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The Role of Long-term Loans for Economic Development: Empirical Evidence in Japan, Korea, and Taiwan

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The Role of Long-term Loans for Economic Development:
Empirical Evidence in Japan, Korea, and Taiwan*

By
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Abstract

The purpose of this paper is to investigate whether long-term funds had a positive impact on investment in Japan, Korea, and Taiwan. When there exists a possibility of a liquidity shortage, the firm's investment decision tends to be conservative. Thus, to the extent that the long-term debt makes the liquidity shortage less likely outcome, long-tern loans can have a positive impact on investment. In the first part of this paper, we estimate Tobin's Q type investment functions of Japanese firms for two different sample periods. In 1972-84, we find that the long-term loan ratio had an additional positive effect on investment. However, in 1985-96, we cannot find that a higher ratio of long-term loans increased the Japanese firm's investment. The result indicates that the size of long-term loans had a great influence on the firm's investment only at the early stage of the financial market development in Japan. In the second part of this paper, we estimate investment functions of Korean and Taiwanese firms in the late 1990s. In the late 1990s, Korea experienced a serious crisis, while the decline of Taiwanese economy was relatively moderate. We, however, find that the long-term debt ratio had a significantly positive impact on the investment in both countries. The result indicates that long-term funds might have mitigated the decline of investment regardless of the magnitude of the crisis.

JEL #: E22, G21, G28
Key Words: Long-term Loans, Economic Growth, Tobin's Q

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1. Introduction

Financial markets are the most prominent means of channeling investment capital to its highest return uses. These markets also provide liquidity and permit the efficient pooling of risk. Both of these activities alter social composition of savings in a way that is potentially favorable to enhanced capital accumulation. Noting these roles of financial markets, classical studies by Patrick (1966), Cameron (1967), Goldsmith (1969), McKinnon (1973) and Shaw (1973) assert that the extent of financial intermediation in an economy affects rates of economic growth. In general equilibrium framework, a similar connection between financial intermediation and growth has been investigated by Greenwood and Jovanovic (1989), Bencivenga and Smith (1991), Obstfeld (1994), Fry (1995), and Greenwood and Smith (1997). In these models, financial intermediaries alter the social composition of savings in a way that is potentially favorable to more productive, illiquid capital investment thorough liquidity provision and enhance capital accumulation.[1]

In most developing countries, it is the banking sector that played a major role in the financial market. As delegated monitors, banks specialize in gathering information about firms and reduce corporate myopia through overcoming the problems associated with informational asymmetry (for example, Leland and Pyle (1977) and Diamond (1984)). The banks also play an important role in selecting good borrowers and in monitoring their ex-post performance (see, among others, Aoki (1994) and Hoshi, Kashyap, and Scharfstein (1991)).

If banks could prevent unnecessary liquidation, these activities would have had a positive impact on economic growth. However, to the extent that the debt maturity is short, there exists a probability of a liquidity shortage in the sense of Diamond and Dybvig (1983). Thus, when panicking external creditors become unwilling to roll over existing short-term credits, otherwise solvent borrowers may suffer from the short-run liquidity problem. The short-run liquidity problem tends to be serious at the early stage of economic development because internal funds are not sufficient for most of borrowers. In particular, without prudential regulation nor a safety net, the liquidity problems of private bank loans may be intensified in the financial market.

The purpose of this paper is to estimate investment functions in Japan, Korea, and Taiwan and to examine the role of long-term loans for economic development in these countries. We focus on the role of long-term loans because they are less mobile forms of capital flows. When loans take the form of long-term contracts, it becomes costly for the external creditors to cancel them. Thus, if a large fraction of the bank debt takes the form of long-term loans, investment would be larger

[1] Empirical studies by Jung (1986), Roubini and Sala-i-Martin (1992), Antje and Jovanovic (1993), and King and Levine (1993a, b) support their views and document a positive correlation between a variety of measures of financial activity and economic development. However, the empirical findings are indecisive on causality between financial activity and economic development.

because long-term loans would make the liquidity shortage less likely outcome.

In the following analysis, we estimate Tobin's Q type investment functions by using individual corporations' financial data in Japan, Korea, and Taiwan. Provided that the concept mentioned above is right, restrained long-term loans would have restricted investment at the early stage of economic development, even if corporations had a high Tobin's Q and a big size of cash flow. We can thus expect that the ratio of long-term loans to total loans had an additionally positive effect on investment in the economy that has a potential liquidity risk in the financial market.

In the first part of this paper, we estimate investment functions of Japanese firms from 1972 to 1996. In post-war Japan, internal financing was highly limited, and issuing corporate bonds had been strictly regulated for most of the firms until the mid 1980s. Under such circumstances, it was widely accepted that long-term funds provided by long-term credit banks and the Japan Development Bank played an important role for high economic growth. In estimating the investment functions, we confirm this conventional view. That is, we find that even if we allow various fundamental variables such as Tobin's Q, profit, and cash flow, the long-term loan ratio had a significantly positive impact on the Japanese firms' investment for the sample period 1972-1984. However, for the sample period 1985-1996, the coefficient of long-term loan ratio was never significantly positive. The result implies that long-term loans had important roles for investment only at the early stage of development and that they came to lose their role during a past two decade in Japan.

In the second part of this paper, we estimate investment functions of Korean and Taiwanese firms in the late 1990s. It is now widely recognized that a large fraction of short-term external liabilities was one of the main reasons why the East Asian countries had the serious crisis in 1997. A large number of studies suggested that otherwise solvent East Asian countries might have suffered from a short-run liquidity problem because the available stock of reserves was low relative to the overall burden of external debt service (interest payments plus the renewal of loans coming to maturity).[2] In particular, the East Asian crisis occurred when foreign lenders suddenly refused to roll over their bank loans in 1997. This implies that if a large fraction of external liabilities had longer maturities, the East Asian crisis might not have taken place as the form of a liquidity shortage. In the analysis, we examine whether this macroeconomic implication can be confirmed by the firm level data in Korea and Taiwan. Korea is one of the East Asian countries that experienced a serious crisis in 1997, while the decline of Taiwanese economy was relatively moderate during the crisis. We, however, find that the long-term debt ratio had a significantly positive impact on the investment in both countries. This indicates that long-term funds might have mitigated the decline of investment

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[2] For example, Corsetti, Pesenti, and Roubini (1998), Radelet and Sachs (1998), Furman and Stiglitz (1998), and Ito (1999).

regardless of the magnitude of the crisis.

This paper is organized as follows. Section 2 discusses the roles of long-term funds in post-war Japan. Section 3 sets out the investment functions and explains the data in Japan. Section 4 explains the construction procedure of capital stock and Tobin's Q. Section 5 presents the estimate results of the investment functions in Japan when the long-term fund ratios are added to explanatory variables. Section 6 examines whether long-term funds have any different influences on investment between keiretsu-affiliated and non-affiliated firms. Section 7 discusses the role of long-term funds in other East Asian countries. Section 8 sets out the investment functions in Korea and Taiwan and section 9 presents their estimation results. Finally, section 10 summarizes our main results and discusses remaining issues.

2 The Roles of Long-Term Funds in Japan

In the following analysis, we first examine whether the long-term loan ratio had an additional positive effect on investment in Japan. In post-war Japan, bank loans had been the major source of external funds for almost all firms. Except for few firms, internal financing was highly limited, and issuing corporate bonds had been strictly regulated until the mid 1980s. Thus, to the extent that the debt maturity was short, there existed a probability of a liquidity shortage for borrowing firms. However, some of the Japanese firms benefited from the policy-based allocation of "long-term loans" which might have mitigated the liquidity risk.

Among Japanese policymakers, there was an implicit agreement that the policy-based finance allocated to specific fields of industry was successful in supporting the postwar high-growth. In particular, it was widely accepted that long-term funds provided by long-term credit banks and the Japan Development Bank played an important role for high economic growth. From the macroeconomic viewpoint, the policy-based allocation of long-term funds is warranted, if the allocated long-term funds had great external effects in increasing capital stock and production. However, without market failure, rolling over of short-term loans are essentially the same as long-term loans. It is, thus, not self-evident whether the policy-based allocation of long-term loans could effectively increase capital stock and production of specific corporations or not.

In previous literature, there are several empirical studies that stressed the role of Japan Development Bank's loans (henceforth called "JDB loans") in increasing capital stock and production of specific industries and corporations. For example, Horiuchi and Sui (1993) carried event studies of corporations listed on Tokyo Stock Exchange Second Section, and demonstrated JDB loans were apt to increase capital investment. Calomiris and Himmelberg (1994) carried the similar studies, using company-specific data in the overall machinery industry, and came up with an outcome supporting the pump-priming effect of JDB loans.[3] The weights of JDB loans among total external borrowings were, however, not so high except for a few corporations. This paper, thus, empirically examines whether the total long-term loans － not only JDB loans but also including private long-term loans － had an effect of increasing capital investment of specific corporations in post-war Japan.

A series of papers by Teranishi, et al. (e.g., Teranishi (1982), Takei and Teranishi (1991)) are outstanding studies, which proved that the policy-based allocation of the long-term loans contributed to increasing capital stock and production of specific industries during the high-growth period in postwar Japan. However, the analyses by Teranishi and others relied solely on the aggregated time-series data. In contrast, this paper tries to examine the appropriateness of their concept by estimating standard investment functions based on the panel data of individual Japanese firms.

Our approach is similar to a large number of studies that estimate investment functions, using the panel data of Japanese firms.[4] In particular, Hoshi, Kashyap and Scharfstein (1990, 1991) estimated investment functions taking account of the role of "main banks" and demonstrated that a company belonging to an affiliated business group ("keiretu") was less restricted by the liquidity constraint.[5] However, none of these studies focused on the role of long-term loans. Although both the main bank and policy-based allocation of long-term funds were inherent features of Japan's financial market in the high-growth period, the mechanism of affecting investment are intrinsically different from each other. Therefore, to the extent that there was the possibility of a liquidity shortage, the allocation of long-term loans would have had a different effect on investment through lessening the constraints of long-term investment funds.

3. The Estimated Equation and the Data

The following four sections examine what additional effects the long-term loan ratio had on investment of Japanese firms. In the analysis, we use the financial data of each Japanese firm and

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[3] Higano (1986) is one of the earliest studies that reached the same conclusions without rigorous analysis. To the contrary, Horiuchi and Otaki (1987) analyzed related issues by using industry-level macro data, and proved that such effects were scanty in many industries. Beason and Weinstein (1996) also came to a paradoxical conclusion that the more dependent an industry was on JDB loans, the lower was its growth rate.

4 For example, Asako, Kuninori, Inoue, and Murase (1989, 1997), Hayashi and Inoue (1991) and Suzuki and Ogawa (1997).

[5] The conclusions of Hoshi et al. were confirmed by, for example, Okazaki and Horiuchi (1992) and Ogawa and Suzuki (1997). Hayashi (1997), however, asserts that the conclusions of Hoshi et al. are not robustly supported when excluding some outliners.

estimate Tobin's Q type investment function as follows:

$$(1) \quad I_t/K_t = \text{Constant term} + \alpha * X_{t-1} + \beta * LONG_{t-1}$$

where I_t = investment amounts in the period t, K_t = capital stocks in the period t, X_t = fundament variables such as Tobin's Q, profit, and cash flow in the period t, and $LONG_t$= the long-term loan ratio in the period t. As referred to in the next section, K_t and Tobin's Q are converted into the market values.

In contrast with the standard investment functions, the long-term loan ratio ($LONG_t$) is added to the explanatory variable in eq. (1). This is because in the case that long-term funds impose different restrictions than short-term loans on investment, the size of long-term fund ratio affects the size of investment, even if the total amounts of loans are the same. Providing that the concept mentioned in the preceding section holds true, thus, the long-term loan ratio is supposed to have a significantly positive impact on investment at the early stage of the financial market development. Since the impact of each fundamental variable is also positive, both coefficients α and β are, hence, expected to be significantly positive at the early stage of the financial market development.

However, as the financial market develops, the potential risk of liquidity shortage becomes smaller. Under such circumstances, the role of long-term loan ratio declines in stimulating investment. It is thus expected that only coefficient α has a statistically significant positive value and that coefficient β becomes less significant for a recent sample period.

In the following analysis, bank loans are divided into long-term and short-term ones. Loans with a maturity exceeding one year are defined as "long-term loans" and the ratio of long-term loans to total loans is defined as "long-term loan ratio". We use this definition because the maturities of bank loans are classified only into those below and above one year in the financial data. As fundamental variables X_t's, we use not only Tobin's Q but also profit and cash flow that are normalized by dividing by the market value of capital stock respectively. In order to avoid the problem of instantaneity bias, all the variables are estimated with a lag of one period.

All the data in Japan are based on the data set contained in NEEDS-COMPANY by Nihon Keizai Shinbun. Those data are originally based on individual corporations' financial reports listed on the Tokyo Stock Exchange First-Section and Second-Section. The data cover the period from 1970 through 1996. The estimation period is from 1972 through 1996.[6] The analysis covers corporations belonging to the five industries of iron and steel, nonferrous metals, chemicals, electrical equipment, and transportation equipment (including ship building and automobile

[6] Many companies close their books in March, but not all the companies covered by the analysis did so. Data are, thus, arranged on the basis of calendar year when books were closed.

manufacturing). For each industry, the investment functions are estimated by the panel analysis (the fixed effect model and random effect model) including corporation dummies and time dummies. As to those corporations whose data were partially missing in the estimation period, we included their data by using an unbalanced panel analysis.

4. The Estimation of Capital Stock

In calculating the market value of capital stocks of Japanese firms, we first apply the perpetual inventory method for four types of capital stocks: (a) buildings and structures, (b) machinery and equipment, (c) vessels and vehicles, and (d) land. We then added up the converted capital stocks to calculate the aggregate capital stocks of individual corporations.[7] Except for land, the values of 1970 were taken as the benchmark, on the assumption that this year's book values of individual capital stocks are equal to their market prices.[8]

For deflector, we used the wholesale price index (p^{Ii}_t) corresponding to each investment goods *i*. Specifically, we used the wholesale price index of construction materials for buildings and structures, the wholesale price index of machinery and tools for machinery and equipment, and the wholesale price index of transportation equipment for vessels and vehicles as the deflectors. Each nominal gross investment is calculated by adding the book values of capital depreciation to the increments of each fixed asset.[9] Dividing the nominal gross investment by the investment goods deflector results in the real gross investments ($I_{i,t}$) of each individual tangible fixed asset.

The physical depreciation rate of capital stocks (δ^i) is calculated according to Hayashi and Inoue (1991) and Hulten and Wykoff (1981). They estimate the rates of asset depreciation at 0.047 for buildings and adjunctive equipment, at 0.09489 for machinery and equipment, and at 0.1470 for vessels and vehicles and transportation equipment.[10]

Upon obtaining the bench marks for capital stocks, real gross investments, and depreciation rates, we can calculate the real values of each individual capital stocks represented by the index *i* by the

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[7] Tools, apparatus and fixtures are not included in capital stocks, because their values are much smaller than those of other capital stocks.

[8] For example, discrepancies at the time of 1970, if any, would have less substantial effect on estimation, since the estimation periods start from 1972.

[9] Data from the NIKKEI NEEDS do not tell the book values of capital stock-specific depreciation, so that the book values of capital stock-specific depreciation were calculated by allocating the total book values of capital stock depreciation (net of land) in proportion to the book values of each individual capital stock.

[10] For the depreciation rate of structures, estimated at 0.0564 by Hulten and Wykoff, we used a 0.047 rate identical to that of buildings and adjunctive equipment.

following expression:

(2) $K_{i,t} = (1-\delta^{i})K_{i,t-1} + I_{i,t}$

The market value of capital stocks ($p^{Ii}{}_{t}K_{i,t}$) can be obtained by multiplying the real stock values by the deflector of capital goods ($p^{Ii}{}_{t}$).

The series of land stock are also calculated using the perpetual inventory method. The benchmark year is 1970, as is the case with other stocks. However, since the discrepancies between the market prices and book values were large, the benchmark for the market prices of land was obtained by multiplying the book values in 1970 by a 5.27. The value of 5.27 is the average ratio of market price to book value in 1970 calculated by Ogawa and Kitasaka (1998). In calculating the ratio, they divided the market prices of the land owned by private non-financial corporations capitalized less than ¥10 million by the book values of the land owned by overall industry, based on the Annual Report on National Accounts (the Economic Planning Agency) and the Quarterly Corporations Statistics (the Ministry of Finance).

The increases in the market value of land are calculated by the increases in the book values. However, the decreases in the book value of land, i.e. sold-out land, are converted into market prices based on the LIFO (last-in-first-out) assumption that the sold-out land was purchased at the last purchase point of time. In previous studies, Hoshi and Kashyap (1990), Ogawa (1990) and Ogawa and Suzuki (1997) used the similar assumption. The land price ($p^{L}{}_{t}$) used for the deflector is the "national index of urban land" (the average price for overall purposes), excluding six major cities, based on the Index of Urban Land Price (Japan Real Estate Institute).

Define the increase in the book value of land by $ILAND_t$ and its decrease by $DLAND_t$. Then, the market value of land investment ($NILAND_t$), the market value of land stock ($LANDY_t = p^{L}{}_{t}L_t$), and the real value of land net investment (IL_t) can respectively be calculated by the following equations:

(3) $NILAND_t = ILAND_t - (p^{L}{}_{t}/p^{L}{}_{t-1})*DLAND_{t,}$

(4) $LANDY_t = (p^{L}{}_{t}/p^{L}{}_{t-1})*DLAND_{t-1} + NILAND_{t,}$

(5) $IL_t = (ILAND_t/p^{L}{}_{t}) - (DLAND_t/p^{L}{}_{t-1}),$

On the other hand, Tobin's average Q is calculated as follows:

(6) $$\text{Tobin's Q} = \frac{V_t + LIB_t - CUR_t - CONSR_t - INTAN_t - OTHER_t - DEF_t}{\sum_i P_t^{Ii} K_{i,t-1}}.$$

where V_t = corporation's market price represented by its share price, LIB_t = total liabilities, CUR_t =

current asset, $CONSR_t$ = construction in process, $INTAN_t$ = intangible fixed asset, $OTHER_t$ = financial investment and other assets, and DEF_t = deferred asset.[11]

In the following analysis, we estimate the investment functions based on the market value of capital stock with and without land. Hence, when we use the market value of capital stock without land, we calculate the Tobin's Q by deducting the market value of land ($p^L_t L_t$) from both numerator and denominator in (6).

Table 1 shows average values and standard deviations of estimated Tobin's Qs with and without land in the five industries of iron and steel (50 companies), nonferrous metals (76 companies), chemicals (125 companies), electrical equipment (186 companies) and transport equipment (79 companies, including shipbuilding and automobile manufacturing). It indicates that Tobin's Q without land has a smaller standard deviation than Tobin's Q with land, which suggests that Tobin's Qs have small dispersions without land in each industry. By contrast, in the electrical equipment industry, the values of Tobin's Q as well as standard deviations are large in general. Regardless of whether land is included in capital stocks, the average value of Tobin's Qs is close to 1 in other four industries (iron and steel, nonferrous metals, chemicals and transportation equipment), which is consistent with the economic theory.

5 The Results of Estimation in Japan

This section estimates the investment function represented by eq. (1), using the data series of "capital stock" and "Tobin's Q" prepared in the preceding section. According to Fukuda, Ji, and Nakamura [1998], the flow of long-term funds showed a substantial structural change in the mid-1980s. We thus split the period of estimation into 1972-84 (before the financial market develops) and 1985-96 (after the financial market develops). We then attempt a panel analysis of the fixed effect model and the random effect model, including a corporation dummy and time dummy, with respect to each of the five industries (iron and steel, nonferrous metals, chemicals, electrical equipment and transport equipment).[12]

Table 2 shows the results of estimation, using capital stocks including land. The results for the period of 1972-84 are shown in Table 2-1 and those for the period of 1985-96 in Table 2-2. Firstly, the estimates of "α", which is the coefficient of fundamental variables, are positive both before and after the mid-1980s, and supports the standard theoretical results. The results remain the same even when either Tobin's Q, the profit rate, or cash flow is used as a fundamental variable. The t-values

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[11] Except for stock prices, any of the variables is based on the financial data of individual corporations. Share prices are stock prices adjusted for dividend off.

[12] Since shipbuilding is peculiar in the transportation industry, estimations were attempted for both of the cases including and excluding shipbuilding firms.

are also statistically significant, except for the random effect model for the iron and steel industry.

However, the estimates of "β", which is the coefficient of the long-term loan ratio, are completely different between 1972-84 and 1985-96. That is, the estimates of β are all positive in 1972-84. In particular, t-values are significantly different from zero except for chemicals, and the results have goodness of fit. The result supports the hypothesis that even with the total amounts of loans being given, the long-term loans had an additional positive impact on investment at the early stage of the financial market development.

In 1985-96, by contrast, the estimates of β never take a significantly positive value. In the two industries of iron/steel and nonferrous metals, they are positive but are not statistically significant. In the three industries of chemicals, electrical equipment and transportation equipment, they become negative. This means long-term loans have had no significantly positive impact on investment after the mid-1980s when the financial liberalization progressed.

The above results are robust even when we use different explanatory variables. For example, Table 3 indicates the results of estimation when we use capital stocks without land. The comparison between Table 2 and Table 3 show slight differences in the estimates of individual coefficient. However, the estimates in both tables are almost similar in sign and statistical significance, which supports our hypothesis even in the case that capital stocks do not include land.

In Table 4, we set out the results of estimation in the case where both Tobin's Q and profit (or cash flow) are used as explanatory variables to estimate eq. (1).[13] The theory implies that Tobin's Q is a sufficient statistic for investment if the market works perfectly. However, previous empirical studies showed that since corporations face with liquidity constraints, profits and cash flows have an important explanatory power in estimating an investment function even if Tobin's Q is included in the explanatory variable. The results in Table 4 reconfirm this previous result in any industry and any period, suggesting that many Japanese corporations faced with liquidity constraints throughout the periods.

However, as far as we focus our attention to the coefficient of long-term loan ratio, "β", the inclusion of plural fundamental variables has nothing to do with the estimated results. That is, Table 4 shows that as in Table 2, the estimates of "β" are all positive in the 1972-84 period, while those in the 1985-96 period never take significantly positive values. This indicates that although profit or cash flow might ease the short-term liquidity constraints, they could never help reducing the constraints of long-term funds at the early stage of the financial market development. This implies that the long-term constraints should be separated from the short-term liquidity constraints at least before the financial market develops in Japan.

[13] Without loss of generality, we reported the case where capital stocks include land in Table 4.

6 The Roles of the Keiretsu Corporate Grouping

In the preceding section, we have demonstrated that up to the mid-1980s, a higher ratio of long-term loans had a positive effect on investment even when we include fundamental variables such as Tobin's Q in the explanatory variables. We have also indicated that the effect of the long-term loan ratio has nothing to do with the size of profit or cash flow, and that the constraints due to a shortage of long-term funds are essentially different from short-term liquidity constraints caused by a shortage of cash flows.

This section examines the robustness of the latter implication by looking at whether the effect of long-term loan ratio on investment is different between keiretsu-affiliated corporations and non-affiliated ones. Some of previous studies proposed that a corporation belonging to a keiretsu corporate grouping faces lesser liquidity constraints. If policy-based allocation of long-term loans is an alternative means to ease liquidity constraints, then the proposition implies that the allocated long-term loans would have had stronger effects on investment for non-affiliated corporations than for affiliated one.

Loans from main banks, however, are basically short-term funds and have the role of easing short-term liquidity constraints such as working funds. By contrast, the policy-based long-term funds are provided in anticipation of mid- and long term prospects of a corporation. Therefore, at least in the period when there existed a possibility of a liquidity shortage, the allotment of long-term funds might have served to lessen the constraints of long-term funds.

Splitting corporations into two groups of keiretsu-affiliated corporations and non-affiliated ones, we shall estimate the investment function represented by eq. (1) with respect to each group. We compare the estimates of "β", a coefficient to indicate the effects of long-term fund ratio on investment, between keiretsu-affiliated corporations and non-affiliated ones. As far as the above conception is correct, no substantial differences are supposed to exist between keiretsu-affiliated corporations and non-affiliated ones concerning the effects of long-term loans on investment

Based on the 1995 version of Keiretsu no Kenkyu by the Economic Research Institute, the corporations belonging to the four corporate groupings or the six corporate groupings are assorted into "keiretsu-affiliated companies" and the others are assorted into "non-affiliated companies". The period of time covered by the following analysis is 1972-84. This is because the preceding section observed that long-term funds had a positive effect on investment in this period. As the result of splitting corporations into two groups, the sample size for each estimation becomes reduced. Thus, in the following estimations, we attempt a panel analysis by way of pooling all the data of corporations belonging to the five industries, rather than make industry-specific estimations.

Table 5 reports the results of estimation when we use capital stock including land. The estimates of "α", which is the coefficient of fundamental variables, take positive values regardless of whether corporations belong to keiretsu corporate groupings or not, and their t-values are all significantly different from zero. However, the coefficients of Tobin's Q are bigger for keiretsu-affiliated companies than for non-affiliated companies, which may show keiretsu-affiliated companies have closer relations between Tobin's Q.

In contrast, the estimates of "β", which is the coefficient of "long-term fund ratio", take positive values regardless of whether corporations belong to keiretsu-affiliated groupings or not. The estimates themselves are almost the same between corporate groups, but they are a little bit larger for keiretsu-affiliated companies than those for non-affiliated ones. These results clearly do not support the hypothesis that even before the mid-1980s, long-term funds had larger effects on the investment of non-affiliated companies than on the investment of keiretsu-affiliated companies. It is thus evident that long-term funds had not served as an alternative to ease short-term liquidity constraints in non-affiliated companies.

Our findings, however, indicate that long-term funds have a slightly bigger effect on the investment of keiretsu-affiliated companies than on those of non-affiliated ones. This property of long-term funds is not statistically significant. However, if that is true, main banks and long-term funds have mutually supplemental effects on easing liquidity constraints. That is, long-term funds had significantly affected investment at least until the mid-1980s, while they had been more effective in the way of corporate groups whose liquidity had been less limited because of the main bank's support. This consequence conforms to the hypothesis attained by Horiuchi and Sui (1993), and would be worthy of closer scrutiny in our future researches.

7. The Role of Long-term Funds in Other East Asian Countries

The purpose of the following sections is to estimate the investment functions of Korean and Taiwanese firms in the late 1990s. It is now widely recognized that a large fraction of short-term external liabilities was one of the main reasons why the East Asian countries had the serious crisis. In particular, the East Asian crisis occurred when foreign lenders suddenly refused to roll over their bank loans in 1997. This implies that if a large fraction of external liabilities had longer maturities, the East Asian crisis might not have taken place as the form of a liquidity shortage.

When we look at the time-series data of international bank loans based on the BIS data, the degree of capital mobility was quite different in different terms to maturity. Table 6 shows the semi-annual growth rates of international bank loans to the East Asian economies before and after the crisis in three different types of maturities: maturities up to one year (short-term loans), maturities over one year and up to two years (medium-term loans), and maturities over two years (long-term loans).[14] It suggests that until 1997, bank loans to the East Asian economies had steadily increased in almost all terms to maturity. In Thailand from 1994 to 1995, the average semi-annual growth rate of short-term loans was close to 20% and those of middle-term and long-term loans were slightly higher than 20%. Similarly, both short-term and long-term loans grew on average about 10% in Indonesia and about 15% in Korea from 1994 to 1996.

In contrast, after the crisis, bank loans declined sharply only for short-term loans. In Korea, the semi-annual growth rate of short-term loans was –16.12% in December 1997 and –44.23% in June 1998 (see Fig. 1a). But, during the same period, the semi-annual growth rates of middle-term and long-term loans were still significantly positive in Korea (see Fig. 1b and Fig. 1c). Similarly, almost all of the other East Asian economies experienced significant decline of short-term loans from December 1997 to June 1998. However, except for Thailand in December 1997, they experienced no serious decline in middle-term and long-term loans for the same period. Instead, several East Asian economies experienced significant increase in middle-term and long-term loans during this period (see Fig. 1b and Fig. 1c).

In general, liquidity problems emerge when panicking external creditors become unwilling to roll over existing credits. Thus, if panicking external creditors could cancel their long-term contracts, liquidity problems might have happened even when external liabilities were financed by long-term loans. However, the above evidence in the East Asian economies suggests that like direct investment, long-term commercial loans were less mobile forms of capital flows. This may imply that if a large fraction of international commercial bank debt took the form of long-term loans, the East Asian crisis might not have taken place at least as a liquidity shortage. The purpose of the following two sections is to examine whether we can confirm this implication when we estimate the firm level investment functions in Korea and Taiwan.

8. The Estimation of Investment Functions in Korea and Taiwan

In this section, we shall identify what additional effects the long-term loan ratio had on individual investment of Korean and Taiwanese firms in the late 1990s. By using the financial data of non-financial companies in Korea and Taiwan, we estimate the following investment function:

$$(7) \quad I_t/K_t = \text{Constant term} + \alpha * X_t + \beta * LONGD_t + \gamma * DEBT_{t-}$$

where X_t = fundament variables such as profit rate in the period t, $LONGD_t$= the long-term debt ratio

[14] The data sources are BIS, The Maturity, Sectoral and Nationality Distribution of International Bank Lending, various issues, from 96.6 to 97.12 and BIS, International Banking and Financial Market Development, August 1998, for 98.6.

in the period t, and $DEBT_t$ = the debt-asset ratio in the period t.

The investment function is analogous to that we estimated for Japanese firms in previous sections. In particular, the long-term debt ratio ($LONGD_t$), which is defined by the ratio of long-term debt to total liability, is added as an explanatory variable to capture the effect of the long-term fund ratio on investment.[15] As fundamental variables X_t's, we use a profit that is normalized by total asset. Providing that the concept mentioned in the preceding section holds true, both coefficients α and β are expected to be significantly positive.

Capital stock is defined by tangible assets with an expected useful life of over one year, which include land, buildings, machinery, equipment, construction work in progress, and so on. Because of the data limitation, we used the book values of the capital stock and total asset for Korean and Taiwanese firms. In case of Korea, we also included the debt-asset ratio, which is defined by the ratio of total liability to total asset, in an explanatory variable. If the debt-overhang exists, the coefficient γ will be negative.

All the data used for estimation are based on the data set contained in World Scope. The data set is originally based on individual corporations' financial reports in Korea and Taiwan. The estimation period is from 1995 through 1999. The analysis covers all non-financial corporations for which the data is available at least for two consecutive years. The number of covered companies is 249 in the case of Korea and 219 in the case of Taiwan.

Pooling all available data for each country, the investment function is estimated by the ordinary least square, the fixed effect model, and the random effect model. As to those corporations whose data were partially missing in the estimation period, we included their data by using an unbalanced panel analysis.

9. The Estimation Results

(i) Korea

Table 7 shows the results of estimation for Korea. We estimate the investment function in Korea with and without the debt-asset ratio. As for the profit, we used the ordinary profit which represents the operating profit plus any non-operating net income.

The coefficient of the profit rate always takes a significantly positive value, implying that the profitable firms had larger investment in Korea. However, the coefficient of the long-term debt ratio is also significantly positive in most estimates. The result supports the view that even with the profit rate and the total amounts of external debt being given, the long-term debt had an additional

[15] In the analysis, "the long-term debt" is defined by all interest bearing financial obligations, excluding amounts due within one year.

positive impact on investment in Korea in the late 1990s.

Korea is one of the East Asian countries that had experienced a serious crisis in 1997. A large number of Korean companies had suffered from a short-run liquidity problem since foreign lenders suddenly refused to roll over their bank loans in November 1997. Our result, however, implies that even under such panicking circumstances, Korean companies with a large fraction of long-term external debt had smaller risk of a liquidity shortage and had relatively mild declines of investment.

The implication becomes more clear-cut when the debt-asset ratio is included as an explanatory variable. In this estimate, the coefficient of the debt-asset ratio is always significantly negative. This implies that there was a possibility of "debt-overhang" in the sense that Korean companies with heavy external debt had a difficulty to finance their investment funds during the crisis period. However, the coefficient of the long-term debt ratio almost doubled and became more significant when the debt-asset ratio was included as an explanatory variable. This implies that the long-term debt might have mitigated the decline of investment caused by the debt-overhang during the crisis period in Korea.

(ii) Taiwan

Table 8 shows the estimation results in Taiwan. In estimating the investment function, we first estimated the investment function with and without the debt-asset ratio. However, the debt-asset ratio was never statistically significant. The table thus reports the estimation results without the debt-asset ratio. As for the profit, we used the general income, which represents the difference between sales or revenues minus cost of goods sold and depreciation, or the difference of sales.

The coefficient of the profit rate takes positive value in all estimates and is statistically significant in most of the estimates, implying that the profitable firms had larger amounts of investment in Taiwan. However, the coefficient of the long-term debt ratio is also significantly positive except for the fixed effect model. The result thus weakly supports the view that even with the profit rate and the total amounts of external debt being given, the long-term debt had an additional positive impact on investment in Taiwan in the late 1990s.

The decline of Taiwanese economy was relatively moderate during the crisis. Thus, to the extent that their profit rates are high, Taiwanese companies had no serious difficulty to finance their investment funds during the crisis even if they heavy external debt. Our result, however, suggests that even in such Taiwanese economy, the long-term debt had an additional positive impact on investment in the late 1990s.

10. Concluding Remarks

In this paper, we estimated investment functions in Japan, Korea, and Taiwan in order to identify the role of long-term funds for economic growth. When there is a possibility of a liquidity shortage, the firm's investment decision tends to be conservative. Thus, to the extent that the long-term debt makes the liquidity shortage less likely outcome, long-tern loans can have a positive impact on investment. Our estimations in Japan have demonstrated that corporations with a higher ratio of long-term loans made significantly larger amounts of investment only before the mid 1980s. This implies that a higher ratio of long-term loans gave an incentive to make significantly big amounts of investment only at the early stage of financial market development. In contrast, we found that the long-term loan ratio had a significantly positive impact on the investment in Korea and Taiwan in the late 1990s. Korea is one of the East Asian countries that had experienced a serious crisis in 1997, while the decline of Taiwanese economy was relatively moderate during the crisis. Our estimation results imply that the long-term loan ratio played an important role in these different types of countries during the crisis.

In interpreting our estimation results, however, we need to keep in mind several limitations of our analysis. First, because of estimating corporation-specific investment functions, our analysis does not necessarily identify how large impacts the long-term funds had for macroeconomic growth. From the macroeconomic viewpoint, the allocation of long-term funds is warranted, if the allocated long-term funds had great external effects in increasing capital stock and production. To measure the external effects, we thus need to analyze not only corporation-specific investment but also the interaction of investment among firms and industries.

Secondly, even though the long-term debt ratio had a positive impact on investment, it does not necessarily mean that a source of the impact is the reduction of the liquidity risk. The long-term funds can affect the investment in various respects. We need further researches to identify that long-term funds really enhance economic growth through reducing the potential liquidity risk in the economy.

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Table 1 Descriptive Statistic of Tobin's Q in Japan

(1) The case of capital stock including land

	Average	Standard Deviation	Number of Samples
Iron & Steel			
1971-84	1.03603	1.66485	643
1975-84	1.05668	1.90303	471
1985-96	1.35711	1.04978	596
Nonferrous Metals			
1971-84	1.10598	1.09497	877
1975-84	1.06007	0.97028	641
1985-96	1.83458	2.10871	861
Chemicals			
1971-84	1.29397	1.80299	1549
1975-84	1.28881	1.84053	1127
1985-96	1.6025	1.62928	1456
Electrical Equipment			
1971-84	3.67443	8.05434	2004
1975-84	3.83776	8.81992	1466
1985-96	2.9081	4.99273	2088
Transportation Equipment			
1971-84	1.248	1.65817	954
1975-84	1.12298	1.36916	690
1985-96	1.17314	0.99024	896

(2) The case of capital stock not including land

	Average	Standard Deviation	Number of Samples
Iron & Steel			
1971-84	1.00985	2.19623	643
1975-84	1.02183	2.46776	471
1985-96	1.57453	1.69316	596
Nonferrous Metals			
1971-84	1.02067	2.21587	877
1975-84	0.89046	2.12955	641
1985-96	2.48359	4.49438	861
Chemicals			
1971-84	1.42381	2.87749	1549
1975-84	1.37989	2.69617	1127
1985-96	1.94832	2.55941	1456
Electrical Equipment			
1971-84	5.36245	13.80353	2004
1975-84	5.35215	14.39372	1466
1985-96	4.03135	8.50317	2088
Transportation Equipment			
1971-84	1.3346	2.51165	954
1975-84	1.11799	1.92877	690
1985-96	1.36135	1.72395	896

Table 2 Estimation of the Investment Function in Japan
- The Case of Capital Stock Including Land

(1) The Period of Estimation : 1972-1984

Iron & Steel	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.01969	3.36905	***	0.00364	1.21368	
Long-term Loan Ratio	0.15852	4.00559	***	0.08619	3.32876	***
Hausman Test				0.00060		
Profit Rate	0.23928	5.92602	***	0.23996	6.60785	***
Long-term Loan Ratio	0.13412	3.81007	***	0.07726	3.34671	***
Hausman Test				0.09110		
Cash Flow	0.48316	6.88681	***	0.49278	7.82164	***
Long-term Loan Ratio	0.12517	3.58300	***	0.07731	3.43371	***
Hausman Test				0.19270		

Nonferrous Metals	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.02929	7.40403	***	0.02114	6.76576	***
Long-term Loan Ratio	0.12175	5.49077	***	0.05204	3.57734	***
Hausman Test				0.00000		
Profit Rate	0.04544	4.25576	***	0.06079	6.21874	***
Long-term Loan Ratio	0.09952	4.52212	***	0.04533	3.27160	***
Hausman Test				0.00000		
Cash Flow	0.03248	3.09956	***	0.04514	4.47638	***
Long-term Loan Ratio	0.10155	4.59238	***	0.04896	3.41484	***
Hausman Test				0.00000		

Chemicals	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.01759	6.12598	***	0.01528	7.74153	***
Long-term Loan Ratio	0.01348	0.67343		0.00337	0.25623	
Hausman Test				0.41570		
Profit Rate	0.23751	6.63199	***	0.23724	8.61837	***
Long-term Loan Ratio	0.02587	1.33921		0.02241	1.72260	*
Hausman Test				0.97100		
Cash Flow	0.64533	10.16410	***	0.60358	12.27330	***
Long-term Loan Ratio	0.00331	0.17420		0.00193	0.15407	
Hausman Test				0.56980		

Electrical Equipment	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.00713	9.09618 ***	0.00311	8.28647 ***
Long-term Loan Ratio	0.05728	4.33098 ***	0.03138	3.68161 ***
Hausman Test			0.00000	
Profit Rate	0.08984	10.17110 ***	0.10536	19.19240 ***
Long-term Loan Ratio	0.03709	2.94382 ***	0.02653	3.24918 ***
Hausman Test			0.05640	
Cash Flow	0.12675	8.78237 ***	0.18321	19.07750 ***
Long-term Loan Ratio	0.04108	3.24313 ***	0.02295	2.86690 ***
Hausman Test			0.00000	

Transportation Equipment (including shipbuilding)	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.01353	5.51411 ***	0.00828	5.22660 ***
Long-term Loan Ratio	0.05994	3.07577 ***	0.01561	1.37328
Hausman Test			0.00020	
Profit Rate	0.50024	11.84460 ***	0.38309	10.88100 ***
Long-term Loan Ratio	0.05288	25.94311 ***	0.02711	2.37180 **
Hausman Test			0.00000	
Cash Flow	0.38470	7.67576 ***	0.35071	8.74403 ***
Long-term Loan Ratio	0.06353	3.39113 ***	0.02816	2.34296 **
Hausman Test			0.02980	

Transportation Equipment (excluding shipbuilding)	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.01332	5.46319 ***	0.00800	5.02923 ***
Long-term Loan Ratio	0.04652	2.38107 **	0.01276	1.10863
Hausman Test			0.00110	
Profit Rate	0.52497	11.07710 ***	0.38382	10.06270 ***
Long-term Loan Ratio	0.04489	2.48040 **	0.02632	2.29220 **
Hausman Test			0.00000	
Cash Flow	0.44113	8.10354 ***	0.38049	8.89105 ***
Long-term Loan Ratio	0.05211	2.78745 ***	0.02337	1.92902 *
Hausman Test			0.03450	

*** significant at a 1% level, ** significant at a 5% level , and * significant at a 10% level

Table 2 Estimation of the Investment Function in Japan
- The Case of Capital Stock Including Land

(2) The Period of Estimation : 19785-1996

Iron & Steel	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.02102	4.72586	***	0.01963	5.30099	***
Long-term Loan Ratio	0.01261	0.50685		0.01802	1.20266	
Hausman Test				0.80200		
Profit Rate	0.33697	6.35166	***	0.30004	6.89531	***
Long-term Loan Ratio	0.01606	0.65757		0.01992	1.33725	
Hausman Test				0.44880		
Cash Flow	0.41463	4.60787	***	0.41897	5.54659	***
Long-term Loan Ratio	0.00776	0.31281		0.01684	1.13713	
Hausman Test				0.89930		

Nonferrous Metals	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.02340	12.05080	***	0.01633	13.27620	***
Long-term Loan Ratio	-0.00571	-0.38356		0.00305	0.30521	
Hausman Test				0.00000		
Profit Rate	0.21989	11.38240	***	0.24469	15.41560	***
Long-term Loan Ratio	0.00113	0.07496		0.00304	0.30275	
Hausman Test				0.07410		
Cash Flow	0.55194	7.03328	***	0.61720	10.31280	***
Long-term Loan Ratio	0.00303	0.19062		-0.00225	-0.19997	
Hausman Test				0.39370		

Chemicals	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.01606	10.62500	***	0.01465	11.84170	***
Long-term Loan Ratio	-0.02827	-2.92174	***	-0.01444	-2.30441	**
Hausman Test				0.02680		
Profit Rate	0.56287	13.99360	***	0.41394	14.00530	***
Long-term Loan Ratio	-0.03662	-3.91507	***	-0.01241	-1.89925	*
Hausman Test				0.00000		
Cash Flow	0.82438	13.21670	***	0.59493	14.52390	***
Long-term Loan Ratio	-0.03081	-3.26878	***	-0.01405	-2.27245	**
Hausman Test				0.00000		

Electrical Equipment	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.00665	16.31400	***	0.00535	15.37660	***
Long-term Loan Ratio	-0.05797	-6.15343	***	-0.03975	-5.68001	***
Hausman Test				0.00000		
Profit Rate	0.01299	3.31561	***	0.03076	9.47366	***
Long-term Loan Ratio	-0.07549	-7.42380	***	-0.04531	-5.99826	***
Hausman Test				0.00000		
Cash Flow	0.03501	4.50396	***	0.07102	10.90000	***
Long-term Loan Ratio	-0.07560	-7.45556	***	-0.04490	-6.04456	***
Hausman Test				0.00000		

Transportation Equipment (including shipbuilding)	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.02641	9.73145	***	0.02272	9.45658	***
Long-term Loan Ratio	-0.07390	-5.58965	***	-0.03386	-3.75077	***
Hausman Test				0.00000		
Profit Rate	0.30828	5.43849	***	0.33144	7.00603	***
Long-term Loan Ratio	-0.09195	-6.91573	***	-0.03874	-4.56754	***
Hausman Test				0.00000		
Cash Flow	0.38173	7.34442	***	0.42873	9.76243	***
Long-term Loan Ratio	-0.09397	-7.18984	***	-0.03667	-4.60130	***
Hausman Test				0.00000		

Transportation Equipment (excluding shipbuilding)	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.02653	9.00998	***	0.02284	8.95300	***
Long-term Loan Ratio	-0.07830	-5.67609	***	-0.03054	-3.32208	***
Hausman Test				0.00000		
Profit Rate	0.47898	6.96148	***	0.45624	8.30453	***
Long-term Loan Ratio	-0.09474	-6.98014	***	-0.03627	-4.22991	***
Hausman Test				0.00000		
Cash Flow	0.41830	7.64527	***	0.45064	9.42059	***
Long-term Loan Ratio	-0.09920	-7.37539	***	-0.03876	-4.64083	***
Hausman Test				0.00000		

*** significant at a 1% level, ** significant at a 5% level, and * significant at a 10% level.

Table 3 Estimation of the Investment Function in Japan
- The Case of Capital Stock not Including Land

(1) The Period of Estimation : 1972-1984

Iron & Steel	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.02094	4.00502 ***	0.00293	1.18518
Long-term Loan Ratio	0.18669	3.87254 ***	0.06937	2.51451 **
Hausman Test			0.00000	
Profit Rate	0.19477	6.31057 ***	0.19457	7.12831 ***
Long-term Loan Ratio	0.16264	3.79182 ***	0.08890	3.10400 ***
Hausman Test			0.06620	
Cash Flow	0.37328	6.72610 ***	0.38767	7.86953 ***
Long-term Loan Ratio	0.15095	3.52746 ***	0.08513	3.04626 ***
Hausman Test			0.12660	

Nonferrous Metals	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.01275	5.34436 ***	0.01035	5.41164 ***
Long-term Loan Ratio	0.15741	5.64925 ***	0.07985	4.22287 ***
Hausman Test			0.00030	
Profit Rate	0.01896	2.40453 **	0.02660	3.55514 ***
Long-term Loan Ratio	0.12895	4.66814 ***	0.07106	3.65767 ***
Hausman Test			0.00120	
Cash Flow	0.01137	1.52323	0.01637	2.25505 **
Long-term Loan Ratio	0.13129	4.74521 ***	0.07186	3.64948 ***
Hausman Test			0.00160	

Chemicals	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.01453	5.90531 ***	0.01296	7.38000 ***
Long-term Loan Ratio	0.02046	0.81826	0.00084	0.04999
Hausman Test			0.34560	
Profit Rate	0.29928	11.74630 ***	0.23447	13.09600 ***
Long-term Loan Ratio	0.04513	1.92745 *	0.03102	2.19584 **
Hausman Test			0.00130	
Cash Flow	0.66355	14.71750 ***	0.61330	16.73010 ***
Long-term Loan Ratio	0.01014	0.44286	0.00428	0.27676
Hausman Test			0.14020	

Electrical Equipment	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.00433	9.02277	***	0.00203	7.61229	***
Long-term Loan Ratio	0.06232	3.89284	***	0.03520	3.33938	***
Hausman Test				0.00000		
Profit Rate	0.09444	13.22770	***	0.07363	18.25010	***
Long-term Loan Ratio	0.04525	2.98386	***	0.03750	3.64927	***
Hausman Test				0.00090		
Cash Flow	0.14712	11.78210	***	0.13994	19.26090	***
Long-term Loan Ratio	0.05292	3.46623	***	0.03268	3.36645	***
Hausman Test				0.15840		

Transportation Equipment (including shipbuilding)	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.01224	6.53538	***	0.00765	5.81919	***
Long-term Loan Ratio	0.07303	3.04181	***	0.02361	1.60600	
Hausman Test				0.00010		
Profit Rate	0.37490	14.41180	***	0.29698	13.07600	***
Long-term Loan Ratio	0.06036	2.78617	***	0.04482	2.96741	***
Hausman Test				0.00000		
Cash Flow	0.34762	9.71679	***	0.32043	10.81260	***
Long-term Loan Ratio	0.07297	3.18682	***	0.03885	2.60487	***
Hausman Test				0.05400		

Transportation Equipment (excluding shipbuilding)	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.01203	6.50145	***	0.00745	5.66550	***
Long-term Loan Ratio	0.05457	2.28150	**	0.01946	1.31304	
Hausman Test				0.00030		
Profit Rate	0.37131	13.09160	***	0.28290	11.71300	***
Long-term Loan Ratio	0.04868	2.22647	**	0.04157	2.75668	***
Hausman Test				0.00000		
Cash Flow	0.38667	10.08800	***	0.34227	10.92760	***
Long-term Loan Ratio	0.05669	2.49727	**	0.03290	2.19933	**
Hausman Test				0.04980		

*** significant at a 1% level, ** significant at a 5% level , and * significant at a 10% level

Table 3 Estimation of the Investment Function in Japan
- The Case of Capital Stock not Including Land

(2) The Period of Estimation : 1985-1996

Iron & Steel	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.01464	3.55132 ***	0.01374	3.86585 ***
Long-term Loan Ratio	0.01177	0.31602	0.01596	0.67648
Hausman Test			0.89130	
Profit Rate	0.23998	5.17110 ***	0.23857	6.18780 ***
Long-term Loan Ratio	0.01059	0.28837	0.01905	0.85964
Hausman Test			0.95590	
Cash Flow	0.28341	3.70388 ***	0.32331	4.76509 ***
Long-term Loan Ratio	0.00610	0.16419	0.01856	0.82218
Hausman Test			0.49890	

Nonferrous Metals	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.00895	8.63041 ***	0.00719	9.61816 ***
Long-term Loan Ratio	0.00593	0.30010	-0.00277	-0.22178
Hausman Test			0.03950	
Profit Rate	0.10155	9.04343 ***	0.10733	11.35960 ***
Long-term Loan Ratio	0.01880	0.97655	0.00375	0.29715
Hausman Test			0.38610	
Cash Flow	0.42637	9.42043 ***	0.42380	11.21760 ***
Long-term Loan Ratio	0.02389	1.24507	0.00718	0.55368
Hausman Test			0.49070	

Chemicals	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.00913	8.00727 ***	0.00840	8.96572 ***
Long-term Loan Ratio	-0.02082	-1.78836 *	-0.01051	-1.44074
Hausman Test			0.21370	
Profit Rate	0.38000	12.03480 ***	0.28356	12.19400 ***
Long-term Loan Ratio	-0.02793	-2.47049 **	-0.00490	-0.63917
Hausman Test			0.00000	
Cash Flow	0.58952	14.07110 ***	0.52588	15.96340 ***
Long-term Loan Ratio	-0.01926	-1.73509 *	-0.00995	-1.27082
Hausman Test			0.02160	

Electrical Equipment	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.00428	13.79430 ***	0.00331	13.15170 ***
Long-term Loan Ratio	-0.04080	-3.68057 ***	-0.02647	-3.45571 ***
Hausman Test			0.00000	
Profit Rate	0.02988	10.64290 ***	0.03541	15.36220 ***
Long-term Loan Ratio	-0.05524	-4.78488 ***	-0.02802	-3.53749 ***
Hausman Test			0.00000	
Cash Flow	0.05373	10.93310 ***	0.06681	15.94540 ***
Long-term Loan Ratio	-0.05616	-4.87231 ***	-0.02867	-3.66910 ***
Hausman Test			0.00000	

Transportation Equipment (including shipbuilding)	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.01630	8.83862 ***	0.01371	8.30269 ***
Long-term Loan Ratio	-0.07433	-4.61038 ***	-0.03070	-2.86111 ***
Hausman Test			0.00000	
Profit Rate	0.30108	7.72921 ***	0.28876	8.66557 ***
Long-term Loan Ratio	-0.08732	-5.55105 ***	-0.03576	-3.56433 ***
Hausman Test			0.00010	
Cash Flow	0.32538	8.73387 ***	0.37081	11.19690 ***
Long-term Loan Ratio	-0.08873	-5.69572 ***	-0.03095	-3.40080 ***
Hausman Test			0.00000	

Transportation Equipment (excluding shipbuilding)	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.01608	7.96775 ***	0.01364	7.76371 ***
Long-term Loan Ratio	-0.08316	-5.00217 ***	-0.02615	-2.45825 **
Hausman Test			0.00000	
Profit Rate	0.36513	7.44940 ***	0.33955	8.54885 ***
Long-term Loan Ratio	-0.09220	-5.72916 ***	-0.03106	-3.10939 ***
Hausman Test			0.00000	
Cash Flow	0.33453	8.49130 ***	0.36749	10.29080 ***
Long-term Loan Ratio	-0.09770	-6.14336 ***	-0.03263	-3.44868 ***
Hausman Test			0.00000	

*** significant at a 1% level, ** significant at a 5% level , and * significant at a 10% level

Table 4 Estimation of the Investment Function in Japan
- The Case of Tobin's Q and Other Fundamental Variables being Included Together

(1) The Period of Estimation : 1972-1984

Iron & Steel	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.01480	2.52077 **	0.00065	0.22213
Profit Rate	0.18922	4.21582 ***	0.20894	5.19609 ***
Long-term Loan Ratio	0.14874	3.81029 ***	0.08319	3.34127 ***
Hausman Test			0.00990	
Tobin's Q	0.01481	2.55588 **	0.00057	0.19800
Cash Flow	0.39203	5.07253 ***	0.43213	6.19534 ***
Long-term Loan Ratio	0.14067	3.62098 ***	0.08395	3.42740 ***
Hausman Test			0.01480	

Nonferrous Metals	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.03011	7.64267 ***	0.02177	7.07101 ***
Profit Rate	0.03447	3.21628 ***	0.04109	3.90366 ***
Long-term Loan Ratio	0.11633	5.26363 ***	0.04726	3.31835 ***
Hausman Test			0.00000	
Tobin's Q	0.03071	7.75473 ***	0.02255	7.26786 ***
Cash Flow	0.03090	3.09070 ***	0.03756	3.79999 ***
Long-term Loan Ratio	0.11666	5.27636 ***	0.04686	3.28804 ***
Hausman Test			0.00000	

Chemicals	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.01449	5.00499 ***	0.01087	5.19328 ***
Profit Rate	0.20906	5.49123 ***	0.17388	5.74132 ***
Long-term Loan Ratio	0.02416	1.21442	0.01350	1.03033
Hausman Test			0.11700	
Tobin's Q	0.01258	4.43980 ***	0.00833	4.09145 ***
Cash Flow	0.62760	9.34476 ***	0.53241	9.74646 ***
Long-term Loan Ratio	0.00517	0.26632	-0.00169	-0.13269
Hausman Test			0.01350	

Electrical Equipment	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.00499	6.20054 ***	0.00112	2.75852 ***
Profit Rate	0.14365	8.66795 ***	0.13290	9.93400 ***
Long-term Loan Ratio	0.04863	3.75058 ***	0.02825	3.48865 ***
Hausman Test			0.00000	
Tobin's Q	0.00618	7.78379 ***	0.00178	4.78319 ***
Cash Flow	0.13494	5.73932 ***	0.17673	8.74116 ***
Long-term Loan Ratio	0.05563	4.24743 ***	0.02592	3.29690 ***
Hausman Test			0.00000	

Transportation Equipment (including shipbuilding)	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.00813	3.41988 ***	0.00557	3.17827 ***
Profit Rate	0.45018	10.08320 ***	0.34251	8.86335 ***
Long-term Loan Ratio	0.05694	3.09395 ***	0.02399	1.94783 **
Hausman Test			0.00000	
Tobin's Q	0.01181	4.89983 ***	0.00614	3.93777 ***
Cash Flow	0.32879	6.52650 ***	0.28299	6.90147 ***
Long-term Loan Ratio	0.06181	3.24482 ***	0.01444	1.31014
Hausman Test			0.00010	

Transportation Equipment (excluding shipbuilding)	Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value
Tobin's Q	0.00798	3.34197 ***	0.00534	3.01260 ***
Profit Rate	0.46603	9.15121 ***	0.33818	7.88039 ***
Long-term Loan Ratio	0.04839	2.60845 ***	0.02216	1.77587 *
Hausman Test			0.00000	
Tobin's Q	0.01137	4.76590 ***	0.00605	3.81411 ***
Cash Flow	0.37738	6.86989 ***	0.30458	6.92317 ***
Long-term Loan Ratio	0.04995	2.62884 ***	0.01127	0.99550
Hausman Test			0.00010	

*** significant at a 1% level, ** significant at a 5% level , and * significant at a 10% level

Table 4 Estimation of the Investment Function in Japan
- The Case of Tobin's Q and Other Fundamental Variables being Included Together

(2) The Period of Estimation : 1985-1996

Iron & Steel	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.00967	1.94240	*	0.00799	1.85110	*
Profit Rate	0.28687	4.73002	***	0.25580	4.97362	***
Long-term Loan Ratio	0.01676	0.68704		0.02004	1.36756	
Hausman Test				0.54490		
Tobin's Q	0.01552	3.26746	***	0.01380	3.31166	***
Cash Flow	0.30192	3.11777	***	0.31313	3.65285	***
Long-term Loan Ratio	0.01145	0.46413		0.01577	0.92867	
Hausman Test				0.87510		

Nonferrous Metals	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.01865	8.66435	***	0.01270	8.76989	***
Profit Rate	0.24694	4.79749	***	0.20313	4.76964	***
Long-term Loan Ratio	-0.00651	-0.44435		0.00575	0.57338	
Hausman Test				0.00000		
Tobin's Q	0.02086	10.22340	***	0.01377	10.44010	***
Cash Flow	0.30083	3.75184	***	0.28540	4.67323	***
Long-term Loan Ratio	-0.00457	-0.30989		0.00539	0.55378	
Hausman Test				0.00000		

Chemicals	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.00935	5.99833	***	0.00946	6.92272	***
Profit Rate	0.52319	11.16460	***	0.36061	9.64791	***
Long-term Loan Ratio	-0.03484	-3.77866	***	-0.01437	-2.21561	**
Hausman Test				0.00000		
Tobin's Q	0.01174	7.87713	***	0.01040	8.13495	***
Cash Flow	0.71534	11.06320	***	0.50155	10.57830	***
Long-term Loan Ratio	-0.02855	-3.09983	***	-0.01677	-2.69702	***
Hausman Test				0.00000		

Electrical Equipment	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.00405	8.94072	***	0.00288	7.61549	***
Profit Rate	0.20662	11.35420	***	0.20868	13.01600	***
Long-term Loan Ratio	-0.05285	-5.83361	***	-0.03779	-5.70835	***
Hausman Test				0.00000		
Tobin's Q	0.00551	13.30080	***	0.00398	11.62640	***
Cash Flow	0.16312	9.45319	***	0.18928	11.62810	***
Long-term Loan Ratio	-0.05513	-6.01684	***	-0.03801	-5.82528	***
Hausman Test				0.00000		

Transportation Equipment (including shipbuilding)	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.02410	8.52854	***	0.01954	7.73834	***
Profit Rate	0.15858	2.77841	***	0.17407	3.46854	***
Long-term Loan Ratio	-0.07543	-5.72740	***	-0.03387	-3.82674	***
Hausman Test				0.00000		
Tobin's Q	0.02409	9.05577	***	0.01983	8.80039	***
Cash Flow	0.30639	6.06653	***	0.36404	8.32413	***
Long-term Loan Ratio	-0.07690	-5.96946	***	-0.02884	-3.57668	***
Hausman Test				0.00000		

Transportation Equipment (excluding shipbuilding)	Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.02189	6.97209	***	0.01750	6.31014	***
Profit Rate	0.28714	3.94302	***	0.27125	4.39341	***
Long-term Loan Ratio	-0.07961	-5.83458	***	-0.03113	-3.46354	***
Hausman Test				0.00000		
Tobin's Q	0.02378	8.27891	***	0.01980	8.21062	***
Cash Flow	0.34230	6.38729	***	0.37822	7.93591	***
Long-term Loan Ratio	-0.08146	-6.09383	***	-0.02888	-3.43701	***
Hausman Test				0.00000		

*** significant at a 1% level, ** significant at a 5% level , and * significant at a 10% level

Table 5 Investment Functions of Keiretsu-Affiliated and Non-Affiliated Groupings

All Industries (Fixed Effect Model)

(i) Four Major Keiretsu Groupings

	Keiretsu-Affiliated Grouping			Non-Affiliated Grouping		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
TobinQ	0.01938	13.24950	***	0.00616	6.84234	***
Long-term Loan Ratio	0.08543	6.95808	***	0.05916	4.64137	***
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.01384	8.62628	***	0.00581	6.47418	***
Profit Rate	0.15511	7.92228	***	0.05800	5.75163	***
Long-term Loan Ratio	0.08359	6.89509	***	0.05464	4.30466	***

(ii) Six Major Keiretsu Groupings

	Keiretsu-Affiliated Grouping			Non-Affiliated Grouping		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
TobinQ	0.01354	12.74650	***	0.00520	4.76569	***
Long-term Loan Ratio	0.07543	7.09282	***	0.06449	3.94865	***
Explanatory variables	Estimate	t-Value		Estimate	t-Value	
Tobin's Q	0.01232	11.53070	***	0.00383	3.51576	***
Profit Rate	0.64498	7.14286	***	0.18712	7.20758	***
Long-term Loan Ratio	0.07298	6.90766	***	0.05148	3.18312	***

*** significant at a 1% level, ** significant at a 5% level , and * significant at a 10% level

Table 6. Semi-Annual Growth Rates of International Bank Loans to the East Asian Economies for Different Terms to Maturity (%)

(I) Maturities up to and; including one year

	Thailand	Indonesia	Korea	Malaysia	Philippines	Taiwan	China	Hong Kong	Singapore
94.6	27.03	0.14	18.95	10.94	12.17	7.34	-5.84	10.83	6.51
94.12	14.06	13.12	15.00	-19.80	19.84	11.90	25.13	8.58	1.46
95.6	23.21	18.69	28.14	10.58	7.44	23.87	-4.87	7.16	23.65
95.12	14.29	9.13	5.51	8.52	19.37	-16.72	33.18	-8.13	-12.34
96.6	9.70	7.28	14.84	26.55	46.25	-1.25	6.25	-13.76	-1.96
96.12	-4.46	15.75	8.30	11.88	30.08	-2.76	9.85	-5.05	-0.48
97.6	-0.31	1.22	5.02	45.37	11.41	16.41	12.12	7.19	11.88
97.12	-14.86	2.07	-16.12	-10.06	38.34	-2.57	12.15	-8.32	-8.65
98.6	-28.42	-21.83	-44.23	-23.37	-14.72	-13.14	-8.77	-20.90	-31.64

(ii) Maturities over one year up to two years

	Thailand	Indonesia	Korea	Malaysia	Philippines	Taiwan	China	Hong Kong	Singapore
94.6	-3.21	8.05	13.96	-20.03	21.46	53.74	4.98	13.39	-39.26
94.12	18.39	16.41	9.43	77.05	-15.55	3.15	5.26	1.11	122.22
95.6	38.91	-9.88	-6.63	61.71	0.00	13.06	8.63	-7.97	40.13
95.12	20.93	2.43	-6.11	-15.66	44.35	59.71	14.94	6.33	-0.93
96.6	15.47	10.01	34.67	-27.29	53.91	-10.00	15.19	4.77	26.61
96.12	18.27	3.34	19.46	-13.55	6.40	-17.44	1.23	2.52	-33.54
97.6	-4.91	-1.31	0.78	-14.70	-42.30	-51.14	-10.74	-15.83	-4.45
97.12	-9.30	4.46	26.17	48.94	31.29	23.31	2.88	32.15	8.90
98.6	2.64	0.68	77.40	7.31	92.29	33.33	0.60	17.23	73.34

(iii) Maturities over two years

	Thailand	Indonesia	Korea	Malaysia	Philippines	Taiwan	China	Hong Kong	Singapore
94.6	17.51	2.39	-6.13	6.90	-2.21	-1.70	8.40	10.10	21.23
94.12	42.20	12.35	21.95	13.30	12.66	73.73	7.79	11.90	25.52
95.6	13.13	18.53	32.35	-2.81	5.55	-7.49	10.95	5.17	10.17
95.12	25.84	11.97	11.35	21.59	5.26	44.16	-2.47	0.04	11.73
96.6	9.79	14.97	11.70	29.65	7.82	13.33	2.53	-0.58	-11.04
96.12	9.46	8.14	18.24	-1.33	10.81	14.09	9.95	9.72	21.76
97.6	0.89	10.94	3.03	12.57	-2.68	-0.08	-0.62	9.71	4.27
97.12	-16.16	1.77	0.45	14.14	57.34	42.65	7.24	12.00	10.32
98.6	-7.49	-0.41	15.08	-8.75	-7.83	-6.48	-3.96	-6.91	2.33

Data Sources of BIS data)
96.6-97.12: The Maturity, Sectoral and Nationality Distribution of International Bank Lending, various issues.
98.6: International Banking and Financial Market Development, August 1998.

Table 7. Investment Functions in Korea

(I) Estimation without the debt-asset ratio

	Ordinary Least Square		Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value	Estimate	t-Value
Profit Rate	1.30619	12.8558 ***	1.24379	9.57017 ***	1.27023	12.7022 ***
Long-term Loan Ratio	0.21162	1.78683 *	0.37476	1.97776 **	0.25665	2.05083 **
Hausman Test					0.84443	

(ii) Estimation with the debt-asset ratio

	Ordinary Least Square		Fixed Effect Model		Random Effect Model	
Explanatory variables	Estimate	t-Value	Estimate	t-Value	Estimate	t-Value
Profit Rate	0.86085	6.54807 ***	0.57229	3.49922 ***	0.72247	5.66394 ***
Long-term Loan Ratio	0.45157	3.59841 ***	0.70009	3.66661 ***	0.54237	4.16247 ***
Debt-Asset Ratio	-0.33131	-5.23374 ***	-0.51315	-6.46500 ***	-0.41063	-6.66482 ***
Hausman Test					4.83210	

*** significant at a 1% level, ** significant at a 5% level , and * significant at a 10% level

Table 8. Investment Functions in Taiwan

(I) Estimation by using gross income

	Ordinary Least Square			Fixed Effect Model		Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value	Estimate	t-Value	
Profit Rate	0.38513	4.18879	***	0.24347	0.93054	0.38035	4.05021	***
Long-term Loan Ratio	0.08966	2.21650	**	-0.02500	-0.28702	0.08725	2.10719	**
Hausman Test						2.1709		

(iii) Estimation by using differenced sales

	Ordinary Least Square			Fixed Effect Model			Random Effect Model		
Explanatory variables	Estimate	t-Value		Estimate	t-Value		Estimate	t-Value	
Differenced Sales	0.46819	10.89540	***	0.46669	8.14094	***	0.46719	10.84330	***
Long-term Loan Ratio	0.11087	2.93963	***	0.05401	0.66815		0.11043	2.89459	***
Hausman Test							0.64525		

*** significant at a 1% level, ** significant at a 5% level , and * significant at a 10% level

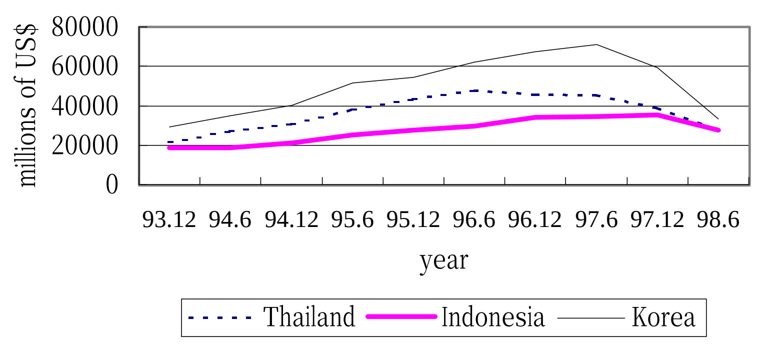

Figure 1a. Short-term Loans before and after the Crisis

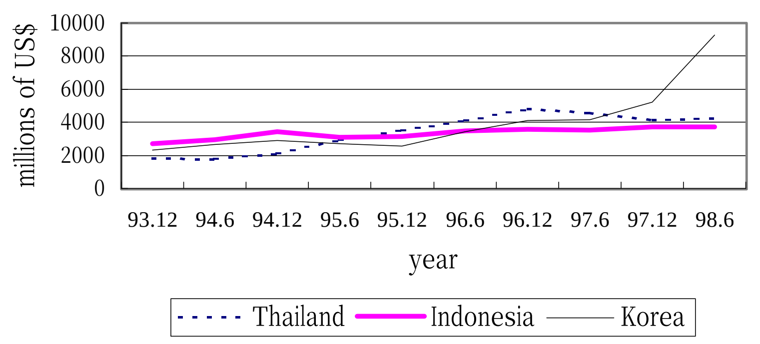

Figure 1b. Medium-term Loans before and after the Crisis

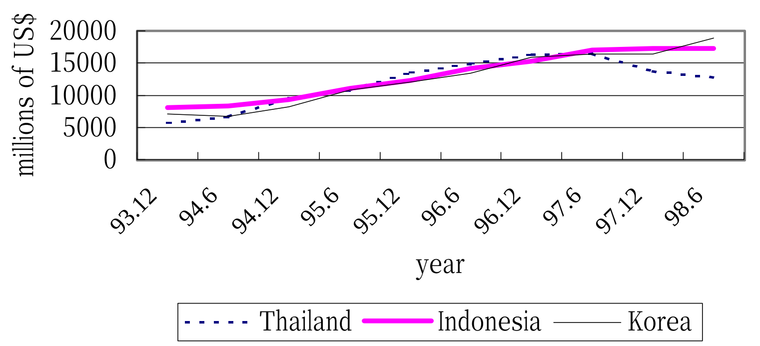

Figure 1c. Long-term Loans before and after the Crisis