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The Case of the Korean Firms**

*Jaiwon Ryou, Konkuk University*  
*Taejoon Kim, Dongduk Women's University*

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# **Overborrowing and Overinvestment in East Asia:**

## **The Case of the Korean Firms**

Jaiwon Ryou (Konkuk University)

Taejoon Kim (Dongduk Women's University)

### **Abstract**

This paper examines whether there has been overinvestment by Korean firms in the 1990s, particularly during the few years leading up to the crisis in Korea. Overinvestment is defined as the statistically significant discrepancy between the forecasted value from an econometric model of investment and the actual investment. Our analysis shows that overinvestment was found most frequently for chaebol firms. Moreover, it was most evident in a few industries showing viable exports in the 1990s, such as electronic and communication equipments, basic metals and transport equipments other than motor vehicles. However, capital account liberalization was not found critical in inducing overinvestment. Overinvestment by chaebols during 1994-1996 period indicates that loosening strict restrictions on lending in the financial sector to chaebols backfired. In this sense, the Korean crisis was caused by structural weaknesses in corporate and financial sectors.

## **I . Introduction**

There has been a lot of debate on what caused the East Asian crisis in 1997. Overinvestment by the corporate sector is often pointed out as one of the fundamental causes which brought about the Asian collapse. Even though overinvestment is not indicated as directly inducing the outbreak of the crisis, it is perceived as contributing to the conditions for the crisis by lowering profitability and raising the likelihood of bankruptcy in borrowing firms. This resulted in an increase in non-performing loans held by banks and downgraded the credit ratings of banks on international financial markets. Banks, therefore, found it more difficult to rollover their exiting loans and to borrow funds to repay their loans. This situation became worse and contributed to the crisis. So, it is important to investigate the incentives which induce overinvestment, and to confirm empirically the existence of overinvestment itself in relation to the studies on the Asian crisis.

Various theoretical models have been put forth regarding causes of overinvestment. At the macroeconomic level, moral hazard generated by implicit as well as explicit government guarantees for bad loans, implementation of financial liberalization policies, changes of industrial policy from sector-specific to functional

intervention, and prevalence of soft-budget constraints are suggested as some key reasons. On the other hand, at the firm level, the agency cost problem between managers and shareholders, misallocation of capital due to diversification, and capital allocation through internal capital markets are discussed as the sources of overinvestment. Although theoretical debates on this subject are relatively active, few studies have been done to verify the existence of overinvestment using empirical tools. Furthermore, it is hard to find a study on whether overinvestment has been done at the firm level in a specific period of time.

In this paper, we investigate, using a simple econometric model, whether there has been overinvestment in the 1990s, particularly during the few years leading up to the crisis in Korea. We classify manufacturing firms into 3 groups. Group 1 consists of the top 5 conglomerates (chaebols), while Group 2 consists of the next top 6-30 chaebols. Group 3 consists of other independent corporations. We focus on the period between 1994 and 1996, when the new government under President Youngsam Kim adopted a new stance on industrial policies to dismantle selective industrial policy that had existed since the 1970s.

We define overinvestment as the statistically significant discrepancy between the forecasted value from an econometric model of investment and the actual investment.

The existence of systematic forecasting errors may be interpreted as evidence for overinvestment. Our analysis shows that overinvestment was found most frequently for chaebol firms. However, capital account liberalization was not found critical in inducing overinvestment. Overinvestment by chaebols during 1994-1996 period indicates that loosening strict restrictions on them backfired.

This paper is organized as follows. Chapter II briefly reviews theoretical and empirical works on overinvestment. In Chapter III, we broadly examine the macroeconomic environment of Korean firms in the 1990s, with a focus on policy changes which are often presumed to be important factors in determining investment decision of firms: industrial policies and capital account liberalization policies. In Chapter IV, we estimate the investment equation of Korean firms, by adopting financial variables such as operational return to total assets, debt ratio, and cash flows as explanatory variables. Two methods are employed to test the existence of overinvestment during the 1994-96 period. We first use a dummy variable for the period of 1994-96 to check whether there has been a surge in investment rate. Then, we estimate the investment equation using panel data covering the period of 1990-1993, and draw forecasting errors for the period concerned. Chapter V summarizes the major findings of this study and draws policy implications.

## **II. Literature Review**

### **1. Moral Hazard and Financial Liberalization**

Various types of incentives have been pointed out as the key to overinvestment. The moral hazard argument, which is the most popular, emphasizes the major role of the implicit as well as explicit safety net provided by government in inducing overinvestment.<sup>1</sup> Krugman(1998) argues that over-guaranteed and under-regulated financial intermediates can lead to excessive investment. Furthermore, this situation can easily be made worse by globalization. As a national economy, in which investment was previously funded by a limited supply of domestic savings, has access to the world capital market, it may be worse off by allowing moral hazard in the financial sector to translate into real excess capital accumulation.

Corsetti et al.(1999) developed a model in which moral hazard was the common source of overinvestment, excessive borrowing, and current account deficit in an economy with a poorly supervised and regulated financial sector. McKinnon and Pill(1996) show that when there is moral hazard in the capital market, especially in the

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<sup>1</sup> Chang et al.(1998) argue that it is hard to say that Korean crisis is the result of moral hazard because there has been no instance where the Korean government has bailed out failing chaebols in the 1990s.

banking sector, and the capital account is liberalized, potential for disaster arises. Given world interest rates, both consumption and investment increase relative to the equilibrium levels without moral hazard leading to over-consumption and over-investment, which would be unsustainable without a lucky payoff for investment. They argue that this is the essence of the overborrowing syndrome.

Financial liberalization is often referred to as another source of overinvestment. Chang et al.(1998) argue that the Korean excessive investment in the private sector, which led to the crisis of 1997, had been made possible by rapid and ill-designed financial liberalization, especially capital account liberalization. McKinnon and Pill(1996) also assert that many liberalizing economies, where banks exploit the potential for moral hazard, have suffered from overborrowing, which is due to overconsumption and overinvestment, followed by financial crisis and bust.

## **2. Incentives for Overinvestment**

There are a number of theoretical models that explain overinvestment from the perspective of an incentive for individual firms. Jensen(1986) explains overinvestment as the agency cost phenomenon. If managers prefer growth over profitability, they

may invest free-cash flow in negative present value projects. This argument can be applied to Korean chaebol's seemingly excessive investment behavior. In the case of Korean chaebols, controlling shareholders, who usually have less than 10% of the total equity, work as top managers of the firm. Therefore, chaebol families in Korea have a tendency to maximize the total size of their groups, not market value of individual firms. This distortion in incentive may have led to an overinvestment.

Extensive diversification of East Asian corporations is also referred to as one of main causes for the financial crisis in 1997. Diversification is usually associated with misallocation of capital investment towards less profitable and more risky business sectors, leading to overinvestment. Classens et al.(1998) test the misallocation of capital hypothesis in East Asian countries. They find that firms in Indonesia, Korea, Taiwan and Thailand appear to have suffered a significant negative impact of vertical integration on short-term performance, which implicitly suggests the possibility of overinvestment in these countries. Scharfstein(1998) and Rajan et al.(1997) also examine investment patterns across segments in diversified firms and find that diversification often leads to misallocation of investment funds.

Meanwhile, Huang and Xu(1999) show that soft-budget constraints, with no explicit termination of a given project, is more likely to generate overinvestment when



there is no bankruptcy. Because poorly informed depositors are misled to be overly optimistic, loss-making projects can be covered financially for a long time by overborrowing.

### **3. Overinvestment in the case of Korean Firms**

As far as the Korean economy is concerned, it is also argued that changes in industrial policies had an influential impact on investment behavior of Korean firms in the mid-1990s.<sup>2</sup> Unfortunately, there are few studies to verify the existence of overinvestment. Demetriades and Fattouch(2001) provide an empirical analysis of the Korean economy in which large volumes of excess or unproductive credit since the late 1970s exist by using a cointegration technique to estimate the underlying long-run equilibrium relationship between the stock of credit and its determinants. Their findings are broadly consistent with the hypothesis of overlending and overinvestment in Korea. They also show that the volume of unproductive credit increased sharply during the 1993-96 period, which reveals the possibility of the overinvestment in that period

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<sup>2</sup> Changes in industrial policies in the 1990s and their effects will be discussed later in Chapter III.

preceding the crisis.

Ueda(1999) investigates whether there was overinvestment or underinvestment in Korea during 1970-90. He calculates the expected marginal products of capital (MPK) of nine manufacturing industries, and compares them with the average value of the manufacturing sector as a whole. If expected MPK of a certain industry is lower than the average, then it is interpreted as evidence for overinvestment in that industry. If the expected MPK is higher than the average, then underinvestment is assumed. According to these criteria, there were overinvestments in Korea's basic metal industry and machinery industry in the 1970s. Meanwhile, Han (1999) shows that the investment rate of Korean firms is positively related to the dummy variable representing affiliation with chaebols. He interprets this finding as evidence for overinvestment for chaebols compared with other independent firms.

### III. Investment and Policy Changes in Korea

#### 1. Overall trend in savings and investment

The gross savings ratio in Korea has continuously declined since 1989. As shown in <Table 1>, the ratio dropped from 37.5% in 1990 to 33.8% in 1996. In contrast, the gross investment ratio fluctuated during that period. In 1991, it peaked to 39.8%, and then decreased to 35.4% in 1993. From 1994, the ratio began to rise to reach 38.1% in 1996. Owing to the declining savings ratio trend, however, the high investment ratio resulted in current account deficits from 1990 to 1997, except for the year 1993. The degree of deficit relative to GDP amounted to 4.4% in 1996.

<Table 1> Savings, Investment and Current Account in Korea, 1989-97

(% of GDP)

Variables	89	90	91	92	93	94	95	96	97
Savings	37.6	37.5	37.3	36.4	36.2	35.5	35.5	33.8	33.4
Investment	33.8	37.6	39.8	37.3	35.4	36.5	37.3	38.1	34.4
Current account balance	2.4	-0.8	-2.8	-1.3	0.3	-1.0	-1.7	-4.4	-1.7

Source: Bank of Korea, *Monthly Statistics*, various issues

Trends in gross capital formation in Korea are shown in <Table 2>. Gross fixed capital formation marked negative growth in 1992, but it rapidly increase in 1994 and 1995. The real growth rate for facility investment skyrocketed to 23.86% in 1994 and 18.12% in 1995. In particular, investment in machinery and equipment increased by 23.83% in 1994 and by 24.36% in 1995. These figures hint at the possibility of overinvestment, especially in the manufacturing sector, during the period of 1994-96.

<Table 2> Trends in Gross Capital Formatoin in Korea (real growth rates, %)

Type	1981 -1985	1986- 1990	1991	1992	1993	1994	1995	1996
Gross fixed Capital formation	7.81	16.59	13.30	-.70	6.28	10.65	11.87	7.32
Facility investment	6.30	17.76	14.80	-.31	.28	23.86	18.12	9.05
Tranport equipment	6.10	13.74	11.95	6.79	3.23	23.73	1.83	8.45
Machinery &equipment	6.36	19.54	15.77	-2.76	-.87	23.83	24.36	9.36

Source: Bank of Korea, *Statistical Data Base*, 2003 ([www.bok.or.kr](http://www.bok.or.kr)).

## 2. Industrial policy in the 1990s

The rapid growth of the Korean economy since the mid-1960s has to do with an all-out efforts of the Korean government to achieve industrialization. To achieve it

goal, the Korean government extensively intervened in the industrial allocation of capital. The essence of Korea's industrial policy was intervention in the financial market through control over credit allocation to render preferential treatment to the targeted industries in allocating scarce funds. It is often said that Korea's remarkable economic growth for the last 40 years was largely attributable to the Korean government's strategic industrial policy. However, such a policy led to a concentration of economic power in a small number of chaebols. During the 1980s and the early 1990s, the traditional predominance of the state over the market, represented by regulation, protection and support, was actively interacting with new forces in the market, represented by trade liberalization, competition, deregulation and privatization (Yoo and Lee(1997)).

Since the new Korean government under President Youngsam Kim was launched in 1993, deregulation was emphasized as the most important reform agenda. Deregulation of entry, price and investment was actively undertaken in order to promote competition and implement market principles. Furthermore, the new government abolished the practice of five-year planning, which had been the backbone of development programming in Korea. The Korean government changed its stance on industrial policy from a sectoral approach to a functional approach. That is, more

freedom was allowed for chaebols in deciding their own investment behavior. In the past, investment was heavily regulated as a means of achieving specific industrial policy objectives. Dismantling of the investment coordination mechanism made it easy for each firm to implement its investment projects and led to an investment boom. This resulted in falling profitability and in the bankruptcies of major chaebols in Korea during 1996-97.

Chang et al.(1998) argue that, with the serious weakening of a sectoral industrial policy, there was a fundamental transformation in the state-business relationship in Korea. According to them, ‘cronyistic’ relationships spread into the major manufacturing industries and policy coordination mechanisms no longer worked to prevent overinvestment in a number of leading industries including electronics, cars, steel, petrochemicals and shipbuilding in the mid-1990s.

### **3. Capital Account Liberalization and Capital inflows in the 1990s**

The Korean government opened the equity market to foreign investors in 1992. Incidentally or not, the Korean economy experienced a substantial increase in capital inflows in the early 1990s. To measure approximately the volume of net capital flows,

we may look into the balance of capital account. In 1989, the capital account balance was in deficit due to liberalization of transactions regarding capital outflows to accommodate the current account surplus. As the current account balance, however, turned into a deficit, capital account balance also changed to a surplus in 1990. The net volume of capital inflows through the private sector abruptly increased to reach US\$10.3 billion in 1994 and amounted to US\$23.3 billion in 1996, which amounts to about 4.5% of GDP. On the other hand, the Korean bank's borrowing from abroad, including both short-term and long-term, was at the insignificant amount of US\$0.5 billion in 1993. It began to surge in 1994, amounting to US\$10.6 billion in 1995 and US\$9.7 billion in 1996, respectively.

<Table 3> Capital Flows and Interest Rates(US\$ Billion and %)

Variable	89	90	91	92	93	94	95	96	97
capital account balance	-2.9	2.6	6.4	6.6	2.7	10.3	16.8	23.3	1.3
Bank's borrowings	0.6	2.1	3.9	1.6	0.5	7.6	10.6	9.7	-9.7
Loan rates of Korea	10.0	10.0	10.0	10.0	8.5	8.5	9.0	11.0	15.32
Prime rates of Japan	5.75	8.25	6.63	4.50	3.30	3.00	1.63	1.63	1.63
Euro dollar Libor	8.25	7.56	4.13	3.31	3.38	6.50	5.81	5.56	5.81

Source: Bank of Korea, *Monthly Statistics*, various issues.

IMF, *International Financial Statistics*, various issues.

Various factors worked to create such voluminous capital inflows during the 1994-96 period. Firstly, an aggressive search for higher return on capital by banks and financial institutions in developed countries, in which growth levels were slow and domestic markets were highly competitive, was the major cause for the expansion of private capital flows to the developing countries. Especially, in the mid-1990s, Japanese banks followed their corporate foreign investors in lending much of their short-term capital to East Asian countries.<sup>3</sup>

Secondly, the big differential between domestic and foreign interest rates, especially in the case between Korea and Japan, created incentives for Korean banks to borrow abroad to accommodate local lending. <Table 3> shows that the gap between Korean and Japanese loan rates began to extensively widen from 1995.

Thirdly, the credit ratings of Korean banks and corporations in the international financial market increased in the mid-1990s. As the result, they could enjoy easier access to investment funds from abroad.

To sum up, the surge in capital inflows to Korea in the mid-1990s was attributable to the rising global liquidity and lower interest rates in international financial market, which created incentives to invest more money to emerging markets. Until the crisis of

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<sup>3</sup> A relatively narrow exchange rate movement created a bias toward short-term borrowing (World Bank(1998)). In Korea, liberalization was much more extensive in relation to short-term borrowing only



1997, the Korean government pursued capital market liberalization very gradually by taking a step-by-step approach.<sup>4</sup> It is only in early 1998 that the Korean government opened its domestic financial market and capital account by taking a big-bang approach. By then, capital flows accommodated the current account balance. Therefore, it is highly debatable that financial liberalization during 1990-96 worked to induce capital inflows to the Korean economy. Push factors appeared to be more relevant than pull factors in explaining the capital account surplus and rising bank borrowing from abroad in the 1994-96 period.

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in case of banks, but not in corporations.

<sup>4</sup> The degree of liberalization can be roughly calculated by using the Code of Capital Movement of OECD. According to our own calculation, it was about 55% at the time of Korea's joining the OECD, which was the lowest among OECD members.

## **IV. Empirical Analysis**

### **1. Analytical Framework**

In order to judge whether there has been overinvestment, we need to know what is the optimal level of investment. There are well-defined economic theories for investment such as a Neoclassical model based on comparison of marginal product of capital with interest rate, Tobin's q theory, and the accelerator model. Each theory is useful to identify determinants of investment, but it is not satisfactory enough in explaining actual investment decision of firms. Therefore, most empirical studies on investment adopt an eclectic approach by utilizing insight from each theory. For example, Hoshi, Kashyap and Scharfstein (1991) use measures of liquidity, Tobin's q, and lagged production as determinants of investment rate. Reeb and Kwok (2000) employ Tobin's q and coverage ratio in order to examine whether Japanese firms with main banks show a tendency for investment inefficiency. In studying investment behavior of Korean firms, Hahn (1999) tests whether uncertainty of rate of return affects investment using sales-capital ratio, rate of return, cash flow, and size of firms as explanatory variables. Lee (2000) uses Tobin's q, cash flow ratio, sales to capital ratio, and total debt rate.

In this paper, we use the following model to explain investment decision of firms:

$$IK_t = f(SK_t, SK_{t-1}, ROR_t, ROR_{t-1}, CFK_t, CFK_{t-1}, SIZE_t, TDK_t, DRSP_t)$$

IK: growth rate of tangible capital

SK: sales to the beginning of the period tangible capital ratio

ROR: operating profit to the beginning of the period total asset ratio

CFK: cash flow to the beginning of the period tangible capital ratio

TDK: debt to capital ratio

SIZE: logarithm of lagged total asset

DRSP: real stock price change rate

The above equation postulates that investment decisions are affected by sales, rate of return, liquidity, size, and debt-capital ratio. DRSP is defined as the rate of increase in stock price minus the inflation rate of the GDP deflator. DRSP may be considered as the first difference of Tobin's q (Barro and Sala-i-Martin (1991)). The rate of increase in real stock price is immune from many problems intrinsic to calculation of the marginal q, and often proves to be effective as a proxy for future profitability (Barro (1990)).

After estimating the above equation, we will use the forecast error as a measure for overinvestment. The fitted value of the dependent variable is interpreted as the optimal investment level for given values of its determinants. If the forecast errors are systematically positive, then we may conclude that there was

overinvestment.<sup>5</sup> This approach is not only objective in defining overinvestment, but also able to consider changes in investment environment. Nevertheless, the forecast error is by definition dependent on the regression result. In our analysis, therefore, there are several problems which deserve due attention.

Firstly, the Korean economy has experienced a substantial structural change while it has continued to grow rapidly. Korean firms have to face a rapidly changing investment environment. Therefore, it is important to take the right sample period for estimation in order to get a meaningful forecast result.

Secondly, affiliation with chaebols may make access to the financial market easier. On the other hand, the Korean government regulated the loans to the chaebol firms since 1987. Therefore, we need to differentiate chaebol affiliates and independent firms, in order to test possible differences in investment decisions.

Thirdly, capital account liberalization in the 1990s may have lowered financial costs of firms in general. The banking sector could have increased its local loans through borrowing in the international capital market. In addition, a boom in the stock market following opening up to foreign investment could have helped direct financing of the listed firms.

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<sup>5</sup> Blanchard and Summers (1984) examines the effect of higher real interest rate on investment using forecast errors of a simple accelerator model.

Fourthly, degrees of overinvestment differ depending on industries. The Korean government has promoted heavy and chemical industries since the mid-1970s. In the 1990s, exports have been most viable in a few industries: automobiles, ships, steel and semiconductors. Therefore, we may expect that overinvestment would be more apparent in these industries.

## **2. Data and Variables**

The firm-level data for Korea can be obtained from the Korea Listed Companies Association. We can get comprehensive corporate and financial information on listed companies beginning in 1980. We selected manufacturing firms listed continuously since 1980. The number of firms is 490. However, data for some variables are missing so that the actual number of observations for regression may be smaller.

Meanwhile, we classified firms into three groups: 1-5 largest chaebol firms, 6-30 largest chaebol firms, and other independent firms. We identified the firms affiliated with chaebols by using official announcements from the Korean government. The Korea Fair Trade Commission has continued to rank the 30 largest chaebols and announced their affiliates every year. These firms are subject to specific restrictions on

loans from the financial sector. The order of chaebols by size changes year to year.

The characteristics of our sample are shown in Table 4. There are 88 chaebol affiliates and 402 independent firms in the sample. 33 chaebol firms are affiliated with the five largest chaebols in 1996: Samsung, Hyundai, LG, Daewoo, and SK. 55 chaebol firms are affiliated with sixth to thirtieth largest chaebols. Differently from the five largest chaebols, these smaller ones show instability in their status and higher risk of default.

The industrial distribution of sample firms shows the big difference between chaebol and independent firms. Chaebol affiliates are most active in chemicals, basic metals, electrical machineries, electric components and motor vehicles. On the other hand, there are few chaebol firms in the light industries such as textiles, apparel, wood, printing, rubber, etc. The food and beverage industry is an exception in this respect. It is noteworthy that our sample consists of firms that have been listed since 1980, so it may be unable to reflect the structural changes fully. For example, the computer and office machinery industry is one of the most heavily invested industries in the 1990s. However, there is just one chaebol firm included in our sample. This sample bias asks for caution in comparing overinvestment patterns in different industries.

&lt;Table 4&gt;

Characteristics of Sample Firms

Industry	Group 1: 1-5 chaebols	Group 2: 6-30 chaebols	Group 3: Independent	Total
Food and Beverages	2	8	34	44
Textiles			22	22
Apparel and Fur articles			20	20
Leather, luggage and footwear		1	5	6
Wood products except furniture			3	3
Pulp and paper products		1	20	21
Publishing and printing			2	2
Coke, refined petroleum products	1	1	4	6
Chemicals and chemical products	10	12	82	104
Rubber and plastic products		1	14	15
Non-metallic mineral products		6	17	23
Basic metals	1	8	34	43
Fabricated metal products		3	7	10
Machinery and equipment	2	3	24	29
Computers and office machinery		1	5	6
Electrical machinery and apparatuses	2	2	18	22
Electronic components, radio, TV and communication equipment	8	0	49	57
Medical, precision&optical instruments	1		8	9
Motor vehicles and trailers	2	6	27	35
Other transport equipment	4	2		6
Furniture and manufacturing n.e.c.			7	7
Total	33	55	402	490

Note: The classification of e affiliates is based on 1996 data.

Before estimating the investment model, it is useful to review general trends in investment. Graph 1 shows the investment rate ( $I/K(-1)=\Delta K/K(-1)$ ), the growth rate of tangible capital for the manufacturing sector as a whole, and for each group of firms.

The overall investment rate was very unstable in the 1980s. It increased after the mid-

1980s, but began to fall in 1989. The rise and fall of investment rate closely follows changes in business environment, which in turn reflects changes in exchange rates of the Korean won after the Plaza agreement and rising factor prices in the late 1980s. The investment rate began to increase after 1992, and recorded 25% in 1996.

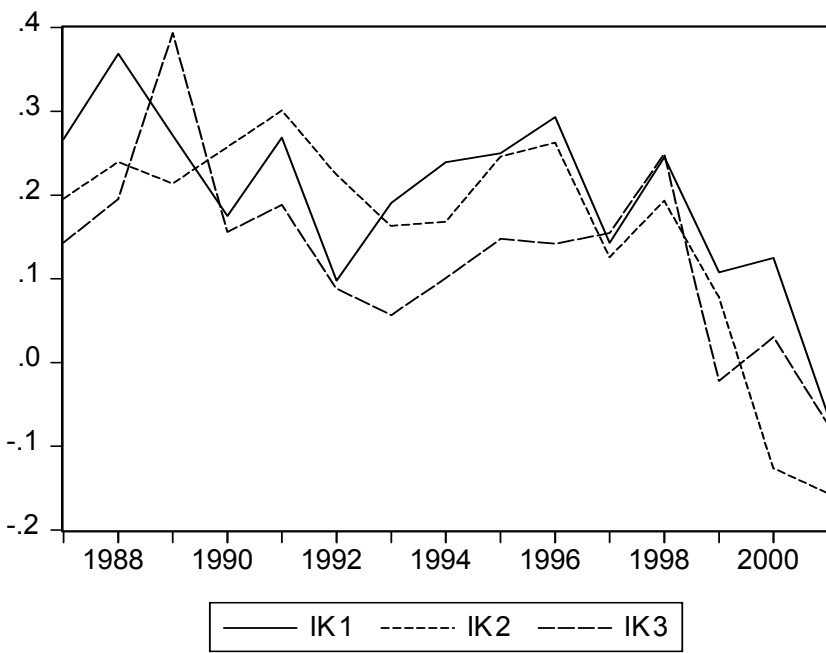
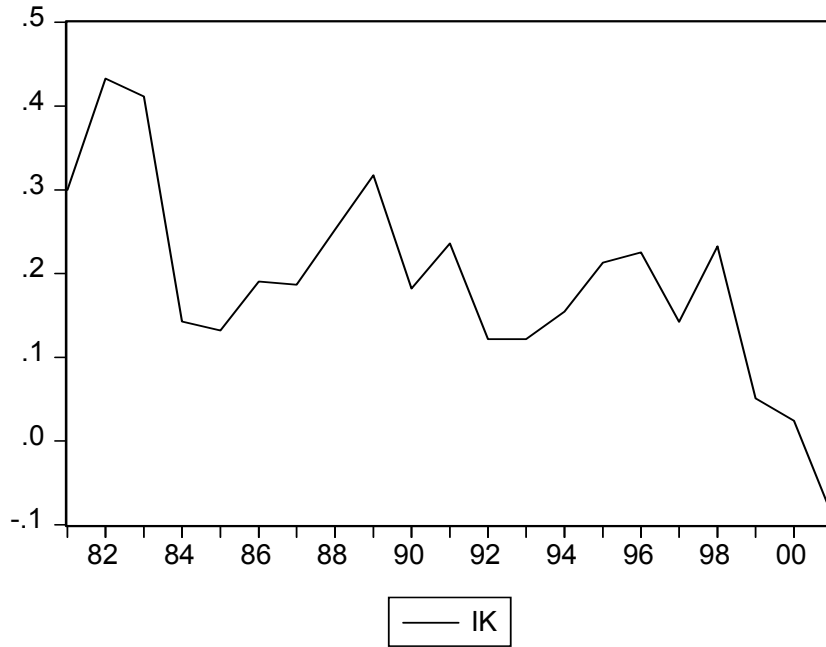
The rise in investment in the 1990s was led by chaebol affiliates. As shown in Graph 1, the consolidated investment rate for Group 1, the five largest chaebol firms, was tripled from 10% in 1992 to 30% in 1996. The investment rate for Group 2, the 6<sup>th</sup> to 30<sup>th</sup> largest chaebols, also showed a similar trend starting in 1993. The independent firms, Group 3, which has no affiliation with chaebols, shows only a gradual increase after 1993, in stark contrast to Group 1 and Group 2.

It is not certain whether capital account liberalization has a significant effect on changes in investment rates. The turning point for higher investment rates for Group 1 coincides with the opening up of the stock market in 1992. However, it was only in 1994 when higher investment started for Group 2. It needs to be further examined whether changes in investment rate were affected by other determinants rather than the capital account liberalization.



<Graph 1>

Trends in Investment Rate

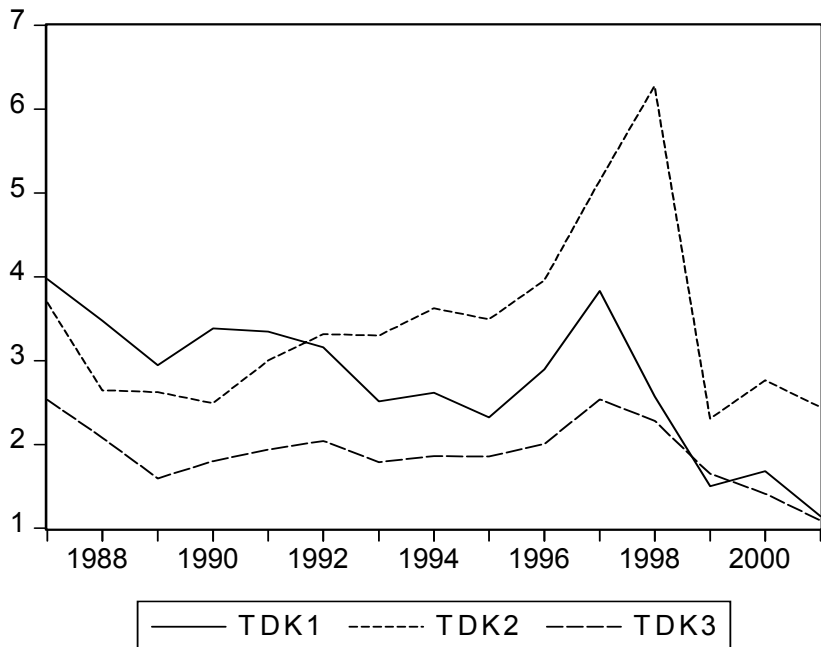
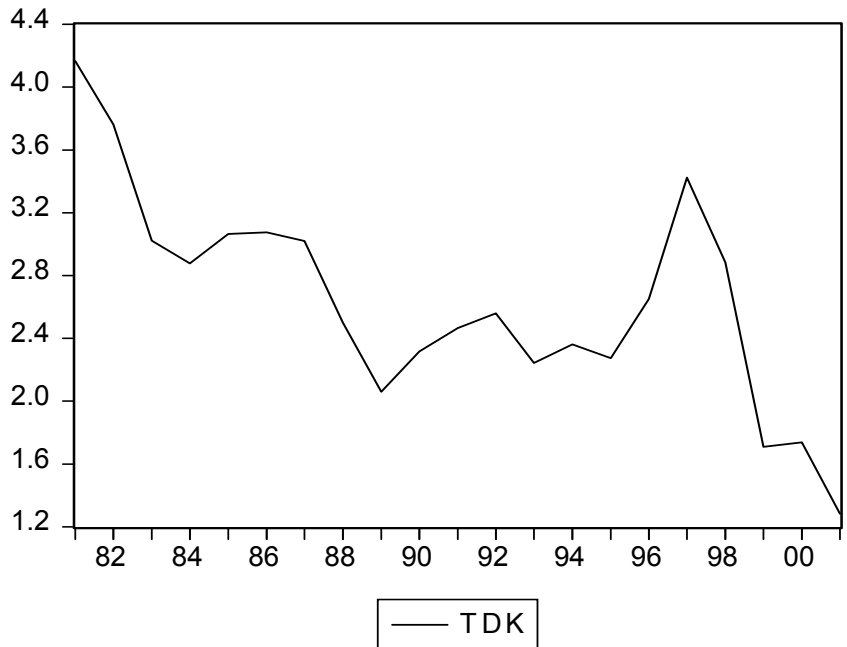


Next, let us consider the changes in the debt-capital ratio in order to check whether an increase in investment rates was accompanied by higher debt burden. As shown in Graph 2, the ratio of total debt to capital continued to fall in the 1980s. It began to rise gradually in the early 1990s, but stayed rather stable until the 1997 crisis.

We can see subtle differences depending on affiliation with chaebols. The debt-capital ratio for Group 1 stayed lower than 300% during 1993 and 1996, before soaring to 400% in 1997. It was Group 2, which showed a continuous rise in debt-capital ratio from 1990. In 1998, the consolidated debt-capital ratio for Group 2 reached a record high 600%. This trend seems to reflect the structural weakness of Group 2.

In contrast to chaebol affiliates, independent firms as a whole showed a stable debt-capital ratio, which seems to indicate limited access to external financing. Combined together with observations on investment rates, the difference in changes in debt-capital ratios according to groups may be interpreted as supporting that chaebol affiliates were responsible for overborrowing and overinvestment.

<Graph 2> Trends in Debt-Capital Ratio



Average values for the investment rate and its determinants are summarized in Table 5. The sample period was set between 1990 and 1996, taking into account rapid changes in investment environment in the late 1980s. The overall investment rate is .19, and the average profit rate is 6%. The rate of change in real return on stock was negative during the period.

As expected, the investment rate was the highest for Group 1, while the lowest for Group 3. Interestingly enough, Group 2 appears to be inferior to Group 1 in the soundness of financial structure as well as in performance. Group 2 recorded the lowest sales to capital ratio, operating profit rate and cash flow rate. Meanwhile, it showed the highest debt-capital ratio.

<Table 5> Main indicators related to Investment (1990-1996)

Variables	All	Group 1: 1-5 Chaebols	Group 2: 6-30 Chaebols	Group 3: Independent
IK	.1940	.2194	.2178	.1888
SK	3.6479	3.5012	3.1462	3.7313
ROR	.0619	.0744	.0537	.0622
CFK	.2102	.2179	.1791	.2143
TDK	3.6916	2.4949	4.3759	3.1991
SIZE	7.9400	8.6751	8.2521	7.8421
DRSP	-.0258	-.1206	-.0435	-.0166
Number of Observations	2636	153	318	2165

### (3) Estimation and Forecast Error

<Table 6> summarizes regression results of the investment model. We applied the ordinary least squares method to panel data of manufacturing firms covering a three year period from 1982-85 up to 1994-96. The regression results consistently show significance of sales ratio (SK), profit rate (ROR), and cash flow ratio (CFK) as explanatory variables. On the other hand, debt-capital ratio, size and real return on stock turn out to have wrong signs or are statistically insignificant, depending on the sample periods.

<Table 7> tests whether affiliation with chaebols makes a difference in investment decisions. The sample period is from 1987, when the Korean government began to restrict loans to chaebol affiliates, to 1996. The value for the dummy variable, C-Dummy, is 1 for Group 1 (1-5 chaebols), 2 for Group 2 (6-30 chaebols) and 3 for Group 3 (independent firms). C-Dummy will have a negative value if chaebol firms have an advantage in access to the financial market. As expected, the parameter for C-dummy has a negative value, which is statistically significant. Regression of subsamples reveals that our model does not fit well in the case of Group 2. Explanatory variables for Group 2 appear to be statistically insignificant except for

current and lagged cash flow ratios. This fact may indicate that these firms made investment decisions without paying enough attention to key variables affecting profitability of investments.

Finally, <Table 8> summarizes the regression results testing the significance of capital account liberalization and deregulation of various restrictions on chaebols. L-dummy, representing capital account liberalization, has 1 for the period between 1992 and 1996, and 0 otherwise. S-dummy, which represents deregulation and changes in industrial policy, has 1 for the period between 1994 and 1996, and 0 otherwise.

As shown in <Table 8>, L-dummy has a negative value, and it is statistically significant. Therefore, we do not find evidence for a positive linkage between capital account liberalization and overinvestment. Meanwhile, the S-dummy has a positive value, though it is not statistically significant. This finding suggests that the role of deregulation between 1994 and 1996 needs further examination.

&lt;Table 6&gt;

## Regression of Investment Function

Variable	1982-84	1985-87	1988-90	1991-93	1994-96	1982-96
C	-.05 (-1.18)	.79 (2.45)	.28 (1.13)	-.16 (-.81)	-.46 (2.15)	-.01 (-.10)
SK	.05 (5.57)	.02 (1.67)	.04 (3.60)	.03 (2.62)	.02 (1.66)	.03 (6.64)
SK <sub>-1</sub>	-.02 (-2.43)	.01 (.64)	.02 (2.64)	-.00 (.28)	.01 (.83)	.01 (1.93)
ROR	-5.31 (-10.72)	-2.58 (-4.78)	-1.04 (-2.44)	-3.01 (-6.67)	-1.60 (-3.47)	-2.20 (-10.97)
ROR <sub>-1</sub>	2.05 (4.28)	1.84 (3.51)	1.28 (2.95)	2.57 (5.91)	.49 (1.07)	1.65 (8.95)
CFK	1.08 (10.28)	.20 (2.31)	-.52 (5.81)	.24 (2.48)	.14 (1.47)	.14 (3.47)
CFK <sub>-1</sub>	-.10 (-1.10)	-.04 (-.64)	-.17 (-2.45)	.01 (.11)	.15 (1.46)	-.05 (-1.93)
TDK	-.001 (-.68)	.00 (.06)	.01 (3.48)	.00 (.18)	.00 (.14)	-.00 (-.09)
SIZE	.04 (.94)	-.09 (-2.19)	-.02 (-.60)	.03 (.13)	.06 (2.44)	.01 (.75)
DRSP	.10 (1.64)	.11 (2.84)	.13 (2.62)	-.07 (-2.52)	-.03 (-1.23)	.01 (.75)
Number of observations	491	551	832	1112	1188	4174
R <sup>2</sup>	.38	.09	.17	.10	.07	.08

Source: Korea Listed Companies Associations, 2003 (on line).

<Table 7> Investment Function for Chaebol and Non-chaebol Firms (1987-1996)

Variable	All	All	Group 1: 1-5 Chaebols	Group 2: 6-30 Chaebols	Group 3: Independent
C	-.11 (-.09)	.11 (.68)	-.21 (-.86)	-.10 (-.22)	.08 (.53)
SK	.02 (3.45)	.02 (3.47)	-.00 (-.24)	.02 (.60)	.02 (2.61)
SK <sub>-1</sub>	.02 (3.27)	.02 (3.27)	.05 (2.16)	.06 (1.73)	.01 (1.63)
ROR	-1.87 (-7.48)	-1.86 (-7.48)	-4.88 (-5.39)	1.62 (1.66)	-2.43 (-9.24)
ROR <sub>-1</sub>	1.70 (6.96)	1.71 (6.99)	3.44 (3.90)	-1.52 (-1.57)	1.93 (7.56)
CFK	.07 (1.51)	.07 (1.50)	.91 (3.50)	-.57 (-5.76)	.35 (5.94)
CFK <sub>-1</sub>	-.15 (-3.08)	-.15 (-3.05)	-.80 (-2.72)	-.25 (-2.42)	-.08 (-1.31)
TDK	..00 (-.34)	-.00 (-.36)	.02 (1.37)	..00 (.67)	.00 (.43)
SIZE	.02 (1.51)	.01 (.44)	.04 (1.23)	.02 (.52)	-.00 (-.21)
DRSP	-.01 (-.68)	-.01 (-.64)	-.10 (-1.85)	-.01 (-.08)	-.02 (-1.17)
C-Dummy		-.04 (-2.20)			
Number of observations	3324	3324	206	395	2723
R <sup>2</sup>	.06	.06	.20	.20	.09

Source: Korea Listed Companies Associations, 2003 (on line).



<Table 8> Capital Account Liberalization and Deregulation (1987-1996)

Variable	All	All	Group 1: 1-5 Chaebols	Group 2: 6-30 Chaebols	Group 3: Independent
C	-.11 (-.94)	.07 (.45)	-.33 (-1.21)	-.09 (-.20)	-.05 (-.34)
SK	.02 (3.77)	.02 (3.76)	.00 (.01)	.02 (.52)	.03 (5.06)
SK <sub>-1</sub>	.02 (2.80)	.02 (2.80)	.04 (1.96)	.06 (1.75)	.00 (.56)
ROR	-1.96 (-7.86)	-1.96 (-7.86)	-4.76 (-5.22)	1.59 (1.63)	-1.09 (-6.56)
ROR <sub>-1</sub>	1.57 (6.41)	1.58 (6.46)	3.28 (3.66)	-1.52 (-1.55)	1.10 (5.52)
CFK	.07 (1.41)	.07 (1.41)	.84 (3.17)	-.56 (-5.69)	.08 (4.55)
CFK <sub>-1</sub>	-.14 (-2.86)	-.14 (-2.83)	-.73 (-2.47)	-.24 (-2.33)	-.05 (-1.60)
TDK	..00 (-.31)	-.00 (-.33)	.02 (1.01)	..00 (-.62)	..00 (-.23)
SIZE	.03 (2.06)	.02 (1.07)	.06 (1.66)	.03 (.54)	.02 (1.11)
DRSP	.00 (.14)	.00 (.16)	-.10 (-1.80)	.01 (.21)	-.00 (-.28)
C-Dummy		-.02 (-1.86)			
L-Dummy	-.08 (-3.71)	-.08 (-3.64)	-.06 (-1.14)	-.06 (-.80)	-.07 (-2.86)
S-Dummy	.01 (.23)	.01 (.31)	.00 (.06)	.06 (.73)	.01 (.58)
Numbr of observations	3324	3324	206	395	2723
R <sup>2</sup>	.07	.07	.21	.21	.09

Source: Korea Listed Companies Associations, 2003 (on line).

Now, we are ready to consider the problem of overinvestment by examining forecast errors of regression. After estimating the investment equation using the sample period of 1990-93, forecast errors are drawn for the period of 1994-96.<sup>6</sup> The year 1990 marks a reversion of the current account balance from positive to negative, and the business cycle also showed a downturn. Therefore, it would be reasonable to presume that there was a structural change in investment decisions.

<Table 9> Forecast Errors (1994-1996)

Group	Forecast Error>0		Forecast Error<0		Number of Observations
	all	Over-investment	all	Under-Investment	
Group 1: 1-5 Chaebols	40	7	28	2	68
Group 2: 6-30 Chaebols	55	10	95	1	150
Group 3: Independent	324	51	646	24	970

Note: Overinvestment (underinvestment) is the case where a forecast error has the positive (negative) sign and its size is larger than a standard error.

<sup>6</sup> Regressions for the period of 1990-93 are reported in Table A.1 in the appendix.

As shown in Table 9, it is Group 1, which shows dominance in positive forecast errors. 40 out of 68 observations have positive errors, while 28 have negative values. Moreover, 7 out of 40 positive forecast errors are statistically significant in the sense that they are larger than one standard error. These 7 observations represent overinvestment.

In the case of Group 2, the number of positive forecast errors is smaller than that of negative forecast errors, However, 10 observations show overinvestment, while just one indicates underinvestment. As for Group 3, there are 51 observations of overinvestment and 24 of underinvestment.

The distribution of forecast errors and their statistical characteristics indicate more differences among three groups (Graph <A.1> in the appendix). In Group 1, the mean value for forecast errors is .10 and the distribution is skewed toward the positive side. In Group 2, the mean value for forecast errors is 0.7. It also shows a tendency for a higher investment rate than predicted. On the other hand, the mean value for Group 3 is negative, and more observations show negative values for forecast errors.

Industrial distribution of overinvestment differ depending on the specific group (Table <A.2> in the appendix) . In Group 1, overinvestment centers on electronic and communication equipment industries, which include the semi-conductor industry.

Meanwhile, Group 2 mainly overinvested in basic metals and other transport equipment (ship) industries. Underinvestment for both groups was very small, requiring no special attention.

As for Group 3, chemical, basic metals, fabricated metals, and electronic & communication equipment industries appear to be peculiar in overinvestment. In regard to underinvestment, it is most apparent in electronic and communication equipment industries, in contrast to the case of chaebols (Group 1 and Group 2).

In sum, overinvestment is apparent for chaebol affiliates. There was a general tendency for higher investment than the trend predicted by its determinants. Moreover, 10% of the firms belonging to Group 1 actually overinvested during 1994 and 1996. In Group 2, the ratio of overinvestment was recorded at 7%. In the independent firms, a tendency for overinvestment is less apparent. Only 5% of all the observations show overinvestment, while 2.5% show underinvestment.

## **V. Conclusion**

In this paper, we have tried to find evidence of overinvestment by Korean firms, which was often criticized as one of the main causes for the Korean financial crisis in 1997. Using the data on investment and its determinants for listed manufacturing Korean firms, we examined whether actual investment during 1994 and 1996 was higher than forecasted by an econometric model of investment. The major findings of this paper may be summarized as follows.

Firstly, overinvestment was found most frequently for chaebol firms. We found that 10% of firms affiliated with the top 5 chaebols overinvested during 1994 and 1996. As for the firms belonging to the top 6-30 largest conglomerates, 7% of those overinvested during the same period. As for firms with no affiliation with chaebols, a 5% overinvestment ratio was observed. The actual investment rate substantially increased during 1994 and 1996. Therefore, we may conclude that conglomerate firms led the increase in investment, which was excessive to a certain extent. Meanwhile, overinvestment by chaebols was most evident in a few industries showing viable exports in the 1990s. The top 5 chaebol firms overinvested in electronic and communication equipment (semi-conductor) industries. The top 6-30 chaebol firms

mainly overinvested in basic metals and other transport equipment (ship) industries.

Underinvestment for both groups was only negligible.

Secondly, capital account liberalization was not found critical in inducing overinvestment. This finding is in stark contrast to the common view, which emphasizes that financial liberalization in the first half of the 1990s ushered in overborrowing and overinvestment by chaebols in Korea. As a matter of fact, there was no drastic measure for financial liberalization in the 1990s, except for opening of the stock market to foreign investors. Of course, we do not deny an increase in capital inflows, mainly through borrowing by the financial intermediaries. However, the sudden increase in capital inflows during 1994 and 1996 could be explained by push factors in international capital markets rather than pull factors in the Korean economy. Our empirical test showed that the investment ratio did not show any systematic increase in response to the Korean government's effort to open up capital market gradually starting in 1992.

Thirdly, our evidence of overinvestment by chaebols supports the view that loosening strict restrictions on lending in the financial sector to chaebols backfired. Under the catchphrase of "globalization", the Korean government allowed greater freedom in investment decision for conglomerates. In particular, promotion of

specialization policy for chaebols, which encouraged chaebols to choose two or three major industries to operate, worked as an excuse for overborrowing from the financial sector. If this is the case, the Korean crisis was caused by structural weaknesses in corporate and financial sectors. Highly leveraged firms continued to borrow in order to expand, while the financial sector believed that they were too big to fail.

Our findings indicate that the IMF program that emphasized the needs for structural reform in corporate and financial sectors was well justified. In order to prevent the recurrence of a financial crisis, investment decisions should be determined by the profitability of each project. In order to cope with the phenomenon of overinvestment, the financial sector should adopt advanced methods of evaluation and supervision for lending. Also, the government should strengthen its supervision of the financial sector, and further promote transparency of corporate financial structures. It remains to be seen how the 1997 crisis has changed behaviors of major market participants, and overborrowing-overinvestment in East Asia.

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<Appendix>

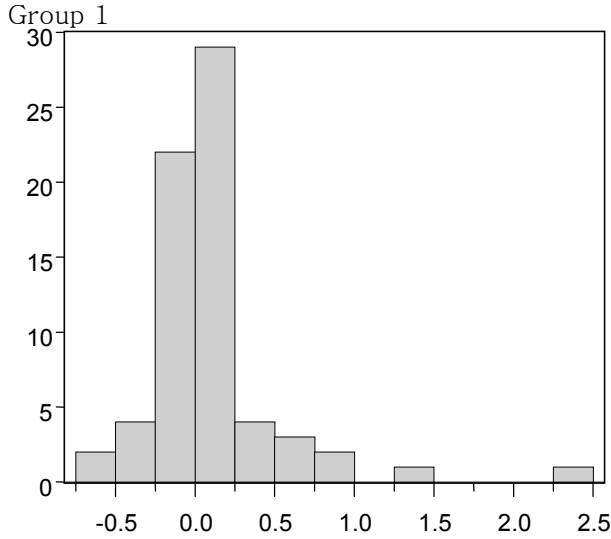
<Table A.1> Regression of Investment Function (1990-93)

Variable	Group 1: 1-5 chabols	Group 2: 6-30 chabols	Group 3: Independent
C	.1181 (.3572)	-.3618 (-.7597)	.0603 (.2719)
SK	-.0719 (-2.4906)	-.0396 (-.9346)	.0210 (2.0075)
SK <sub>-1</sub>	.0729 (2.29)	.0539 (1.3016)	.0226 (2.3503)
ROR	-2.0745 (-1.93)	-2.2392 (-1.8795)	-3.1286 (-7.4022)
ROR <sub>-1</sub>	.9093 (.8616)	2.1446 (1.7118)	2.7495 (6.6892)
CFK	-.7374 (-1.8300)	.0504 (.1571)	.2992 (3.1485)
CFK <sub>-1</sub>	.5642 (1.4256)	.1124 (-2.42)	-.2595 (-2.7662)
TDK	-.0189 (-1.2119)	-.0002 (-.6303)	.0004 (.5997)
SIZE	.0319 (.8297)	.0619 (1.0987)	.0060 (.2142)
DRSP	.0083 (.0848)	-.0260 (-.3133)	.0017 (.0466)
L-Dummy	-.0889 (-1.4475)	-.0609 (-.8058)	-.1058 (-2.9692)
Number of observations	85	168	1195
R <sup>2</sup>	.3298	.0945	.1153

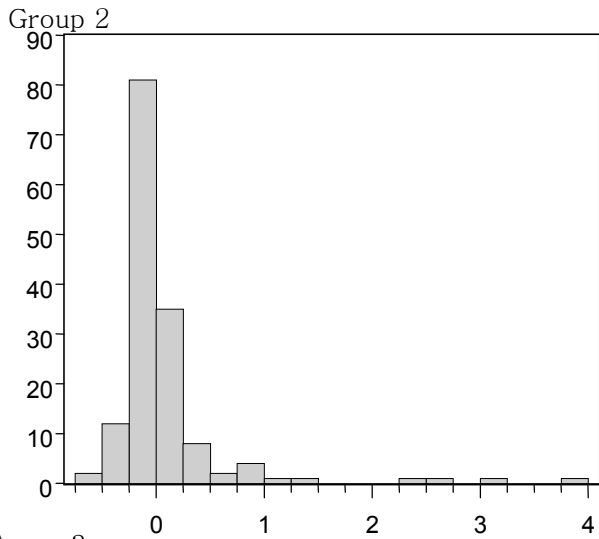
Source: Korea Listed Companies Associations, 2003 (on line).

<Graph A.1>

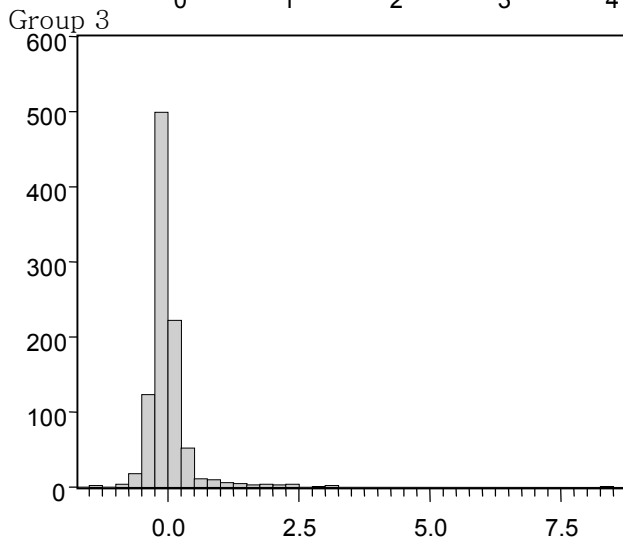
Distribution of Forecast Errors



Series: RESID1	
Sample 139 206	
Observations 68	
Mean	0.104463
Median	0.046925
Maximum	2.290688
Minimum	-0.605448
Std. Dev.	0.417765
Skewness	2.757844
Kurtosis	14.01077
Jarque-Bera	429.7027
Probability	0.000000



Series: RESID2	
Sample 503 652	
Observations 150	
Mean	0.078137
Median	-0.056412
Maximum	3.970403
Minimum	-0.588536
Std. Dev.	0.570633
Skewness	4.268142
Kurtosis	24.46145
Jarque-Bera	3334.138
Probability	0.000000



Series: RESID3	
Sample 2514 3483	
Observations 970	
Mean	-0.004603
Median	-0.079029
Maximum	8.365608
Minimum	-1.318995
Std. Dev.	0.487913
Skewness	7.224302
Kurtosis	100.1304
Jarque-Bera	389740.7
Probability	0.000000

<Table A.2> Industrial Distribution of Overinvestment and Underinvestment

Industry	Overinvestment			Underinvestment		
	Group1	Group2	Group3	Group1	Group2	Group3
Food and Beverages	1		2			
Textiles			4			2
Apparel and Fur articles			4			3
Leather, luggage and footwear						
Wood products except furniture						
Pulp and paper products			4			2
Publishing and printing			1			
Coke, refined petroleum products			1		1	
Chemicals and chemical products		2	10			1
Rubber and plastic products			2			
Non-metallic mineral products			2			
Basic metals		5	7			2
Fabricated metal products			4			
Machinery and equipment			1			
Computers and office machinery			1			
Electrical machinery and	1	1	2	1		1
Electronic components, radio, TV and communication equipment	5		4	1		13
Medical, precision, and optical instruments						
Motor vehicles and trailers						
Other transport equipment		2	2			
Furniture and manufacturing n.e.c.						
Total	7	10	51	2	1	24

Note: The classification of chaebol affiliates is based on 1996 data.