

WP/00/25

# IMF Working Paper

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## Financial Crisis and Credit Crunch in Korea: Evidence from Firm-Level Data

*Eduardo Borensztein and Jong-Wha Lee*

WP/00/25

INTERNATIONAL MONETARY FUND

Research Department

**Financial Crisis and Credit Crunch in Korea: Evidence from Firm-Level Data**

Prepared by Eduardo Borensztein and Jong-Wha Lee<sup>1</sup>

February 2000

**Abstract**

This paper analyzes the credit crunch following the recent financial crisis in Korea. Using enterprise-level data, we find that there were big differences in the magnitude of the credit contraction across different types of firms. In particular, chaebol (conglomerate)-affiliated firms appeared to have lost the preferential access to credit they enjoyed in the pre-crisis period, and credit appears to have been reallocated in favor of more efficient firms. This suggests that the credit crunch suffered by certain sectors can be attributed to the adjustment by banks and enterprises to the restructuring of the financial sector, rather than to tight monetary policy or an external credit constraint.

JEL Classification Numbers: E52, O16, O53

Keywords: Korea, credit crunch, financial crisis

Authors' E-Mail Addresses: eborensztein@imf.org; jong-wha\_lee@harvard.edu

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<sup>1</sup>Part of this work was undertaken while Jong-Wha Lee was visiting the IMF's Research Department and the Center for International Development at Harvard University. The authors are grateful to Andrew Berg, Ajai Chopra, Jason Furman, Jeanne Gobat, Sungwoog Kim, Cheng Hoon Lim, Steve Radelet, Andrew Warner, and seminar participants at the NBER Summer Institute, the Center for International Development, and the Korea-America Economic Association annual meeting for helpful comments on earlier versions of the paper. The views expressed are the authors' alone and should not be attributed to the organizations that the authors are affiliated with. The authors thank Nada Mora for excellent research assistance and Young Soo Lee for assistance in collecting data.

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## I. INTRODUCTION

A financial crisis of unprecedented dimension developed after the exchange rate collapse of December 1997 in Korea. The real economy suffered a sharp, if short-lived, decline, with GDP plummeting by 5.5 percent in 1998, and fixed investment contracting by almost 40 percent. This constituted the worst economic contraction since the end of the Korean War in 1950, average monthly bankruptcies surpassed 3,000, more than double the volume for the same period of 1997.<sup>2</sup>

Financial distress, however, can result from different factors. Despite widespread criticism of tight monetary policies, citing the level of interest rates as evidence of such tightness, weaknesses in financial institutions and corporate borrowers may in fact explain much of the credit contraction.<sup>3</sup> For example, banks needed to increase their capital ratios in line with Basle standards, and those institutions unable to increase equity were not in a position to expand credit to their customers. Moreover, it is also the case that the financial reforms changed economic incentives for banks and corporations and affected both the demand for and the supply of credit. For example, the corporate sector understood that, under the new conditions, it was necessary to reduce their very high leverage rates (and was instructed to do so). Banks may (should) have become more selective in choosing borrowers, at a time when promising activities may not have been in abundance in Korea. Under those conditions, it is not clear that an easy monetary policy would have contributed much to expand credit to the corporate sector.

The purpose of this paper is to examine the nature of the credit crunch, as suggested by the pattern of the contraction (actually only a slowdown) in credit to the private sector in Korea in the months after the collapse of the won exchange rate in December 1997. In particular, the paper focuses on the following question: was there a general credit contraction or did the cutbacks affect only overindebted and probably nonviable firms? This question is better addressed using firm-level information rather than macroeconomic data. It should be noted that although there is anecdotal evidence indicating that many firms had difficulties in obtaining credit to finance investment and production, there has not been a systematic research into the characteristics of the firms that received less finance after the crisis in the Korean economy. This paper will start to fill this gap.<sup>4</sup>

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<sup>2</sup> The term "credit crunch" typically denotes a situation in which an unusual sharp decline in the supply of credit generates an unsatisfied excess demand for credit at the prevailing interest rates. The term has also been used more loosely to describe a situation of tight credit conditions in general. See Ding, Domac, and Ferri (1998) for the various concepts of credit crunch.

<sup>3</sup> A selective reading list on these issues includes Berg (1999), Furman and Stiglitz (1998), Lane, et al (1998), and Radelet and Sachs (1998).

<sup>4</sup> A notable exception is a study by Dollar and Hallward-Driemeier (1998) based on a survey of 1200 firms in the Thai manufacturing sector. It is noteworthy that the responses of the Thai firms in this survey, from the third quarter of 1997 to the first quarter of 1998, do not  
(continued...)

Previous studies have approached the credit crunch question in different ways, mostly by examining aggregate data. Ding, Domac, and Ferri (1998) and Domac and Ferri (1998) found evidence of a credit crunch in the sharp increases in the spread between bank lending rates and corporate bond yields, reflecting the tightening of bank loan market. Ferri and Kang (1998) found, based on individual bank data, that banks, in particular those with lower equity, raised lending rates and reduced their lending rapidly. Kim (1998) and Ghosh and Ghosh (1998) followed the approach of estimating equations for loan demand and supply and found opposite results. Kim found that the demand for bank loans exceeded the loan supply by a large margin after the financial crisis, but Ghosh and Ghosh failed to find an excess demand for credit in either Korea, Thailand or Indonesia.

Regardless of whether credit supply was the constraining factor or not for the economy as a whole, individual firms can face credit rationing, especially in a situation of financial crisis<sup>5</sup>. Using firm-level data enables us to analyze the differences in the determinants of the credit constraints faced by different firms. One of the crucial issues related to the credit crunch is *the extent to which profitable and viable firms did or did not have access to finance*. By looking at the characteristics of the firms that observed reductions in their bank credit volumes, we can assess the nature of the credit crunch in Korea in 1998. If the credit constraints affected all firms regardless of their financial situation, there would be evidence pointing to tight monetary policy as the cause for the credit crunch. If, on the contrary, there is evidence that profitable and viable firms were not affected by credit constraints, there would be evidence consistent with the structural corrections in the financial (and corporate) sectors being the main explanation for the credit crunch stories.

Our results indicate that, in contrast to evidence for the period before the crisis (Borensztein and Lee (1999)), there was a shift in the pattern of allocation of credit in the post-crisis period. Based on a data base of firm-level balance sheet records, we find evidence that, in the pre-crisis period, there was easier access to credit for firms connected with chaebols, while non-chaebol firms' access to bank credit was more influenced by market considerations. In 1998, the relative advantage of chaebol firms seems to disappear, and the track record of profitability appears as a significant determinant in the flow of credit to those firms. This changing pattern of credit allocation is at least consistent with the intended effect of the structural reforms in the financial sector.

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indicate that firms had problems obtaining financing for profitable projects but instead that unfavorable demand conditions led them to demand less credit.

<sup>5</sup> Note that credit rationing, which describes a situation where credit demand exceeds supply and credit is allocated through non-price mechanisms, can occur without a contraction of the supply of credit; that is, there is no necessary connection between credit rationing and a credit crunch.

## II. MONETARY CONTRACTION AND CREDIT CRUNCH

### A. What Credit Crunch?

Monetary and financial indicators in Korea in 1998 depict a mixed picture, with interest rates increasing sharply in the first months after the currency crisis but monetary aggregates displaying a less clear pattern. Interest rates were sharply raised initially (at least in nominal terms) to defend the exchange rate and restore market confidence. The overnight call rate rose from 12.5 percent to 21 percent on December 5, 1997 and reached 32 percent on December 26, 1997.<sup>6</sup> The overnight rate started to decline rapidly after its peak, and by July it was back at pre-crisis levels. In fact, by August, the overnight rate was at its lowest level in the 1990s, in nominal terms. The three-year corporate bond rate, a benchmark for the medium-term rate in Korea, displayed slightly less sharp changes, starting to decline a little earlier and more moderately. (Figure 1).<sup>7</sup>

It is hard to establish the behavior of real interest rates. One problem is that, as a consequence of the exchange rate depreciation, wholesale prices increased much faster than consumer prices, as the latter include a higher share of nontraded goods that did not rise in price to the same extent as traded goods. This means that there is no unique real interest rate measure; the relevant price index is not the same for an exporter than for a firm in the services sector, for example. Furthermore, inflationary expectations are particularly hard to approximate because the outlook for inflation depended heavily on expectations about the behavior of the highly volatile exchange rate. *Ex-post* short-term real interest rates can be calculated, for example, on the basis of (the monthly average of) overnight interest rates and price index movements over the same month. This measure of the real interest rate, while more erratic than nominal rates, also displays a significant increase in the first half of 1998. In addition, the *ex-post* real interest rate was highly negative in the period of passthrough of the devaluation, but tended to show some increase towards the end of 1998 on account of further declines in the rate of inflation. (Figure 1, bottom panel.)

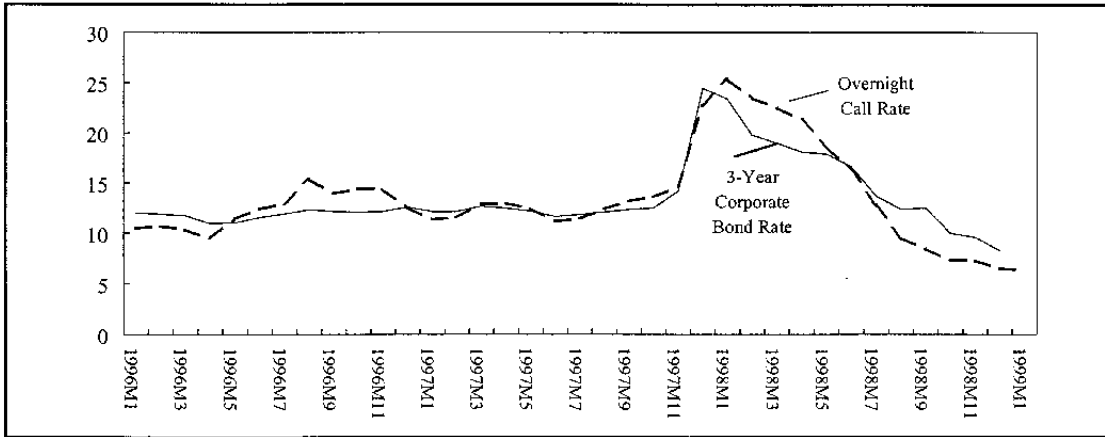
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<sup>6</sup> The call rate, the interest rate on the interbank market, is the commonly monitored indicator of liquidity conditions in the money market.

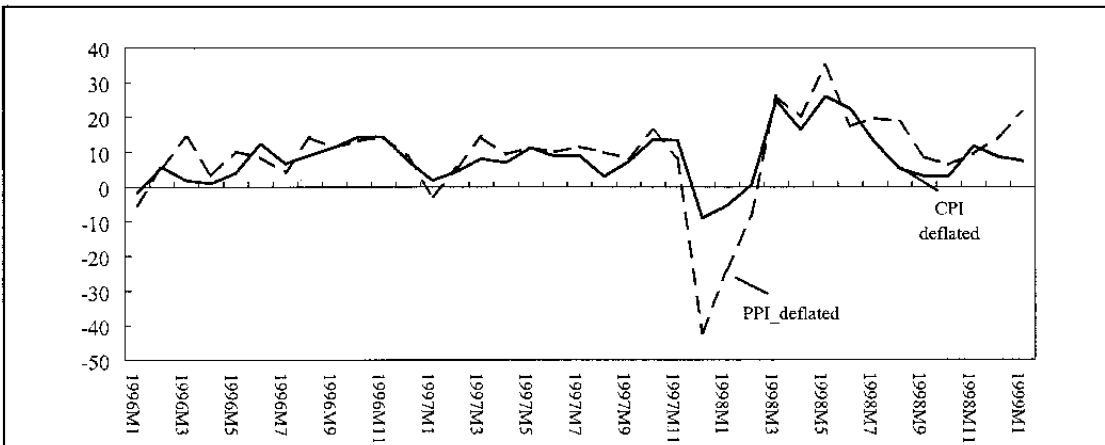
<sup>7</sup> A detailed analysis of monetary and financial market developments and reforms can be found in Baliño and Ubide (1999).

Figure 1. Nominal and Real Interest Rates

Nominal Interest Rates



Real Interest Rates (Overnight Call Rate)



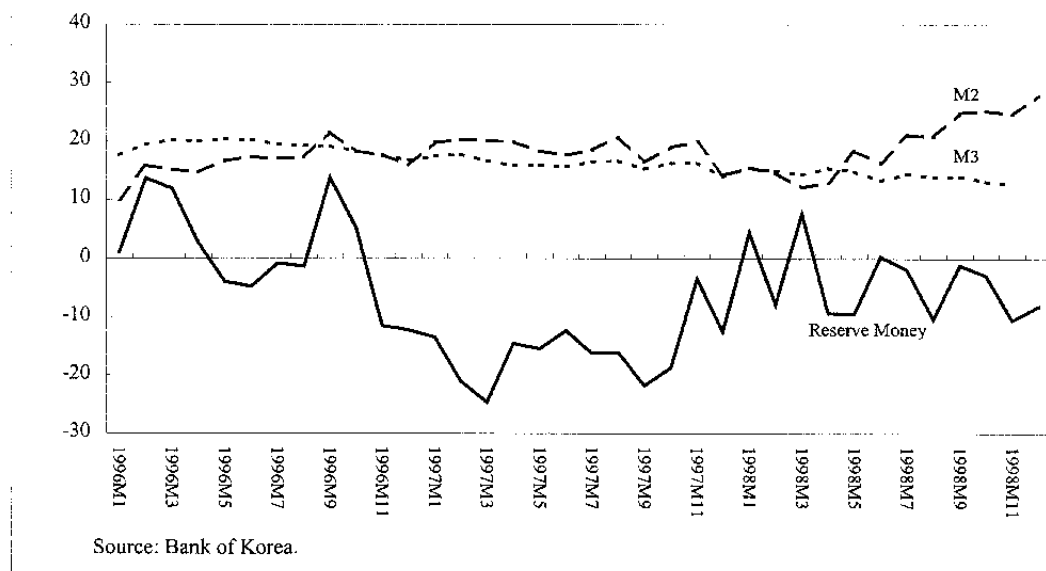
Source: Bank of Korea

Although high interest rates suggest a tight monetary stance in the early part of 1998, interest rates alone may not provide an adequate measure of the tightness of monetary conditions. Devaluation expectations pushed up the whole structure of won interest rates, again of the stance of monetary policy; higher interest rates reflected also increased default risks (or at least an increase in perceived default risks).

The behavior of monetary aggregates is most surprising in light of the widely prevailing "credit crunch" view. In particular, it is surprising that broad money (M3) grew in 1998 at roughly the same rate as in previous years. Base money, by contrast, declined by 12.5 percent (measured in 12-month growth rates) by December 1998; the behavior of base money may be more indicative of the true stance of monetary policy, as it indicates that

relatively tight liquidity prevailed, especially in the early part of 1998 (Figure 2).<sup>8</sup> The implied behavior of the money multiplier is somewhat of a puzzle. Under conditions of financial uncertainty, one would expect that the banks' reluctance to extend loans, and perhaps the public's preference for saving vehicles outside the banking system, would have reduced the value of the money multiplier. In fact, there was a sizable shift of deposits away from the troubled merchant banks; yet these resources were mostly channeled towards deposit money banks and, in the aggregate, the financial sector experienced a net *positive* shift of demand.<sup>9</sup> Whatever the reasons for this behavior by depositors, the result is that the mass of financial resources at the disposal of financial institutions in 1998 increased roughly at the same pace as in "normal" times.<sup>10</sup>

Figure 2. Growth of Monetary Aggregates  
(12-month percent change)



Financial institutions did cut back loans despite this relative abundance of resources. Deposit Money Banks used the increase in resources obtained from higher level of deposits and credit from the Bank of Korea to pay down foreign debts, increase credit to the public

<sup>8</sup> The behavior of the 12-month growth rate of base money was also affected by the reduction in reserve requirements in 1997.

<sup>9</sup> The financial sector definition in M3 in Korea is very broad, including deposit money banks, specialized banks, development banks, investment institutions and savings and insurance institutions.

<sup>10</sup> Although a part of the increase in total liquidity came from the revaluation of foreign currency deposits, this effect was not significant. The increase in foreign currency deposits accounted for 15 percent of the increase in M3 over the period November 1997 to June 1998.



sector and moderately expand credit to the private sector. (Table 1). On a broader basis, credit to the private sector from the financial sector as a whole was basically flat in real terms over the year (Figure 3).

While the aggregate data indicates that real money and credit slowed down during the crisis, it is not clear on how significantly domestic credit conditions tightened.<sup>11</sup> In particular, considering that both credit supply and demand fell simultaneously in the crisis period, it is not clear whether credit supply was really the binding constraint. Some studies have tried to avoid this simultaneous problem by looking at the changes in the interest spreads. Ding, Domac, and Ferri (1998) and Domac and Ferri (1998) suggest that a credit crunch occurred because there were sharp increases in interest rate spreads, in particular, the spread between the bank overdraft lending rate and the corporate bond yield. They argue that the increase in the spread between bank loans and corporate bonds interest rates reflected the tightening credit conditions that affected bank-dependent borrowers more adversely. While this evidence is suggestive, a rise in interest rate spreads does not necessarily imply the existence of a general credit crunch. The increase in overdraft lending rates right after the crisis may have resulted from the fact that overdraft borrowers represented a higher default risk at a time of crisis than before.<sup>12</sup>

A look at monetary aggregates and interest rates data alone is insufficient to ascertain the existence of a credit crunch and, furthermore, it cannot explain why a credit crunch occurred. A fall in real credit and a rise in interest rates and spreads do not indicate necessarily that monetary contraction caused a credit crunch. The contraction of real lending can be caused not only by monetary contraction but by structural changes in the financial sector.

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<sup>11</sup> In other financial crisis episodes, money and credit contracted sharply in real terms. In the case of Mexico, the growth rates of real money and real credit were -12.3 and -19.2 percent respectively in 1995. See Lane et al. (1999).

<sup>12</sup> The bank overdraft lending rate soared to 37.5 percent in December 1997 from 17.1 in November 1997, while the interest rates of general bank loans increased more modestly to 15.3 percent from 12.3 percent over the same month.

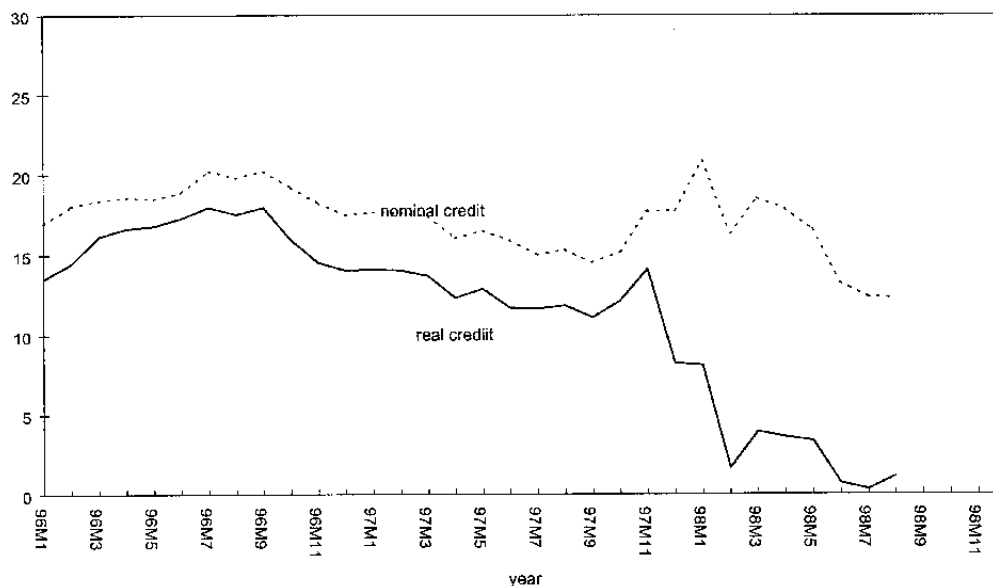
Table 1. Korea: Assets and Liabilities of Deposit Money Banks  
(End of Period, in Trillion Won)

	1995	1996	Nov-1997	Jun-1998	Nov-1998	Nov-1998 one-year change
Claims on Public Sector	21.1	23.3	21.3	37.4	42.1	20.8
Claims on Private Sector	200.8	240.9	294.0	299.4	307.4	13.4
Foreign Assets	21.5	28.6	39.1	52.8	44.8	5.7
Deposits	138.7	163.0	190.3	206.1	241.5	51.3
Credit from Bank of Korea	28.4	24.5	22.9	55.2	44.7	21.9
Foreign Liabilities	24.4	36.5	49.5	42.7	34.1	-15.4
Other items (Net) 1/	51.9	69.0	91.8	85.7	74.0	-17.8

Source: International Financial Statistics, IMF.

1/ Sum of reserves (negative sign) and other liabilities (bonds, restricted deposits, government deposits and lending funds, capital accounts, and other net items).

Figure 3. Growth of Financial Sector Credit to the Private Sector  
(12-month percent change)



## B. The Causes for the Contraction in Lending

The literature on the transmission mechanism of monetary policy may provide some insights on the response of banks and firms in 1998. The traditional view of the monetary transmission mechanism is that a shift in monetary policy affects real consumption and investment through an increase in interest rates. In contrast to this 'interest rate channel,' recent literature has focused on a 'bank lending channel'. The lending view emphasizes the

mechanism through which central bank actions have a direct effect on banks' loan supply and, in turn, real spending by bank borrowers.<sup>13</sup>

The operation of bank lending channel centers on two conditions. First, banks change the supply of loans in response to a shift in monetary policy by the central bank. This implies that, for instance, when reserves fall, banks will not keep their outstanding loans unchanged by simply drawing down their stock of government securities. Second, bank loans are not a perfect substitute for other sources of finance from the perspective of borrowers. This may generally be true for small- and medium-sized firms that cannot easily obtain funding by issuing securities directly to investors.

Empirical work on the bank lending channel has focused on identifying the relationship between bank lending and aggregate output<sup>14</sup>. However, when output and bank loans contract simultaneously, it is not obvious how to tell the causality between the bank lending and aggregate output. Essentially, the deceleration of bank credit may come from a shift in demand or supply. Kashayp, Stein and Wilcox (1993), and Oliner and Rudebusch (1995) attempted to avoid this identification problem by looking at the change of the ratio of bank borrowing to non-bank borrowing after a monetary contraction. The idea is that while output contraction or the usual interest rate channel is considered to shift the demand for bank loans and other types of finance altogether in the same direction, the contraction of loan supply will make bank loans lose their relative importance compared to other sources of finance. In their empirical work based on the US economy, Kashayp, Stein and Wilcox find that a monetary tightening induces a decline in the ratio of bank debt outstanding to the sum of bank debt plus commercial paper. By contrast, Oliner and Rudebusch do not find clear evidence that a monetary contraction induces a drop in the supply of bank debt relative to other forms of finance both for a sample of large firms and a sample of small firms in the US.

In the Korean context, the contraction in bank loans responded to both monetary conditions and structural changes in the financial sector. Several factors can explain the changes in the pattern of credit allocation. First, financial institutions became more reluctant to extend loans to enterprises because of the new financial sector regulations and environment. In particular, some banks did not meet capital adequacy ratios and could not raise equity capital easily; in that situation, exposure to highly-leveraged or loss-making customers does not help.<sup>15</sup> In general, government securities or foreign assets (or a reduction

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<sup>13</sup> See Kashayp and Stein (1994) and Bernanke and Gertler (1995) for surveys of the bank lending view. Monetary tightening can also have an adverse effect on firms by the depressing effect on the firms' collaterals and internal funds- which is called separately as a "balance sheet channel."

<sup>14</sup> See, for example, Bernanke and Blinder (1988, 1992), and Romer and Romer (1989, 1990).

<sup>15</sup> Bernanke and Lown (1991) show that in the 1990-91 US recession period, banks with low capital ratio had slow lending growth. Peek and Rosengren (1995) show that banks that were targets of formal regulatory actions reduced their lending at a significantly faster rate than those that were not. Hall (1993) finds evidence that the introduction of the BIS risk-based  
(continued...)

in foreign debt) were more attractive options than loans to Korean borrowers. Second, the higher level of interest rates, by weakening the state of borrowers' balance sheets, may have reduced the demand for credit. Highly-leveraged corporate firms were more vulnerable to the interest rate increases, and their investment demand declined substantially. Third is the traditional "crowding-out" effect. The fiscal deficit increased from a small surplus in 1997 to a deficit of almost 4 percent of GDP, without including the (noninterest) cost of financial restructuring in the deficit measure. As a result, the government had to tap domestic financial markets to a large extent in 1998. Fourth, as foreign lines of credit dried up, banks had no choice but to repay their short-term foreign debts, or later repay the emergency support that the Bank of Korea had provided on a temporary basis. Fifth, prudential regulations imposed by the new institutional framework including the establishment of a new independent financial supervisory agency may have prompted financial institutions to upgrade standards in project monitoring and risk evaluation.

In sum, to adapt themselves to the new regulations and the new incentives in the new financial environment, banks needed to change their lending practices. To be sure, a change in the composition of credit is not an unusual response by banks to any tightening in monetary conditions. In particular, a "flight to quality" may happen, whereby banks respond to a monetary tightening by shifting their loan portfolio toward more credit-worthy borrowers. Gertler and Gilchrist (1993,1994), Lang and Nakamura (1995), and Oliner and Rudebusch (1995) provide evidence of a broad reallocation of short-term bank lending away from small firms toward large firms after a monetary contraction. In the Korean context, however, a flight to quality in favor of more profitable and less leveraged firms is also consistent with the objectives of the financial sector reforms. Note that, in the distorted incentives circumstances of nearly bankrupt financial institutions, the opposite result could have been observed. That is, financial institutions could have channeled more resources to their weakest borrowers to keep them from going bankrupt and to maintain the appearance of a less troubled loan portfolio.

### **III. CREDIT ALLOCATION DURING THE CRISIS: EMPIRICAL EVIDENCE**

In this section we assess the allocation of credit by financial institutions after the start of the crisis. Traditionally, the Korean financial system had been used for industrial policy purposes, and banks did not need to attach importance to market principles in evaluating and monitoring projects. Furthermore, there was the expectation that troubled borrowers and lenders would benefit from government bailouts.<sup>16</sup> A break from those practices would be

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capital standards induced US commercial banks to change the portfolio towards safer assets (e.g. Treasury securities) away from commercial loans, while Berger and Udell (1994) claim the effect of the risk-based capital regulations on lending was not quantitatively important. Ito and Sasaki (1998) confirm the effect of the risk-based capital standards on the lending behavior of Japanese banks in the period between 1990 and 1993.

<sup>16</sup> Borensztein and Lee (1999) provide some empirical evidence of inefficient credit allocations among Korean manufacturing sectors for the period from 1970 to 1996.

reflected in a significant redistribution of credit. To the extent that the financial reform started to have an impact, we would expect to see a redistribution of credit on stricter market basis.

### A. The Firm-level Data

The firm-level data used in this study come from the database constructed by the Korea Listed Companies Association, which provides comprehensive corporate and financial information on listed companies beginning in 1981. The company profiles and financial information data are compiled from the financial statements, business reports, and audit reports that every company is legally mandated to produce on a bi-annual basis. This is one of the most reliable data bases available on financial information on Korean firms.<sup>17</sup> We do not include financial service firms in our sample because their accounting practices are different from those of firms in other industries.

We then identified our sample firm's affiliation with business groups or "chaebols". Chaebols consist of many subsidiaries usually owned and controlled by a single family or by companies within the family's control.<sup>18</sup> In this study, we distinguish the top 30 chaebols from the non-chaebol firms on the basis of their asset size as of end-1996. The 30 largest chaebols produced about 16 percent of GDP and more than 40 percent of manufacturing output.<sup>19</sup> In 1996, the top 30 chaebols possessed on average some 22 subsidiaries (See Yoo, 1998, Table 4), while in our sample they have about 4 publicly listed companies on average.<sup>20</sup>

Table 2 provides summary statistics of the basic data for all sample firms over the period 1996 to June 1998. The table confirms that Korean firms went through difficult times in the crisis period of December 1997 to June 1998. The year-on-year rate of growth of real sales for the average firm dropped from 4.3 percent in 1997 to -6.8 percent in the first half of 1998. The share of interest payments in total sales increased from 7.4 percent in 1997 to

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<sup>17</sup> Note that this database covers only listed companies which comprised 776 companies as of 1997. Another database compiled by the Korea Investors Service (KIS) contains financial information on much larger number of companies, including both listed and unlisted companies. The financial information on the unlisted firms can be considered as less reliable.

<sup>18</sup> The Korean Fair Trade Commission (KFTC) legally defines a business group as "a group of companies, more than 30 percent of whose shares are owned by some individuals or by companies controlled by those individuals". The KFTC identifies business groups and announces them every year.

<sup>19</sup> Among the 30 chaebols, the top 5 chaebols, comprising Hyundai, Samsung, Daewoo, LG, and SK, are the most powerful. The top five chaebols alone produced about 9 percent of GDP and accounted for 27 percent of manufacturing GDP in 1995.

<sup>20</sup> In 1996 total number of subsidiaries that belonged to the top 30 chaebols was 669. The listed companies accounted for 26 percent of the total (Yoo, 1998).

11.6 percent in the first half of 1998. The profit rate started to decline in 1997, dropping from 1.59 percent in 1996 to -0.03 in 1997 and 0.05 percent in the first half of 1998.<sup>21</sup> The lower profit rates went hand in hand with higher leverage: the debt/capital ratio was 68.8 percent in December 1996 and increased to 71.8 percent in December 1997 and 72.1 percent in June 1998.

Both short-term and long-term bank borrowing slowed down in real terms in the first half of 1998. The annualized growth rate of real short-term bank borrowing dropped for the average firm from 35.9 percent in the year 1997 to 20.6 percent in the first half of 1998. By contrast, the annualized growth rate of real total bank borrowing dropped more significantly from 30.5 percent in 1997 to 6.2 percent over the first six months of 1998. The higher growth rate of short-term borrowing, compared to that of total borrowing, may result from new short-term loans that were granted in order to capitalize interest on loans.

The firm-level data indicate that despite the financial crisis, there was no general credit contraction in the first half of 1998: both total and short-term real bank credit increased for the average firm. In fact, bank borrowing increased relative to other forms of finance over the period. The share of short-term bank borrowing in short-term debt slightly increased from 47.9 percent in December 1997 to 48.3 percent in July 1998. Over the same period, the share of total bank borrowing increased from 43.7 to 44.9 percent of total debt. This suggests that firms reduced their recourse to alternatives to bank lending, such as commercial paper and corporate bonds, relative to bank loans.

Table 2 also compares the performance of the top-30 chaebol firms with the other (non-chaebol) firms in the sample. The chaebol firms had higher debt ratios and lower profit rates over the period. In June 1998 the financial situation was worse for the chaebol than for the non-chaebol firms: the average chaebol firm had a profit rate of -1.34 percent and the debt/capital ratio of 83.1 percent, while the average non-chaebol firm had a profit rate of 0.41 percent and a debt/capital ratio of 69.3 percent. Both the chaebol and the non-chaebol firms were hit hard by the crisis, however. The growth rate of sales for the average chaebol company dropped from 11.6 percent in 1997 to -5.9 percent in the first half of 1998, while it declined from 2.4 percent to -7.0 percent over the same period for the average non-chaebol firm. Bank lending also contracted both for chaebols and non-chaebols. The annual growth rate of real short-term bank borrowing dropped on average from 46.7 percent in 1997 to 21.2 percent in June 98 for chaebol firms, while it dropped from 33.1 to 20.4 over the same period for non-chaebols. The growth rate of real total bank borrowing dropped even further:

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<sup>21</sup> The profit rate is defined as the ratio of ordinary income (net profit before income tax plus net extraordinary gains) to total assets.

Table 2. Summary Statistics of Korean Firm Data  
(simple average, in percent)

	Total Firms (N=534)			Top 30 Chaebols (n1=112)			Non-Chaebols (n2=442)		
	1996	1997	June 1998	1996	1997	June 1998	1996	1997	June 1998
Profit rate	1.59	-0.03	0.05	0.57	-0.82	-1.34	1.85	0.17	0.41
Debt/asset	68.8	71.8	72.1	77.1	82.2	83.1	66.6	69.0	69.3
Short-term debt/total debt	62.1	63.3	65.5	61.4	60.3	61.3	62.3	64.1	66.6
Interest payments/sales	6.7	7.4	11.6	7.1	7.9	13.6	6.5	7.3	11.2
Real sales growth <sup>1)</sup>	9.3	4.3	-6.8	12.1	11.6	-5.9	8.6	2.4	-7.0
Export/sales	27.2	28.9	34.5	29.1	34.4	40.0	26.8	27.5	33.1
Short-term bank credit <sup>2)</sup>									
Real growth rate <sup>1)</sup>	23.6	35.9	20.6	24.9	46.7	21.2	23.2	33.1	20.4
Ratio to Short-term Deb	45.2	47.9	48.3	47.2	47.7	51.2	44.6	47.1	47.5
Total Bank Credit <sup>2)</sup>									
Real growth rate <sup>1)</sup>	18.9	30.5	6.2	24.0	47.7	5.2	17.8	26.0	6.4
Ratio to total debt	40.2	43.7	44.9	41.4	45.5	45.7	39.9	43.2	44.7

1/ The growth rate is per annum. The real sales growth in 1998 is the year-on-year change over June 1997-June 1998.

2/ Bank credit indicates firm's borrowings from all financial institutions including banks and nonbank financial institutions.

from 47.7 percent in 1997 to 5.2 percent in the first half of 1998 for the chaebols and from 26.0 to 6.4 percent over the same period for the non-chaebols. Despite the slowdown in real bank borrowing, bank borrowing increased relative to other forms of finance in 1998 for both chaebols and non-chaebols. The share of short-term bank borrowing in short-term debt and the share of total bank borrowing in total debt both increased slightly in the first half of 1998 for both kinds of firms.

## **B. The Pattern of Credit Allocation**

This section analyzes whether there were significant changes in the allocation of credit across firms after the crisis erupted in end-1997. As noted earlier, we want to test whether there was a general contraction of bank lending to Korean firms or whether profitable and viable firms were largely not affected.

We first analyze how the supply of bank credit related to the firm's profit rate and leverage ratio in 1998. We divide all individual firms into five groups based on the quintile of firm's average profit rate over the three years from 1995 to 1997. For the five groups, we study the change in the supply of credit in the first half of 1998. The supply of credit is measured by the annualized growth rates of real short-term bank borrowing and of real total borrowing. In the spirit of the "credit channel" of monetary transmission, we also measure it by the changes in the ratio of short-term bank borrowing to short-term debt and the ratio of total bank borrowing to total debt.

Table 3 reports the relationship between firm's profitability and supply of credit. Comparing across the five groups, a clear pattern emerges, showing that credit was allocated to the more profitable firms. For instance, firms in the top quintile of the profit distribution observed an increase in real short-term borrowing of 38.8 percent per annum, while firms in the bottom quintile experienced a decline in real short-term bank credit of 6.8 percent. If the sample is divided into chaebols and non-chaebols, the relationship between profitability and bank credit is slightly weaker but still remains positive.

We also divide all individual firms into five groups based on the distribution of the average debt/capital ratio over the three-year period from 1995 to 1997. We compare the change in the supply of credit in 1998 for the five quintiles of the distribution in Table 4. The relationship between finance availability and leverage is not monotonic. At lower levels of leverage (firms in the first to the third quintile) there is a positive association between credit growth and leverage but at higher levels of leverage (from the third to the fifth quintile) the relationship is negative. This pattern seems to be consistent with a redistribution of credit towards more creditworthy borrowers.



Table 3. Profit Rates and Credit Allocation  
(in percent, p.a.)

	Profit Rate		Rate of Change from December 1997 to June 1998			
	(Avg.1995-97) Range in Quintile	Average	ST Credit Growth Rate	Total Credit Growth Rate	ST Credit/ ST Debt	Total Credit/ Total Debt
All Firms (N=527)	(1) 4.58~32.4	7.8	38.8	12.0	7.6	5.8
	(2) 2.23~4.58	3.3	22.6	9.6	1.8	3.2
	(3) 0.77~2.23	1.5	31.6	15.4	2.2	2.6
	(4) -1.23~0.77	-0.1	16.2	4.8	-0.2	3.4
	(5) -25.8~-1.23	-5.2	-6.8	-11.0	-4.6	-2.4
Chaebols (n1=106)	(1) 1.91~10.10	4.4	38.6	-6.2	2.8	-2.4
	(2) 1.12~1.91	1.5	70.8	40.2	8.8	5.6
	(3) 0.53~1.12	0.8	40.2	15.4	10.0	5.8
	(4) -1.61~0.53	-0.3	-6.6	-3.0	-2.4	0.2
	(5) -9.11~-1.61	-4.3	-35.6	-20.8	-17.2	-6.8
Non-Chaebc (n2=421)	(1) 5.16~32.4	8.4	25.6	5.8	6.4	5.4
	(2) 2.71~5.16	3.8	45.2	28.4	5.6	6.6
	(3) 1.08~2.71	1.9	15.2	2.8	-0.4	2.4
	(4) -1.10~1.08	0.1	14.6	2.4	-1.6	2.2
	(5) -25.8~-1.10	-5.5	1.6	-7.0	-1.8	-1.2

Table 4. Debt Ratio and Credit Allocation  
(in percent, p.a.)

	Debt Ratio		Rate of Change from December 1997 to June 1998			
	(Avg.1995-97) Range in Quintile	Average	ST Credit Growth Rate	Total Credit Growth Rate	ST Credit/ ST Debt	Total Credit/ Total Debt
All Firms (N=527)	(1) 23.0~55.4	45.0	19.6	2.0	4.2	3.6
	(2) 55.4~65.1	60.2	19.8	4.4	1.6	3.0
	(3) 65.1~73.3	69.0	30.4	17.8	-1.2	3.4
	(4) 73.3~81.5	77.2	25.0	8.2	3.0	2.6
	(5) 81.5~310	97.6	7.6	-1.6	-0.8	0.2
Chaebols (n1=106)	(1) 54.1~70.1	64.2	45.0	16.6	1.6	3.0
	(2) 70.1~77.2	73.9	42.6	17.2	3.4	1.4
	(3) 77.2~81.7	79.2	31.6	2.0	7.8	2.0
	(4) 81.7~86.1	83.8	8.2	0.4	-3.6	-0.2
	(5) 86.1~120.9	93.9	-20.8	-9.8	-7.6	-4.0
Non-Chaebols (n2=421)	(1) 23.0~52.3	43.5	21.8	4.4	3.6	3.6
	(2) 52.3~61.9	57.8	22.8	2.4	3.8	3.2
	(3) 61.9~70.0	65.8	11.8	3.6	-1.8	2.6
	(4) 70.0~78.3	73.6	38.0	25.4	1.4	5.0
	(5) 78.3~310	97.1	8.2	-3.2	1.0	0.8

We formally test whether a firm's financial characteristics were a significant factor in the distribution of bank loans. Using the panel data set of 1583 firms over three periods (1996, 1997, and the first half of 1998), we estimate the following regression:<sup>22</sup>

$$(1) \quad D(BL)_{jt} = a_0 + a_1 D(BL)_{j,t-1} + a_2 * D98 + a_3 * D98 * Profit_{j,t-1} \\ + a_4 * D98 * Debt_{j,t-1} + a_5 * D98 * Chaebol_{j,t-1} + \epsilon_{j,t}$$

where  $D(BL)_{j,t}$  is the change in bank lending to firm  $j$  at time  $t$ . We use four different measures for  $D(BL)$ : the growth rate of real short-term bank borrowing, the growth rate of real total borrowing, the change in the ratio of short-term bank borrowing to short-term debt, and the change in the ratio of total bank borrowing to total debt. We include a dummy variable for the crisis period,  $D98$ , which captures the average change of  $D(BL)$  in the first half of 1998. We expect the coefficient on  $D98$  to be negative if the supply of credit was reduced on average in 1998. The effects of firms' profitability and debt size on the magnitude of credit contraction are captured by two multiplicative terms: the product of the previous period profit rate and  $D98$ , and the product of the debt ratio and  $D98$ . Hence, this specification allows us to detect the possible reallocation of bank lending among firms during the crisis period. We also include an interactive term between a chaebol dummy and the crisis dummy to see if bank loans were reallocated in favor of the chaebol group. The regression was estimated allowing for random effects, and controlling for each firm's previous year's dependent variable.<sup>23</sup>

Table 5 reports the results of regressions for the four different measures of credit contraction based on the total sample of 1583 firms. The results show that the profit rate variable always has a significantly positive coefficient, indicating that bank loans were indeed re-directed in favor of firms which had shown better profitability in the past.<sup>24</sup> In a

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<sup>22</sup> We have used only the more recent years for the regression in order to maximize the number of firms included in the balanced panel. Since financial data are available for a much smaller number of firms in the earlier years than in the recent period, extending the data set into the earlier period would force many firms to drop out of the sample. The results reported below do not change qualitatively, however, when we use a balanced panel data set over the whole period from 1990 to 1998.

<sup>23</sup> The results do not change qualitatively when we allow for firm-specific fixed effects or when the lagged dependent variable is excluded. The results also do not change when we include dummies for industry (total 24 dummies for 16 manufacturing and 8 non-manufacturing sectors) to control for industry effects.

<sup>24</sup> Ideally, we should test the effect of future profitability, rather than past profit rates, on credit growth. Unfortunately, we do not have an accurate measure of firm's future profitability such as Tobin's  $Q$ .

Table 5. Determination of Credit Allocation after the Crisis  
(Panel of three time periods: 1996, 1997, Jan-June 1998)

Sample: Total Firms (N=1583)

	Dependent Variable			
	ST Credit Growth Rate	Total Credit Growth Rate	D(ST Credit/ ST Debt)	D(Total Credit/ Total Debt)
Lagged dependent Variable	-0.073 (0.030)**	0.017 (0.028)	-0.268 (0.038)**	-0.155 (0.036)**
D98 (dummy for crisis period)	-14.650 (14.34)	-27.070 (10.35)**	-0.511 (3.189)	1.250 (2.275)
D98* profit rate(t-1)	2.297 (0.563)**	1.717 (0.400)**	0.536 (0.125)**	0.462 (0.089)**
D98* debt ratio(t-1)	0.072 (0.194)	0.126 (0.140)	0.011 (0.043)	0.009 (0.031)
D98* chaebol	2.821 (9.574)	-1.740 (6.917)	-0.325 (2.121)	-2.101 (1.517)
Constant	31.730 (2.914)**	24.010 (2.085)**	1.445 (0.608)**	1.382 (0.438)**

The estimation is based on panel estimation with random effects.

Standard errors are reported in parentheses.

\*\* significant at 5 percent level.

typical case, the estimated coefficient implies that a one percentage point higher profit rate is associated with a 2.3 percentage points higher growth rate of real short-term bank credit. We also examined how bank lending was reallocated depending on the firms' leverage ratio. The debt-to-capital variable (again multiplied by the crisis dummy) resulted insignificant. This result casts some doubt on the extent to which leverage was a relevant consideration in banks' decisions once one controls for profitability, although it may also be related to a nonlinearity in the relationship between finance and leverage.

We also checked if the affiliation with chaebol groups had an impact on the allocation of bank loans during the crisis period. The estimated coefficient turns out to be statistically insignificant. Hence, there is no evidence that chaebol-connected firms were treated in a differential way in terms of access to bank after the financial crisis.

To better gauge the nature of changes in the determinants of credit allocation, we also estimated an additional specification. In this specification, we estimate the effect of the three variables that describe a firm's economic and financial situation (profitability, leverage and affiliation with a chaebol group) on the allocation of credit both before the currency crisis (the years 1996 and 1997) and after the currency crisis (the first half of 1998). That is, we estimate the following equation:

$$(2) \quad D(BL)_{jt} = a_0 + a_1 D(BL)_{j,t-1} + a_2 * D98 + a_3 * D98 * Profit_{j,t-1} + a_4 * D98 * Debt_{j,t-1} \\ + a_5 * D98 * Chaebol_{j,t-1} + b_3 * D96\sim 97 * Profit_{j,t-1} + b_4 * D96\sim 97 * Debt_{j,t-1} \\ + b_5 * D96\sim 97 * Chaebol_{j,t-1} + \epsilon_{j,t}$$

where D96~97 represents a dummy variable that is equal to one for the observations corresponding to 1996 and 1997 and zero otherwise.

The results, summarized in Table 6, are quite interesting. They show that the main change in the aftermath of the crisis was experienced by chaebol firms. Before the crisis, affiliation with a chaebol group could increase access to credit significantly. The coefficients on D96~97\*Chaebol are not only significant but quantitatively important in the regressions both for real short-term bank credit and real total bank credit growth: for instance, affiliation with a Chaebol is associated with about an 18 percentage point higher growth rate of real total bank credit over the period from 1996 to 1997. In contrast, after the crisis, affiliation with a chaebol was not a significant determinant of credit allocation: the corresponding coefficients on D98\*Chaebol are not significantly different from zero and in fact negative in three of the four specifications. This suggests that the credit crunch was largely a chaebol problem.

To further investigate the chaebol/nonchaebol differences, we ran regression (2) on two separate samples: one constituted by firms affiliated with the top-30 chaebols and the other conformed by non-chaebol firms. The results, presented on Table 7, are revealing. For chaebol firms, profitability was not a significant determinant of the allocation of credit in the

Table 6. Determination of Credit Allocation after the Crisis  
 (Panel of three time periods: 1996, 1997, Jan-June 1998)  
 Sample: Total Firms (N=1583)

	Dependent Variable			
	ST Credit Growth Rate	Total Credit Growth Rate	D(ST Credit/ ST Debt)	D(Total Credit/ Total Debt)
Lagged dependent Variable	-0.074 (0.030)**	0.008 (0.028)	-0.265 (0.038)**	-0.154 (0.036)**
D98 (dummy for Crisis period)	-17.730 (16.87)	-32.810 (12.18)**	-1.684 (3.773)	2.801 (2.695)
D98* profit rate(t-1)	2.306 (0.562)**	1.721 (0.404)**	0.537 (0.125)**	0.462 (0.089)**
D98* debt ratio(t-1)	0.061 (0.193)	0.121 (0.139)	0.011 (0.043)	0.009 (0.031)
D98* chaebol	3.392 (9.549)	-1.238 (6.883)	-0.332 (2.117)	-2.077 (1.517)
D96~97* profit rate(t-1)	1.449 (0.566)**	0.691 (0.406)*	0.269 (0.125)**	0.148 (0.089)*
D96~97* debt ratio(t-1)	-0.139 (0.128)	-0.164 (0.092)	-0.031 (0.028)	0.015 (0.020)
D96~97* chaebol	12.410 (6.968)**	17.940 (4.985)**	1.827 (1.524)	1.152 (1.527)
Constant	35.560 (9.704)**	30.270 (6.952)**	2.600 (2.121)	-0.182 (1.527)

The estimation is based on panel estimation with random effects.

Standard errors are reported in parentheses.

\*\* significant at 5 percent level.

\* significant at 10 percent level.

Table 7. Determination of Credit Allocation after the Crisis  
for Chaebol and Non-Chaebol firms  
(Panel of three time periods: 1996, 1997, Jan-June 1998)  
*Chaebols*(*n*=325)

	ST Credit Growth Rate	Total Credit Growth Rate	D(ST Credit/ ST Debt)	D(Total Credit/ Total Debt)
Lagged dependent Variable	-0.061 (0.069)	0.124 (0.058)**	-0.156 (0.087)*	-0.009 (0.094)
D98 (Dummy for Crisis Period)	-51.590 (92.76)	-48.310 (66.72)	-47.220 (20.29)**	-11.030 (15.65)
D98* Profit Rate(t-1)	12.690 (2.803)**	5.533 (2.205)**	3.265 (0.613)**	1.006 (0.471)**
D98* Debt Ratio(t-1)	1.100 (1.026)	0.352 (0.740)	0.523 (0.223)**	0.104 (0.172)
D96~97* profit rate(t-1)	2.466 (1.630)	1.002 (1.179)	0.307 (0.357)	0.125 (0.272)
D96~97* debt ratio(t-1)	0.530 (0.547)	0.116 (0.396)	-0.074 (0.119)	-0.022 (0.091)
Constant	-5.329 (43.80)	22.960 (31.64)	7.585 (9.520)	3.701 (7.261)

*Non-Chaebols* (*n*=1258)

	ST Credit Growth Rate	Total Credit Growth Rate	D(ST Credit/ ST Debt)	D(Total Credit/ Total Debt)
Lagged dependent Variable	-0.071 (0.033)**	-0.016 (0.031)	-0.281 (0.042)**	-0.180 (0.039)**
D98 (dummy for Crisis period)	-19.630 (17.30)	-34.290 (12.55)**	-0.550 (3.884)	3.105 (2.738)
D98* profit rate(t-1)	1.852 (0.577)**	1.564 (0.415)**	0.429 (0.128)**	0.442 (0.091)**
D98* debt ratio(t-1)	0.055 (0.198)	0.130 (0.142)	-0.002 (0.044)	0.007 (0.031)
D96~97* profit rate(t-1)	1.399 (0.608)**	0.665 (0.435)	0.263 (0.134)**	0.144 (0.098)
D96~97* debt ratio(t-1)	-0.174 (0.132)	-0.178 (0.094)*	-0.028 (0.029)	0.016 (0.021)
Constant	37.890 (10.01)**	37.739 (7.140)**	2.427 (2.193)	-0.277 (1.588)

See Table 6.

pre-crisis period. In 1998, profitability becomes an important determinant of credit growth.<sup>25</sup> For non-chaebol firms, by contrast, profitability was already a significant determinant for short-term bank credit in the pre-crisis period, while profitability became a significant variable for total bank credit only after the crisis.

### C. Credit Contraction and Output Decline

This section investigates the extent to which the monetary contraction depressed output via the bank lending channel of the monetary transmission mechanism. A credit contraction does not necessarily induce a fall in output in the short-run. Lower credit could be compensated by other sources: for example, (i) using up inventories, (ii) lowering employees' compensation, or (iii) obtaining alternative finance sources, including falling into arrears. Moreover, a positive association between credit and output is not sufficient to support the bank lending channel. The causality between credit and output can be in either direction. Credit could follow an output decline induced by other factors such as, for example, an adverse terms of trade shock.

To look more closely into the link between credit contraction and output decline after the Korean financial crisis, we run cross-section regressions using the firm-level data set. We regress proportional changes in real sales (in the first half of 1998 over the first half of 1997) against the change of bank credit in the first half of 1998. We use four different measures of bank credit. Because the change in bank credit can itself be an endogenous variable, we applied a two-stage least squares method, using the independent variables that we used in the regressions of Table 5 - the lagged bank credit variable, the lagged profit rate, and the lagged debt ratio- as instruments for the supply of credit.<sup>26</sup>

The results from running the above regression are displayed in Table 8. The test finds a strong association between credit contraction and output decline.<sup>27</sup> This implies that the allocation of bank credit indeed had an important impact on real output. This suggests that firms that saw their access to credit constrained adjusted, at least in part, via lower production and that higher-performing firms that found an increased level of credit availability were able to expand their level of production. The regression results also suggest that the export share in total sales was another important factor in the firms' sales

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<sup>25</sup> A recent study by Choi and Kang (1999) based on survey of 863 Korean firms also finds support for the result that firms belonging to chaebol groups became subject to tougher loan appraisal. The study shows that the proportion of large firms rejected for loans rose sharply from 21 percent in 1997 to 61 percent in the first half of 1998, far exceeding that of small and medium firms.

<sup>26</sup> This regression is in the spirit of Calvo and Coricelli (1992) analysis of the output decline in the economies of Central and Eastern Europe at the outset of the reform process.

<sup>27</sup> The results do not change when we include dummies for industry to control for industry effects.



Table 8. Bank Credit and Real Sales Growth  
(Dec.1997-June1998)

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Sample: Total Firms (N=499)

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Lagged dependent Variable	0.206 (0.045)**	0.214 (0.046)**	0.204 (0.052)**	0.230 (0.052)**
Export/sales(t-1)	0.446 (0.057)**	0.466 (0.055)**	0.529 (0.064)**	0.567 (0.069)**
ST credit Growth rate	0.201 (0.097)**			
Total credit Growth rate		0.272 (0.135)**		
D(ST credit/ ST debt)			0.910 (0.309)**	
D(total credit/ Total debt)				1.147 (0.443)**
Constant	-24.190 (2.510)**	-22.280 (2.279)**	-24.340 (2.724)**	-27.220 (3.248)**

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The estimation is based on 2SLS regressions. Instruments for the credit variable are previous period bank credit variable, the lagged profit rate and the lagged debt ratio  
\*\* significant at 5 percent level.

performance. Export-oriented firms, which benefited from the effects of the exchange rate depreciation, experienced an increase in sales and could compensate the impact of any credit restrictions.<sup>28</sup>

#### IV. CONCLUSIONS

This paper examined the nature of credit crunch in the aftermath of the Korean financial crisis. We used firm-level data to analyze changes in the allocation of credit in the post-crisis period. The evidence shows some significant changes in the determinant of credit allocation among borrowers. In particular, firms belonging to chaebol groups seem to have lost the preferential access to credit that they enjoyed in the pre-crisis period and seemed to be subject to more stringent profitability tests in order to obtain bank credit.

These results suggest that the “credit crunch” may have been the outcome of the structural changes in the financial sector rather than that of a general monetary contraction. This implies that a more expansionary monetary policy would have done little to alleviate this kind of “credit crunch.” But we should note that while affiliation with the largest and most powerful groups became less of a consideration for obtaining bank credit and market viability gained in importance, this does not imply that nonchaebol firms were unaffected by the crisis. Although the volume of bank credit to the chaebol firms decreased by a larger magnitude than that to the non-chaebol firms, the non-chaebol firms could have been more affected by the credit decline because they lack access to other sources of finance. In the Korean economy, chaebols do have easier access to other sources of financing including bond financing than non-chaebols do.

It should be expected that a fundamental change in the behavior of financial institutions in terms of credit appraisal and loan allocation will certainly require a much longer period of learning and practice. Nonetheless, the results reported in this paper are moderately encouraging, although they comprise data on listed companies only. We could have seen an increasing volume of resources flowing to distressed corporation just to keep them alive. Instead, credit allocation seems to have improved by becoming more market-based. In the end, the process of financial reform and corporate restructuring, although triggered by a costly currency crisis, may provide the opportunity for long-term improvement in efficiency and soundness of the Korean financial system.

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<sup>28</sup> Krueger and Tornell (1999) show that in the years after the Mexican financial crisis of 1994, tradable sector firms were subject to a less stringent credit crunch and experienced a faster recovery than firms in the non-tradable sector.

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