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Country Operations

Country Department IV
Asia Regional Office
The World Bank
July 1991
WPS 727

The Effects of Debt Subsidies on Corporate Investment Behavior

Mansoor Dailami
and
E. Han Kim

Credit subsidies are ineffective in stimulating business investment in productive assets. Instead, they lead to an increase in corporate holdings of financial assets and real estate.

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This paper — a product of the Country Operations Division, Country Department IV (India), Asia Regional Office — is the second in a planned series of research on the performance of capital markets and their role in providing risk capital to the corporate sector in India and the Republic of Korea. The research is funded by the Bank's Research Committee (RPO 675-84). Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Adala Bruce-Konuah, room D10-079, extension 80356 (22 pages, with figures and tables).

Dailami and Kim argue that credit subsidies are ineffective in stimulating business investment in productive assets. Instead, they lead to an increase in corporate holdings of financial assets and real estate.

For empirical verification, Dailami and Kim examined investment patterns in a sample of 241 Korean corporations listed on the Korea Stock Exchange between 1984 and 1988. They found a significant positive relation between corporate speculative asset holdings and access to subsidized loans.

Their estimates indicate that without interest rate controls and other forms of subsidy, corporate holdings of speculative assets would have been one-seventh of observed levels. Moreover, most corporate real estate holdings appear to be unrelated to production activities.

They find little evidence that the Korean government's interest rate controls and credit allocation policy have accelerated expansion of corporate investment. If anything, they are partly to blame for the overheated Korean stock market during 1986-88.

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I. INTRODUCTION

Government intervention in the pricing and allocation of credit remains an enduring feature of both developed and developing countries. Although considerable world-wide progress has been achieved in recent years toward financial liberalization and open capital markets, governments continue to deploy credit instruments to address a variety of social, political, and economic problems. In industrialized countries governments frequently intervene on a broad scale in efforts to increase the availability of loans to students, farmers, and home owners.[1] They also extend loan guarantees to exporters and to large enterprises in financial distress.[2]

In developing countries government intervention figures more prominently. Both loans at subsidized interest rates and government loan guarantees are frequently used to encourage investment and foster industrialization. Governments also impose ceilings on interest rates and loan guarantee fees, provide cheap direct credit to targeted industries, and bail out firms in financial distress.

Two basic assumptions underlie developing countries' reliance on these strategies. First, externalities in financial markets are presumed to follow from either market failure and structural weaknesses--e.g., the absence of well organized equity and bond markets--and/or from severity of information asymmetries between lenders and borrowers.[3] Second, it is widely perceived that the

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[1] For instance, Bosworth, Carron, and Rhyne (1987), Gale (1990, 1991) and a report by the Congressional Budget Office (1981) describe practices in the United States. For other industrialized countries, see Teranishi (1990), Cox (1986), and the report of the Joint Economic Committee of the U.S. Congress (1981).

[2] The best known examples of federal loan guarantees in the United States are the Lockheed and Chrysler bailouts. See Moritz and Seaman (1981), Ho and Singer (1982), and Chaney and Thakor (1985). Government provisions of loan guarantees abound in other industrialized countries. See, for instance, Green (1985) for the case of France and Sakakibara and Feldman (1983) for Japan.

[3] It is often argued that financial intermediaries, left alone, behave overly conservatively and deny credit to some creditworthy firms with positive net present value projects. The foregoing of such projects entails social welfare costs. This underinvestment problem can be alleviated if government intervention fills the information gap and facilitates the provision of long-term loans to the appropriate users. See Stiglitz (1991) for an in-depth discussion on the market failure due to informational asymmetry and moral hazzard problems and Berkovitch and Kim (1990) on the interaction between debt contracts and the under- and over-investment incentives.

various debt subsidies will, by lowering the cost or increasing the supply of funds, induce firms to expand capital holdings in productive assets such as plants and equipment. These investments are in turn anticipated to generate a higher rate of employment and economic growth.

The objective of this paper is to question the validity of this second assumption. We suggest that access to low cost borrowing may not necessarily lead to higher investment in productive assets, but rather to investment in financial and speculative assets. We elaborate on the conditions under which such an adverse result may occur, and show that these conditions are of a sufficiently general nature to warrant serious attention by policymakers.

For empirical verification we focus on investment patterns in Korea, which provides an interesting case study for several reasons. It is well known that Korea has relied on financial market intervention as an important policy instrument for channeling resources to priority sectors and firms. This strategy, which involves directed lending through the Bank of Korea, subsidization of debt via interest rate controls, and provision of loan guarantees at below market rates, has been a hallmark of Korean industrialization policy since the 1960s. By exercising control over corporate funding, the Government has played an active role in determining allocation of scarce capital. One aspect of this intervention is the provision of funds to priority sectors at preferential rates. A second aspect involves risk sharing in long-term investments. By investing in a project which had the government's blessing, a firm can benefit from the guarantee of a stable and subsidized flow of credit, often irrespective of its economic and financial performance. The result of this policy is a significant reduction in the risk of bankruptcy, which in turn reduces the cost of capital for eligible firms.

How effective has this strategy been? To address this question we proceed in the next section with a discussion of debt subsidies. We then provide a simple theoretical analysis of the effect of debt subsidies on corporate investment behavior. The analysis shows debt subsidies to be ineffective in increasing the stock of productive fixed assets. Instead, subsidies provide an incentive for firms to increase their holdings of speculative assets. Based on these theoretical results we develop a testable hypothesis in Section III, which is followed by empirical tests in

Sections IV and V. The results indicate a significant positive relation between the availability of subsidized loans and corporate speculative investment. Section VI contains concluding remarks.

II. CORPORATE DEBT SUBSIDIES AND INVESTMENT BEHAVIOR

1. Debt Subsidy

The most obvious form of debt subsidy is the provision of funds at below market interest rates. More subtle implicit subsidies arise when there are: (i) official ceilings on interest rates and loan guarantee fees and (ii) bail-outs of companies in financial distress. Effective ceilings on interest rates and loan guarantee fees create excess demand for credit and lead to rationing. If for some reason (e.g., persuasion by governmental agencies) banks are required to extend or guarantee loans to high risk firms within the ceilings, the firms that are fortunate enough to obtain such loans or guarantees receive an implicit debt subsidy.

To illustrate, consider a bank that must earn a ten percent return on its loans to break even. The bank is contemplating a loan request from a firm that has a five percent probability of default, with twenty percent of the loan recoverable in the event of default. To break even the bank must charge at least $[(1 + .1) - (.2)(.05)]/(1 - .05) - 1 = 14.7\%$.[4] If this rate exceeds the interest rate ceiling, the optimal response for the bank is to deny the loan request. Suppose, however, that the bank is required to extend the loan and that the maximum rate it can charge is only 11.5 percent.[5] At this promised rate, the rate the bank expects to receive is $(1 + .115)(.95) + (.2)(.05) - 1 =$

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[4] Let

$\hat{R}$ = the promised interest rate that fully reflects the default risk of the borrower;

p = the probability of default;

d = the percentage of the loan recoverable in the event of default;

R = the break-even return on the bank's loan portfolio.

Then the promised rate $\hat{R}$ that the bank must charge to break even is:

$$\hat{R} = [(1 + R) - p * d]/(1 - p) - 1.$$

[5] The 11.5% used in this example was the actual interest rate ceiling on Korean bank loans during the mid 1980s, which is the sample period used for our empirical tests.

6.925%. Thus, for every dollar loaned, the bank expects to lose 3.075%, and the borrower receives an equivalent implicit subsidy.

A ceiling on loan guarantee fees has an identical effect. Suppose the borrower has instead requested a loan guarantee. Ignoring the costs involved in administering loan guarantees, the minimum guarantee fee that the bank must charge in order to break even is (1 - .2)(.05)/(1 - .05) = 4.2% of the amount loaned.[6] Suppose, however, that the ceiling on the guarantee fee is only 1.5% and the bank is required to guarantee the loan.[7] Then for every dollar guaranteed, the bank expects to lose .015(1 - .05) - (1 - .2)(0.5) = -2.575%.

In sum, ceilings on interest rates and loan guarantee fees in combination with the nonprice allocation of credits, provide implicit interest subsidies to high risk firms.

A final category of debt subsidy arises from government bailouts of financially troubled firms. These bailouts typically involve a restructuring of the firm's debt in which the government provides new capital at a substantially below-market interest rate. The new capital often takes the form of mandated bank loans.[8]

2. Effects of Debt Subsidy on Corporate Investments

To analyze the impact of these explicit and implicit debt subsidies on corporate investment behavior, we first consider the traditional approach embodied in both the Keynesian and the neoclassical models of investment. These models reduce the multitude of asset categories on a

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[6] Let g be the loan guarantee fee per dollar of borrowing. Then for each dollar guaranteed the bank will earn g if the firm does not default, and will lose (1 - d) if the firm defaults. (See the preceding footnote for notational definitions.) Thus to break even, g must satisfy the following equation:

$$g = (1 - d)p/(1 - p)$$

[7] The 1.5% in this example was the official ceiling for loan guarantee fees in Korea for several years during the 1980s.

[8] See Kim (1990) for an analysis of the effects of debt subsidies on the financing behavior of Korean corporations and Teranishi (1990) regarding the nature of government bailouts during the industrialization of Japan.

companies' balance-sheet to a single item.[9] By concentrating on one asset, which is conventionally taken to be "productive fixed capital", these models can describe the set of investment opportunities available to the firm by means of a single downward sloping marginal efficiency of capital schedule. Given such a schedule, a lower (marginal) cost of capital brought about, for instance, through interest rate subsidies, can readily be shown to induce a higher level of investment in productive fixed capital.

This argument is illustrated in Figure 1 which describes the opportunity set of investments facing a representative firm Figure 1 depicts the marginal cost of capital (MCC) line and the marginal rate of return (MRR) curve. The marginal cost of capital should be constant in a competitive capital market. As is typically assumed, the firm is confronted with a decreasing marginal rate of return from incremental fixed investments. Without interest subsidies, the profit-maximizing firm will invest up to I* where the marginal cost of capital is equal to the marginal rate of return.

Suppose, however, that the firm is given an opportunity to obtain a subsidized loan in the amount of X_1 at the rate of MCC minus k. The firm's cost of capital will be reduced by k up to X_1. If X_1 is less than the profit maximizing level of investment, I*, the subsidy does not affect the marginal cost of capital at I* and hence will not increase the investment level. The subsidized loan will only enrich the owners of the firm by an amount kX_1 without achieving the goal of increasing the firm's investment in fixed assets.

Figure 2 depicts the case in which the size of the subsidized loan (X_2) is greater than I*. Even in this case, it is unlikely that the firm will increase its investment in fixed assets. Note that the cost of capital is the opportunity cost that the owners of the firm forego by not investing elsewhere. In other words, the marginal cost of capital line not only represents the cost of obtaining funds, but also represents the investment opportunity set available to the owners of the

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[9]Theoretically, such an aggregation is viable only if all assets on the company balance sheet are perfect substitutes.

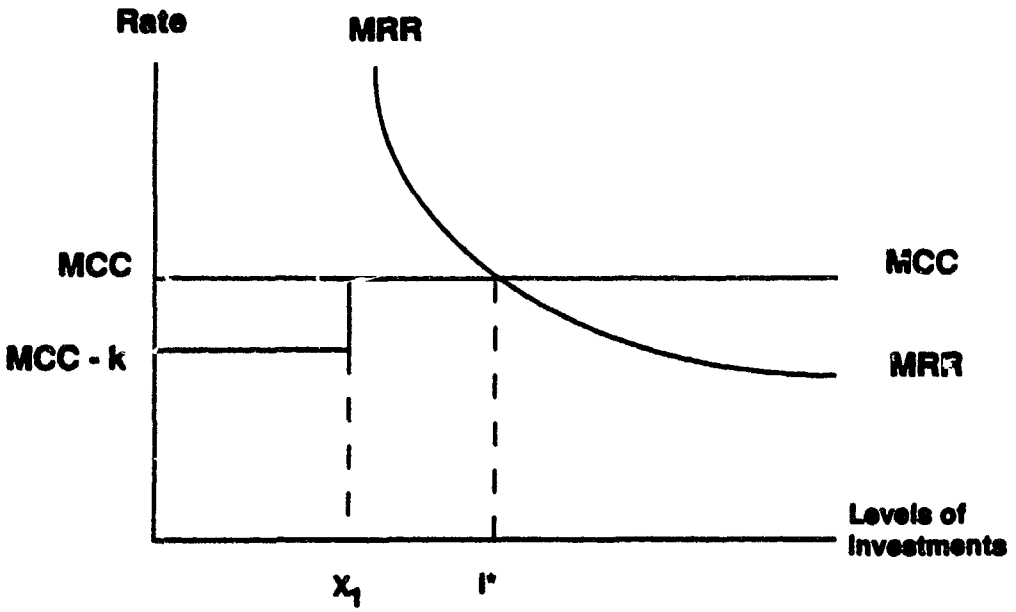

Figure 1: The Impact of Subsidized Loan X_1 at MCC - k on Corporate Investments in Productive Assets: $X_1 < I^*$

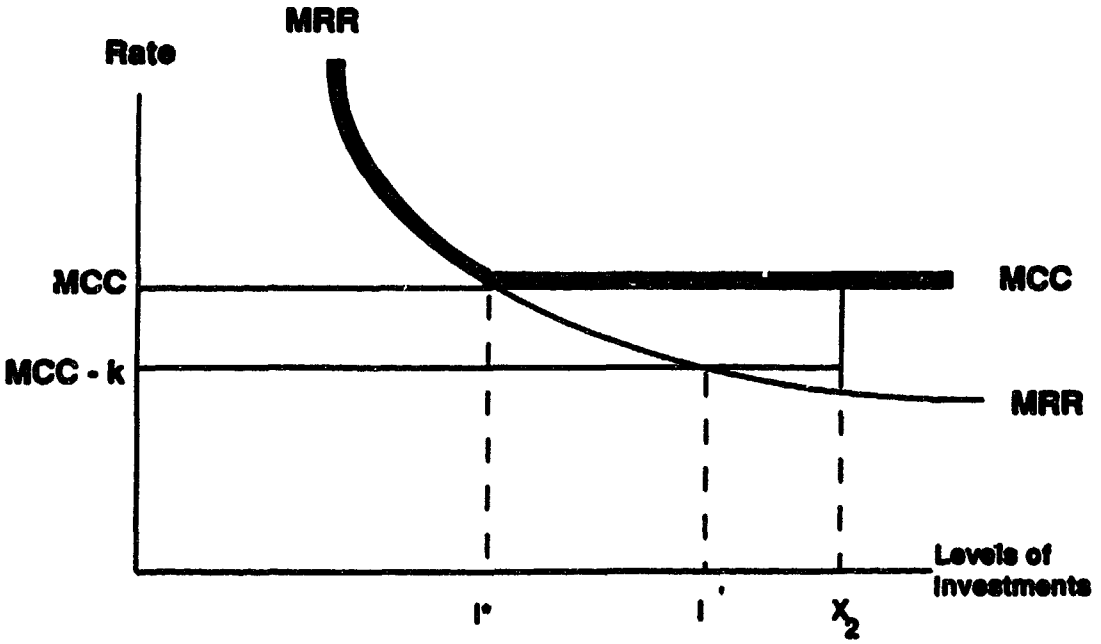

Figure 2: The Impact of Subsidized Loan X_2 at MCC - k on Corporate Investments in Productive Assets: $X_2 > I^*$

firm via "speculative" assets such as financial assets and real estate. Consequently, the optimal investment decision requires investment in fixed assets only up to the original I* with the remaining amount of X_2 diverted to speculative assets. This investment path is traced by the bold line in Figure 2. As in the previous case, the subsidized loan will only enrich the owners of the firm without increasing the firm's investment in productive assets.

The objective of increasing the level of corporate investment beyond I*, say to X_2 or I' in Figure 2, can only be achieved if there is an effective monitoring mechanism that prohibits firms from investing the subsidized loans in anything other than the fixed productive assets which yield rates of return below the firm's opportunity cost of capital. This would require that (1) the process of investment is verifiable at every stage through its completion and (2) there is no collusion between the monitoring agent and the firm.

In practice governments monitor investments even if the process of investment is not verifiable at every stage, and penalize firms for diverting funds to other uses. While collusion is possible, monitoring agents will require adequate compensation for the risk of detection. Thus a profit maximizing firm will weigh the expected penalties and the cost of bribery against the difference in yields on productive and speculative assets. Consequently, the greater are the expected penalties and the cost of bribery, the greater will be the proportion of subsidized loans used to finance productive assets. In sum, the impact of debt subsidies on the investment behavior of the recipient firm is dependent on the monitoring effectiveness of the government agency which is providing or mandating the subsidies.

III. THE HYPOTHESIS

1. The Model

The theoretical predictions in the preceding section can be formalized by means of a switching regression model with a stochastic sample separation point. Let us define Y_i and X_i respectively as the amount of investment in speculative assets by firm i and the net flow of subsidized loans received by firm i in a given year. Then Figures 1 and 2 imply that, absent any

other sources and uses of funds, Y_i will be equal to $X_i - I^*_i$ if $X_i > I^*_i$ and zero otherwise. More generally, the relation between Y_i and X_i can be stated as follows:

$$Y_i = \beta_0 + \beta_1 X_i + u_{1i}, \qquad \text{if } X_i > I^*_i \tag{1}$$

$$Y_i = \alpha + u_{2i}, \qquad \text{if } X_i \leq I^*_i$$

where β_0, β_1, and α are the estimation parameters. We assume that the error terms u_{1i} and u_{2i} satisfy the usual conditions of $E(u_{1i}) = E(u_{2i}) = 0$, and $E(u^2_{1i}) = E(u^2_{2i}) = \sigma^2$.

Equation (1) implies that the relation between a firm's investment in speculative assets and its access to subsidized loans depends on whether or not the firm's supply of subsidized loans exceeds its desired level of investment in productive assets. Thus, for firms with $X_i > I^*_i$, a positive fraction, β_1, of the subsidized loan is used to finance speculative investment. In the extreme case in which government monitoring is either nonexistent or totally ineffective, profit maximizing firms will divert all excess financing into speculative assets.

For the group of firms for which $X_i \leq I^*_i$, we postulate that $\beta_1 = 0$. The sample separation between the two groups of firms occurs at the point where $X_i = I^*_i$, i.e., the net supply of subsidized loans is equal to the desired level of investment in productive assets. Note that the location of this sample separation point is not readily observable as it depends on the determinants of optimal investment in productive assets.

The procedure for estimating the switching regression model (1) is well known [See Kiefer (1980), Maddala (1983)]. Let the probability that firm i belongs to the group of firms with net flows of subsidized loan in excess of I_i^* be:

$$P_{it} = Pr[I_i^* < X_i] = F(Z_{it}\theta_t), \tag{2}$$

where Z_{it} is a matrix containing observable determinants of each firm's optimal investment in productive assets and supply of subsidized loans, θ_t is a corresponding vector of parameters, and $F(\bullet)$ is the standard normal distribution function. Potential candidates for inclusion in the matrix Z would include the firm's level of output and profits which may be related to the optimal level of investment in productive assets and the firm's access to subsidized loans.

Assume that a proportion λ of observations are generated by regime I and $(1 - \lambda)$ by regime II, where regime I represents the group of firms for which $X_i > I^*_i$, and regime II represents the remaining firms. Then the likelihood function for an observation Y_i can be written as:

$$L(\lambda,\beta_0,\beta_1,\alpha,\sigma^2) = \lambda L_1(\beta_0,\beta_1,\sigma^2) + (1-\lambda)L_2(\alpha,\sigma^2), \tag{3}$$

where L_1 and L_2 are respectively given by

$$L_1 = (2\pi)^{-\frac{1}{2}} \sigma^{-1} \exp\left\{-\frac{1}{2}(Y_i - \beta_0 - \beta_1 X_i)^2/\sigma^2\right\}. \tag{4}$$

$$L_1 = (2\pi)^{-\frac{1}{2}} \sigma^{-1} \exp\left\{-\frac{1}{2}(Y_i - \alpha)^2/\sigma^2\right\}. \tag{5}$$

Assuming that u_{1i} and u_{2i} are normally and independently distributed, the likelihood function for observations $(Y_1 \ldots Y_N)$ is given by

$$L(\lambda,\beta_0,\beta_1,\alpha,\sigma^2) = \prod_{i=1}^{N} \{\lambda L_{1i}(\beta_0,\beta_1,\sigma^2) + (1-\lambda)L_{2i}(\alpha,\sigma^2)\}. \tag{6}$$

Maximizing the log of likelihood function (6) with respect to its four relevant arguments, we obtain:

$$\hat{\beta}_1 = \frac{\Sigma W_i X_i Y_i - (\bar{W}X)(\bar{W}Y)}{\Sigma W_i X_i - (\bar{W}X)^2} \tag{7}$$

$$\hat{\beta}_0 = (\bar{W}Y) - \beta_1 \bar{W}Y \tag{8}$$

$$\hat{\alpha} = \frac{\Sigma(1 - W_i)Y_i}{\Sigma(1 - W_i)} \tag{9}$$

$$\lambda = \frac{\Sigma W_i}{N} \tag{10}$$

where $W_i = \dfrac{\lambda L_{1i}}{\lambda L_{1i} + (1 - \lambda)L_{2i}} = p_i$ is the conditional probability of regime I given Y_i; $(\bar{W}X)$ and $(\bar{W}Y)$ are respectively the weighted average of x_i and y_i.

2. Specification

The estimation of the switching regression model described above involves specifying, first, the optimal level of productive investment (I*) and, second, the supply of subsidized loans (X). To estimate the desired level of investment in productive assets, we rely on the following standard model of corporate investment behavior:

$$I_t = \gamma_0 + \gamma_1(\gamma_2 Q_t - K_{t-1}) + \gamma_3 F_t + v_t , \tag{11}$$

where $\gamma_0, \gamma_1, \gamma_2, \gamma_3$ are parameters to be estimated, Q_t is a firm's level of output as measured by sales plus the change in inventories of final goods, K_{t-1} is its capital stock of productive assets lagged one year, F_t is a financial variable alternatively measured by either the firm's previous year profits or by the first difference in the firm's value as measured by the market capitalization of its equity. Finally, v_t is a disturbance term. All variables are scaled by the firm's beginning of year book value of total assets.

Equation (11) combines the conventional accelerator model with the usual intertemporal adjustment specification. It also contains a measure of profitability and stock market performance designed to capture the firm's present and future investment opportunities.[10]

If the supply of subsidized loans to each firm is observable, it is possible to determine the probability, P_{it}, that firm i at time t belongs to regime I. Using equation (11) we obtain:

$$\begin{aligned} P_{it} &= Pr[I_{it}^* < X_{it}] \\ &= Pr[v_{it} < X_{it} - \gamma_0 - \gamma_1(\gamma_2 Q_{it} - K_{it-1}) - \gamma_3 F_{it}] \\ &= \Phi\left[\frac{X_{it} - \gamma_0 - \gamma_1(\gamma_2 Q_{it} - K_{it-1}) - \gamma_3 F_{it}}{\sigma_v}\right], \end{aligned} \tag{12}$$

where $\Phi(\bullet)$ represents the unit normal distribution function and σ_v is the standard deviation of v.

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[10] Firm profits are included in the micro investment study of Tybout (1985) for Columbia and Nabi (1989) for Pakistan. The relevance of stock market performance to corporate investment behavior in Korea is discussed in detail in Dailami (1990).

The quantity of subsidized loans available to individual firms, however, is not directly observable. We proxy the subsidized loans by the sum of short and long term domestic loans plus foreign loans, which we henceforth define as "loans." There are two main justifications for choosing this proxy. First, most explicit debt subsidies for priority industries and firms have been provided through bank loans which are the major source of short and long term domestic loans. Foreign loans are included because most carry explicit government guarantees.

Second, the implicit debt subsidies due to bailouts and ceilings on interest rates and loan guarantee fees mainly apply to loans emanating from banks and other financial intermediaries. Existing interest rate ceilings do not effectively extend to corporate debt instruments with secondary markets. For instance, the interest rate ceiling on corporate bonds is easily circumvented by selling new bond issues at a discount. Furthermore, government bailouts of firms in financial distress usually require bank participation. The new capital provided in bailouts often takes the form of postponing repayment on old bank debt, extension of new bank loans, and the provision of loan guarantees which allow firms to obtain low cost loans outside of the banking system.[11]

The identity of the firms which have benefited from these subsidies is not public information. Although the priority industries were the heavy and chemical industries in the 1970s and the electronics industry in the 1980s, not all firms in these industries received equal treatment. Furthermore, the eligibility requirements for individual firms changed over time as the government revised its industrial policy.

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11. This heavy reliance on bank participation in the bailout process is possible because Korean banks have been quasi-government agencies. Even after the considerable progress made toward financial liberalization in the late 1980s, bank presidents are still appointed by the government.

IV. DATA AND MEASUREMENTS

1. The Sample

The sample of companies analyzed here represents all non-financial corporations that had been listed on the Korea Stock Exchange from 1983 through 1988. The primary data source is the Pacific-Basin Capital Market (PACAP) Data Base from the University of Rhode Island. The PACAP data is supplemented by the data provided by National Information and Credit Evaluation (NICE) Inc. of Korea. NICE compiles the raw data from which the PACAP data base is constructed and hence provides a more detailed breakdown of balance sheet items than does PACAP.

Due to new listings, delistings, mergers, and bankruptcies, the number of non-financial firms listed on the Korea Stock Exchange varies from a low of 275 in 1983 to a high of 441 in 1988. To estimate the parameters of equations (1) and (11) we require sufficiently detailed balance sheet, income statement, and stock market data for all sample firms throughout the sample period. Thus, to be included in the sample, firms must be listed on the Korea Stock Exchange throughout the 1983-88 period, thereby limiting our sample to 241 firms. The sample covers 27 industries which account, in aggregate, for 62.7 percent of the total market value of non-financial corporations listed on the Korea Stock Exchange at the end of 1988.

2. Subsidized Loans

As discussed in the previous section, we use the sum of short and long term domestic loans plus foreign loans to proxy for the firm's supply of subsidized loans.[12] The net flow of these loans received by each firm in a given year is estimated by taking first differences of their

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[12] To the extent that some of these loans are not subsidized, our measure overstates the true amount of subsidized loans. Note, however, that in equilibrium risk adjusted rates of return on speculative assets are the same as the risk adjusted cost of non-subsidized loans; consequently, firms have no incentive to take out non-subsidized loans to make speculative investments. Thus the upward bias in our estimate of subsidized loans works against detecting a significant relation between our measure of subsidized loans and speculative asset holdings.

beginning and end of year outstanding balances.[13] Table 1 shows that during the sample period of 1983-1988, total domestic and foreign loans account on average for about 35 percent of the book value of firm capital, while debentures account for about 22 percent. The table also illustrates a high degree of variability in the loan to asset ratio across industries. Firms in "other manufacturing" have the lowest average loan to asset ratio (9 percent) while firms in the rubber tire industry have the highest (48.9 percent).

3. Measuring Investment in Speculative Assets

Determining what portion of a firm's assets are being held for speculative as opposed to productive purposes is difficult. Balance sheet information, even if it were available in greater detail, could not fully resolve the issue. Clearly, investments in certain assets, such as machinery and equipment, can be regarded as productive, while investments in marketable securities can be categorized as speculative. The difficulty resides in the treatment of other balance sheet items, particularly land and buildings, which can satisfy both productive and speculative needs. While firms clearly need land and structures to house their machinery and equipment, these assets are at the same time known to be the most popular avenues of speculative investment for Korean corporations.

Thus to define speculative assets, we classify total assets into three broad categories:[14]

i) Liquid assets = Cash + Accounts and Notes Receivable + Other Current Assets,

ii) Productive Assets = Machinery and Equipment + Inventories + h (Buildings and Land),

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[13]See User's Guide of PACAP Database for more precise definitions of short-term loans (BAL 11) and long-term loans (BAL 14). The data on foreign loans are obtained from National Information and Credit Evaluation, Inc. of Korea.

[14]See User's Guide for the PACAP Database for the definition of cash (BAL 1), Accounts and Notes Receivable (BAL 3), Other Current Assets (BAL 5), Inventories (BAL 4), Marketable Securities (BAL 2), and Investments and Other Assets (BAL 8). PACAP Database does not separate fixed assets into machinery and equipment versus buildings and land. These data are obtained from National Information and Credit Evaluation, Inc. of Korea.

Table 1

Mean Debt-to-Asset Ratios
For Korean Non-financial Corporations
(Average 1983 - 1988)

Industry	Number of Companies	Loan to Asset Ratio (Mean)	Debenture to Asset Ratio (Mean)
Fishing	2	0.291	0.172
Mining	3	0.228	0.173
Food	20	0.307	0.194
Beverage	9	0.259	0.209
Textile	22	0.363	0.284
Apparel & Leather	8	0.407	0.165
Wood & Wood Products	2	0.421	0.071
Paper & Paper Products	10	0.478	0.216
Chemicals	22	0.289	0.267
Rubber & Tire	6	0.489	0.176
Pharmaceuticals	17	0.296	0.212
Plastics	3	0.408	0.246
Nonmetallic Mineral	12	0.287	0.293
Iron & Steel	9	0.290	0.173
Nonferrous Metal	4	0.285	0.183
Fabricated Metal	4	0.337	0.158
Machinery	8	0.381	0.213
Electronic & Electrical	20	0.405	0.259
Motor Vehicles & Equipment	5	0.400	0.290
Watch Making	2	0.287	0.165
Other Manufacturing	2	0.090	0.224
Construction	29	0.460	0.141
Wholesale	15	0.362	0.144
Retail Trade	1	0.436	0.184
Land Transportation	3	0.242	0.309
Shipping Air Transportation	1	0.302	0.434
Air Transportation	2	0.154	0.536
Total	241	0.353	0.217

iii) Speculative Assets = Marketable Securities + Investments and Other Assets + (1-h) (Buildings and Land),

where h is a parameter denoting the proportion of the land and buildings category that can be attributed to productive use.

The parameter h is not, of course, directly observable. To estimate h we postulate a linear relation between a firm's productive use of land and buildings and the level of firm output. This relation is estimated based on pooled time-series cross section data for the sample of 241 companies over the 1983-88 period, resulting in 1,446 estimates of h.[15] The overall mean and median of these estimates during the sample period are 0.135 and 0.078.[16] To illustrate a typical distribution of h, Figure 3 portrays the distribution for 1988, which has a mean and median of 0.126 and 0.075 respectively. These results confirm our earlier conjecture that land and buildings are one of the most popular means of speculation for Korean corporations.

Using the above estimates of h, Table 2 decomposes total assets into productive, liquid, and speculative assets for each of the years 1983 to 1988. The table reveals little variation in the composition of corporate assets from year to year. On average, firm asset allocation consists of 42.3, 43.5, and 22.2 percent in productive, liquid, and speculative assets, respectively.[17]

The 43.5 percent for liquid assets appears large compared to U.S. data: the average ratio of liquid assets to total assets for U.S. manufacturing, mining, and trade corporations during the

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[15]Specifically, we estimate the following equation:

$$(BL)_{it} = \delta_0 + \sum_{j=1}^{26} \delta_j D_{ijt} + \eta_0 Q_{it} + \left(\sum_{j=1}^{26} \eta_j D_{ijt} \right) Q_{it} + e_{it},$$

where BL = value of building and land assets, Q = output, and D_j, j=1,...26, are industry dummy variables. Note that $(\eta_0 + \eta_j)$ measures the marginal capital (land and building)/output ratio for industry j. We choose the industry with the lowest marginal capital/output ratio and denote it by η^*. We then generate estimates for h as $h_{it} = (\eta^*)(Q_{it}/BL_{it})$, for t equal to 1983-1988, and i=1,..., 241.

[16]Out of the 1446 estimates, 34 estimates were greater than 1 and one estimate was negative. We assign a value of h=1 for those that were greater than one, and h=0 for the negative estimate.

[17]The sum of the ratios exceeds one hundred percent because the ratios are obtained by dividing the end of year balance of each asset category by the beginning of year book value of total assets.

FIGURE 3

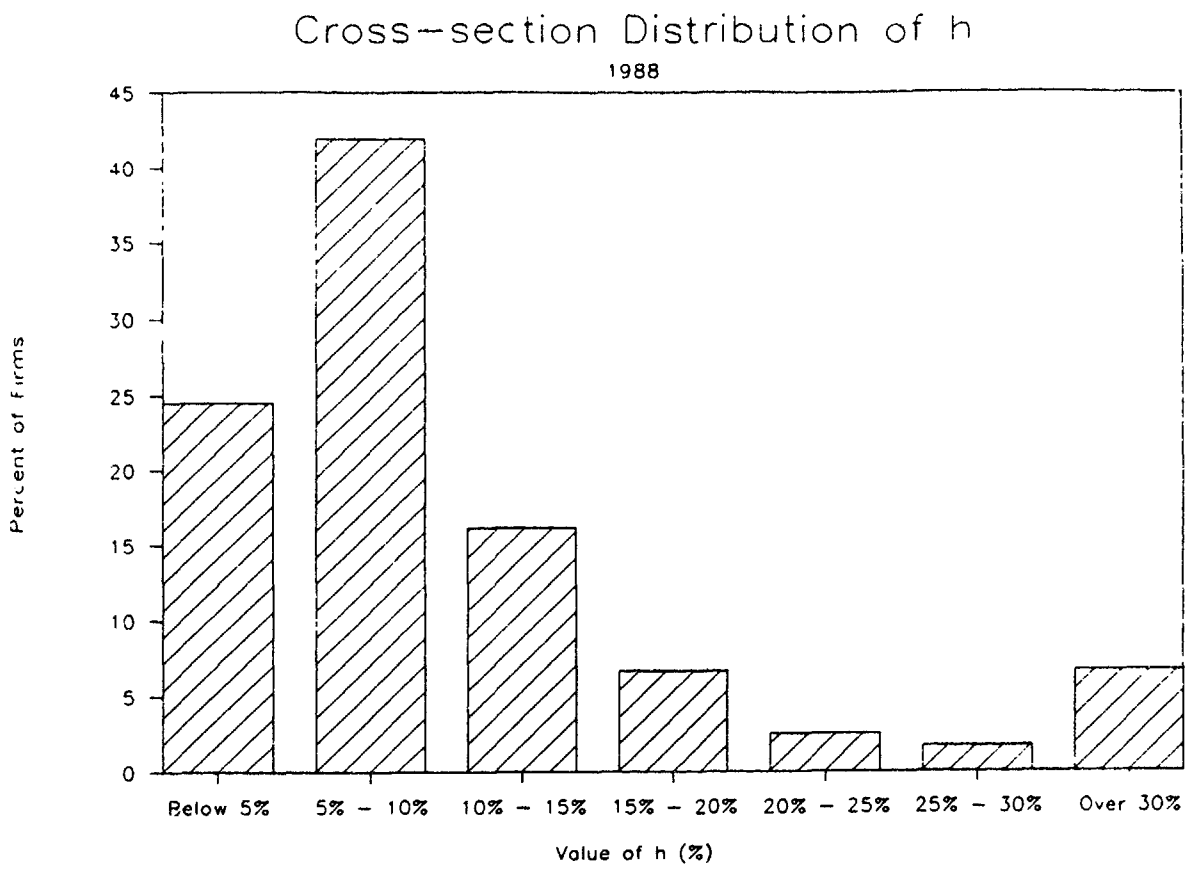
Cross-section Distribution of h
1988
Percent of Firms
45
40
35
30
25
20
15
10
5
0
Below 5%
5% - 10%
10% - 15%
15% - 20%
20% - 25%
25% - 30%
Over 30%
Value of h (%)

Table 2

Corporate Asset Composition: Ratio of Productive, Liquid, and Speculative Assets to Total Assets[a]

1983 - 1988

	Mean Asset Ratio[b]		
	Productive	Liquid	Speculative
1983	0.443 (0.155)	0.454 (0.161)	0.205 (0.125)
1984	0.436 (0.167)	0.462 (0.188)	0.229 (0.139)
1985	0.418 (0.193)	0.438 (0.201)	0.221 (0.122)
1986	0.409 (0.203)	0.421 (0.163)	0.213 (0.106)
1987	0.413 (0.187)	0.422 (0.145)	0.224 (0.119)
1988	0.416 (0.191)	0.412 (0.185)	0.237 (0.141)
1983-1988	0.423 (0.184)	0.435 (0.176)	0.222 (0.126)

a. Ratios are obtained by dividing the end of the year balances of asset categories by the beginning of the year book value of total assets.

b. Standard deviation in parentheses; mean and standard deviation are based on the sample of 241 companies.

1983-1988 period is 22%.[18] One possible explanation for the larger Korean ratio is the use of compensating balances to increase the effective bank lending rate. However, if banks were able to attain the market clearing rate via compensating balances, there would be no subsidies in domestic loans and hence no credit rationing. The implication of no credit rationing clearly contradicts the chronic shortage of bank credits in Korea. Furthermore, if the effective interest rates were at the market clearing level, firms would not use domestic loans to make speculative investments, because the equilibrium risk adjusted expected returns on speculative assets are equal to the risk adjusted cost of non-subsidized loans. Thus, if this equivalency held, there would be no systematic relation between a firm's access to domestic loans and its holdings of speculative assets. Thus, in estimating the switching regression model in equation (1), we are testing the joint hypotheses that subsidized loans lead to increased speculative holdings and that compensating balances have not completely circumvented the interest rate ceilings. To the extent that compensating balances reduce the interest subsidies in domestic loans, however, our test contains a bias against detecting a positive relation between subsidized loans and speculative asset holdings.

V. EMPIRICAL RESULTS

We report below our estimates of the proportion of speculative assets held by Korean corporations that are attributable to the availability of loan subsidies. Since our theoretical analysis shows that the sample separation point depends on the optimal level of productive investments, we first estimate investment equation (11) utilizing ordinary least squares (OLS) regression methods and pooled time-series cross section data. Our regression model includes a set of yearly and industry dummies. Inclusion of the yearly dummies is designed to capture the effect of macro economic shocks on corporate investment behavior; the industry dummies adjust for industry differences.

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[18]See Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations (1990). The definition of liquid assets for U.S. firms is identical to that used for Korean firms.

Table 3 reports the regression results under two alternative specifications for the financial variable: (1) firm profitability lagged one year, and (2) the first difference in the firm's market value of equity. These financial variables are intended to capture the effect of present and anticipated future profitability on decisions to invest in fixed assets.

Several conclusions emerge from the estimates reported in Table 3. First, the estimated coefficients on both output and capital stock are statistically significant and have the expected signs. Furthermore, the magnitude of the coefficients is not sensitive to the choice of financial variables: the coefficients on output and capital stock change respectively from 0.25 to 0.27 and from 0.098 to 0.097, as we switch from the use of stock market capitalization to previous year's profit.

Second, the estimated coefficient for the financial variable is both positive and statistically significant under either specification. Measuring profitability by the stock market performance results in a higher R^2. This is not surprising because the stock market based measure is forward looking whereas the previous year's profit is backward looking. The first difference in the firm's market value of equity reflects not only current profitability but also the prospects for future profitability and growth opportunities. Because this variable proves to be both theoretically and empirically superior, we conduct the remaining empirical analyses based on results obtained with the stock market performance measure.

Finally, the estimated coefficients for yearly dummies, with the exception of 1987 in column (1), are all statistically insignificant. This result indicates that the fundamental determinants of corporate investment behavior in Korea were not subject to temporal instability during the sample period.

We use the estimates reported in column (1) of Table 3 to generate estimates of P_{it} in equation (12) and calculate estimates of β_0, β_1, α, and λ as described in equations (7) through (10).[19] The results are reported in Table 4. The estimated value of β_1 is positive and significant,

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[19] This estimation process requires the assumption that supplies of subsidized loans are determined exogenously.

Table 3

Regression Coefficients on the Determinants of Corporate Investment in Productive Assets

(Dependent variable: ratio of investment in productive assets to the beginning of year book value of assets)

Independent variables	(1)	(2)
output	0.25 (2.52)	0.27 (2.49)
capital stock	0.098 (2.87)	0.097 (2.80)
stock market capitalization	0.243 (6.76)	-
profits	-	0.206 (2.81)
constant	0.062 (2.63)	0.041 (1.62)
Year Dummies:		
1985	0.002 (0.018)	0.0002 (0.02)
1986	-0.011 (1.01)	-0.006 (0.53)
1987	-0.024 2.13	-0.0007 (0.06)
1988	-0.017 (1.5)	0.006 (0.52)
R^2	0.146	0.118
N	1199	1199
Dependent variable mean	0.056	0.056

Note: 1) sample consists of 241 in 1984, 240 in 1985, 238 in 1986, 231 in 1987, and 241 in 1988, non-financial corporations listed on the Korea stock exchange, covering 27 industries.

2) 26 industry dummies were included in the estimation but are not reported in the table.

Absolute values of t-statistics are in parentheses.

Table 4

The Relation between Firm Speculative Asset Holdings and Subsidized Loans with Exogenous Loan Supply: 1984 through 1988

(Dependent variable: ratio of investment in speculative assets to the beginning of year book value of total assets)

	1984	1985	1986	1987	1988
Subsidized loans (β_1)	0.254	0.175	0.0612	0.289	0.193
	(4.26)	(5.63)	(4.74)	(9.10)	(3.02)
Constant: regime I (β_o)	0.0271	0.0219	0.0243	0.0178	0.0444
	(2.59)	(2.82)	(7.01)	(3.58)	(4.54)
Constant: regime II (α)	0.0501	0.0219	0.0141	0.0278	0.0373
	(11.98)	(10.42)	(6.25)	(8.12)	(6.61)
Proportion of firms in regime I (λ)	0.527	0.488	0.441	0.423	0.363
	(30.23)	(28.59)	(27.44)	(25.93)	(22.32)
Number of firms	241	240	238	238	241

Absolute values of t- statistics are in parentheses.

supporting our hypothesis of a positive relation between level of speculative investment and access to subsidized loans. The point estimates of β_1 indicate that the proportion of subsidized loans diverted to speculative assets ranges from a high of 0.289 in 1987 to a low of 0.06 in 1986. For the 1984-88 period as whole, the average value of β_1 is 0.194, indicating that about one-fifth of each dollar of subsidized loans is used for speculative purposes. The remaining four-fifths is used to finance liquid and productive assets.

The proportion of firms receiving subsidized loans in excess of their optimal productive investments, i.e., firms in regime I, declines systematically over time from 53% of the sample in 1984 to 36% in 1988. Thus it appears that there has been a steady improvement in the allocational efficiency of capital. One possible source of explanation is the steps taken toward financial liberalization in the latter half of the 1980s.

Table 4 also shows that the constant terms β_0 and α are significantly positive, but the magnitudes are small. The average values of β_0 and α during the 1984-1988 period are 0.027 and 0.030, indicating that, on average, firms hold about 3% of assets in speculative categories irrespective of the availability of subsidized loans. Possible reasons for these investments include the cross holding of shares held for control purpose and the temporary investment of excess cash.

Recall that Table 2 shows that on average 22% of corporate assets are in speculation categories. Comparison of that 22% with the 3% for the constant terms in Table 4 indicates that most corporate investment in speculative assets is due to the availability of subsidized loans. Had there been complete financial liberalization such that all interest rates were competitively determined, the fraction of corporate assets invested in speculative assets would have been about one-seventh of observed levels.

To assess the sensitivity of our findings to the estimation method used to separate holdings of buildings and land between productive and speculative purposes, we rerun the switching regression model under two extreme assumptions: (1) all buildings and land were held for speculative purposes, i.e., $h_{it} = 0$, and (2) all were for productive purpose, i.e., $h_{it} = 1$, for all firms over the entire sample period. Table 5 contains the resulting estimates for the coefficients β_1

and λ. As expected, the estimates of β_1 are much higher under the assumption h = 0 than under the assumption h = 1. More interestingly, the assumption h = 0 increases the estimates of β_1 and λ only slightly from those in Table 4. Even under the extreme assumption of h=1, the estimates of β_1 remain significantly positive in two out of five years, and the estimates of λ continue to be significant throughout the sample period.

The results reported in Tables 4 and 5 assume that subsidized loans must be invested in either productive, liquid, or speculative assets. This need not be so. The subsidized loans can also be used to retire higher cost loans and equity. The end result would be identical to that achieved by the diversion of subsidized loans to speculative assets: the loans would only enrich the borrower without increasing investment in productive assets. To account for this possibility, we treat declines in other liabilities and equity as increases in speculative assets. Table 6 shows that declines in other liabilities and equity occur frequently and with some yearly variation. Of 241 firms, the number of firms experiencing such declines ranges from 26 in 1983 to 61 in 1985.

Table 7 reports the estimates of β_1, β_0, α and λ using the revised definition of changes in speculative assets. The results generally approximate those reported in Table 4. However, β_1 is higher in 1984 and 1985 and lower in 1987 and 1988 when compared with estimates using the previous definition of speculative assets. Table 7 provides a clearer pattern of secular decline in β_1 from a high of 0.327 in 1984 to 0.161 during the 1986-1988 period. Apparently, the proportion of subsidized loans put into speculative uses declined by about half after 1986. This declining use of subsidized loans for speculative purposes may be due to the dramatic increase in profitability experienced during the 1986-1988 period. The so-called three lows--low inflation, low oil price, and low exchange rate--during the 1986-1988 period, have reinvigorated the Korean economic miracle.[20] The increase in profitability due to the three lows, together with the relaxation of

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[20]The average annual real GNP growth rate was 6.9% during 1984-1985 and an astounding 12.1% during 1986-1988.

Table 5

Estimated Coefficients for β_1 and λ
Under Alternative Measures of Speculative Assets

Coefficient:	1984	1985	1986	1987	1988
Subsidized Loans (β_1)					
(i): all land and buildings assumed to be speculative (h=0)	0.257 (4.29)	0.185 (5.87)	0.066 (5.13)	0.295 (9.25)	0.196 (3.07)
(ii): all land and buildings assumed to be productive (h=1)	0.106 (4.50)	0.006 (0.96)	0.009 (1.39)	0.026 (1.89)	-0.013 (0.79)
Proportion of Firms in Regime I (λ)					
(i): all land and buildings assumed to be speculative (h=0)	0.530 (30.46)	0.491 (28.71)	0.444 (27.41)	0.428 (26.10)	0.366 (22.45)
(ii): all land and buildings assumed to be productive (h=1)	0.459 (29.05)	0.436 (28.31)	0.390 (27.74)	0.397 (27.57)	0.330 (23.40)

Absolute values of t- statistics are in parentheses.

Table 6

Frequency of Negative and Positive Changes in Other Capital [a]

(1983-1988)

Year	Negative	Positive	Total
1983	26	215	241
1984	56	185	241
1985	61	180	241
1986	50	191	241
1987	32	209	241
1988	26	215	241

a: Other capital is defined as total assets minus subsidized loans.

Table 7

The Relation Between Firm Speculative Asset Holdings
and Subsidized Loans under the Alternative Definition of Speculative Assets [a]

	1984	1985	1986	1987	1988
Subsidized Loans (β_1)	0.327	0.204	0.066	0.250	0.168
	(4.78)	(6.05)	(4.53)	(7.34)	(2.64)
Constant: Regime I (β_0)	0.042	0.041	0.041	0.033	0.055
	(3.50)	(4.95)	(10.40)	(6.25)	(5.61)
Constant: Regime II (α)	0.060	0.033	0.022	0.036	0.045
	(13.92)	(13.13)	(8.51)	(9.96)	(10.28)
Proportion of Firms	0.527	0.488	0.444	0.424	0.364
in Regime I (λ)	(30.22)	(28.58)	(27.46)	(25.93)	(22.32)
Number of Firms	241	240	238	239	241

a: Changes in speculative assets include the decline in other capital, where other capital is defined as total assets minus subsidized loans.

Absolute values of t-statistics are in parentheses.

interest rate controls in the latter part of the 1980s, may have reduced the incentive to divert subsidized loans to nonproductive uses.[21]

VI. CONCLUSIONS

This paper develops a theoretical model which predicts that, absent effective government monitoring, subsidized corporate loans will not lead to greater investment in productive assets and instead will be diverted into speculative assets. To test this hypothesis we investigate Korean corporate behavior between 1984 and 1988.

We find a significant positive relation between corporate investments in speculative assets and access to subsidized loans. About one-fifth of all subsidized loans appear to have been used to finance speculative investments. The remaining amount apparently was used as intended: to finance fixed and liquid assets. In addition, we find that a substantial number of Korean firms were allocated considerably more subsidized loans than were required for the acquisition of productive investments.

Our estimates indicate that an overwhelming proportion of corporate speculative asset holdings are induced by the availability of subsidized loans. It appears that, had interest rates been competitively determined, the share of corporate assets devoted to speculative holdings would have been one-seventh of that actually observed. Furthermore, a substantial fraction of corporate real estate holdings appears to be unrelated to production activity: our estimates indicate that on average, 86.5% of all corporate real estate holdings were motivated by speculative purposes.[22] These results imply that corporate investments in speculative assets are both excessive and are induced by the availability of subsidized loans. Thus, if the Korean stock market was indeed

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[21] Consistent with the above conjecture, new equity offerings increased substantially starting in 1986. See Kim and Lee (1990) for further discussion on issuing stocks in Korea.

[22] Although 86.5% may appear at first glance to be extremely high, it is not inconsistent with the prior impression one receives from reading Korean daily economic newspapers. Even a casual perusal reveals persistent press criticism regarding excessive real estate holdings by large corporations. Although these criticisms are based on anecdotal evidence, they have led to government policies forcing a massive liquidation of corporate real estate holdings. As of this writing, the forced liquidations are still underway.

overheated during the sample period, the government's credit allocation policy and debt subsidies are at least partly to blame.[23]

Our estimate of the extent to which subsidized loans were diverted to speculative assets may be biased downward due to possible measurement errors in the data. The errors arise because the identity of individual subsidized loans is not public information and because compensating balances may have been used to increase effective interest rates. Depending on the magnitude of those measurement errors, our proxy for subsidized loans overstates the quantity of debt subsidies and biases the result toward finding no relation between subsidized loans and speculative asset holdings.

Finally, what are the implications of our findings for developing economies in general? Did Korea achieve its economic miracle because of, or in spite of, its credit allocation policy? Although analyzing the underlying causes of Korea's economic miracle is beyond the scope of this paper, we believe that Korea's credit allocation policy has been at best a coincidental feature of the Korean success story. Our data reveal a clear pattern of secular decline in the proportion of firms receiving more subsidized loans than are needed for productive investment, from a high of 0.54 in 1984 to 0.36 in 1988. In contrast, the average annual real GNP growth rate increased from 6.9% during 1984-1985 to 12.1% during 1986-1988.

If anything, the key factors providing the impetus for high economic growth after 1986 were the so-called three lows, low inflation, low oil price, and low exchange rate, which prevailed from 1986 through the end of our sample period. These three lows represent favorable macro shocks that have drastically enhanced the profitability of real investments. The increase in expected profitability in turn has increased the incentives for corporations to invest available funds in productive assets. Our data support this conjecture: the proportion of subsidized loans diverted to speculative investments declined from 27% during the pre-three-low era (1984-1985) to 16%

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[23]The average rate of return for all stocks listed on the Korean Stock Exchange during the 1984-1988 period was 56% per year. See Kim and Lee (1990) for further details.

during the post-three-low era (1986-1988). In conclusion, we find little evidence supporting the contention that subsidized loans have contributed to corporate investment boom in Korea.

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