln(Loans) <sub>t</sub>	-0.0675*** (-6.66)	-0.0188 (-0.36)	-0.0631*** (-3.52)	-0.0747*** (-5.59)	-0.2126 (-1.18)	0.0279 (1.30)
Business history <sub>t-1</sub>	0.0301 (0.95)	-0.3077 (-1.37)	-0.0444 (-0.86)	0.0310 (0.71)	0.1077 (0.80)	-0.1055 (-0.46)
Business history <sup>2</sup> <sub>t-1</sub>	-0.0011*** (-5.82)	-0.0010 (-0.80)	-0.0008*** (-2.63)	-0.0005** (-2.15)	-0.0034 (-0.97)	-0.0004 (-0.50)
Enterprise Ln(Assets) <sub>t-1</sub>	-0.0537*** (-2.83)	0.0125 (0.07)	-0.1119*** (-3.35)	-0.0206 (-0.88)	0.0998 (0.54)	0.1151 (1.02)
Enterprise Profitability <sub>t-1</sub>	-0.8214*** (-10.01)	-0.0127 (-0.02)	-0.4692*** (-3.35)	-0.7594*** (-7.37)	-1.5868 (-1.45)	0.0176 (0.04)
Enterprise leverage ratio <sub>t-1</sub>	0.0124*** (4.78)	0.0389 (0.51)	-0.0018 (-0.28)	0.0157*** (5.66)	-0.0150 (-0.82)	-0.0201 (-1.21)
Enterprise coverage ratio <sub>t-1</sub>	-0.0011* (-1.66)	0.0010 (0.51)	0.0004 (0.46)	-0.0016 (-1.55)	-0.0155 (-0.51)	-0.0027 (-0.49)
Ratio of total loans to total assets <sub>t-1</sub>	0.3090*** (7.91)	1.0128*** (2.68)	0.5028*** (7.20)	0.2104*** (4.33)	-0.2815 (-0.76)	-0.4662 (-1.42)
Bank Ln(Assets) <sub>t</sub>	-0.9271***	3.0937	1.3053***	-0.3327**	-0.6147	11.5943**

VARIABLES	INTEREST (Total Enterprises)	INTEREST credit rating (1~2)	INTEREST credit rating (3~4)	INTEREST credit rating (5~6)	INTEREST credit rating (7~8)	INTEREST credit rating (9~10)
	(-8.65)	(1.63)	(3.58)	(-2.00)	(-0.33)	(2.03)
Bank leverage ratio	-0.0443***	0.1139	-0.0616**	-0.0403***	-0.1913*	0.1547
	(-4.92)	(0.25)	(-2.05)	(-4.20)	(-1.74)	(0.92)
Constant $\tau$	24.4741***	-48.1602*	-16.0175**	12.0308***	19.1824	-214.778**
	(11.95)	(-1.67)	(-2.34)	(3.77)	(0.57)	(-1.99)
Time dummy	YES	YES	YES	YES	YES	YES
Hausman Test Statistics	1786.01	32.29	495.86	953.95	45.97	86.71
Hausman Test p-value	[0.0000]	[0.0059]	[0.0000]	[0.0000]	[0.0001]	[0.0000]
R-squared(within)	0.094	0.110	0.069	0.107	0.117	0.379
Observations	120,773	1,783	30,082	81,882	3,229	3,797
Number of Firm-Bank	54,476	1,204	15,897	40,655	2,488	2,618

Notes: 1) Dependent variable is loan interest rates of banks to specific enterprise. Loan interest rate means weighted average interest calculated as {[Loan amount per account of the borrower × Loan interest rate per account] / Total loan amount of the borrower}.

2) Fixed effects are used for this panel analysis, and the sample period is 2009 to 2011.

3) Enterprise credit rating is classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

4) Numbers in parentheses indicate t-statistics. \*, \*\*, and \*\*\* refer to 10%, 5%, and 1% statistical significance, respectively.

Table 5.7. The effects of ACCL eligible loan on the interest rate of bank loans to SMEs

**Panel B: Focusing on business history**

VARIABLES	INTEREST (Total Enterprises)	INTEREST business history (0~5)	INTEREST business history (6~10)	INTEREST business history (11~15)	INTEREST business history (16~20)	INTEREST business history (Over 21)
Ratio of ACCL <sub>t</sub>	-0.0435* (-1.68)	-0.0985 (-1.17)	-0.0679 (-1.12)	-0.1061* (-1.91)	-0.0891 (-1.14)	0.0159 (0.31)
Enterprise credit rating <sub>t</sub>	0.1640*** (23.11)	0.1771*** (10.02)	0.1625*** (12.15)	0.1777*** (9.79)	0.1443*** (6.37)	0.1171*** (6.61)
Weight of bank transaction <sub>t</sub>	-0.1434*** (-4.53)	-0.1501* (-1.96)	-0.0763 (-1.20)	-0.0537 (-0.68)	-0.0693 (-0.73)	-0.2619*** (-3.36)
Mortgage ratio <sub>t</sub>	-0.3503*** (-10.60)	-0.3624*** (-3.67)	-0.3330*** (-4.51)	-0.3206*** (-4.22)	-0.2227** (-2.16)	-0.4042*** (-6.20)
Ln(Loans) <sub>t</sub>	-0.0675*** (-6.66)	-0.1725*** (-6.18)	-0.0941*** (-4.53)	-0.0346 (-1.42)	-0.0647** (-2.15)	0.0242 (1.10)
Business history <sub>t-1</sub>	0.0301 (0.95)	0.1287*** (2.64)	-0.6066** (-1.96)	-1.3632*** (-11.68)	0.2324 (1.30)	0.0224 (0.31)
Business history <sup>2</sup> <sub>t-1</sub>	-0.0011*** (-5.82)	-0.0037 (-0.63)	-0.0029 (-0.81)	0.0030 (0.83)	-0.0021 (-0.42)	-0.0003 (-0.59)
Enterprise Ln(Assets) <sub>t-1</sub>	-0.0537*** (-2.83)	-0.0131 (-0.33)	-0.0587 (-1.47)	-0.0936* (-1.85)	0.0088 (0.14)	0.0238 (0.35)
Enterprise Profitability <sub>t-1</sub>	-0.8214*** (-10.01)	-0.0393 (-0.22)	-0.9298*** (-5.01)	-1.0578*** (-4.98)	-0.7198*** (-2.76)	-0.9868*** (-5.15)
Enterprise leverage ratio <sub>t-1</sub>	0.0124*** (4.78)	0.0146*** (3.42)	0.0059 (0.99)	0.0108 (1.52)	-0.0024 (-0.23)	0.0256*** (3.29)
Enterprise coverage ratio <sub>t-1</sub>	-0.0011* (-1.66)	-0.0005 (-0.40)	-0.0005 (-0.31)	-0.0010 (-0.58)	-0.0058*** (-2.72)	0.0008 (0.58)
Ratio of total loans to total assets <sub>t-1</sub>	0.3090*** (7.91)	0.2027*** (2.58)	0.2200*** (2.73)	0.3687*** (3.78)	0.3450** (2.29)	0.4355*** (3.91)
Bank Ln(Assets) <sub>t</sub>	-0.9271*** (-8.65)	0.8014** (2.48)	-0.8666*** (-3.86)	-0.9475*** (-3.79)	-1.4807*** (-4.62)	-1.1980*** (-4.96)
Bank leverage ratio <sub>t</sub>	-0.0443*** (-4.92)	-0.0459* (-1.70)	-0.0530*** (-2.68)	-0.0633*** (-3.06)	-0.0398 (-1.48)	-0.0549*** (-2.95)
Constant <sub>t</sub>	24.4741*** (11.95)	-8.7665 (-1.46)	28.3819*** (5.94)	40.8063*** (8.72)	30.8863*** (5.21)	27.5937*** (5.60)
Time dummy	YES	YES	YES	YES	YES	YES
Hausman Test Statistics	1786.01	179.15	465.01	454.13	284.54	484.66
Hausman Test p-value	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
R-squared(within)	0.094	0.101	0.093	0.116	0.084	0.102
Observations	120,773	20,225	36,534	27,708	14,959	21,347
Number of Firm-Bank	54,476	11,611	20,560	15,916	8,388	10,135

Notes: 1) Dependent variable is loan interest rates of banks to specific enterprise. Loan interest rate means weighted average interest calculated as {[Loan amount per account of the borrower × Loan interest rate per account] / Total loan amount of the borrower}.

2) Fixed effects are used for this panel analysis, and the sample period is 2009 to 2011.

3) Enterprise credit rating is classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

4) Numbers in parentheses indicate t-statistics. \*, \*\*, and \*\*\* refer to 10%, 5%, and 1% statistical significance, respectively.

Table 5.8. Transition matrix between ACCL eligible and ineligible enterprises

**Panel A: Transition matrix between ACCL eligible and ineligible enterprises by bank**

	ACCL ineligible enterprises $t$	ACCL eligible enterprises $t$
ACCL ineligible enterprises $t-1$	56.95%	9.24%
ACCL eligible enterprises $t-1$	8.74%	25.06%

Notes: This table shows a transition matrix between ACCL eligible enterprises and ineligible enterprises. According to the results, 25.06% of the enterprises which were eligible for the system at the end of the previous year maintained their eligibility at the end of the year under review, while 9.24% became eligible from ineligible for the ACCL during the year.

**Panel B: Transition matrix between an increase in the ratio of the ACCL eligible loans and decrease of those by banks**

	Decrease of ACCL ratio $t$	Increase of ACCL ratio $t$
Decrease of ACCL ratio $t-1$	54.83%	9.43%
Increase of ACCL ratio $t-1$	6.86%	28.87%

Notes : This table describes a transition matrix between an increase in the ratio of the ACCL eligible loans and a decrease in the ratio. Upon analysis, 54.83% of the enterprises that suffered a decrease in the ratio at the end of the previous year had another year of decrease, while 9.34% experienced a switch to an increase during the year under review.

Table 5.9. The effects of new eligibility or an increase in the ratio of ACCL on bank loans and interest rates to SMEs

VARIABLES	LN LOAN	LN LOAN	LN LOAN	INTEREST	INTEREST	INTEREST
	(Total Enterprises)					
New eligibility for ACCL <sub>t</sub>	0.0495*** (5.55)		0.0505*** (5.57)	-0.0704*** (-5.48)		-0.0718*** (-5.50)
Increase in ACCL ratio <sub>t</sub>		-0.0011 (-0.17)	0.0065 (0.99)		0.0015 (0.15)	-0.0093 (-0.88)
Enterprise credit rating <sub>t</sub>	-0.0463*** (-8.34)	-0.0465*** (-8.38)	-0.0463*** (-8.34)	0.1585*** (19.00)	0.1590*** (19.02)	0.1586*** (19.00)
Weight of bank transaction <sub>t</sub>	1.8575*** (50.41)	1.8592*** (50.44)	1.8576*** (50.41)	-0.1329*** (-3.13)	-0.1321*** (-3.12)	-0.1331*** (-3.14)
Mortgage ratio <sub>t</sub>	0.2911*** (7.83)	0.2881*** (7.74)	0.2914*** (7.84)	-0.3778*** (-8.47)	-0.3734*** (-8.37)	-0.3781*** (-8.47)
Loan interest rate <sub>t</sub>	-0.0350*** (-6.14)	-0.0358*** (-6.28)	-0.0350*** (-6.14)			
Ln(Loans) <sub>t</sub>				-0.0849*** (-6.08)	-0.0868*** (-6.22)	-0.0849*** (-6.08)
Business history <sub>t-1</sub>	0.1007*** (3.87)	0.1011*** (3.89)	0.1007*** (3.87)	0.0202 (0.59)	0.0198 (0.58)	0.0202 (0.59)
Business history <sup>2</sup> <sub>t-1</sub>	-0.0010*** (-5.41)	-0.0010*** (-5.42)	-0.0010*** (-5.41)	-0.0013*** (-5.06)	-0.0013*** (-5.06)	-0.0013*** (-5.06)
Enterprise Ln(Assets) <sub>t-1</sub>	0.2547*** (9.75)	0.2520*** (9.63)	0.2548*** (9.75)	-0.0405 (-1.37)	-0.0363 (-1.23)	-0.0408 (-1.38)
Enterprise Profitability <sub>t-1</sub>	-0.1607** (-2.37)	-0.1609** (-2.38)	-0.1611** (-2.38)	-0.6003*** (-5.34)	-0.6009*** (-5.34)	-0.5997*** (-5.33)
Enterprise leverage ratio <sub>t-1</sub>	-0.0082*** (-3.62)	-0.0081*** (-3.57)	-0.0082*** (-3.63)	0.0085** (2.12)	0.0084** (2.08)	0.0086** (2.13)
Enterprise coverage ratio <sub>t-1</sub>	0.0002 (0.27)	0.0002 (0.30)	0.0002 (0.27)	-0.0015* (-1.70)	-0.0016* (-1.72)	-0.0015* (-1.70)

VARIABLES	LN LOAN	LN LOAN	LN LOAN	INTEREST	INTEREST	INTEREST
	(Total Enterprises)	(Total Enterprises)	(Total Enterprises)	(Total Enterprises)	(Total Enterprises)	(Total Enterprises)
Ratio of total loans to total assets <sub>t-1</sub>	-0.1101*** (-3.29)	-0.1174*** (-3.50)	-0.1102*** (-3.29)	0.2583*** (4.84)	0.2688*** (5.03)	0.2584*** (4.84)
Bank Ln(Assets) <sub>t</sub>	0.2529 (1.42)	0.2760 (1.55)	0.2483 (1.40)	-4.0970*** (-15.05)	-4.1335*** (-15.19)	-4.0903*** (-15.01)
Bank leverage ratio <sub>t</sub>	0.0059 (0.52)	0.0044 (0.39)	0.0062 (0.55)	0.0720*** (4.17)	0.0741*** (4.29)	0.0715*** (4.14)
Constant <sub>t</sub>	-3.9115 (-1.17)	-4.2884 (-1.28)	-3.8279 (-1.14)	83.9664*** (16.49)	84.5827*** (16.62)	83.8465*** (16.46)
Time dummy	YES	YES	YES	YES	YES	YES
Hausman Test Statistics	5,135.28	5,957.82	6,034.69	1,409.59	1,455.22	1,464.26
Hausman Test p-value	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
R-squared(within)	0.266	0.265	0.266	0.172	0.171	0.172
Observations	82,032	82,032	82,032	82,032	82,032	82,032
Number of Firm-Bank	49,539	49,539	49,539	49,539	49,539	49,539

Note. 1) Dependent variables are Ln (Loans) and interest rate of each bank to each enterprise. The loan amount includes domestic currency loan, foreign currency loan, advances for customers, and acceptances and guarantees outstanding. Loan interest rate means weighted average interest calculated as {[Loan amount per account of the borrower × Loan interest rate per account] / Total loan amount of the borrower}.

2) Fixed effects are used for this panel analysis, and the sample period is 2009 to 2011.

3) Enterprise credit rating is classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

4) Numbers in parentheses indicate t-statistics. \*, \*\*, and \*\*\* refer to 10%, 5%, and 1% statistical significance, respectively.

Table 5.10. The effects of new eligibility or an increase in the ratio of ACCL on an increase or decrease in transacting banks

VARIABLES	Increase/Decrease of transacting banks	Increase/Decrease of transacting banks	Increase/Decrease of transacting banks
New eligibility for ACCL <sub>t</sub>	0.1935*** (11.65)		0.1964*** (11.66)
Increase in ACCL ratio <sub>t</sub>		-0.0116 (-0.72)	0.0168 (1.03)
Enterprise credit rating <sub>t</sub>	0.0391*** (4.04)	0.0395*** (4.06)	0.0390*** (4.03)
Weight of bank transaction <sub>t</sub>	-2.7632*** (-41.29)	-2.8025*** (-41.70)	-2.7616*** (-41.29)
Mortgage ratio <sub>t</sub>	-0.8783*** (-17.38)	-0.9087*** (-17.79)	-0.8765*** (-17.36)
Ln(Loans) <sub>t</sub>	0.3492*** (24.64)	0.3657*** (25.64)	0.3488*** (24.60)
Loan interest rate <sub>t</sub>	-0.0064 (-0.71)	-0.0100 (-1.11)	-0.0064 (-0.71)
Business history <sub>t-1</sub>	-0.0117 (-0.56)	-0.0084 (-0.40)	-0.0121 (-0.58)
Business history <sup>2</sup> <sub>t-1</sub>	0.0006 (1.15)	0.0006 (1.17)	0.0006 (1.16)
Enterprise Ln(Assets) <sub>t-1</sub>	-0.3118*** (-8.64)	-0.3230*** (-8.91)	-0.3124*** (-8.66)
Enterprise Profitability <sub>t-1</sub>	0.7034*** (4.55)	0.7138*** (4.58)	0.7039*** (4.55)
Enterprise leverage ratio <sub>t-1</sub>	0.0090* (1.69)	0.0088 (1.62)	0.0090* (1.69)
Enterprise coverage ratio <sub>t-1</sub>	0.0017 (1.44)	0.0019 (1.56)	0.0017 (1.44)
Ratio of total loans to total assets <sub>t-1</sub>	-0.3896***	-0.4259***	-0.3917***

VARIABLES	Increase/Decrease of transacting banks	Increase/Decrease of transacting banks	Increase/Decrease of transacting banks
	(-5.28)	(-5.74)	(-5.31)
Bank Ln(Assets) <sub>t</sub>	-0.1462*	-0.1384*	-0.1462*
	(-1.83)	(-1.73)	(-1.83)
Bank leverage ratio <sub>t</sub>	0.0322*	0.0320	0.0321*
	(1.66)	(1.64)	(1.65)
Constant <sub>t</sub>	7.1789***	7.1349***	7.1951***
	(4.80)	(4.77)	(4.82)
Time dummy	YES	YES	YES
Hausman Test Statistics	3,236.50	3,353.22	3,237.53
Hausman Test p-value	[0.0000]	[0.0000]	[0.0000]
R-squared(within)	0.224	0.217	0.224
Observations	39,392	39,392	39,392
Number of Firm	21,712	21,712	21,712

Notes: 1) Dependent variable is an increase or decrease in transacting banks compared to the end of the previous year.

2) Fixed effects are used for this panel analysis, and the sample period is 2009 to 2011.

3) Enterprise credit rating is classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

4) Numbers in parentheses indicate t-statistics. \*, \*\*, and \*\*\* refer to 10%, 5%, and 1% statistical significance, respectively.

Table 5.11. The effects of ACCL eligible loan on bank loans to SMEs:  
Bank loans excluding the BOK's support from the total loan amount

**Panel A: Focusing on credit rating**

VARIABLES	LN LOAN (Total Enterprises)	LN LOAN credit rating (1~2)	LN LOAN credit rating (3~4)	LN LOAN credit rating (5~6)	LN LOAN credit rating (7~8)	LN LOAN credit rating (9~10)
Ratio of ACCL	0.0715*** (3.47)	-0.1054 (-0.55)	0.1283*** (3.16)	0.0562** (2.21)	0.0029 (0.01)	-0.1493 (-1.24)
Enterprise credit rating	-0.0572*** (-13.85)	0.2377 (1.08)	0.0013 (0.12)	-0.0562*** (-7.88)	0.0402 (0.99)	-0.0056 (-0.07)
Weight of bank transaction	1.8737*** (71.57)	1.3874*** (5.65)	1.7488*** (31.69)	1.8821*** (57.22)	1.3260*** (5.89)	3.1709*** (8.48)
Mortgage ratio	0.3150*** (12.04)	-0.1301 (-0.48)	0.2079*** (3.64)	0.3396*** (10.88)	0.9806** (2.24)	-0.6150* (-1.70)
Loan interest rate	-0.0253*** (-6.62)	-0.0240 (-0.34)	-0.0341*** (-3.37)	-0.0262*** (-5.64)	-0.0339 (-1.11)	0.0452 (1.28)
Business history <sub>t-1</sub>	0.0715*** (3.83)	-0.7106 (-1.34)	0.0650** (2.07)	0.0281 (0.60)	0.0194 (0.34)	0.0247 (0.24)
Business history <sup>2</sup> <sub>t-1</sub>	-0.0008*** (-6.68)	0.0003 (0.22)	-0.0008*** (-3.12)	-0.0009*** (-6.60)	-0.0020 (-1.38)	-0.0003 (-0.25)
Enterprise Ln(Assets) <sub>t-1</sub>	0.3552*** (26.32)	0.3908* (1.69)	0.3613*** (11.79)	0.3212*** (18.93)	0.1772** (2.26)	0.1774 (1.27)
Enterprise Profitability <sub>t-1</sub>	-0.0925* (-1.88)	-0.3075 (-0.44)	-0.2406** (-2.06)	-0.0054 (-0.09)	0.2396 (0.73)	-0.7103 (-1.50)
Enterprise leverage ratio <sub>t-1</sub>	-0.0066*** (-4.71)	-0.0882 (-0.90)	-0.0112* (-1.80)	-0.0064*** (-4.14)	0.0125 (0.87)	-0.0010 (-0.07)
Enterprise coverage ratio <sub>t-1</sub>	0.0012** (2.12)	-0.0003 (-0.10)	0.0013 (1.33)	0.0014* (1.72)	0.0020 (0.43)	0.0047 (0.47)
Ratio of total loans to total assets <sub>t-1</sub>	0.1419***	-0.1923	0.0637	0.1446***	-0.0468	-0.1865

VARIABLES	LN LOAN (Total Enterprises)	LN LOAN credit rating (1~2)	LN LOAN credit rating (3~4)	LN LOAN credit rating (5~6)	LN LOAN credit rating (7~8)	LN LOAN credit rating (9~10)
	(5.83)	(-0.48)	(1.14)	(4.83)	(-0.27)	(-0.73)
Bank Ln(Assets) <sub>t</sub>	0.2401***	7.7092	0.0869	-0.4022***	-0.7592	1.4941
	(3.68)	(1.46)	(0.28)	(-4.50)	(-1.08)	(0.64)
Bank leverage ratio	0.0159***	0.5828	-0.0200	0.0263***	0.0526	0.1007
	(3.09)	(0.56)	(-0.70)	(4.76)	(1.13)	(1.22)
Constant <sub>t</sub>	-5.0918***	-139.0937	-1.8747	8.2008***	16.3173	-28.6669
	(-4.09)	(-1.58)	(-0.32)	(4.61)	(1.29)	(-0.66)
Time dummy	YES	YES	YES	YES	YES	YES
Hausman Test Statistics	7,061.84	141.14	2,194.38	4,402.78	189.60	73.24
Hausman Test p-value	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
R-squared(within)	0.276	0.134	0.265	0.282	0.214	0.236
Observations	120,773	1,783	30,082	81,882	3,229	3,797
Number of Firm-Bank	54,476	1,204	15,897	40,655	2,488	2,618

Notes: 1) Dependent variables is Ln (Loans) of each bank to each enterprise. However, the loan amount is calculated excluding the BOK's support from the total loan amount. The loan amount excluding the BOK's support is calculated as {[Total loans – (ACCL eligible loan x BOK's support ratio)]}. The loan amount includes domestic currency loans, foreign currency loans, advances for customers, and acceptances and guarantees outstanding.

2) Fixed effects are used for this panel analysis, and the sample period is 2009 to 2011.

3) Enterprise credit rating is classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

4) Numbers in parentheses indicate t-statistics. \*, \*\*, and \*\*\* refer to 10%, 5%, and 1% statistical significance, respectively.

Table 5.11. The effects of ACCL eligible loan on bank loans to SMEs:  
Bank loans excluding the BOK's support from the total loan amount

**Panel B: Focusing on business history**

VARIABLES	LN LOAN	LN LOAN	LN LOAN	LN LOAN	LN LOAN	LN LOAN
	(Total Enterprises)	business history (0~5)	business history (6~10)	business history (11~15)	business history (16~20)	business history (Over 21)
Ratio of ACCL <sub>t</sub>	0.0715*** (3.47)	0.2012*** (3.15)	0.0496 (0.97)	-0.0149 (-0.31)	-0.0388 (-0.68)	0.1341*** (3.56)
Enterprise credit rating <sub>t</sub>	-0.0572*** (-13.85)	-0.0480*** (-4.25)	-0.0683*** (-8.15)	-0.0538*** (-6.06)	-0.0407*** (-3.45)	-0.0392*** (-3.97)
Weight of bank transaction <sub>t</sub>	1.8737*** (71.57)	1.3696*** (25.10)	1.8024*** (32.86)	1.9971*** (30.84)	2.1741*** (22.61)	2.1604*** (29.61)
Mortgage ratio	0.3150*** (12.04)	0.5850*** (7.58)	0.3035*** (5.52)	0.2920*** (5.06)	0.3139*** (3.87)	0.0738 (1.23)
Loan interest rate	-0.0253*** (-6.62)	-0.0644*** (-6.46)	-0.0339*** (-4.56)	-0.0131 (-1.39)	-0.0256** (-2.12)	0.0119 (1.24)
Business history <sub>t-1</sub>	0.0715*** (3.83)	0.1419*** (4.70)	0.2583 (1.01)	0.6994*** (9.40)	-0.0400 (-0.37)	-0.0136 (-0.33)
Business history <sup>2</sup> <sub>t-1</sub>	-0.0008*** (-6.68)	-0.0166*** (-4.91)	-0.0011 (-0.52)	0.0063*** (2.77)	0.0009 (0.28)	-0.0006** (-2.00)
Enterprise Ln(Assets) <sub>t-1</sub>	0.3552*** (26.32)	0.2650*** (8.62)	0.3068*** (12.11)	0.2975*** (8.73)	0.2513*** (6.04)	0.3693*** (6.99)
Enterprise Profitability <sub>t-1</sub>	-0.0925* (-1.88)	0.2381** (1.96)	-0.3239*** (-3.18)	-0.3392*** (-2.86)	-0.2117 (-1.22)	0.0722 (0.66)
Enterprise leverage ratio <sub>t-1</sub>	-0.0066*** (-4.71)	-0.0032 (-1.07)	-0.0054** (-2.19)	-0.0041 (-1.09)	-0.0016 (-0.28)	-0.0029 (-0.91)
Enterprise coverage ratio <sub>t-1</sub>	0.0012** (2.12)	0.0016 (1.63)	0.0040*** (3.32)	0.0019 (1.30)	-0.0038* (-1.95)	-0.0031** (-2.10)
Ratio of total loans to total assets <sub>t-1</sub>	0.1419***	0.0220	0.0993**	0.0677	0.0393	0.2604***

	(5.83)	(0.47)	(2.00)	(1.07)	(0.45)	(3.54)
Bank Ln(Assets) <sub>i</sub>	0.2401***	1.0094***	0.1243	0.2176	0.4558**	0.3368**
	(3.68)	(4.93)	(0.94)	(1.38)	(2.11)	(2.16)
Bank leverage ratio	0.0159***	0.0096	0.0295***	0.0140	-0.0119	0.0189*
	(3.09)	(0.61)	(2.80)	(1.14)	(-0.73)	(1.68)
Constant <sub>t</sub>	-5.0918***	-17.902***	-3.3718	-12.056***	-6.1335	-5.5564*
	(-4.09)	(-4.72)	(-1.10)	(-4.06)	(-1.52)	(-1.76)
Time dummy	YES	YES	YES	YES	YES	YES
Hausman Test Statistics	7,061.84	1,184.19	2,032.82	1,535.91	792.51	1,234.30
Hausman Test p-value	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
R-squared(within)	0.276	0.278	0.265	0.276	0.292	0.274
Observations	120,773	20,225	36,534	27,708	14,959	21,347
Number of Firm-Bank	54,476	11,611	20,560	15,916	8,388	10,135

Notes: 1) Dependent variable is Ln (Loans) of each bank to each enterprise. However, the loan amount is calculated excluding the BOK's support from the total loan amount. The loan amount excluding the BOK's support is calculated as {[Total loans – (ACCL eligible loan x BOK's support ratio)]}. The loan amount includes domestic currency loans, foreign currency loans, advances for customers, and acceptances and guarantees outstanding.

2) Fixed effects are used for this panel analysis, and the sample period is 2009 to 2011.

3) Enterprise credit rating is classified from Grade 1 to Grade 10, and Grade 1 is the highest grade.

4) Numbers in parentheses indicate t-statistics. \*, \*\*, and \*\*\* refer to 10%, 5%, and 1% statistical significance, respectively.

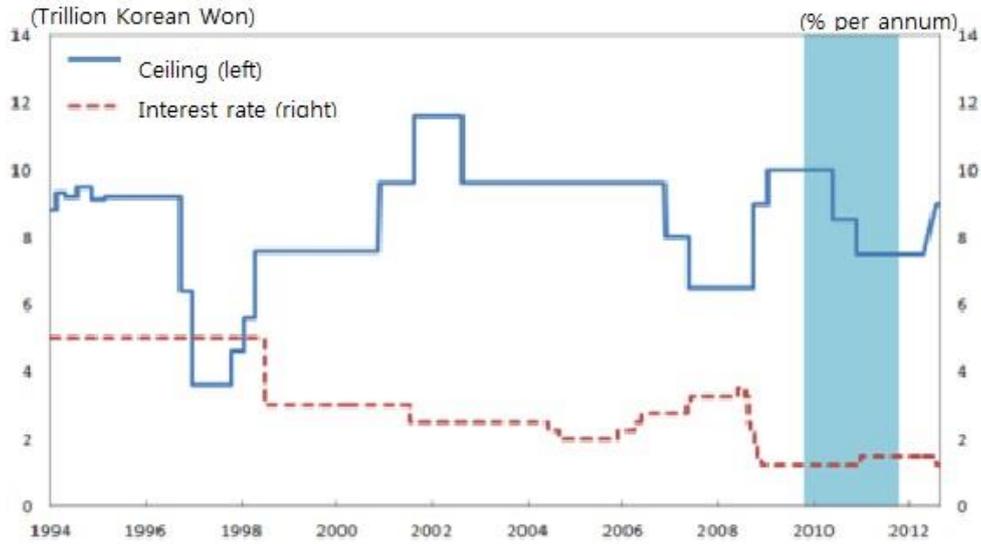


Figure 5.1. Changes in Aggregate Credit Ceiling and its interest rate  
 Note: Shaded part is the period used for the analysis. Source: The Bank of Korea

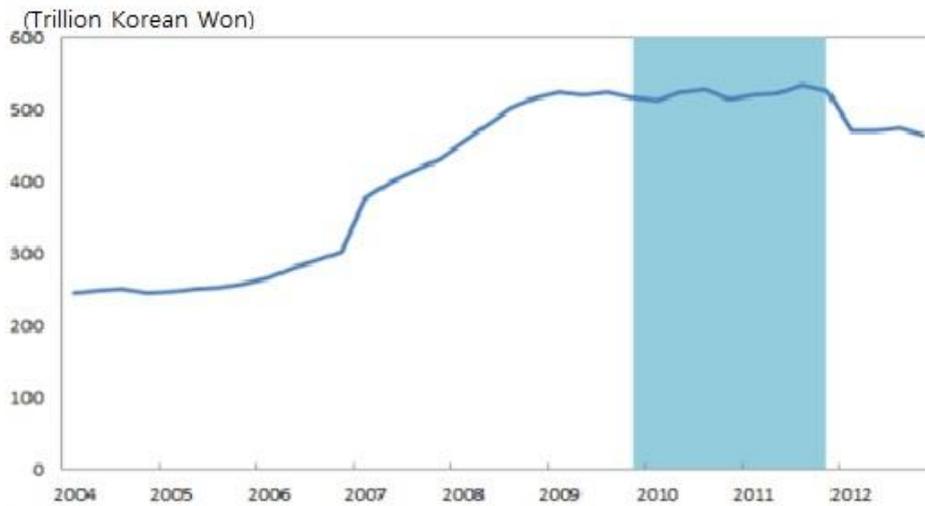


Figure 5.2. Trend of bank loans to SMEs  
 Note: Shaded part is the period used for the analysis. Source: Financial Supervisory Service, Korea

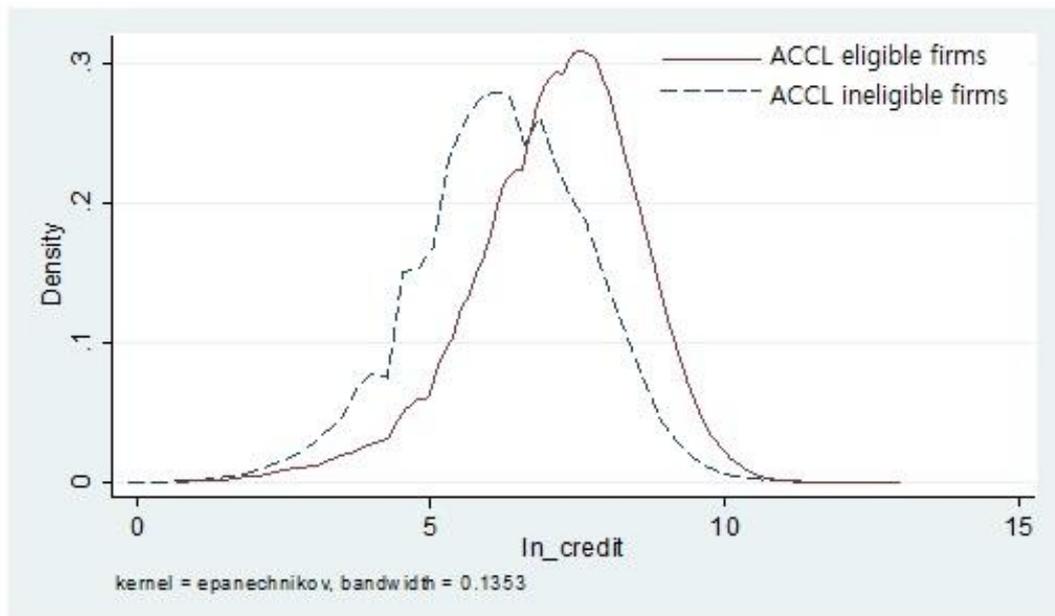


Figure 5.3. Bank loan distribution of SMEs

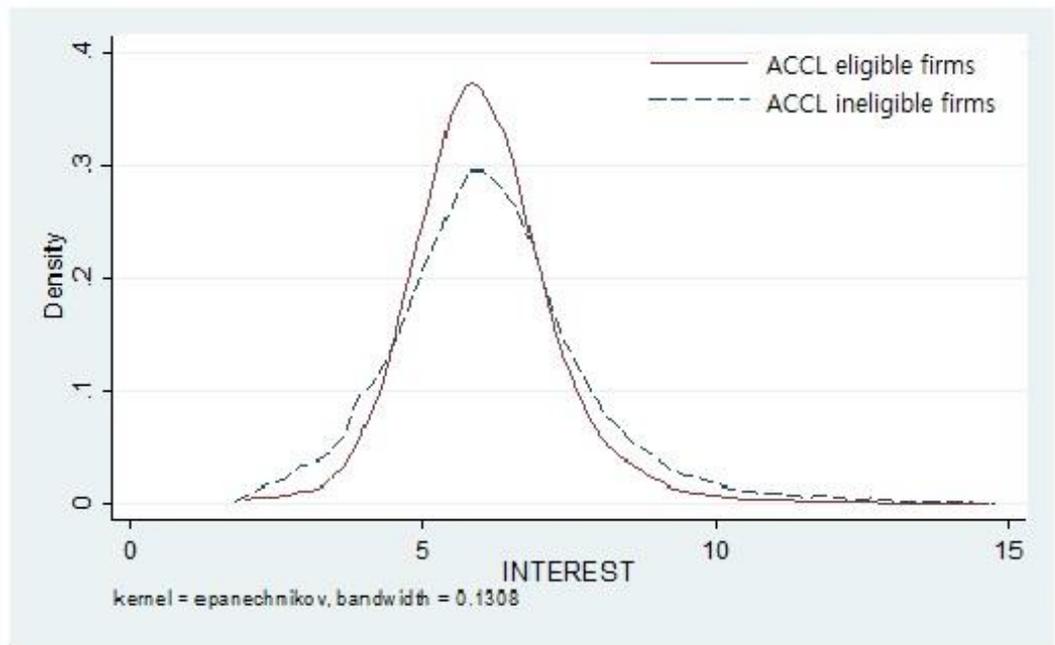


Figure 5.4. Interest rate distribution of bank loans to SMEs

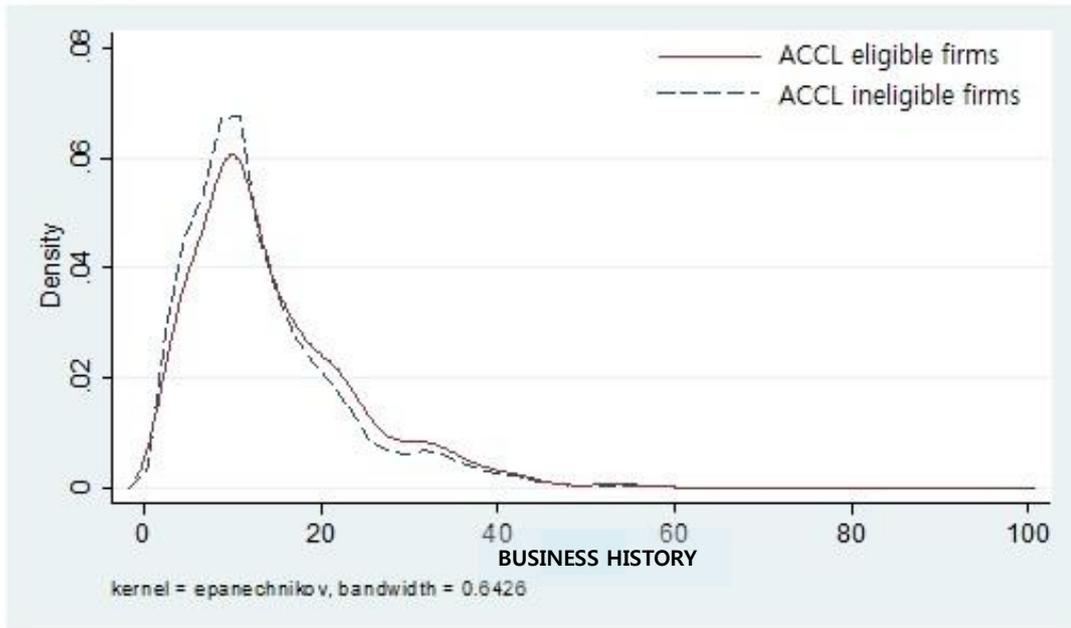


Figure 5.5. Business history distribution of SMEs

## Chapter 6. Conclusions

The thesis examined different aspects of monetary policy transmission mechanism of Korea focusing on bank lending channel, exchange rate balance sheet channel together with the effectiveness of a primary tool of a credit policy. The thesis examined four distinct topics with a common theme of monetary policy transmission mechanism.

The empirical results of the first essay, chapter 2, show that smaller, less collateralised, riskier firms are more dependent on short-term bank finance. Especially after the currency crisis period, banks have more concerns about firms' profitability and the level of debt in their lending practices, and firms with higher profits or lower leverage have easier access to short-term bank borrowing. When examining the impact of tight monetary policy on firms' external finance, firm size, profitability, and indebtedness have significant role in bank lending channel during the post-crisis period. The results were drawn using not only large listed firms but also unlisted small and medium firms. By using comprehensive data covering whole external audited firms, the estimation results of this essay reflect small firms' behaviour more closely in capital structure choices. However, the dataset contains only surviving firms which are those that exist as of the date when we obtain data after its entry into markets. Therefore, this research limits its analysis to only surviving firms because data on liquidated firms is not available from the database. However, the liquidation rate of statutory audited firms in Korea is only around two to three per cent in the sample period. Therefore, it is probable that the effect of inclusion of liquidated firms may not make a significant difference from the estimation results using surviving firms. For future research, it is needed to use panel data methods controlling for cross-sectional dependence and also to consider Markov regime switching models instead of interaction dummies. It is also worthwhile to consider the ratio of long-term debt to total debt as an alternative dependent variable.

The findings of the second essay, chapter 3, helped uncover the elusive real exchange rate balance sheet effect on firms' investment by using firm-level data which include information about foreign currency denominated debt and firms; export sales. A dynamic panel data framework is used to explain the effects of the

interaction between foreign currency denominated borrowing and real exchange rate depreciation on firms' investments. The findings are summarized as follows. Firstly, a contractionary balance sheet effect mostly occurs in the presence of large real exchange rate depreciation. Secondly, real exchange rate depreciations lead to lower investments for the firms with high foreign currency borrowing and low exports which are highly vulnerable to exchange rate shock. Thirdly, the firms with a low short-term foreign currency borrowing ratio tend to increase investment even when there is real exchange rate depreciation, while firms with an extremely high short-term foreign currency borrowing ratio experience no significant effects. To clarify the elusive real exchange rate balance sheet effect, three major dummy variables are introduced considering the magnitude of depreciation, the ratio between foreign currency denominated borrowing vs. export sales, and short-term foreign currency denominated borrowing ratio. However, it is also worthwhile to estimate models using continuous variables instead of dummy variables.

In the third essay, chapter 4, using bank-level panel data of the banking system in Korea, we present consistent evidence on the buffering impact of the foreign banks, especially foreign bank branches including U.S. bank branches, on the effectiveness of the monetary policy transmission mechanism in Korea from the bank-lending channel perspective during the global financial crisis of 2008-2009. That's our main contribution of this essay. One of the underlying reasons for the buffering effect by foreign bank branches including U.S. bank branches is the existence of internal capital markets operated by multinational banks to overcome capital market frictions faced when the foreign banks finance their loans. Our findings suggest an important policy implication for policy-makers as well as banking regulators in Korea that, when the Bank of Korea conducts monetary policies - expansionary or contractionary - during crisis periods to bail them out from the credit crunch and spillover effects of financial shocks from abroad, it must take into account the buffering or hampering effects of foreign banks on the effectiveness of the monetary policy transmission mechanism.

The fourth essay, chapter 5, presents the results that the Aggregate Credit Ceiling System (ACCS) helps increase bank loans to SMEs and decrease lending rates. Especially, ACCS is quite helpful to increase funding availability of SMEs. These

effects are particularly prominent for enterprises with medium-credit scores, start-ups, and enterprises newly eligible for the ACCS. This essay empirically analyses availability of credit for SMEs based on bank-firm level data, with a particular focus on the BOK's credit policy. We set up a novel data set for analyzing the impact of credit policy on bank loans. The data set used in this analysis connects four databases containing yearly information on balance sheet items for banks and small and medium sized enterprises, and also information showing loan relationship between banks and SMEs. We set up bank-firm level data using these four databases to analyze the impact of credit policy on bank loans to SMEs focusing on the Aggregate Credit Ceiling System which is one of primary tools of BOK's credit policy. As far as we know, these kind of bank-firm level data were firstly used for analyzing the impact of credit policy of a central bank, the BOK, on bank loans to SMEs. We limit our analysis only for the three year period from 2009 to 2011 because there was limitation to collect seven major banks' loan data to each enterprise much longer. If we can extend the time period of our data set, we can analyse the business performance of ACCL-eligible SMEs to check whether there are moral hazard in the lending scheme, and also introduce other estimation methods for our analysis such as dynamic panel estimation. The findings of this essay can serve as a useful reference for implementing credit policy, which is being increasingly adopted by central banks since the global financial crisis, and the analysis of this essay can also provide some criteria for improving credit policy to the policy authorities.

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