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Was the Credit Channel a Key Monetary Transmission Mechanism following the Recent Financial Crisis in the Republic of Korea?

Hyun E. Kim

A marked decline in bank lending after the recent financial crisis in the Republic of Korea amplified the real effects of the tightened monetary policy implemented in response to the crisis A substantial excess demand for bank loans in the wake of the crisis was caused essentially by a capital-induced bank credit crunch rather than by a weak demand for loans This finding reveals compelling evidence of the importance of the credit channel after the crisis

Summary findings

Kim investigates whether the credit channel is a key monetary transmission mechanism in the Republic of Korea, especially after its recent financial crisis.

To identify the existence of a distinctive credit channel (especially the bank lending channel), he applies two empirical tests to both aggregate financial data and disaggregated bank balance sheet data.

As a more definitive analysis of the role of the credit channel, he estimates a disequilibrium model of the bank loan market, specifying separate loan demand and supply equations to characterize the credit crunch and identify its intensity in the wake of the crisis.

He finds convincing evidence of the importance of the credit channel in the aftermath of the crisis. Bank lending plays a significant independent role in amplifying the real effects of the tightened monetary policy implemented in response to the crisis.

There is strong evidence to suggest a substantial excess demand for bank loans following the crisis. This excess demand was caused by a sharp decline in loan supply largely attributable to pervasive and stringent bank capital regulation (a capital-induced bank credit crunch), rather than by weak demand for loans.

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I. Introduction

Since the early 1997, there has been a gradual process of fragile credit market conditions in Korea such as an exposure of the banking sector to large non-performing loans driven predominantly by a wave of major corporate bankruptcies. As the financial crisis unfolded in the early December of 1997, the Bank of Korea evidently maintained the stance of monetary tightening according to the IMF rescue package by allowing a substantial rise in interest rates. The resulting severe liquidity shortage in the money markets and an observed sharp fall in bank lending primarily due to banks' desperate needs to meet BIS capital/asset ratio were immediately followed by a massive credit squeeze. Some skeptics argued that the sharp reduction in bank loans was essentially associated with nothing more than the typical weak loan demand in a recession. However, the sharp decline in bank lending has evoked claims by many observers of a credit crunch in the banking sector and raised great concern about its implications for the availability of credit to the private sector and the real economic activities. Actually, there was a serious risk that financial distress in both banking and corporate sectors would lead to a significant and prolonged economic decline in Korea.

This anecdotal evidence appears to lend strong credence to the possible existence of a credit channel in the monetary transmission mechanism. In particular, the episode of severe monetary restriction and the alleged credit crunch in the banking sector in the aftermath of the crisis, which deem rather unusual from a historical perspective, motivate us to identify whether the credit channel played a distinctive role in transmitting the monetary/financial shocks to real economic activity. As we will fill in some detail below, the credit channel in monetary transmission, which is operative through the bank lending channel, the balance sheet channel or both, may be characterized as having a role of amplifying and propagating the direct effects of monetary/financial shocks on interest rates (a liquidity effect). More importantly, it seems clear that the credit channel based on much solid micro-foundation (i.e., credit market imperfections) provides a richer, and more plausible, account of the inextricable link between financial and real sectors than the traditional interest rate (cost of capital) channel. In this sense, it is expected that the credit channel will help us to better understand the monetary transmission mechanism underlying the crisis.

The objective of this paper is to investigate whether the credit channel is a key monetary transmission mechanism in Korea, particularly following the recent financial crisis. We also attempt to identify the characteristics of the credit crunch and its intensity in the wake of the crisis in order to more definitively capture the role of the credit channel.

To this end, we first carry out two empirical tests for identifying the existence of a distinctive lending channel in Korea. These two tests involve the so-called "narrative approach", using a sequence of focal episodes of restrictive monetary policy as a means of identifying monetary shocks in the sense of Romer and Romer (1990). Another test was used to explore what the lending channel has to say about the differential responses of bank's primary assets (bank loans and securities) to a contraction in monetary policy between small and large bank groups, following Kashyap and Stein (1994, 1995, 1997).

Next, a definitive test of the existence of the credit crunch is performed by fitting and estimating separate demand and supply functions for bank loans in Korean commercial loan market, using a disequilibrium model of loan market advanced by Maddala and Nelson (1974, 1984).

This paper finds convincing evidence of the practical importance of the credit channel (more specifically, the bank lending channel), in the monetary transmission, particularly during the financial crisis. In addition, the empirical investigation of the credit crunch using the disequilibrium model reveals a compelling evidence that in the aftermath of the financial crisis, there has been a substantial excess demand for bank loans caused by a sharp loan supply decline mostly driven by a pervasive and stringent bank capital regulation. It is noteworthy that the pattern of the excess demand for loans was reasonably consistent with the survey measure to the extent of the credit market tightness faced by small and medium-sized firms.

The next section describes the theoretical underpinnings of the credit channel in the monetary transmission. Section III gives empirical evidence on the existence of the bank lending channel and the disequilibrium model evidence of the credit crunch. Section IV presents conclusions.

II. Theoretical Underpinnings of the Credit Channel

The credit view contends that two channels of monetary transmission – the bank lending channel and balance sheet channel – arise mainly due to informational asymmetry existing between borrowers and lenders in financial markets.

The bank lending channel centers on the premise that bank loans are of special importance particularly for bank-dependent small firms in monetary policy transmission.[1] This special nature of bank loans is attributable to the more realistic presumption that bank loans differ from publicly issued securities in a meaningful way (i.e., an imperfect substitutability of the two assets). In contrast, the pure money view of the transmission mechanism is characterized by the simple two-asset (money and publicly issued securities) feature where bank loans are conveniently lumped together with the securities. The lending channel presumes that small and medium-sized firms, facing informational frictions in financial markets, rely primarily on bank loans for external finance because it is prohibitively expensive for these borrowers to issue securities in the open market. To assert the existence of a distinctive lending channel of monetary policy transmission, it is important to correctly identify whether a reduction in bank lending following tight monetary policy is largely the consequence of an inward shift in loan supply (i.e., the loan supply effect), rather than just an inward shift in loan demand (i.e., the loan demand effect). This identification issue boils down to the following question: can the central bank reduce the loan supply of banks merely by draining reserves?

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[1]   see Bernanke and Blinder (1988), Morgan (1992), Bernanke (1993), Kashyap and Stein (1994,1995).

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An insight into a distinctive feature of the lending channel may be gained by examining the real effect of a sharp rise in open-market interest rate following tight monetary policy. The key point here is that the real effect of higher interest rates may be amplified through the lending channel beyond what would be predicted were policy transmitted solely through the traditional interest rate (cost of capital) channel. As market interest rates rise subsequent to monetary tightening, business investment falls not only due to a higher cost of capital that forces most firms including even large ones to cut back on their demand for investment (i.e., via the interest rate channel) but also due to a reduction of banks' loan supply to mostly the small and medium-sized firms (i.e. via the lending channel). Thus, the lending channel would reinforce the dampening effect of rising market interest rates on investment by generating a further decline in those small firms' spending on investment, which in turn can aggravate the downturn of the real economic activity.

Kashyap and Stein (1994, 1995) argue that banking firms may be subject to the same sort of capital market imperfections as their non-financial counterparts (i.e., small and medium-sized firms). According to their view, if a bank lending channel is effective, the loan supply effects can be captured as follows. A monetary contraction should cause small banks to cut their loan supply by relatively more than large banks, reflecting the hypothesis that small banks are more likely to face higher costs in attracting non-deposit sources of external finance such as CDs to offset a loss in reserves.

The balance sheet channel arises because rising interest rates, following tight monetary policy, directly increase the interest expenses of the non-financial firms who rely heavily on short-term debt to finance inventories and working capital, reducing their net cash flows and weakening their balance sheet positions. Further, rising interest rates are also associated with falling asset prices, which indirectly shrink the value of the firms' collateral. These effects lead to a reduction of the firms' net worth, thereby raising the premium for external finance (a wedge between the cost of funds raised externally and the opportunity cost of internal funds). It is for the most part small and medium-sized firms having relatively lower collateralizable net worth (i.e., lower creditworthiness) than large firms that are most likely to face a disproportionately larger premium for external finance. Hence, small and medium-sized firms that have relatively poor access to short-term credit markets respond to the deteriorated balance-sheet positions principally by drawing down inventories and by cutting investment more than large firms.[2] This shrinkage in investment provides an additional source of amplifying and propagating the initial decline in investment that would be predicted if the interest rate channel alone is operative subsequent to tight monetary policy. This phenomenon is consistent with what has been referred to as the "financial accelerator".[3]

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[2] Note that the credit channel is supportive of the asymmetric effect of monetary policy: the substantial disadvantages facing small and medium-sized firms in financing and investment behaviors compared to large ones arise mainly in tight-money periods and in recessions.

[3] See Gertler and Gilchrist (1993, 994), Bernanke and Gertler (1995), Hubbard (1994), Mishkin(1995), Bernanke, Gertler and Gilchrist (1998).

It is worth emphasizing that non-financial firms' net worth positions are potentially sensitive to a number of adverse shocks including a sharp increase in market interest rates, such as an unanticipated exchange depreciation, a reduction in the rate of growth rate in return to capital and debt deflation.

III. Empirical Evidence

As we have already argued, in order to capture the existence of a distinctive lending channel, it is critical to resolve the identification problem, identification of the loan supply effects. Two empirical tests focusing on adequately dealing with the identification issue are applied in order to explore whether the bank lending channel has a distinctive role in amplifying the real effects of monetary tightening, particularly during the financial crisis in Korea. These two tests involve the so-called "narrative approach", using a sequence of focal episodes of restrictive monetary policy as a means of identifying monetary shocks in the sense of Romer and Romer (1989, 1990). Another test is to examine what the lending channel has to say about the differential responses of bank's primary assets to a contraction in monetary policy between small and large bank group, following Kashyap and Stein (1994, 1995, 1997).

More importantly, it seems also very informative to examine whether a credit crunch has taken place in the aftermath of the financial crisis in December 1997 and, if so, to directly measure its intensity. This attempt may give us considerable insight into the practical importance of the credit crunch as a principal source of propagating an economic decline.

1. Test for the Bank Lending Channel During the Financial Crisis: a Narrative Approach

Empirical Methodology

First, we need to identify a sequence of *focal episodes* of restrictive monetary policy in which the monetary authority (the Bank of Korea) appeared to have deliberately been willing to accept some output sacrifices. Since there were no appropriate official statements available which can provide useful information for selecting with sufficient precision the focal episodes of a monetary tightening, we instead relied on information from the historical trends of major financial variables available, such as various monetary aggregates and short-term interest rates, including the major shifts in the policy stance of the Bank of Korea to monetary contraction. This approach is expected to help identify reasonably well the dates when monetary policy has been tightened (i.e., the loan-supply effects), compared to the allegedly questionable information on the tight monetary policy stance delivered from the traditional approach using the growth of the monetary aggregates.

5

Second, if monetary policy is indeed a relatively more important source of output fluctuations in the chosen focal episodes and affects output not only through money but also through bank lending, we would expect the effect of bank lending on output to be strong enough after the focal episodes over some prolonged period. If the bank lending has played an important role in amplifying the real effects of tightened monetary policy, the impact of bank lending on output might be larger than those of money in the focal episodes. These differential effects can be identified using an econometric methodology elaborated below.

Identification of the December 1997 Episode as a Measure of Tighter Monetary Contraction.

We identified solely one focal episode of monetary contraction during the period of 1990s in which the Bank of Korea appeared to have deliberately been willing to accept monetary tightening by both raising its intervention rate (RP rate) and reducing the base money. The identified focal episode of restrictive monetary policy involve *December 1997*. We selected this focal episode in consideration of the distinctive shift in policy stance of Bank of Korea and on the basis of information from the historical trends of all relevant financial variables available, including the growth rates of base money, total reserves, M1, MCT, and bank loans; movements in short-term interest rates; and the gap between the target growth rates of M2 (and MCT) [4] and their actual rates. It is worth noting that December 1997 is tied together with the central bank's obvious shift to the restrictive monetary policy in response to the onset of financial crisis.

In fact, the Bank of Korea has been under sustained pressure to shore up the sharply depreciated Won against the US dollar as the currency crisis began in the early July of 1997 in Thailand, and as the currency contagion spread to Korea. As the financial crisis unfolded in the early December of 1997, the Bank of Korea evidently maintained the stance of monetary tightening according to the IMF rescue package by allowing a substantial rise in interest rates and cutting back on base money. The resulting severe liquidity shortage in the money markets and a sharp fall in bank lending mainly due to banks' desperate needs to improve anemic capital/asset ratios were immediately followed by a massive credit squeeze.

We also verified that the movement of the major relevant financial variables around the December 1997 episode identified on the basis of the obvious shift in policy stance of the Bank of Korea in response to the financial crisis event were largely consistent with the general effect of a monetary tightening. As shown in Figure 2, there was a sharp increase in both call rates (RCA) and RP rates (RAP) in December 1997 due to the severe monetary tightening. Note that with the gradual realization of market-based pricing of government bonds and Monetary Stabilization Bonds (MSBs: special

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[4]   M2 = M1 + quasi-money (time and saving deposits and residents' foreign currency deposits at deposit money market). MCT is defined as M2 + CDs of banking institutions + Money-in-trust of non-bank financial institutions and has been adopted as an intermediate target along with M2 since 1997. MCT is supposed to provide a better measure of the overall liquidity of the financial system.

negotiable obligations of the Bank of Korea) through competitive bidding from 1990 onwards, repurchase agreements and reverses (RPs) involving government bonds and MSBs mostly with one-year maturity have been used as central bank's key instruments for carrying out open market operations.
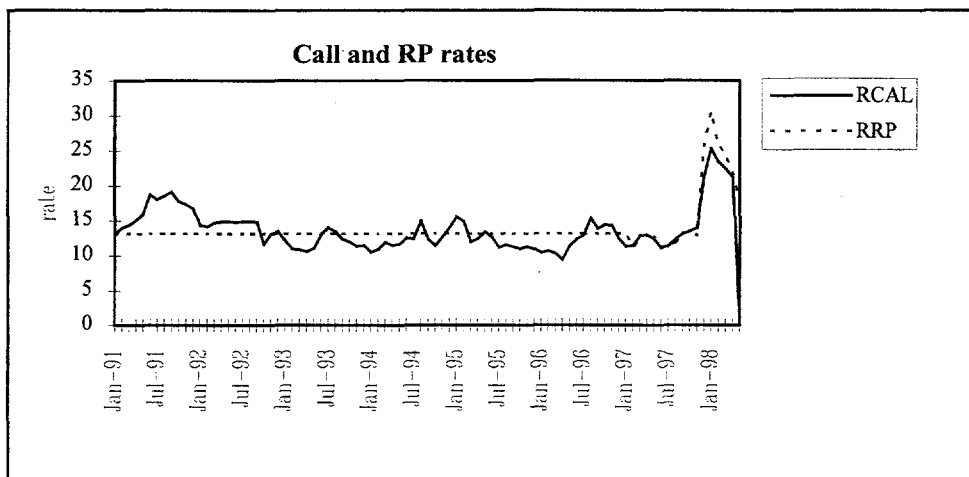
< Figure 2 >

Furthermore, it seems clear from Figure 3 that at about the end of December 1997 the Bank of Korea tried to absorb banks' reserve to a greater extent by selling sizable amount of Monetary Stabilization Bonds (MSBs) to the deposit money banks as a way of implementing tight monetary policy.
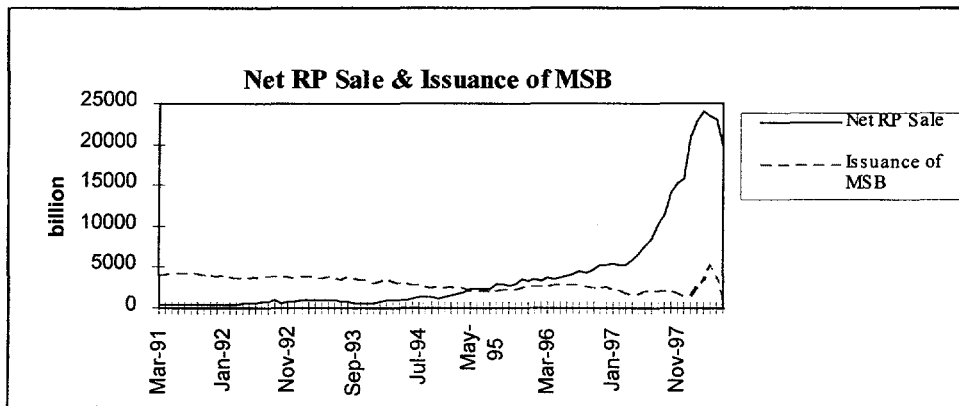
< Figure 3 >

To gain a further insight into whether the chosen episode is likely to reflect the central bank's serious intention of pursuing tighter monetary policy, we estimated the effects of the general tightening after the focal episode of restrictive monetary policy on the base money, M1, MCT and bank loans. All series are examined from the period covering January 1987 to June 1998 on a monthly basis. We have excluded pre-1987 observations not only because the data on the amount of MCT are not available but also

in light of this paper's main focus on examining how important role the credit channel has played and how significant and strong the real effect of credit crunch has been in the wake of the recent financial crisis in Korea. To this end, we first regress, from January 1987 up to the month just before the episode, the monthly change in the logarithm of the base money on 16 own lags in a univariate forecast equation 1, the monthly change in the logarithm of M1, MCT and bank loans on 16 own lags, the contemporaneous value and 16 lags and one lead of the change in the logarithm of the index of industrial production, as shown respectively in equations 2 through 4.

$$\Delta \ln RB_t = a + \sum_{i=1}^{16} b_i \Delta \ln RB_{t-i} \tag{1}$$

$$\Delta \ln M1_t = a + \sum_{i=1}^{16} b_i \Delta \ln M_{t-i} + \sum_{i=-1}^{16} c_i \Delta \ln Y_{t-i} \tag{2}$$

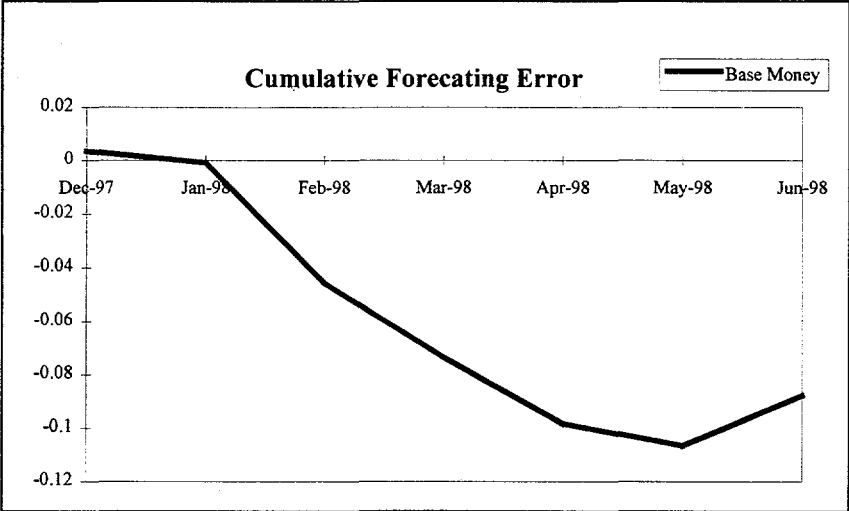$$\Delta \ln MCT_t = a + \sum_{i=1}^{16} b_i \Delta \ln M_{t-i} + \sum_{i=-1}^{16} c_i \Delta \ln Y_{t-i} \tag{3}$$

$$\Delta \ln L_t = a + \sum_{i=1}^{16} b_i \Delta \ln L_{t-i} + \sum_{i=-1}^{16} c_i \Delta \ln Y_{t-i} \tag{4}$$

where RB is base money, Y is the index of industrial production, and L is the total amount of bank loans for sixteen nation-wide banks and ten regional banks combined. Note that the lag length of each univariate forecast equation was selected based on the criteria suggested by Said and Dickey (1984)[5] and the Box-Pierce Q-statistics indicating no evidence of residual auto-correlation in each estimated forecast equation at a 5 percent level. We then used the actual paths of money (base money, M1, MCT) and bank loans up to the month before the focal episode (December 1997) and the estimated coefficients from those equations to construct dynamic forecasts of the paths of money and bank loans over the next seven months. We cumulated the forecasted changes to obtain forecasts for the levels of money and bank loans, finding the resulting forecast errors. If the cumulative forecasting errors (actual values - cumulative forecasts) for money and lending are negative soon after the shift to tight monetary policy, money and bank lending may be said to have fallen as a result of the restrictive monetary policy after the episode.

The plotting of the base money shown in Figure 4 indicates that the forecast errors for the episodes are consistently negative, and their absolute values continue to increase over the seven month forecasting period. The analogous forecast errors for M1 and MCT, as shown in Figure 5 and 6, also indicate patterns that are quite similar to those for the base money but the departures of RB and M1 from their forecasted paths are more rapid than the movements in MCT. Note in particular that the actual lending appears to have fallen more immediately and to a greater extent from its forecasted path than did the movement in the forecast errors for MCT.

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[5]   They suggest that the lag length on the augmented AR polynomial equation should grow with the sample size according to $\ell = Int\{12(T / 100)^{1/4}\}$, where T is the sample size and *Int* is the integer function. Although the maximum lag length this formula suggests is thirteen, we preferred to choose a lag length of sixteen because the reduced-form model specification appears to be more adequate in that the error term of each equation turned out to be white noise with that lag length.

In summary, our findings would suggest that the single focal episode we identified represented important monetary shock, and potentially that the bank lending played a crucial role in the monetary transmission mechanism.

Cumulative Forecating Error — Base Money

< Figure 4 >

Cumulative Forecast Error — M1

< Figure 5 >

9

Cumulative Forecasting Error

< Figure 6 >

Cumulative Forecasting Error
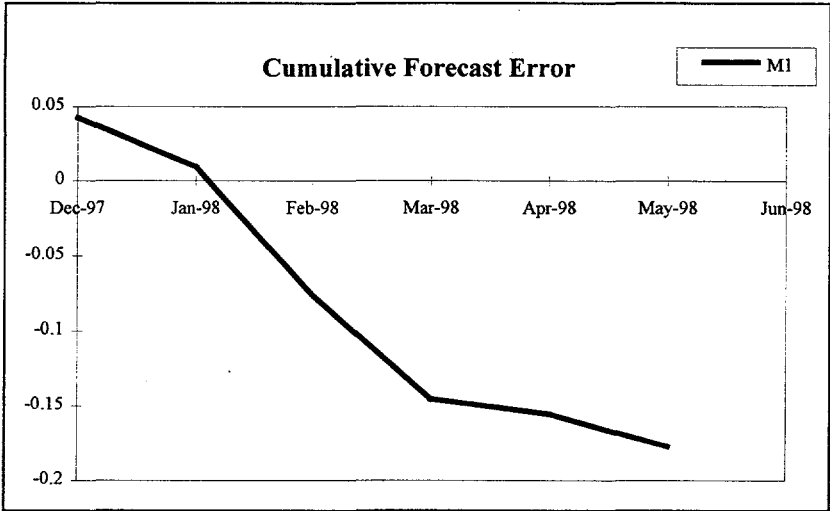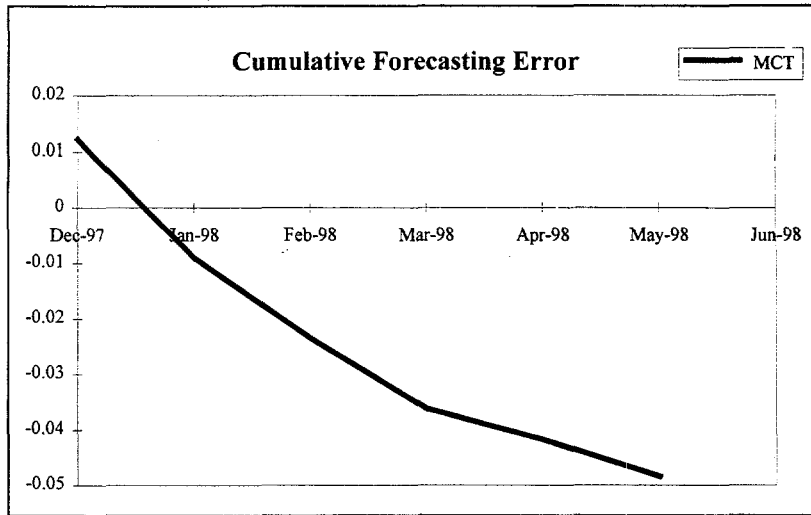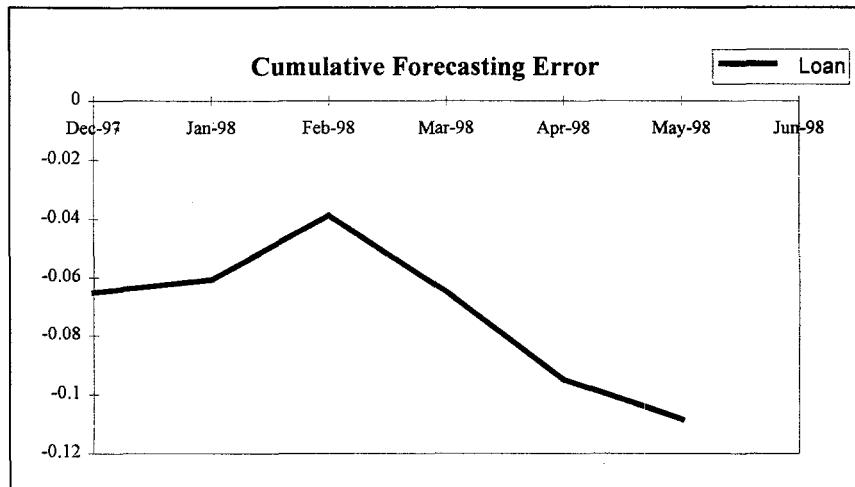
< Figure 7 >

Empirical Results on the Real Effect of the December 1997 Episode: Interest Rate Channel vs. Bank Lending Channel

We now turn to the question of whether the strengths of the money/output and lending/output relationships are different in response to the December 1997 policy shift to a monetary tightening in the aftermath of the financial crisis. This question may be addressed by regressing industrial production (Y) on money (M: M1 and MCT) and on

10

bank lending (L)[6] using the reduced-form forecasting equations 5 and 6, as shown below, and comparing the estimated coefficients, b_i and c_i, of each equation.

$$\Delta \ln Y_t = a + \sum_{i=1}^{16} b_i \Delta \ln Y_{t-i} + \sum_{i=0}^{16} c_i \Delta \ln M_{t-i} + \sum_{i=0}^{5} \delta_i D_{ti} \qquad (5)$$

$$\Delta \ln Y_t = a + \sum_{i=1}^{16} b_i \Delta \ln Y_{t-i} + \sum_{i=0}^{16} c_i \Delta \ln L_{t-i} + \sum_{i=0}^{5} \delta_i D_{ti} \qquad (6)$$

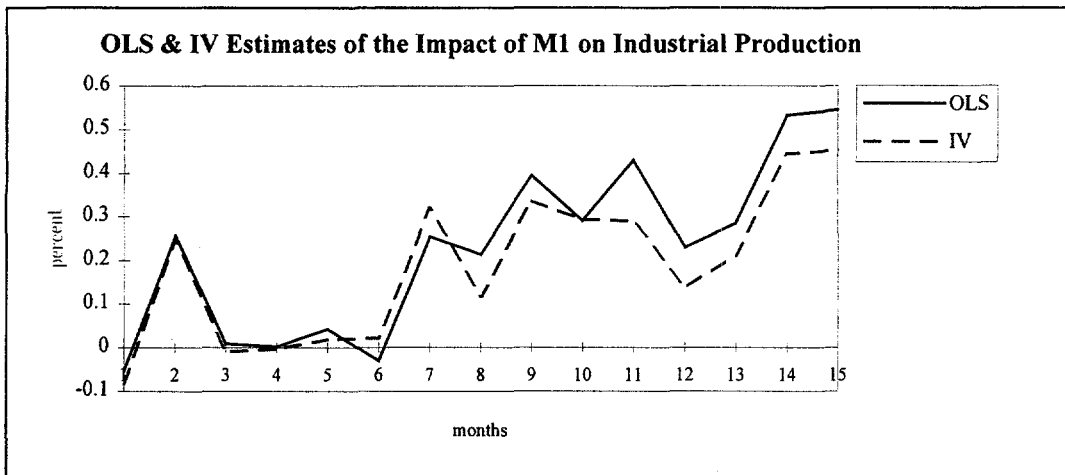where Y, L and M are the same as in equations 2 to 4 and the monthly dummies (D) for the restrictive monetary policy are included in each equation. We first estimated equations 5 and 6 without dummies (D) by OLS and then estimated each equation with dummies (D) by two-stage least squares, instrumenting with the lagged values of the right-hand-side variables[7] and the current and lagged values of a dummy that is equal to one on the focal episode on which we identify shift to restrictive monetary policy. The next step is to show the dynamic responses of industrial production (Y) to money (M1 and MCT) or bank lending (L), implied by the OLS and IV estimates of the money/output or lending/output regressions.[8]

We then need to compare the OLS and the two-stage least squares (IV) estimates of equations 5 and 6 to examine the relative strength of the estimated relationships between money (or bank lending) and output. Note that the OLS estimates of equation 5 simply summarize the usual money/output relations, whereas the IV estimates summarize the relationship between movements in output and the average deviation of money from its usual behavior in the focal episodes. Again, analogous comments apply to the difference of the OLS and IV estimates of the lending/output relationship. As just discussed, if we allow for the possibility that monetary policy affects output not only through money but also through bank lending, and if monetary policy is a relatively more important source of output fluctuations in the focal episode than other normal times, it may be the case that the tightened monetary policy in the focal episode would cause the IV estimates to imply a weaker impact of money on output than the OLS estimates. In contrast, we may expect the IV estimates of the lending/output relationships to be stronger than the OLS estimates.

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[6] This data refer to the total loans (averages) of domestic deposit money banks comprising domestic commercial banks (sixteen nationwide commercial banks, ten local banks and fifteen-two foreign banks in Korea) and specialized banks such as the Industrial Bank of Korea.

[7] A set of instrument variables used here include constant, lagged values (1 through 18) of the measured Y and M (or L). It turns out that there were no substantial differences in the results for adding other instrumental variables such as deposits and security holding of banks which presumably do not belong in each equation explicitly but enter only through their influence on the monetary aggregates or bank lending.

[8] For example, the response of M to Y at period zero is c_0. The period one response amounts to $c_0 + (b_1 c_0 + c_1)$. The period two response is $c_0 + (b_1 c_0 + c_1) + b_1(b_1 c_0 + c_1) + b_2 c_0 + c_2$; and so on.

OLS & IV Estimates of the Impact of M1 on Industrial Production

< Figure 8 >

OLS & IV Estimates of the Impact of MCT on Industrial Production

< Figure 9 >

OLS & IV Estimates of the Impact of Loan on Industrial Production

months
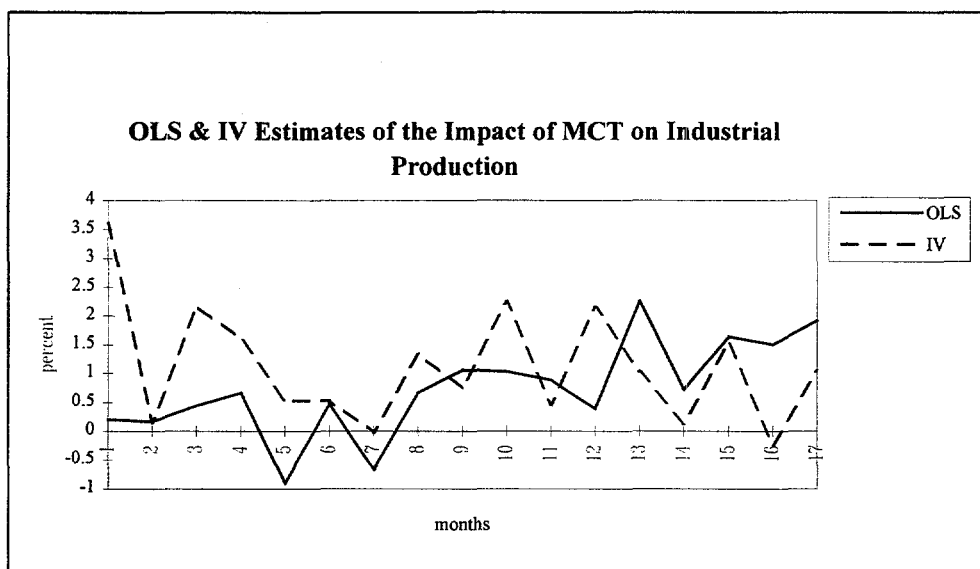
< Figure 10 >

Figure 8 through 10 presents the results of the OLS and IV estimates of equations 4 and 5. Figure 10 shows that the IV estimates of the impact of bank lending on industrial production are much larger than the OLS estimates at all horizons. However, as shown in Figure 8 and 9, the responses of industrial production to money (M1 and MCT) using the IV estimates appear not to be distinctively larger than those obtained using the OLS estimates; the effects implied by the IV estimates are somewhat lower for M1 and not consistently larger for MCT than those implied by the OLS estimates at most horizons.
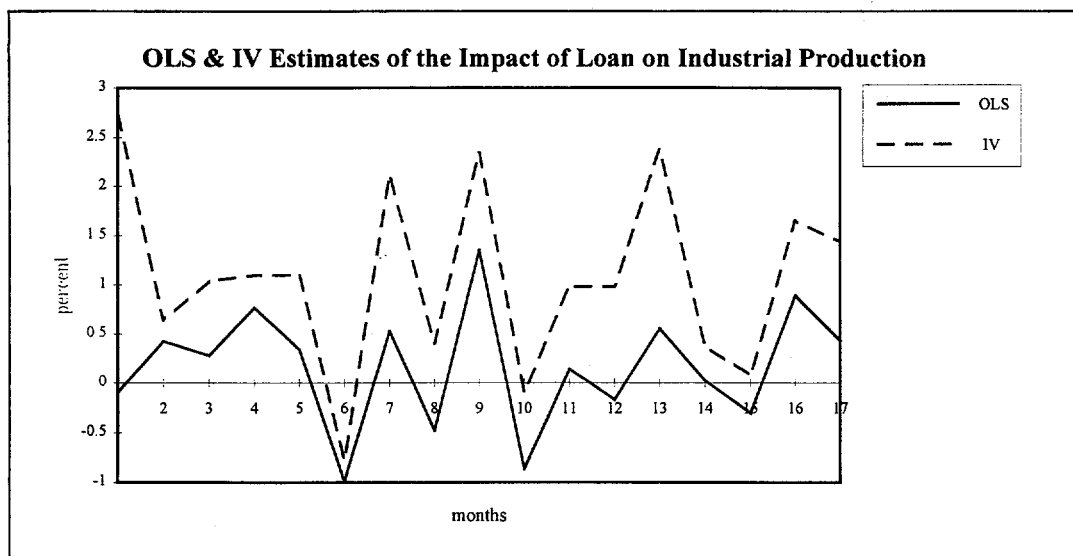
These results would be supportive of the view that bank lending has played an important independent role in amplifying the real effects of tightened monetary policy implied by the interest rate channel in the December 1997 focal episode of restrictive monetary policy.

2. Test for the Bank Lending Channel Using Disaggregated Bank Data

Testable hypotheses

The first testable hypothesis underlying this approach provides the following prediction: if the bank lending channel is operating (i.e. when loan supply rather than loan demand effects is identified as being very important), both lending volume and the securities holding of smaller banks are expected to decline more rapidly in response to a contraction of monetary policy than do those of larger banks. Note that this prediction

13

will holds when loan demand schedules facing the small banks are sufficiently inelastic[9] (Kashyap and Stein, 1994). A simple graphical analysis may be of great use for gaining a better understanding of the intuitive case for the loan supply effect.

<u>When loan supply effects are important</u>

LS_s^1 LS_s^0 LS_L^1 LS_L^0

r_L r_L

r_{L1} ①   ①

r_{L0} r_{L2}

LD_S (inelastic) LD_S(elastic)

L_1 L_0 L L_1 L_0 L
Small banks   Large banks

< Figure 11>
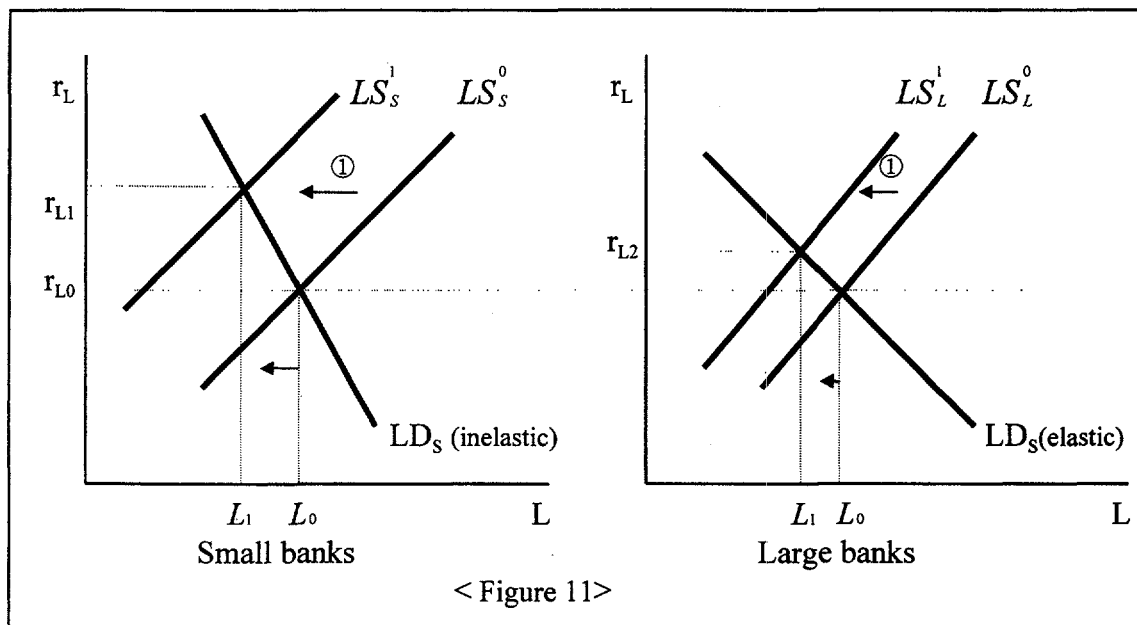
where ① is based on the prediction that a given contraction in reserves (deposits) in the wake of a contraction in monetary policy can cause lending to fall more for small banks than for large banks. Intuitively, if the loan demand schedule facing a given small bank is sufficiently inelastic as shown in the Figure 11, there will be a sharp increase in the small bank's loan rate relative to the return on security holding (i.e. an increase in the bank's loan-security spread) compared with the large bank. This movements in loan rate might be inferred by looking at movement in securities. If there were a sharp increase in the small bank's loan-security spread, it might be possible to have a situation where the small bank favors loans in its portfolio relative to securities, and thus be more willing to cut securities to maintain lending volume. Accordingly, this intuitive case implies that small banks are expected to cut both lending volume and the securities holding by more than large banks after a contraction in monetary policy, just in line with the testable prediction mentioned above. Furthermore, it may not be hard to infer what would happen if the loan demand effects are at work on the basis of the Figure 11 (although not shown here, suppose that the loan demand schedule, LAD, instead of loan supply shifts in to the left). In this case, the loan demand schedule facing both the small and large banks will shift in to the left. But if we suppose that the loan demand facing the small banks will shift in by

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[9]   It appears most likely that this requirement is satisfied in practice in Korea in the sense that small banks typically lend to smaller, more recession-sensitive (and more bank-dependent) customers. This also implies that small-bank loan demand may be more pro-cyclical.

14

more than that of large bank, there will be a sharp increase in the loan-security spread for the small banks compared with large bank, leading them to favor securities in its portfolio relative to loans. The movements in securities holding are apparently in contrast with the prediction that may be valid when the loan supply effects are operating.

Another testable hypothesis just in line with the first one is to exploit the implication that the sensitivity of the lending volume to monetary tightening is greater for banks facing tighter liquidity constraints in raising uninsured external finance and, if this is the case, the sensitivity should be more pronounced for small banks with weaker internal liquidity positions (Kashyap and Stein, 1997). But this hypothesis is not also completely free from some potential counterweight argument: if small banks face tighter liquidity constraints than large banks, it is expected that they would hold larger buffer stocks of liquid assets such as securities and short-term inter-bank market funds mainly to insulate their lending behavior from the impact of unexpected severe monetary tightening. This means small banks should not be necessarily more liquidity constrained than large banks all the time. Nonetheless, it may be quite possible to occur that the buffer stock of the typical small banks will not be sufficient enough to be shielded from the very severe monetary policy tightening and will be more subject to liquidity constraints in credit market than the large banks.

Econometric Specification

To identify whether the loan supply effects are really important (i.e., whether bank lending channel has a distinctive role in monetary transmission mechanism), it may be worthwhile to test the cross-sectional implications of the prediction empirically. To this end, the test procedure should be of the following sort: we first need to divide banks on the basis of their total assets into small and large categories that would also potentially reflect differential in their costs of raising non-deposit external funds. The six largest commercial banks[10] were classified as banks in the large category and ten regional banks[11] as banks in the small category. The next step is to compare the responses of primary assets (bank loans, securities) of each bank group to a monetary contraction using the impulse responses in the standard vector autoregression (VAR).

In our case, the VAR approach was applied to monthly Korean data from January 1993 to May 1998 (65 observations) because of the paucity of relevant data. The short-term RP rate over which the Bank of Korea has direct leverage in the short-term may be a

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[10] The six largest commercial banks include Cho Hung Bank (39,551 billion Won), Commercial Bank of Korea (32,498 billion Won), Korea First Bank (31,771 billion Won), Hanil Bank (34,470 billion Won), Bank of Seoul (29,655 billion Won) and Korea Exchange Bank (38,594 billion Won). The amount in parenthesis indicates the total assets of relevant bank as of the end of 1997.

[11] Ten regional banks include Daegu Bank (10,713 billion Won), Pusan Bank (10,168 billion Won), Chung Chong Bank (4,909), Kwangju Bank (6,182 billion Won), Bank of Cheju (1,475 billion Won), Kyungki Bank (8,258 billion Won), Jeonbuk Bank (2,532 billion Won), Kangwon Bank (3,435 billion Won), Kyongnam Bank (7,034 billion Won), Chungbuk bank (2,970 billion Won). The amount in parenthesis indicates the total assets of relevant bank as of the end of 1997.

good indicator of the stance of monetary policy. The overnight rate, however, was instead chosen to proxy for changes in the stance of monetary policy (a monetary policy indicator) because sufficient time series of the RP rate were not available and the recent movements in the call rate have been very much similar to those in the RP rate.[12] Of particular relevance for our analysis is to exploit the December 1997 policy episode which appears to adequately capture apparently severe contractionary shift in monetary policy. This exogenous episode of tighter policy would provide more insightful information about whether the bank lending channel operating mainly due to the presence of credit market imperfections in the form of borrowing restrictions has played an important role in propagating the real effect of the monetary policy shock not captured by the traditional interest rate channel. Both consumer price index (CPI) and the industrial production index (y) were selected to control for macro conditions. One class of primary assets (bank loans and security holdings) of each bank group was considered in the VAR analysis. Data used were logarithms of the nominal level data of all variables considered except the call rate.

For estimation purpose, the following standard finite vector autoregressive (VAR) representation is considered:

$$\Delta x_t = \alpha + \Sigma_{i=1}^{3} A_i \Delta x_{t-1} + u_t, \qquad E(u_t u_s) = \Omega, \text{ if } t \neq s \qquad (7)$$
$$0, \text{ otherwise}$$

where A_i is a square coefficient matrix; u_t denotes the vector of mean-zero, serially uncorrelated variables, and its contemporaneous variance matrix, Ω, is assumed to be positive definite symmetric; α is a 4x1 column vector of parameters; the vector x_{it} include three observable random time series variables under consideration, i.e., the index of industrial production (Y_{it}), consumer price index (CPI_{it}), lending volume (L_{it}) (or securities holdings (S_{it})) and one of the call rate and the December 1997 policy episode as a monetary policy indicator (M_{it}).

We estimated the vector autoregressive representation (7) in the first difference to reflect the preliminary unit root test results indicating the time series variables being considered are integrated of order one. A lag length of three was selected and the Box-Pierce Q-statistics at that length were consistent with the evidence that the error term of each reduced-form equation is white noise within at least 10 percent level. Furthermore, it seems reasonable to focus on the VAR analysis containing only four variables of our particular interest in light of the practical consideration such as degree of freedom as much as the potential cost of misspecification involved in selecting further lag length and variables.[13] So this rather parsimonious VAR specification seems quite adequate. A

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[12]   Note that the contemporaneous correlation of these two series(RP rate and call rate) during the period of January 1996 through May 1998 turns out to be 0.99.

[13]   Estimating the coefficient on 4 lags of four variables in the VAR specification by adding another variable with this short sample would pose a problem of exhausting all degree of freedom.

temporal ordering of variables is considered based upon the following rationale; the call rate appears first on the presumption that exogenous policy influence such as the central bank's intervention through conducting open market operations has a direct impact on the call rate. Lending volume (L_{it}) or securities holding (S_{it}) of each bank group is placed second prior to the industrial production index and consumer price index placed last, primarily because bank portfolio behavior is unlikely to be appreciably affected by contemporaneous macro conditions. Note that lending volume (L_{it}) in the above equations should be replaced by securities holding (S_{it}) for each group to compare their behaviors of securities holding in response to one standard-deviation shock to a monetary tightening.

Empirical Results

Figure 12 and 13 provide a graphical illustration, plotting the cumulative responses of the log of loan volumes and securities holding for banks in each group (large and small banks) to a one-standard-deviation increase in the overnight rate (an indicator of monetary policy) over a period of 24 months.[14] If there is a much greater dampening effect on the lending volume and the securities holding of small banks than those of the large banks after a positive innovation in the call rate, the results would be largely decisive in favor of the prediction of the bank lending channel in the sense of Kashyap and Stein (1995, 1997).

The Cumulative Response of Large and Small Bank Loan Growth to a Call Rate Shock

months after shock
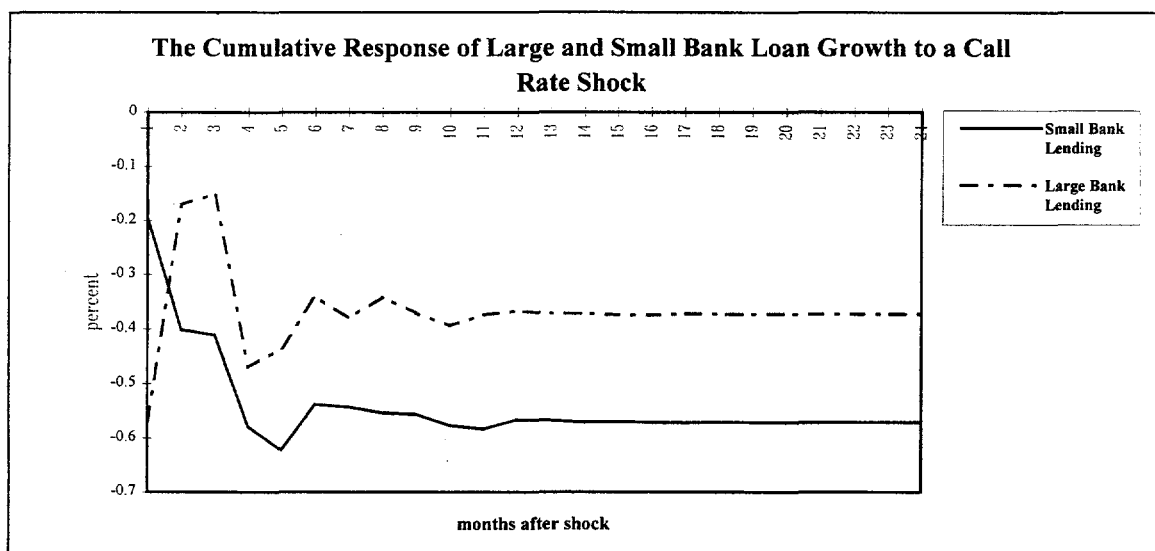
< Figure 12 >

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[14] It is worth emphasizing that the effect of contemporaneous innovation on the long-term forecast of economic variables differs markedly from either VARs in levels or in first differences. For the VARs in first difference, a contemporaneous shock to the series has a permanent effect on the long-term forecast of the series, while any shock in period t has only a temporary effect for the VAR in levels.

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The cumulative impulse responses shown in Figure 12 indicate that the lending volume of small banks shrinks more about 6 months after a one-standard-deviation increase (say, a one percent increase) in the call rate than the large banks' lending. Small banks appear a little sluggish in cutting down on their lending volume compared with large banks during six months after the call rate shock, leading up to a decline in lending volume of about 0.55 percent at six months out after a one percent increase in the call rate. Meanwhile, large banks' lending volume reveals relatively large low-frequency movements for a period of the first six months before beginning to drop by about 0.35 percent at six months after the call rate shock. The difference in their responses appears not to be substantial; at six months after the shock, small banks' lending volume is declining merely by about 0.20 percent more relative to large banks' lending.

The evidence in Figure 13, tracing out the cumulative impulse responses of securities holdings for large and small banks to a one percent increase in the call rate, suggests that small banks' securities holdings are indeed more sensitive to monetary policy than large banks' securities holdings. Small banks appear to downsize their securities build up about four months after a monetary tightening (as proxied by a one percent increase in the call rate) probably to maintain lending volume, but with a shorter lag than the patterns observed for lending volume. Namely, after rising initially to some extent, the growth rate of small banks' securities holdings drops sharply starting four months after the shock up to almost zero percent from about 1.5 percent level before leveling off at 0.2 percent or less after ten months. In contrast, large banks' securities holdings tend to be essentially back to the initial growth trend at about ten months after increasing sharply during the first several months.

It is important to note from Figure 13 that small banks' securities holding in particular continues to grow rather than decrease following a monetary contraction, although its growth rate tends to be lowered substantially after about four months. This evidence, however, would not be inconsistent with the above-mentioned theoretical prediction if we take into consideration the widely-held implication of credit rationing that commercial loan rates are "sticky" in that they are very slow to increase with open market rates and credit market tightness following a monetary tightening.

One plausible explanation for the result may be as follows: small banks will have to curtail loans mostly to their small bank-dependent, collateral-poor customers allegedly perceived to be less sensitive to changes in loan rates subsequent to a monetary contraction while engaging in the so-called "flight-to-quality" in lending.[15] However, if the resulting loan rates are very slow to increase, so that the loan rates relative to the yields of securities are not sufficiently high, it is certainly conceivable that small banks would not be willing to cut their securities holdings significantly and instead try to hold them as a cushion against the probability of facing potential illiquidity.

In addition, some structural feature of the open market operations in Korea presumably sheds light on the reason for the evidence shown in Figure 13; that is, when

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[15] It may be defined as an increase in the share of bank credits flowing to borrowers with low agency costs, such as large firms, see Gilchrist and Gertler (1994).

the Bank of Korea intends to shift to the restrictive monetary policy, it usually absorb bank reserves by resorting to the (outright) sales of RPs with the banks involving mainly Monetary Stabilization Bonds and government bonds. But up until recently, open market operations have been undertaken primarily with a view to absorbing short-term liquidity supplied through the automatic rediscount facility necessitated by policy-based loans and by foreign sector when the current account ran a substantial surplus. This kind of quasi open market operations have frequently restricted banks' autonomous portfolio management and led banks to hold some unwanted proportion of those securities.[16]

The Cumulative Response of Large and Small Bank Securities Growth to a Call Rate Shock
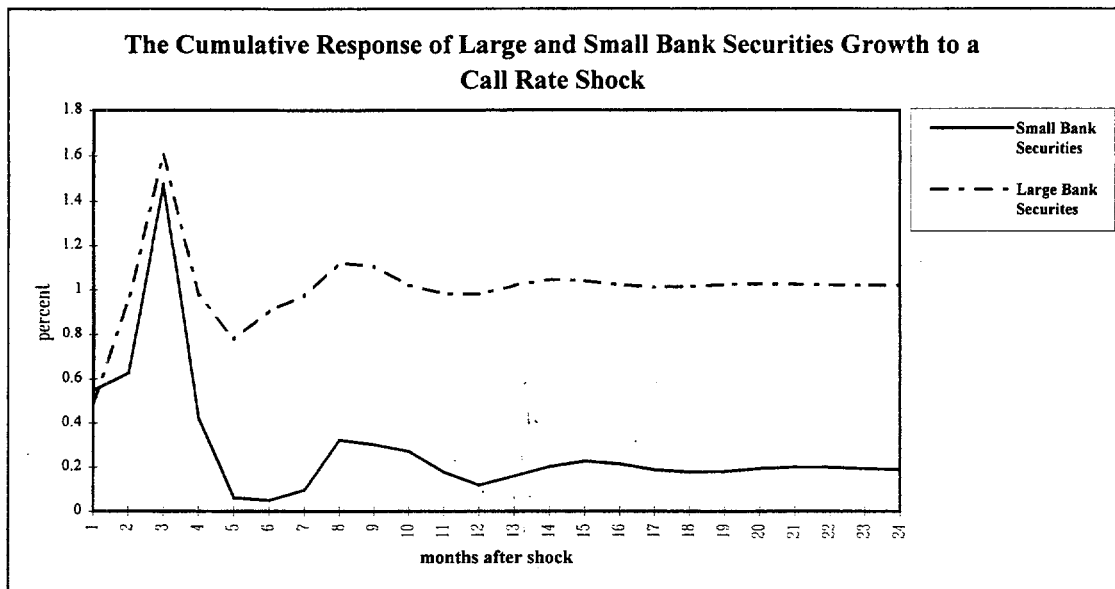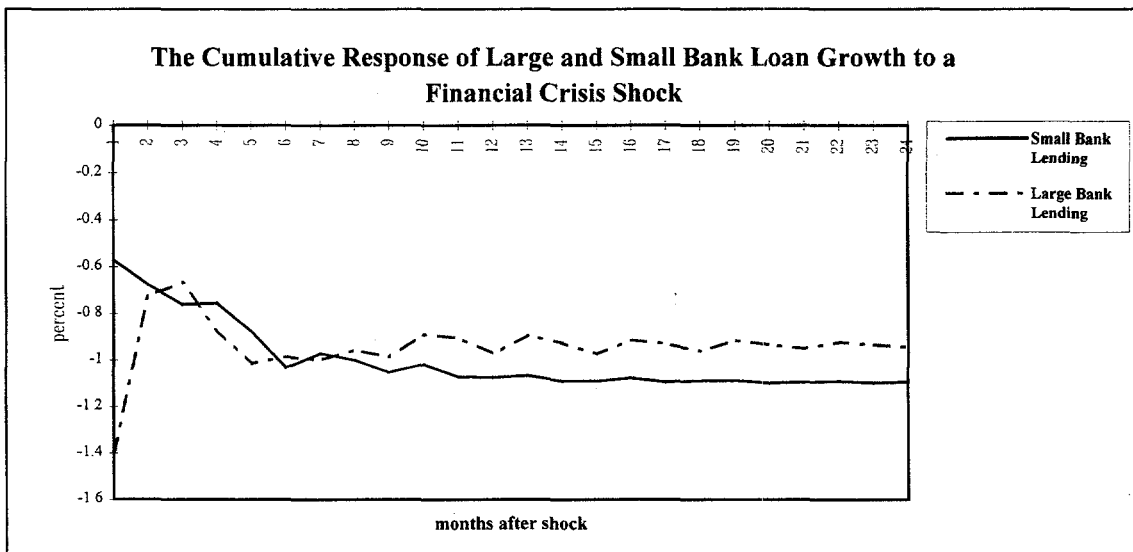
< Figure 13 >

On balance, the results in Figure 12 and 13 would seem to provide some positive evidence in favor of the theoretical prediction that both lending volume and securities holdings of small banks tend to be more sensitive to a monetary contraction than by large banks if the loan supply effects become more pronounced for the small banks facing typically inelastic loan demand schedules and higher costs (tighter liquidity constraints) in attracting non-deposit sources of external finance such as CDs.

We also reran all the equations corresponding to the above VAR specification replacing the December 1997 episode as an alternative indicator of monetary policy for the call rate to ensure the robustness of our results. If the call rate used as our measure of the monetary shock adequately proxies for the change in the stance of monetary policy, then one should expect the cumulative impulse responses estimated with the alternative VAR specification including the December 1997 episode as a measure of the apparently severe monetary contraction to give some results similar to those in Figure 12 and 13.

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[16]   In accordance with the Article 22 of the General Banking Act in Korea, a banking institution's investment in stocks or debentures and other securities with maturity exceeding three years should not exceed one hundred per cent of its equity capital. However, note that this stipulation is not applied to government bonds and the Monetary Stabilization Bonds of the Bank of Korea.

As it turns out in Figure 14 and 15, the cumulative response patterns of both lending volume and securities holdings in the wake of the financial crisis shock (December 1997) appear virtually identical to those in Figure 12 and 13. A noteworthy difference is that the lending volumes of both large and small bank groups were more sensitive to the crisis shock than they were to the call rate shock; the lending volumes for banks in small group drops slowly up to about 1.0 or more percent at six months after the financial crisis shock, which is more than twice the size shown in Figure 12. The same pattern also holds for the response of lending volume for large banks. However, the cumulative responses of securities holdings for banks in each group to the financial crisis shock appear essentially identical to those in Figure 13.

The Cumulative Response of Large and Small Bank Loan Growth to a Financial Crisis Shock

< Figure 14 >

The Cumulative Response of Large and Small Bank Securities Growth to a Financial Crisis Shock

< Figure 15 >

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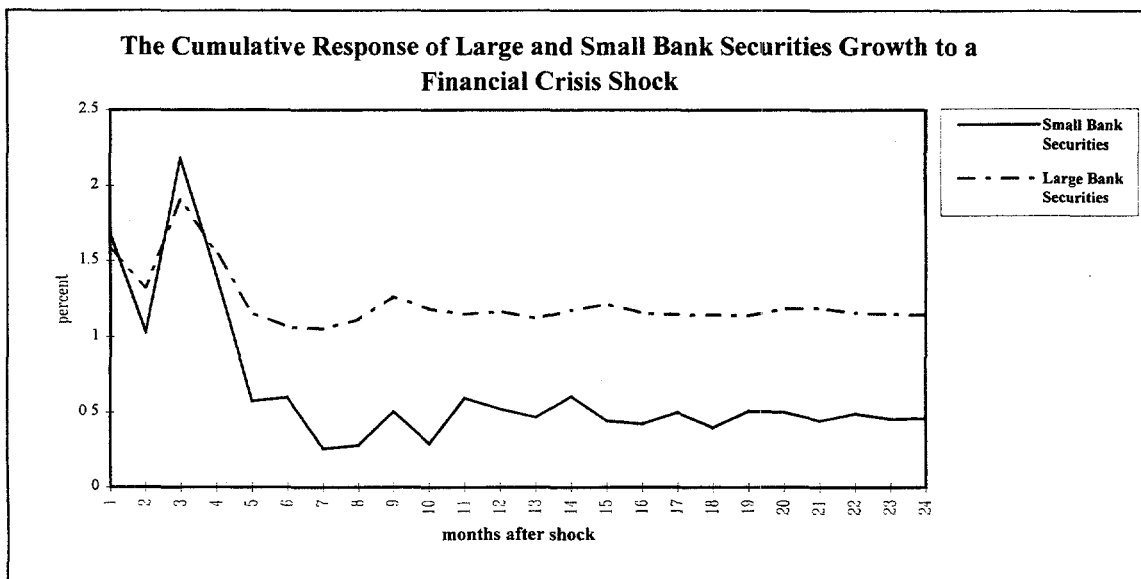
Interestingly, these results could conceivably be interpreted as real evidence to support the widely-held view that there occurred a substantial credit crunch in the banking sector in the wake of the recent financial crisis.

3. Disequilibrium Model Evidence of a Credit Crunch in the Aftermath of the Financial Crisis

Why Does a Credit Crunch Matter ?

A credit crunch, defined as an unusual sharp decline in the supply of bank loans usually perceived as quite possible to occur even with prevailing loan rates and quality of borrowers,[17] is widely recognized as having substantial real effects by severely restricting borrowers' (mostly bank-dependent, poorly capitalized small firms) ability to obtain credits and thereby causing a significant reduction in their spending on investment. In this respect, we may interpret a credit crunch as a negative IS-curve shock, which can have a dampening effect on the real economy as IS curve shifts downward substantially even without a monetary policy-induced leftward shift in LM curve (i.e., even when the traditional interest rate channel is not operative) in the context of the Bernanke and Blinder model (1988). If the credit crunch, however, is accompanied by a monetary tightening immediately followed by a rise in market interest rates, then it would provide the important source of propagating the economic decline beyond what would be predicted by the interest rate channel.[18] So it seems clear that an attempt to identify whether there was indeed a credit crunch in the banking sector in the aftermath of the financial crisis is key to better understanding how much a credit channel has played a distinctive role in exacerbating the overall economic conditions as well as the real sector in Korea.

This chapter aims at identifying whether a credit crunch has actually taken place in the wake of the financial crisis and, if so, directly measuring its magnitude by fitting and estimating separate demand and supply functions for bank loans in Korean commercial loan market.

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[17]   See Bernanke and Lown (1991), among others.

[18]   Bernanke and Blinder (1988) present a simple model in which the traditional IS curve is modified as the so-called CC curve ("commodities and credit" curve) capturing the role of credit (bank loans) in the monetary transmission such that $y = Y(i, \rho)$ and $\rho = \psi(i, y, R)$, where i is the interest rate on

bonds, R is bank reserves, y and ρ refer to GNP and the interest rate on loans respectively. Note that the CC curve is shifted by monetary policy (R) and credit market (ρ) shocks. For example, if a monetary tightening (a decrease in R) is accompanied by a credit crunch (a higher ρ), the CC curve (a variant of IS curve) as well as the LM curve would shift inward, leading to a substantial decline in aggregate demand. In that case, it is expected that these shocks would reinforce a contractionary impact on the CC curve and thereby causing a larger inward shift of the CC curve.

Specification of a Model of Loan Market in Disequilibrium

As an equilibrium credit rationing in the sense of Stiglitz and Weiss (1981) predicts, in equilibrium a loan market is characterized by a disequilibrium status. Loan rates are not presumed to adjust in each period to clear the market (i.e., loan rate stickiness) and thereby the "short side" of the market prevails, in contrast to the usual equilibrium setup. One problem with the market model in disequilibrium is that we have to obtain estimators for the parameters in the loan supply and demand functions only with one observed quantity of transactions in loan market in the absence of any a priori information concerning the loan rate adjustment process, and concerning which observations are on the demand function and which are on the supply function. To avoid this problem, we employ the assumption of the "short side" principle in which the observed quantity is constrained to be the smaller of the amount demanded and supplied, which are not directly observed. It seems important to note that such a disequilibrium state can prevail even in an unregulated and competitive loan market, and reflect the actual loan market conditions reasonably well.

We here examine the characteristics of Korean commercial loan market condition using a disequilibrium model of loan market specifying separate loan demand and supply equations along the lines of the models advanced by Laffont and Garcia (1977), Sealey (1979), King (1986) and Pazarbasiouglu (1997). We estimate the parameters of the model using the likelihood function and the maximum likelihood methods proposed by Maddala and Nelson (1974, 1984) over the sample period of January 1993 through May 1998.

$$L_t^D = \alpha_0 + \alpha_1 L_{t-1} + \alpha_2 (RL - RCB)_t + \alpha_3 IP_{t-1} \tag{8}$$

$$L_t^S = \beta_0 + \beta_1 L_{t-1} + \beta_2 RL_t + \beta_3 (RL - RCD)_t + \beta_4 DEP_t + \beta_5 IP_{t-1} + \beta_6 DMY_t \tag{9}$$

$$L_t = \min(L_t^S, L_t^D) \tag{10}$$

where L denotes real bank loans, i.e., total bank loans by the sixteen commercial banks and ten regional banks are all deflated by the CPI, and RL refers to the weighted average of loan rates applied by those banks; RCB denotes the yield of corporate bonds with a three-year maturity; RCD indicates the interest rate on CDs; IP and DEP are the index of industrial production for all items and real bank deposits (demand deposits plus time and saving deposits deflated by the CPI), respectively. DMY, a dummy variable for the financial crisis in December 1997, is introduced to capture any structural changes that may have occurred in the commercial loan market in the aftermath of the crisis and takes on the value of unity following December 1997 and zero elsewhere. The variables included in the equations are all logged except the interest rates.

The determinants of the real loan demand and supply functions in equations (8) and (9) are chosen based on the following rationale; a lagged dependent variable (L_{t-1}) is allowed to enter the real loan demand equation (8) to avoid a potential problem of endogeneity between dependent and explanatory variables, and in part to take into account the issue of stationarity of the variables under consideration.[19] A price differential between the loan rate and the yield of corporate bonds measuring the cost of obtaining alternative important source of external financing for firms, ($RL-RCB$), is used to capture the sensitivity of financing policy and to avoid the problem of high co-linearity between these two variables in the sense of Laffont and Garcia (1977). But the weighted average of loan rate is excluded from the loan demand components because it is not found to be statistically significant and its effect on the real bank loans turns out to be negligible when estimated along with the rate differential. A lagged index of industrial production (IP_{t-1}) is used to approximate the firm's expectations about future economic activity.

A lagged dependent variable (L_{t-1}) is allowed to enter the real loan supply equation (9) for the same reason as in the real loan demand function. Both the weighted average of loan rates (RL) approximating the profitability of bank's lending activities and the price differential between the loan rate and the rate on CDs representing a typical non-deposit source of external financing for banks, ($RL-RCD$), are included. Real bank deposits (DEP) is used as a measure of the most important resources available to the bank. A lagged index of industrial production (IP_{t-1}) is also used in the supply equation to reflect the bank's expectations about the overall economic activity. The dummy variable (DMY) is included only in the loan supply equation and dropped from the loan demand components because it is not found to be significant in the estimated loan demand equation.

Empirical Results

The results are shown in Table 1. They indicate that all coefficients of both the loan demand and supply functions have the expected signs. Significant residual variances (σ^2) in both equations imply that the model is reasonably well specified. In the loan demand equation, the interest differential ($RL-RCB$) has the expected negative sign although its effect on the loan demand is rather small. Industrial production does appear to have a significant explanatory power in the loan demand equation.

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[19] Univariate unit root test indicates that the real bank loans, real bank deposits and the index of industrial production are all well described as difference-stationary processes.

< Table 1 >

Maximum Likelihood Estimates of Loan Demand and Supply Functions

| Variable	Loan Demand Function	Loan Supply Function
Constant	2.82	0.55
	(1.32)	(2.22)
L_{t-1}	0.69	0.31
	(3.21)	(2.03)
RL_t		0.25
		(2.43)
$(RL-RCB)_t$	- 0.017	
	(- 1.97)	
$(RL-RCD)_t$		- 0.80
		(- 1.76)
DEP_t		0.52
		(4.05)
IP_{t-1}	0.21	0.06
	(1.83)	(0.83)
DMY_t		- 0.14
		(- 2.99)
σ^2	0.00102	0.00028
	(2.75)	(3.08)

Notes : all series are non-seasonally adjusted monthly data and cover the period of January
1993 to May 1998 (65 observations). The data used in this study, with the exception of the
interest rates, are available in various issues of the *Monthly Bulletin*, The Bank of Korea.
The weighted average of loan rate and the interest rates on CDs are from an unpublished
source available from the Bank of Korea. Asymptotic t-statistics are provided in parentheses.

In the loan supply equation, both the loan rate (RL) and interest differential
($RL-RCD$) are significant and have the expected signs, suggesting that the cost of
obtaining non-deposit source of external financing (CDs) as well as the loan rate appears
important in determining lending decisions.[20] The volume of real bank deposits (DEP)
has a highly significant positive coefficient. This result confirms that lending decisions
are heavily dependent on bank deposits. But the fact that the coefficient of industrial
production is insignificant may imply that industrial production is not taken into account
in lending in an important way. Interestingly, the dummy variable for the financial crisis

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[20] While I included the market capitalization of the equities listed in Korea stock market in the loan
supply equation to capture a potential effect of firm's equity capital position on lending decisions, it
turned out that its coefficient was statistically insignificant and didn't have an expected sign. So we
excluded it from the supply equation.

is found to have a significant negative sign. This result appears to be in supportive of the widely-held view that faced with the difficulty in attracting new loans from abroad and rolling over their obligations along with desperate needs to improve their anemic capital/ asset ratios in the aftermath of the financial crisis, commercial banks have unusually engaged in a massive credit squeeze.

Given the estimates presented in Table 1, it is also possible to directly measure the magnitude of excess demand for loans, the primary interest of this analysis, by fitting the estimated loan demand and supply equations. Figure 16 plots the fitted loan demand and supply equations, and Figure 17 shows estimated excess demand for loans.
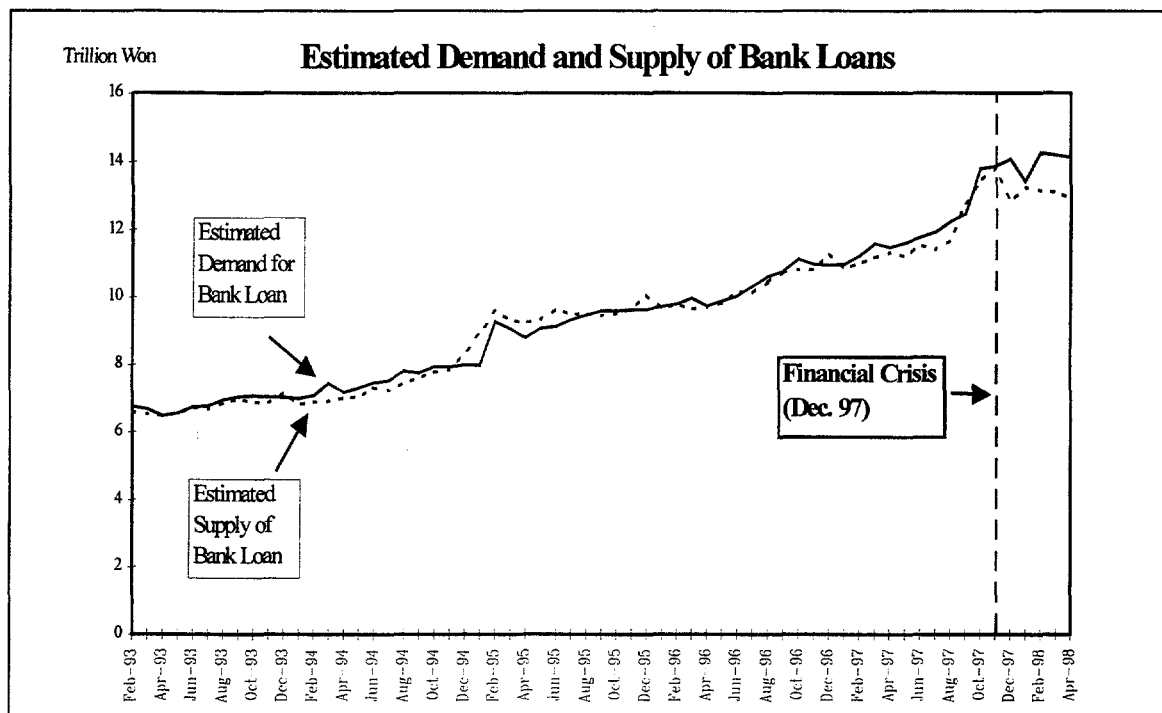
< Figure 16 >

The results reveal that the loan market is characterized by a state of predominantly excess demand for loans, although with intermittent periods of excess supply. Of the 65 months in the sample, only 15 months exhibit excess supply while 50 months are associated with excess demand. More importantly, there has occurred a marked large excess demand caused by a sharp decline in loan supply (i.e., by the credit crunch), right after the financial crisis in December 1997. This evidence suggests that in the crisis period after December 1997, the bank loans are essentially supply determined.

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Excess Demand and Supply for Bank Loans
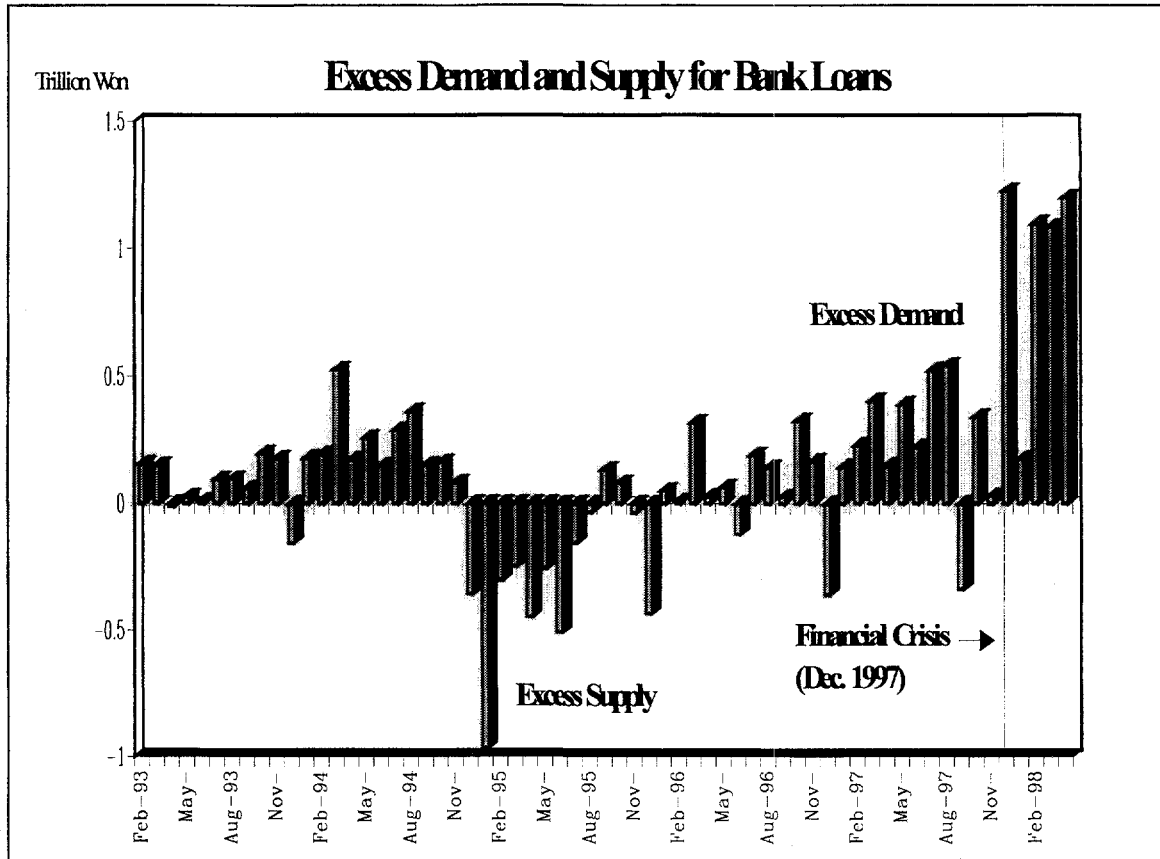
< Figure 17 >

A comparison of the excess demand for loans with the survey results of the external financing conditions facing small and medium-sized firms in manufacturing in Figure 18 shows that the trend of the excess demand seems reasonably consistent with the extent of the credit market tightness. The survey has been undertaken every month since January 1994 by the Industrial Bank of Korea with a view to examining the external financing conditions of small and medium-sized firms operating in manufacturing. The number on the left scale in Figure 18 represents the percent of all the respondents who identified greater difficulties in getting access to external financing including bank loans relative to the immediately previous month. While there is one appreciable caveat on the similarities between those two trends during the excess supply period of the first half of 1995, the pattern of the excess demand during other periods is very similar to that of the survey measure.

In particular, it is noteworthy that the ratio of the respondents reporting greater difficulties in getting access to credits considerably increased (almost three times compared to other periods) during the crisis. This result is broadly in line with the occurrence of the substantial excess demand for bank loans owing to the credit crunch during the crisis period starting November 1997.

A Comparison of the Excess Demand for Bank Loans with the Survey Results
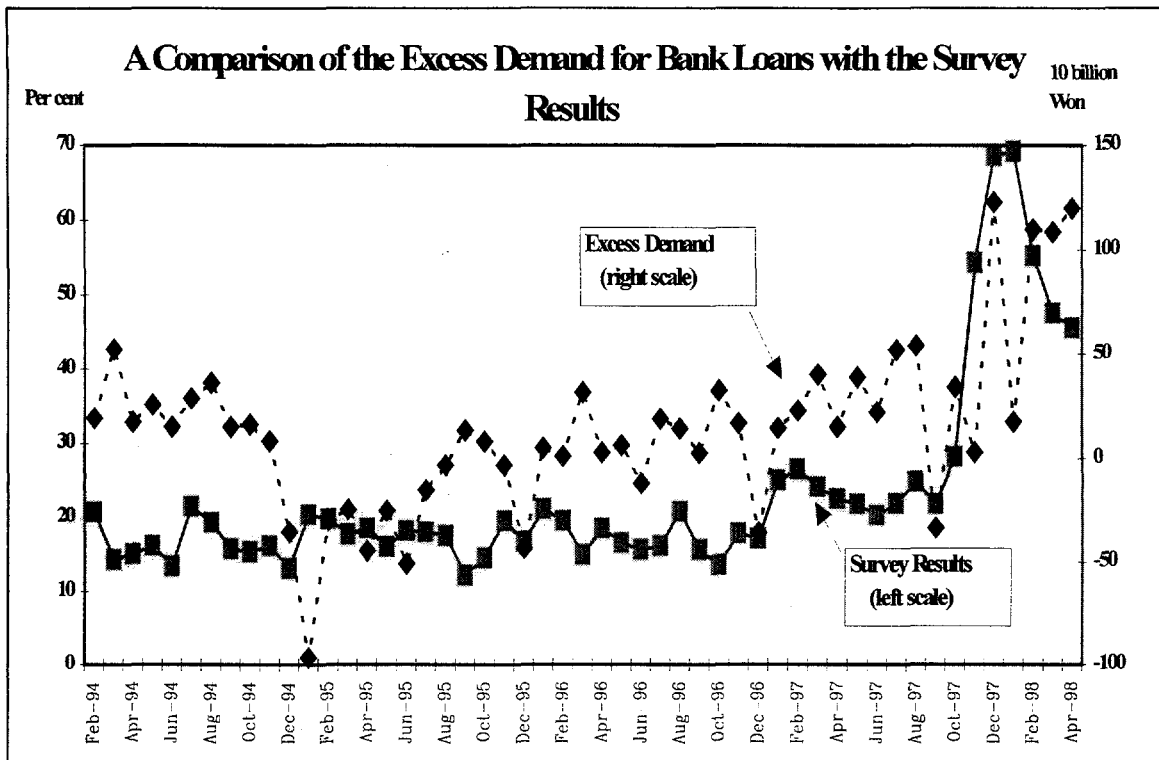
< Figure 18 >

Overall, two inferences can be drawn from the disequilibrium model evidence presented here. First, a crippling credit crunch, rather than the typical weak demand for bank credits attributable to exceptionally higher interest rates, appears to have provided a more important source behind a substantial decline in bank loans after the onset of the financial crisis in December 1997. It seems most likely that the massive credit squeeze created by the commercial banks during the crisis period was essentially associated with a pervasive structural shift in bank behavior that occurred probably due to deteriorating credit-market conditions such as substantial illiquidity, a wave of major corporate bankruptcies, and those banks' desperate needs to rebuild the BIS capital/asset ratios, etc. Furthermore, such a structural change was consequently responsible for posing a critical impediment to the ordinary functioning of the credit generating mechanism in the banking sector. Second, the episode of the credit crunch occurred as a result of the crisis sheds light on the independent role of the credit channel in providing an additional source of amplifying the economic decline. Therefore it allows us to better understand the serious contractions of real economic activities after the crisis. Namely, the credit crunch would have a sufficiently-strong, real effect beyond what would be predicted merely by the higher interest rate, by causing binding constraints on firms' (the small and medium-sized firms most likely to be constrained) availability of credit to finance both short-term working capital and investment spending.

IV. Conclusions

This paper finds convincing evidence of the practical importance of the credit channel (more specifically, the bank lending channel) in the monetary transmission mechanism, particularly following the financial crisis. A number of major conclusions can be drawn from the empirical results presented in this paper.

First, as shown in the so-called "narrative" approach to identifying if the bank lending channel is operating (i.e., if the loan supply rather than loan demand effects are identified as being important), bank lending was found to play a significant independent role in amplifying the real effects of tightened monetary policy, which was implemented in response to the crisis (December 1997 episode). Bank lending channel reinforced the dampening effect of tightened monetary policy on real economic activity that would be expected had the policy been transmitted sorely through the interest rate channel. It seems most likely that the transmission mechanism from the financial distress in the banking industry due to the crisis to a decline in the real economic activity presumably have worked largely through a reduction in bank credit to small and medium-sized firms.

Second, when disaggregated bank balance sheet data were used to test for the existence of the loan supply effects over the 1990s, there was a much greater dampening effect on both lending volume and the securities holding of small bank group than those of the large bank group after a tightened monetary policy (i.e., a positive innovation in the call rate). These results would be largely consistent with the testable prediction of the bank lending channel that the sensitivity of both lending volume and securities holding to monetary tightening should be more pronounced for small banks typically facing higher costs in attracting non-deposit sources of external finance and thereby tighter liquidity constraints, just as for their non-financial counterparts (i.e., small and medium-sized firms). Notably, the lending volume for each bank group was found to drop more substantially in response to the crisis shock used as an alternative measure of the severe monetary contraction. This evidence could conceivably suggest the role for the credit crunch that would have occurred in the wake of the crisis, although some definitive test is needed to identify more precisely whether such a larger decline in lending for each bank group in response to the crisis shock is attributable to the diminished loan supply or demand.

Third, empirical investigation of the credit crunch using a disequilibrium model of loan market specifying separate loan demand and supply function revealed an evidence that in the aftermath of the crisis in December 1997, there has occurred a substantial excess demand for bank loans caused by a sharp loan supply decline (i.e., by the credit crunch). It is noteworthy that the credit crunch during the crisis was associated with a pervasive structural shift in bank behavior nationwide that led to a critical impediment to the ordinary functioning of the credit generating mechanism in the banking sector (i.e., a systemic crisis). While the exact source of the structural shift is difficult to identify, it appears most likely that such a structural shift stemmed from the fragile credit market conditions which was under way even before the crisis unfolded. The adverse conditions would involve an exposure of the banking sector to huge non-performing loans driven predominantly by a wave of major corporate bankruptcies and the consequent desperate

needs to rebuild the BIS capital/asset ratios. What is more, the pattern of the excess demand for loans seems reasonably consistent with the survey measure to the extent of the credit market tightness faced by the small and medium-sized firms. It was found during the crisis period after December 1997 that the ratio of the respondents who answered greater difficulties in getting access to credits almost tripled compared to other normal times.

Finally, it is worthwhile to consider several policy prescriptions for the distributional consequences that would arise if there exists a distinctive lending channel of the monetary policy transmission or a systematic crisis such as the credit crunch occurs. First, as we have argued, it is for the most part the bank-dependent small firms that have to bear a disproportionate share of the real cost of monetary tightening or the credit crunch. What may be needed to address such a distributional disadvantage is to provide a cushion against the credit crunch or monetary policy contractions either by facilitating steady small business finance using trade credits, or by fostering relationship lending and larger funds of credit guarantees.[21] Second, the supervision of banks should be strengthened to prevent such a systemic crisis as the credit crunch that might substantially reduce the supply of credits to the small businesses. In this case, however, bank regulatory policy (on the recapitalization, for example) should not be imposed too strictly during the crisis in particular, in light of its potential adverse effects on banks' small business lending. It is widely recognized that strictly-enforced BIS capital/asset ratios after the IMF bail-out actually resulted in a substantial decline in banks' small business lending by making their lending behaviors excessively cautious.

In addition, from the standpoint of monetary policy management, if the lending channel is quantitatively important, monetary policy-induced change in bank loans can have significant effects on business investment and aggregate spending even if open-market interest rates do not move by much. Consistent with this, bank loans have actually shown a close link to those real variables in Korea. In this respect, it seem clear that bank loans should be included as one of key information variables that the central bank need to closely monitor when formulating policy.

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[21] See Berger and Udell (1998).

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4-29