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Investment and Financing Constraints Around the Korean Financial Crisis

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Abstract:

This paper examines investment behavior and the effects of financing constraints among Korean manufacturing companies before and after the 1997 financial crisis using a firm-level panel data. I estimate the Q and sales accelerator models considering the possibility of cash constraint of investment by categorizing firms based on their age, size and affiliations to the Korean industrial conglomerates (i.e., *chaebols*). The results indicate that Q becomes a key determinant of investment decision while the sales variable becomes less important after the crisis began. Q remains to be important for bigger and more mature firms even after the 1997 crisis and becomes significant to smaller and relatively younger ones. It suggests that there could have been a shift from the quantity (sales) to the quality (Q) as the key component of firm's investment. The effect of cash balance becomes statistically and economically significant in the post-crisis period reflecting increase in financial stress among corporations. Moreover, firms' financing constraints, as measured by their cash balances, turn out to be more binding among financially "weaker" groups such as younger or smaller firms. While these results are consistent with the predictions of the "pecking order" theory of corporate financing, I also find, somewhat surprisingly, that the effects of cash on investment demand are stronger for chaebol-affiliated firms than for non-affiliates. This suggests that government regulation of chaebol companies may need to be reconsidered because they also face binding finance constraints and no longer have a large advantage in financing their business projects.

JEL classification: F3; G11

Key words: Financial crisis, investment demand, panel data GMM, financing constraints

1. Introduction

A financial crisis is an unfortunate event for any economy. It is likely to increase the cost of capital and eventually hurt the growth potential of the country. Given that they do occur, however, these crises also provide researchers with opportunities to observe their causes and effects. Among these, the role of credit crunches has been particular interest. For example, there could be some financially weaker firms suffering from credit rationing due to conventional problems of asymmetric information. And yet, one may be unable to detect such underlying factors when the economic situation is good because they tend to be hidden in the overall flow of funds. A financial crisis may amplify this type of credit intermediation problem and create sufficient variation to test empirically the hypothesis of whether credit conditions have heterogeneous effects on firms with different characteristics. This paper investigates what happened in Korea's corporate sector in the wake of the 1997 financial crisis by testing for the existence of cash constraints after controlling for the conventional determinants of a firm's investment decision such as its Tobin's Q and sales. Also, the paper studies the changes in firms' investment behavior by considering the pre- and post-crisis periods separately.

The Korean economy experienced its first financial crisis in 1997. The crisis caused distress in both the financial and corporate sectors. Since then, Korean corporations have been required by law to maintain ratios of debt to equity below 200 percent.[1] Financial institutions have also needed to keep up with new regulations such as the Basle standards and to be more diligent in finding profitable projects for their funds. For firms, a key policy question is whether the resulting contraction of credit raised the costs of external funding for some classes of borrowers and forced them to forgo investment opportunities due to inadequate internal liquidity.

[1] While a debt to equity of 200 percent may appear large for an exchange-listed firm, the average level on the eve of the crisis among listed manufacturing firms was 329 percent! By 2001, the average had fallen to 119 percent. See Table A1 in the Appendix A.

Indeed, the financial crisis offers an opportunity to observe changes in the severity of firms' financing constraints because they tend to be less binding when economic conditions are good (see Hubbard, 1998). In addition to that, it may also be useful for evaluating how effective an IMF program was in reviving and maintaining a well-functioning financial system in a crisis situation. The specific program that was initiated after the crisis called for reforms in the Korean financial and corporate sectors.

Before the crisis, the Korean government exerted some control over the flow of funds from financial intermediaries to firms. From the beginning of the nation's modern economic development, the government held the power to channel funds to specific sectors through direct controls over the economic and managerial activities of financial intermediaries. Until the end of the 1980s, the beneficiaries had for the most part been large and well-established corporations in industries that required large fixed investments. As the government shifted its concern in the early 1990s from economic growth to the structure of the economy, and specifically to adjusting imbalances that had been created across industries by earlier interventions, it began to direct funds to less well-established firms of small and medium-size through policy loan programs and the regulation of interest rates.[2] The result was a more balanced allocation of loanable funds across the distributions of firm ages and sizes, but perhaps also a tendency to lend to firms for which there was less reliable information about the quality of their business plans.

This paper examines what happened in this lending climate after the crisis struck in December 1997 and it became apparent that the government's policy change had led to many delinquent or defaulting loans. The evidence suggests that Korean banks, in response to the contraction of credit that immediately followed the crisis, began to screen potential applicants more intensely based on market criteria rather than policy objectives, and that as foreign capital

[2] See Dekle and Kletzer (2001) and Laeven (2002) for further discussion.

began to flow back into the country by late 1998, this new market orientation strengthened. In other words, the tradeoff between a firm's future expected profitability, as measured by Tobin's Q and perhaps the volatility of this profitability, become a much stronger force in the credit allocation process.

The empirical evidence is based on an analysis of 418 Korean manufacturing firms over the 10 years surrounding the 1997 financial crisis (1992-2001). As in earlier studies of the United States and Japan (e.g., Fazarri, Hubbard and Petersen, 1988; Hayashi and Inoue, 1991), I consider firm level-investment decisions with Tobin's Q, the stock of cash, cash flow, and the level of sales entering as possible determinants in the neoclassical and sales accelerator frameworks. To implement the idea of financial hierarchy or "pecking order", firms are classified by their age, size, and whether they are affiliated with large Korean industrial conglomerates, or "*chaebols*". The priors would suggest that younger and smaller firms would be less well-established and thus more constrained financially in terms of the availability of external funding opportunities than older, larger, and more established ones. Chaebol-affiliated firms, before the crisis, enjoyed preferential access to funding and thus might be expected to be less financially constrained than non-affiliates. The models are estimated using the generalized methods of moments (GMM) estimator developed for the analysis of panel data by Arellano and Bond (1991). The GMM method has been chosen among other possible dynamic panel estimators because it is well-suited for the considerable breadth yet relatively short time dimension of our panel (see Judson and Owen, 1999).

The main findings indicate that the nature of financial constraints changed across classes of Korean manufacturing firms importantly after the crisis. In particular, the level of cash balances, cash flow, and sales became less important for younger and smaller firms after the

crisis, whereas the quality of investment opportunities, as proxied by Tobin's Q, became a critical determinant of investment despite its lack of explanatory power beforehand. For older and bigger firms, Q was a strong determinant of investment before and after the crisis, but cash and sales became less important afterwards. This suggests that lenders are now screening more thoroughly over corporations' projects when they apply for funding rather than by simply checking their sizes or reputations. This paper also finds chaebol-affiliated firms becoming more financially constrained after the crisis, with their cash positions and sales becoming all the more important. The evidence suggests that a loss of preferential access to credit, to which the government-imposed ceiling on the debt to equity ratios played a particularly potent role for the well-connected conglomerates, combined with a traditionally low risk, low return tradeoff to render chaebols less well suited to lender tastes in the more competitive banking climate that emerged after the crisis.

The rest of the paper is organized as follows. In Section 2, I summarize the theoretical underpinnings of the analysis and introduce the empirical specifications that will be estimated. Section 3 describes the firm-level panel data set and the classification system that will be used. Section 4 presents the estimation results from the panel GMM models with three different firm classifications. To check the robustness of my classifications, in section 5, I re-estimate the sub-samples by firms' age and size excluding chaebol –affiliated firms. Section 6 concludes.

2. Methodology

Conventional models of the firm-level demand for investment emphasize expected profits and the cost of capital as important determinants. The standard Q-theory summarizes the neoclassical view by holding that Q, defined as the ratio of the market valuation of a firm to the replacement value of its assets, is a sufficient explanatory factor for investment demand. Other

frameworks move beyond the frictionless economy and representative firm assumed by the neoclassical model to address the role of capital market imperfections, and particularly those deriving from informational asymmetries.[3] Among these is Fazarri, Hubbard and Petersen (FHP, 1988), which introduces a modified version of the financial hierarchy model of Myers and Majluf (1984) that implies a "pecking order" starting with low-cost funding sources, such as retained earnings, and proceeding to higher-cost ones such as bank loans and new share issues.[4] Since internal and external financing are no longer perfect substitutes, firms do not issue shares unless the marginal Q for their new projects is sufficiently high. Thus, the financial structure of a firm is not as independent of its investment decision as Modigliani and Miller (1958) would suggest.

Following FHP, a vast empirical literature emerged to investigate these questions further. Hoshi, Kashyap and Scharfstein (1991), using panel data from 145 Japanese manufacturing firms for the period from 1977 to 1982, find that liquidity is more important to independent firms than to those with strong ties to major banks. Hayashi and Inoue (1991) studied 687 manufacturing firms listed on the Tokyo Stock Exchange for the period from 1977 to 1986. After classifying firms into two categories, light industry and heavy industry, they found that the significance of cash flow for investment disappeared among firms in heavy industry from 1984 to 1986, which coincided with the period after Japan liberalized its capital markets. Similarly, Gallego and Loayza (2001), in a study of 79 listed Chilean companies from 1985 to 1995, conclude that investment became more responsive to Q and less tied to cash flow and debt in the 1990s, which is the period following the second wave of its financial liberalization. For the Korean

[3] For example, Stiglitz and Weiss (1981) find that equilibrium credit rationing can arise in loan markets with adverse selection caused by asymmetric information.

[4] FHP describe the sources of this cost differential, which include transaction costs, tax advantages, agency problems, and distortions associated with financial distress.

manufacturing sector, Park and Shin (1998) classified 629 firms by affiliation to a chaebol from 1990 to 1995 (i.e., before the crisis), and found that chaebol-affiliated firms were less constrained by internal funds than non-chaebol firms. Interestingly, Borensztein and Lee (2002) find that a firm's profit in the previous year became a key factor for procuring credit from financial intermediaries after the crisis, and that chaebol firms seem to have lost their preferential access to bank lending.

In this analysis, I start with a dynamic panel version of Hayashi's (1982) specification as a baseline.[5] This model is consistent with the Q-theory of investment under a linear and homogeneous profit function and an efficient stock market. The specification is

$$\left(\frac{I}{K}\right)_{it} = \alpha \cdot \left(\frac{I}{K}\right)_{i,t-1} + \beta \cdot Q_{it} + \eta_i + \Phi_t + \varepsilon_{it}, \qquad (1)$$

where *I/K* is the ratio of firm *i*'s investment in year *t* to its capital stock, with the latter measured at the beginning of the period, *Q* is Tobin's Q, also measured at the beginning of the period, the Φ_t are dummy variables for years, and the η_i are firm-specific fixed effects.

Since the neoclassical model implies that *Q* is sufficient for explaining firm investment, adding other explanatory variables such as cash balances or sales should not significantly affect the regression if the model is correct. To test this, I estimate two variants of equation (1). First, cash balances and cash flows are added to the benchmark equation to test for the presence of financing constraints as follows:

$$\left(\frac{I}{K}\right)_{it} = \alpha \cdot \left(\frac{I}{K}\right)_{i,t-1} + \beta \cdot Q_{it} + \gamma \cdot \left(\frac{C}{K}\right)_{it} + \eta_i + \Phi_t + \varepsilon_{it}, \qquad (2)$$

[5] Hayashi (1982) estimated the time series version of equation (1) using aggregates from 1952 to 1978 as $\left(\frac{I}{K}\right)_t = c + \beta_1 Q_t + \varepsilon_t$.

$$\left(\frac{I}{K}\right)_{it} = \alpha \cdot \left(\frac{I}{K}\right)_{i,t-1} + \beta \cdot Q_{it} + \gamma \cdot \left(\frac{C}{K}\right)_{it} + \delta \cdot \left(\frac{CF}{K}\right)_{it} + \eta_i + \Phi_t + \varepsilon_{it}\,, \tag{3}$$

where *C/K* is firm *i*'s cash balance at the beginning of period *t* and *CF/K* is firm *i*'s cash flow over period *t* relative to its capital stock at the beginning of the period.

Next, I add the current level of sales to examine whether the investment decisions of Korean firms conform to a simple acceleration principle[6]:

$$\left(\frac{I}{K}\right)_{it} = \alpha \cdot \left(\frac{I}{K}\right)_{i,t-1} + \beta \cdot Q_{it} + \gamma \cdot \left(\frac{C}{K}\right)_{it} + \xi \cdot \left(\frac{S}{K}\right)_{it} + \eta_i + \Phi_t + \varepsilon_{it}\,, \tag{4}$$

$$\left(\frac{I}{K}\right)_{it} = \alpha \cdot \left(\frac{I}{K}\right)_{i,t-1} + \beta \cdot Q_{it} + \gamma \cdot \left(\frac{C}{K}\right)_{it} + \delta \cdot \left(\frac{CF}{K}\right)_{it} + \xi \cdot \left(\frac{S}{K}\right)_{it} + \eta_i + \Phi_t + \varepsilon_{it}\,, \tag{5}$$

where *S/K* is the ratio of firm *i*'s sales in period *t* to the beginning-of-period capital stock.

Following Arellano and Bond (1991), we can eliminate the firm-specific effect by differencing equation (1):

$$\left[\left(\frac{I}{K}\right)_{it} - \left(\frac{I}{K}\right)_{i,t-1}\right] = \alpha\left[\left(\frac{I}{K}\right)_{i,t-1} - \left(\frac{I}{K}\right)_{i,t-2}\right] + \beta\left[Q_{it} - Q_{i,t-1}\right] + \tilde{\Phi}_t + \left[\varepsilon_{it} - \varepsilon_{i,t-1}\right]. \tag{1'}$$

Because the *(t-1)* component of the error term is potentially correlated with *(t-1)* component of the differenced lag of the investment rate, OLS estimation may produce biased coefficient estimates for all of the right-hand side variables when, as is the case here, the time dimension of the panel is small. For this reason, I instrument for the difference of the lagged investment rate using its lag levels in *t-2* and *t-3*, thus implementing Arellano and Bond's GMM estimator.

[6] Abel and Blanchard (1986) describe three possible sources of a sales accelerator. First, a firm is more likely to choose its current level of investment using forecasts of future sales that are based upon current and past sales. Second, both delivery lags on investment goods and the adjustment costs of putting them in place will make firms either unable or unwilling to adjust their capital stocks immediately in response to changes in current sales. Finally, an order made in the current period may not appear as an investment expenditure on a firm's financial statements until some time later.

When adding cash and/or sales to the baseline model as in (2) and (5), I also take first differences and estimate with GMM:

$$\Delta\left(\frac{I}{K}\right)_{it} = \alpha\left[\Delta\left(\frac{I}{K}\right)_{i,t-1}\right] + \beta[\Delta Q_{it}] + \gamma\left[\Delta\left(\frac{C}{K}\right)_{it}\right] + \tilde{\Phi}_t + [\varepsilon_{it} - \varepsilon_{i,t-1}] \quad (2')$$

$$\Delta\left(\frac{I}{K}\right)_{it} = \alpha\left[\Delta\left(\frac{I}{K}\right)_{i,t-1}\right] + \beta[\Delta Q_{it}] + \gamma\left[\Delta\left(\frac{C}{K}\right)_{it}\right] + \delta\left[\Delta\left(\frac{CF}{K}\right)_{it}\right] + \tilde{\Phi}_t + [\varepsilon_{it} - \varepsilon_{i,t-1}] \quad (3')$$

$$\Delta\left(\frac{I}{K}\right)_{it} = \alpha\left[\Delta\left(\frac{I}{K}\right)_{i,t-1}\right] + \beta[\Delta Q_{it}] + \gamma\left[\Delta\left(\frac{C}{K}\right)_{it}\right] + \xi\left[\Delta\left(\frac{S}{K}\right)_{it}\right] + \tilde{\Phi}_t + [\varepsilon_{it} - \varepsilon_{i,t-1}] \quad (4')$$

$$\Delta\left(\frac{I}{K}\right)_{it} = \alpha\left[\Delta\left(\frac{I}{K}\right)_{i,t-1}\right] + \beta[\Delta Q_{it}] + \gamma\left[\Delta\left(\frac{C}{K}\right)_{it}\right] + \delta\left[\Delta\left(\frac{CF}{K}\right)_{it}\right] + \xi\left[\Delta\left(\frac{S}{K}\right)_{it}\right] + \tilde{\Phi}_t + [\varepsilon_{it} - \varepsilon_{i,t-1}]. \quad (5')$$

3. Data Description and Firm Classifications

The primary sources of firm-level data are the annual members' reports published by the Korea Listed Companies Association (KLCA). These data are available in electronic format for 1997-2001, and were collected from the print version of the 1997 KLCA yearbook for 1992-1996. The reports include information from balance sheets, income statements, and statements on distributions and cash flows for all firms listed on the Korea Stock Exchange (KSE), which listed 686 companies in 2001. The attention will be limited to exchange-listed firms in the manufacturing sector because of the greater credibility and consistency of the financial statements of listed firms than unlisted ones and the relatively smooth investment schedules of manufacturing firms compared to other sectors such as construction or service (see Hayashi and Inoue, 1991).[7] This gives us 418 firms with continuous observations for the ten years surrounding the crisis.[8]

[7] Those firms listed on the Korea Securities Dealers' Automated Quotation System (KOSDAQ) are excluded for two reasons. First, KOSDAQ was officially established in 1996, one year before the financial crisis. Since the objective is to explore changes in the severity of financing constraints before

I construct a proxy for Tobin's Q as the ratio of market to book values of a firm's financial obligations.[9] In general, the true marginal Q as it appears in standard Q-theory is not observable, but rather investigators must be satisfied with the average Q as reflected in market prices.[10] Net cash flow is measured as the difference between the starting and ending cash balances over the calendar year. Similarly, net investment is measured as the difference between the starting and ending capital stocks (i.e., not adjusted for depreciation).[11] When used as explanatory variables, cash balances are measured at the start of the year and sales reflects gross receipts over the course of the year. I also include several dummy variables in all of the specifications but do not report them in the tables that follow. These are dummy variables for time and for years when a firm shows net losses on its income statement or has a negative cash flow. Even though these indicators turn out to be statistically insignificant nearly all of the time, I believe that it is important to control for them since the investment decision is likely to be affected critically for firms suffering losses or severe problems with cash flow.

To explore the effects of firm heterogeneity in the sample, I classify firms on three different dimensions. The first two are in the spirit of FHP, who classified firms according to

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and after the 1997 crisis, I prefer to use the same group of firms across the pre- and post-crisis periods. Second, most of the KOSDAQ-listed firms started up after the financial crisis and often as a result of government policies aimed at promoting small businesses.

[8] Like FHP, I limit the analysis to manufacturing firms that survived over the full sample period. This comes at some cost in terms of sampling bias due to the financial crisis, which caused many firms to end their operations.

[9] In particular, the numerator of Q is the sum of the market value of a firm's common stock (i.e., share price multiplied by number of shares) and its short and long-term liabilities. The denominator is the sum of the book value of a firm's common stock (i.e., shareholders' equity less intangible assets) and its short and long-term liabilities. (see Appendix B.)

[10] Hayashi (1982) showed that average Q coincides with marginal Q for a price-taking firm with constant returns to scale in both the production and the installation functions.

[11] The capital stock includes land as well as other property and equipment. I include land because it is a scarce and especially important input in Korea. (see Appendix B.)

their retention practices. I choose to classify firms by their maturity rather than their dividend policies, however, because the stable dividend policies of the types of US firms included in the Value Line database allowed FHP to associate the group with the lowest dividend payouts with firms most likely to be faced with problems of asymmetric information. Firms in emerging markets, however, generally have less stable dividend payments than their US counterparts, and fluctuations in these payments are more likely to reflect fluctuations in industry fundamentals than informational problems.[12] More specifically, I classify firms by dividing the sample into two groups based on the median of the sample age distribution. It turned out that "young" firms (i.e., younger than the median firm) were those that listed on the KSE on or after August 1, 1987, while "old" firms were those that listed before August 1987. I suspect that classifying firms by age may capture the concept of financial "weakness" for emerging market firms more clearly than FHP's payout classification because young firms are less well established and therefore less well known to potential investors than older ones, making them potentially more constrained financially.

Using the same general reasoning, I also classify firms by their size, with small firms being presumably more cash constrained than larger ones. Small firms are defined as those with total assets below the sample median. The final classification is based on whether or not a firm is affiliated with a Korean industrial conglomerate or *chaebol*.[13] I obtained a list of chaebol firms from the annual announcements of the Korean Fair Trade Commission (FTC). The FTC updates

[12] Using companies in eight emerging market markets over the period from 1980 to 1990, Aivazian, Booth and Cleary (2003) find that it is more difficult to predict dividend changes for companies in a number of emerging markets than for a sample of 100 U.S. companies.

[13] Park and Shin (1998), Laeven (2002) and Borensztein and Lee (2002) also consider financing constraints among chaebol and non-chaebol firms. Similarly, Hoshi, Kashyap and Scharfstein (1991) consider financing constraints among Japanese firms that are members of a "*keiretsu*" (i.e., a Japanese industrial conglomerate).

their ranking of the top 30 chaebol-firms annually, listing them by size. Table A2 in the Appendix includes cross tabulations of firms in the sample by age, size and chaebol affiliation.

4. Empirical Results

This section begins by estimating the baseline equations (1) to (5) for the full panel of 418 manufacturing firms over the period from 1992 to 2001. Next, I divide the panel into two periods, covering the pre-crisis (1992-1996) and post-crisis (1997-2001) years, and compare the results with those obtained from the baseline and under the three different classification schemes (i.e., age, size, and chaebol affiliation). This allows us to evaluate changes that may have occurred in the relative importance of various determinants of firm level investment after the crisis.

4.1. Investment decision for the pooled sample

Table 1 reports the pooled regression results for equations (1) to (5) for 1992-2001. In the first column the coefficient on Q is positive and statistically significant at the 5 percent level when it enters the specification alone, which is consistent with standard Q-theory. Adding cash balances to the specification (equation 2) yields statistically significant coefficients for both cash balances and Q, suggesting that constraints on internal financing may also have played a role in firm-level investment decisions. The third column (equation 3) indicates that the cash balances at the beginning of a year and cash flow over that year are both statistically significant when entered into the investment equation together. The last two columns add the ratio of current sales to the capital stock to the specification in a “sales accelerator” formulation. In equation 4, Q and cash balances remain statistically significant at the 5 percent level and the coefficient on sales

Table 1
Investment GMM regressions with pooled sample, 1992 – 2001

Equation No.	(1)	(2)	(3)	(4)	(5)
I/K_{t-1}	0.052**	0.048**	0.047**	0.050**	0.051**
	(0.024)	(0.023)	(0.023)	(0.023)	(0.022)
Q	0.158**	0.162**	0.153**	0.123**	0.123**
	(0.055)	(0.057)	(0.056)	(0.047)	(0.048)
C/K		0.139*	0.214**	0.188**	0.154*
		(0.077)	(0.063)	(0.063)	(0.081)
CF/K			0.134**		-0.071
			(0.033)		(0.071)
S/K				0.057*	0.063**
				(0.033)	(0.029)
Hansen	0.465	0.271	0.249	0.238	0.236
N	2,837	2,833	2,833	2,833	2,833

The table reports one-step GMM results for equations (1) to (5) as described in Section 2 of the text. The dependent variable is the ratio of investment expenditures to the capital stock. *T*-statistics based on robust standard errors appear in parentheses beneath the coefficient estimates. The last two rows report the *p*-value for the Hansen test of the over-identifying restrictions and the number of observations. * and ** denote statistical significance at the 10 and 5 percent levels respectively.

Table 2
Investment GMM regressions with pooled sample, pre and post-crisis

Equation No.	(1)	(2)	(4)	(1)	(2)	(4)
	pre-crisis period (1992-1996)			***post-crisis period (1997-2001)***		
I/K_{t-1}	0.040	0.040	0.040	0.056*	0.053*	0.053*
	(0.036)	(0.036)	(0.032)	(0.029)	(0.030)	(0.029)
Q	0.393**	0.390**	0.249	0.141**	0.145**	0.115**
	(0.186)	(0.182)	(0.158)	(0.051)	(0.053)	(0.044)
C/K		0.415**	0.093		0.105*	0.152**
		(0.130)	(0.137)		(0.064)	(0.063)
S/K			0.221**			0.043*
			(0.050)			(0.026)
Hansen	0.412	0.286	0.307	0.382	0.254	0.211
N	763	763	763	2,074	2,070	2,070

See notes for Table 1.

itself is positive and significant at the 10 percent level. When cash flows are added in equation 5, however, it does not have a significant coefficient. This may reflect collinearity between sales and the two cash variables, as suggested by their high correlations.[14] Hansen tests do not reject the over-identifying restrictions imposed by the instrument set in any of the specifications.[15]

Table 2 considers the periods before and after the financial crisis separately. The results are in many respects similar to those obtained over the full sample period, but there are subtle differences. For example, Q remains statistically significant at the 5 percent level except in the regression that includes sales in the pre-crisis period (equation 4), and the size of the coefficient on sales is much larger in the pre-crisis period than after the crisis. Measured at the sample means of S/K, the elasticity of the investment rate with respect to sales is about 0.10 in the pre-crisis period and 0.01 in the post-crisis period (i.e., a one percent change in S/K is associated with about a 0.1 percent change in the investment rate before the crisis and 0.01 percent change afterwards). This suggests that the sales accelerator was potentially quite strong in the pre-crisis period but weakened later. Also notable is that the coefficients on Q (and the implied elasticities of investment) are smaller and the coefficients on lagged investment are larger for 1997 – 2001, suggesting greater persistence in the investment decision after the crisis.

Overall, the similarities across the two periods seem to outweigh the differences. It would not be appropriate to conclude, however, that the patterns of corporate financing were unaffected

[14] The correlation coefficient in the sample of sales with cash balances is 0.43, and that of sales and cash flows is 0.52. Since the stock of cash also seems to perform better than cash flow in the investment regressions when each enters the specification alone, I decide to limit the presentation in the subsequent tables to equations (1) – (4). This also reflects the intuition behind Blinder's (1988) comment on FHP, which suggests that liquidity constraints should pertain to stocks of potential resources rather than flows. For example, a low current cash flow may not constrain acquisitions of capital for a firm with a large accumulated stock of cash.

[15] The test for higher order serial correlation proposed by Arellano and Bond (1991) also supports the specification. Also, the hypothesis of higher order serial correlation in all the specifications that follow are rejected.

by the crisis. Indeed, I will show next that the pooling of data in Tables 1 and 2 masks important effects of the crisis on certain classes of firms.

4.2. Investment by age

Table 3 shows estimation results when I classify firms by their maturity. I define a firm as "young" if it listed on the KSE after August 1987, which corresponds to the median age of firms in our sample. This gives 209 young companies and 209 older ones. The classification is conceptually similar to FHP's retention categories because young firms are likely to be those more recently recognized by the financial markets. The results indicate that Q is significant for the "old" (i.e., more established) firms both before and after the crisis, whether or not I include sales in the specification. For younger firms, Q is not a significant determinant of investment in the pre-crisis period but is significant afterwards. Interestingly, the cash position of an older firm, which is significant in equation 2 and 3 before the crisis, is not significant after the crisis. Even the level of sales does not have a significant impact on investment for the older firms after the crisis. For younger firms, there is a statistically significant relationship between cash balances and/or sales and investment in both periods.

The rising importance of Q for the younger firms in the post-crisis equations may reflect greater risks associated with doing business in Korea after 1997, and a reluctance to implement ideas whose quality was not already implicitly reflected in a firm's market price. In other words, the quality of the business plan, rather than the amount of excess cash, became the prime mover for investment. This seems reasonable since many of younger, less established Korean firms had been targets of stimulatory government programs before the crisis, but were targeted less afterwards. For the older firms, where the coefficient on Q was significant in both sub-periods,

Table 3
Investment GMM regressions by median age

Equation No.	Young (2)	Young (3)	Young (4)	Old (2)	Old (3)	Old (4)
			Pre-crisis period (1992-1996)			
I/K_{t-1}	0.043*	0.047**	0.031	0.105**	0.104**	0.112**
	(0.025)	(0.023)	(0.023)	(0.048)	(0.049)	(0.051)
Q	0.035	0.068	-0.093	1.009**	0.998**	0.895**
	(0.196)	(0.154)	(0.159)	(0.327)	(0.319)	(0.294)
C/K	0.285**	0.640**	0.072	0.690**	0.757**	0.130
	(0.128)	(0.256)	(0.111)	(0.172)	(0.304)	(0.354)
CF/K		0.485*			0.081	
		(0.251)			(0.316)	
S/K			0.287**			0.192**
			(0.102)			(0.026)
Hansen	0.820	0.962	0.824	0.602	0.597	0.363
N	364	364	364	399	399	399
			Post-crisis period (1997-2001)			
I/K_{t-1}	0.093**	0.094**	0.082*	0.053	0.050	0.050
	(0.042)	(0.042)	(0.045)	(0.034)	(0.034)	(0.034)
Q	0.074**	0.074**	0.055**	0.465**	0.423**	0.376**
	(0.031)	(0.031)	(0.024)	(0.118)	(0.113)	(0.120)
C/K	0.138**	0.128**	0.084*	0.097	0.176	0.156
	(0.060)	(0.059)	(0.049)	(0.087)	(0.146)	(0.123)
CF/K		-0.030			0.134	
		(0.044)			(0.103)	
S/K			0.087**			0.031
			(0.018)			(0.026)
Hansen	0.054	0.065	0.229	0.899	0.898	0.860
N	1,042	1,042	1,042	1,028	1,028	1,028

See notes for Table 1.

I note that past investment decisions, as reflected in the lag of the investment rate, became a less important determinant of current investment after the crisis. It therefore appears that pure "inertia" was becoming no longer a reason for more established firms to withhold dividends from their shareholders.

To check the robustness of the regressions to the split of the sample at the median firm age, I repeated them using the youngest 25 percent and counting the remaining 75 percent among the old. Table 4 shows that the coefficient estimates are similar to those obtained with the split

Table 4
Investment GMM regressions by quartile age

Equation No.	**Youngest 25%** (2)	(3)	(4)	**Oldest 75%** (2)	(3)	(4)
			Pre-crisis period (1992-1996)			
I/K_{t-1}	0.212**	0.160**	0.185**	0.013	0.032	0.022
	(0.087)	(0.071)	(0.065)	(0.034)	(0.026)	(0.030)
Q	0.046	0.058	-0.039	0.556**	0.525**	0.412*
	(0.117)	(0.094)	(0.057)	(0.260)	(0.240)	(0.224)
C/K	0.266*	0.466**	0.115	0.511**	0.913**	0.105
	(0.140)	(0.088)	(0.130)	(0.139)	(0.345)	(0.195)
CF/K		0.241**			0.552	
		(0.031)			(0.356)	
S/K			0.165**			0.225**
			(0.048)			(0.059)
Hansen	0.143	0.063	0.053	0.074	0.125	0.068
N	155	155	155	608	608	608
			Post-crisis period (1997-2001)			
I/K_{t-1}	0.112*	0.111*	0.096	0.038	0.038	0.041
	(0.064)	(0.065)	(0.065)	(0.030)	(0.030)	(0.030)
Q	0.114**	0.117**	0.080*	0.156**	0.147**	0.127**
	(0.046)	(0.046)	(0.043)	(0.071)	(0.067)	(0.059)
C/K	0.285**	0.315**	0.243**	0.085	0.128*	0.135**
	(0.112)	(0.119)	(0.100)	(0.059)	(0.071)	(0.066)
CF/K		0.041			0.085**	
		(0.071)			(0.042)	
S/K			0.069**			0.039
			(0.019)			(0.027)
Hansen	0.707	0.715	0.683	0.294	0.266	0.261
N	520	520	520	1,550	1,550	1,550

See notes for Table 1.

at the median. For example, Q is a significant determinant of investment for young firms in the post-crisis period only, just as before, and cash becomes no longer statistically significant for the older firms. The main differences are that lagged investment is more important for the young firms in the pre-crisis period and the coefficient on cash balances is larger in the post-crisis period for the 25 percent sample than when the split occurs at the median. The latter result suggests that problems of asymmetric information and financing constraints became even more severe after the crisis for the very youngest firms in the sample. Indeed, the elasticity of investment with respect to cash balances (evaluated at the sample means of I/K and C/K) in the post-crisis period was 0.71 for the youngest 25 percent and 0.23 for the youngest 50 percent.

Comparing the results in Table 3 and 4 with those in Table 2, it appears that stratifying the sample by firm age uncovers potentially important differences in the determinants of investment that were masked in the pooled analysis, particularly an increased role for Q along with cash balance among younger firms after the crisis.

4.3. Investment by size

The standard asymmetric information framework suggests that classifying firms by size could also be an appropriate way to evaluate the role of possible cash constraints on investment (see, for example, Blinder's (1988) comment on FHP). In practice, this is not easy to implement as sharply as one might like in the sample of exchange-listed Korean manufacturing firms. It is because most of the truly "small" firms in Korea are not listed on the organized exchange, and any data available for them are likely to be less reliable than data for larger firms. This means that the smallest enterprise in the sample is still quite large relative to most unlisted ones. If size is indeed related to independent financial strength, however, one should still expect to see investment affected by it.

Table 5
Investment GMM regressions by size (based on median total assets)

	Small			**Large**		
Equation No.	(2)	(3)	(4)	(2)	(3)	(4)
			Pre-crisis period (1992-1996)			
I/K_{t-1}	0.031	0.033	0.032	0.114**	0.116**	0.091*
	(0.029)	(0.026)	(0.027)	(0.052)	(0.051)	(0.053)
Q	0.165	0.180	0.026	0.973**	0.954**	0.736**
	(0.199)	(0.166)	(0.167)	(0.311)	(0.305)	(0.266)
C/K	0.266**	0.823**	0.024	0.791**	0.847**	0.296
	(0.125)	(0.338)	(0.114)	(0.163)	(0.179)	(0.303)
CF/K		0.680**			0.084	
		(0.322)			(0.124)	
S/K			0.326**			0.170**
			(0.097)			(0.021)
Hansen	0.767	0.943	0.621	0.398	0.422	0.526
N	368	368	368	395	395	395
			Post-crisis period (1997-2001)			
I/K_{t-1}	0.029	0.027	0.028	0.084*	0.089**	0.092**
	(0.027)	(0.027)	(0.026)	(0.044)	(0.043)	(0.043)
Q	0.081**	0.078**	0.064**	0.469**	0.450**	0.267*
	(0.036)	(0.035)	(0.031)	(0.126)	(0.124)	(0.137)
C/K	0.085	0.104*	0.123**	0.499**	0.987**	0.265
	(0.056)	(0.057)	(0.061)	(0.206)	(0.270)	(0.214)
CF/K		0.036			0.580**	
		(0.029)			(0.191)	
S/K			0.029			0.163**
			(0.019)			(0.053)
Hansen	0.402	0.443	0.429	0.138	0.098	0.030
N	1,034	1,034	1,034	1,036	1,036	1,036

See notes for Table 1.

To examine this possibility, Table 5 reports the same regressions as in Tables 3 and 4, but with firms classified this time into two groups based on their total assets. I do this by computing the mean of a company's total real assets over the 10-year period of this study, and then using the cross sectional median of these means to define 209 smaller firms and 209 larger ones. The

evidence of Q becoming more important factor is not quite as strong as I found when classifying firms by age, yet the coefficients on Q are once again statistically significant at the 5 percent level for both groups after the financial crisis and not significant for smaller firms before the crisis. Further, cash balances seem to matter for smaller firms in the post-crisis period, while sales dominated before the crisis began.

In this particular classification, I conclude that the existing data are consistent with one of the main hypotheses, namely that financial resources migrated after the 1997 crisis to firms whose quality was better known to investors. In other words, cash and other balance sheet quantities mattered less as lenders now pay more attention to the quality. However, there is weak evidence that relatively smaller firms suffered from binding internal cash holding.

4.4. Investment by Chaebol affiliation

In this part, I consider whether the financial crisis affected the availability of funds for firms affiliated with large industrial conglomerates (i.e., chaebols). As noted earlier, chaebol firms are members of well-established and presumably well-diversified business groups, and as such one might have expected the crisis, with of course a few important exceptions, to affect them less severely, and perhaps to have even moderated some of our earlier results with pooled samples of older and larger firms. To test this, I divided the sample into chaebol and non-chaebol firms and ran our earlier regressions once again with the new sub-samples.[16]

Table 6, which reports the findings, shows that previous investment is a statistically significant determinant of current investment for chaebol firms, both before and after the crisis,

[16] After splitting the sample, I found that 75 companies had chaebol affiliations before the crisis and 52 after, while only 45 companies remained chaebol-affiliated over the full 1992-2001 sample period. The decline seems mainly due to the bankruptcies of several of these companies around the time of the crisis. (e.g., Kia, Hanra, Hanbo and New-Core in 1997; Jinro, Hanil and Geopyung in 1998; Daewoo, Hae-Tae and Shinho in 1999).

Table 6
Investment GMM regressions by affiliation

Equation No.	Chaebol-affiliated (2)	Chaebol-affiliated (3)	Chaebol-affiliated (4)	Not affiliated (2)	Not affiliated (3)	Not affiliated (4)
			Pre-crisis period (1992-1996)			
I/K_{t-1}	0.254**	0.271**	0.192**	0.034	0.037	0.036
	(0.070)	(0.094)	(0.081)	(0.033)	(0.028)	(0.029)
Q	2.038**	1.972**	1.625**	0.229	0.217	0.105
	(0.539)	(0.420)	(0.479)	(0.177)	(0.162)	(0.151)
C/K	1.164**	1.913**	0.382	0.389**	0.696**	0.082
	(0.444)	(0.390)	(0.324)	(0.130)	(0.227)	(0.139)
CF/K		1.070**			0.402*	
		(0.297)			(0.223)	
S/K			0.319**			0.214**
			(0.067)			(0.052)
Hansen	0.527	0.696	0.334	0.180	0.443	0.442
N	148	148	148	615	615	615
			Post-crisis period (1997-2001)			
I/K_{t-1}	0.129**	0.143**	0.201**	0.043	0.041	0.042
	(0.054)	(0.054)	(0.061)	(0.032)	(0.032)	(0.031)
Q	0.371	0.349	-0.041	0.132**	0.128**	0.105**
	(0.237)	(0.241)	(0.204)	(0.049)	(0.048)	(0.041)
C/K	1.808**	2.167**	1.196**	0.096	0.132*	0.139**
	(0.632)	(0.695)	(0.599)	(0.060)	(0.068)	(0.059)
CF/K		0.421**			0.067**	
		(0.204)			(0.034)	
S/K			0.600**			0.039
			(0.069)			(0.024)
Hansen	0.207	0.235	0.114	0.450	0.408	0.438
N	260	260	260	1,810	1,810	1,810

See notes for Table 1.

while it is never significant for non-chaebol firms. This is probably due to the chaebol's continued control over many of Korea's heavy industries, which are more capital intensive and require more persistent investment than light-industry firms that comprise a large part of the non-chaebol category. In comparing the panels in the upper and lower left of the table, I also find

that the effect of cash balances on the investment of chaebol firms is much stronger in the post-crisis regime than before the crisis, while the coefficient on Q becomes smaller and no longer statistically significant after the crisis.

These results are quite the opposite of those found when I compared older firms with younger ones in Tables 3 through 5, and present something of a puzzle since most chaebol firms would generally be among the larger listed firms in Korea. Further, the coefficient on cash balances for chaebol firms after the crisis (with an elasticity with respect to investment of 0.704 when measured at the sample mean of C/K) is much larger than that of non-chaebol firms (with an elasticity of 0.302). This is again the opposite of what I found when comparing older and younger firms. All of this suggests that chaebol firms faced a different financial environment in the post-crisis period than a typical well-established Korean firm.

Why, then, did the crisis affect the chaebol affiliates more emphatically than non-chaebol firms in terms of tightening cash constraints, and why did their investment decisions become increasingly dependent on the level of internal funds? One explanation, supported in earlier work by Borensztein and Lee (2002) and Laeven (2002), suggests that chaebol-affiliated firms lost their preferential access to external financing after the financial crisis.

5. Robustness of classification: Do chaebols dominate the results?

The main findings from estimation of the investment equations in Section 4 is that Tobin's Q is a significant determinant of investment in the post-crisis period for all categories of firms in our sample, whereas it was not for younger, smaller, and non-chaebol firms before the crisis. One possible explanation is that firms placed more weight after the crisis on potential profitability when considering new investments rather than simply responding to indicators of

Table 7
Investment GMM regressions by median age excluding chaebols

Equation No.	Young Non-chaebols (2)	Young Non-chaebols (3)	Young Non-chaebols (4)	Old Non-chaebols (2)	Old Non-chaebols (3)	Old Non-chaebols (4)
			Pre-crisis period (1992-1996)			
I/K_{t-1}	0.044*	0.045**	0.035	0.083	0.083	0.097
	(0.022)	(0.022)	(0.021)	(0.051)	(0.052)	(0.061)
Q	-0.062	-0.016	-0.181	0.854**	0.855**	0.754**
	(0.191)	(0.142)	(0.154)	(0.352)	(0.344)	(0.312)
C/K	0.288**	0.621**	0.078	0.625**	0.622**	0.077
	(0.129)	(0.258)	(0.111)	(0.178)	(0.312)	(0.398)
CF/K		0.464*			-0.004	
		(0.255)			(0.355)	
S/K			0.280**			0.184**
			(0.110)			(0.025)
Hansen	0.801	0.934	0.988	0.751	0.751	0.670
N	320	320	320	295	295	295
			Post-crisis period (1997-2001)			
I/K_{t-1}	0.080	0.081	0.064	0.047	0.043	0.044
	(0.053)	(0.053)	(0.055)	(0.036)	(0.036)	(0.036)
Q	0.069**	0.070**	0.052**	0.454**	0.411**	0.372**
	(0.028)	(0.028)	(0.023)	(0.129)	(0.123)	(0.129)
C/K	0.128**	0.119**	0.076	0.087	0.163	0.139
	(0.056)	(0.055)	(0.047)	(0.080)	(0.135)	(0.111)
CF/K		-0.028			0.128	
		(0.042)			(0.099)	
S/K			0.081**			0.027
			(0.017)			(0.022)
Hansen	0.113	0.124	0.405	0.951	0.948	0.923
N	967	967	967	843	843	843

See notes for Table 1.

past performance such as sales. The lending sector may also have considered future profitability more carefully in making resource allocations after the crisis, rather than relying on traditional measures of repayment ability such as reputation, size or chaebol affiliation. Indeed, lenders may have found the risk and return characteristics of older, larger, and chaebol firms to be less

desirable after the crisis than before, and found the tradeoff for younger and smaller firms comparatively more attractive.

Table 8
Investment GMM regressions by size excluding chaebols

Equation No.	Small Non-chaebols (2)	Small Non-chaebols (3)	Small Non-chaebols (4)	Large Non-chaebols (2)	Large Non-chaebols (3)	Large Non-chaebols (4)
			Pre-crisis period (1992-1996)			
I/K_{t-1}	0.031	0.033	0.030	0.066	0.069	0.058
	(0.025)	(0.023)	(0.023)	(0.087)	(0.086)	(0.091)
Q	0.070	0.092	-0.058	0.773**	0.721**	0.524*
	(0.187)	(0.149)	(0.144)	(0.316)	(0.316)	(0.279)
C/K	0.255**	0.817**	0.011	0.710**	0.719**	0.281
	(0.124)	(0.348)	(0.113)	(0.172)	(0.196)	(0.322)
CF/K		0.680**			0.012	
		(0.328)			(0.128)	
S/K			0.336**			0.149**
			(0.099)			(0.020)
Hansen	0.851	0.995	0.875	0.176	0.205	0.395
N	346	346	346	269	269	269
			Post-crisis period (1997-2001)			
I/K_{t-1}	0.025	0.024	0.024	0.071	0.073	0.073
	(0.027)	(0.027)	(0.026)	(0.053)	(0.052)	(0.051)
Q	0.082**	0.079**	0.064**	0.432**	0.416**	0.262*
	(0.036)	(0.035)	(0.031)	(0.133)	(0.133)	(0.141)
C/K	0.084	0.103*	0.123**	0.375**	0.870**	0.179
	(0.055)	(0.056)	(0.061)	(0.185)	(0.281)	(0.194)
CF/K		0.036			0.591**	
		(0.029)			(0.224)	
S/K			0.029			0.131**
			(0.019)			(0.042)
Hansen	0.552	0.594	0.578	0.080	0.048	0.029
N	1,019	1,019	1,019	791	791	791

See notes for Table 1.

One may be suspicious if the results from the age and/or size classifications are driven by chaebols as the chaebols-affiliated firms which are, in general, older and/or larger. Since the

financing behavior of chaebol firms seems to differ from typical older or larger non-chaebol firms in the sample, I first check the sensitivity of the regression results in Tables 3-5 by running the GMM equations excluding chaebol-affiliated firms from the sample. Table 7 reports the results from the smaller sub-sample of non-chaebol old and young firms. The concern was that chaebol firms were among oldest and might have influenced our results for older firms. Interestingly, the results in Table 7 remain quite similar to those in Table 3.

Then, I repeated the regressions in Table 7 for small and large non-chaebol firms as well, and found that eliminating the chaebol-affiliated firms gave qualitatively similar results to Table 5 as introduced in Table 8. Although, the previous investment becomes now a statistically insignificant determinant of current investment for larger firms especially in the pre-crisis period, it is probably due to the fact that about 90 percent of chaebol affiliates are classified as the large companies in the sample. As noted earlier, chaebols operate in heavy industries, which require more persistent investment.

The evidence from the experiment of excluding chaebols, described in Table 7 and 8, suggests that the previous estimations (in Table 3 and 5) were neither sensitive to nor driven by the potentially influential chaebol-affiliated firms in the sample.

6. Conclusion

In this study, I examine the role of Tobin's Q, cash balances and sales on the investment decisions of Korean manufacturing firms in the five years before and after the East Asian financial crisis of late 1997. To investigate the issue of heterogeneity embedded in a financing hierarchy or "pecking order" theory of investment, three different classifications are defined, by age, size, and affiliation to a chaebol. To address econometric issues such as endogeneity and the serial correlation of errors in our dynamic panel models, GMM estimation was used.

I find that the standard Q-theory of investment explains firm-level decisions well when I pool data for all firms listed on the Korean Stock Exchange, and that this result for the most survives when the pre- and post-crisis periods are considered separately. Allowing for firm heterogeneity before and after the financial crisis, however, I find that the investment of younger and/or smaller firms did not depend on Q before the crisis but that Q became an important determinant afterwards. The opposite occurred among chaebol-affiliated firms.

I also find that the cash variables, which are proxing for financing constraints, affect firms' investment decisions significantly after the crisis. The financial constraint appears to be more binding in the younger and/ or smaller firms after controlling for Q and sales variables. This result is also consistent with the pecking order theory. Moreover, the estimated effects in this study probably underestimate the extent of problems of asymmetric information and financing constraints in the Korean economy because the sample contains only those companies listed on the formal stock exchange. In addition, the level of internal cash balances became much more important for the investment of chaebol firms after the crisis, suggesting that chaebols lost some of their earlier preferential access to credit.

These findings could reflect an increased importance of the future profitability in the lending decisions of Korean and international financial institutions in the post-crisis regime. By this I mean that resource allocation decisions became more market-oriented after the financial crisis and less dependent on imperfections in the capital markets. This is not to say that such imperfections are now unimportant, but rather that the financial crisis was a defining event in Korea's postwar history – a time when its capital markets matured significantly and prices therein became more informative about the underlying quality of business plans.

One of the findings in this empirical study implies that the Korean government may need to re-examine its regulation on chaebol-affiliated companies because they now seem to face financing constraints and no longer have an advantage in financing business projects. Another implication that can be drawn from this study involves the effectiveness of the IMF program that followed the crisis. The main purposes of the program were to reform the corporate and financial sectors and to eliminate economic inefficiencies by reducing a number of interventions and regulations. At the same time, the government imposed and emphasized new regulations to revive and maintain well-functioning financial intermediation. Table A1 in the Appendix summarizes the changes in firms' financing decisions that followed the shift to the post-crisis regime. They tried to reduce their debt levels in both the short and long-term, with the ratio of debt to equity falling sharply as I mentioned earlier. Along with the estimation results from this study, it seems that the IMF program has been successful. Of course, now may not be the best time to evaluate the performance of the IMF program, at least for the manufacturing sector, because structural reforms in an economy often occur quite slowly. Nevertheless, the evidence suggests that the IMF program along with the Korean government policy reaction to the crisis led the economy towards a more market-oriented financial environment than before.

Appendix A

Table A1
Financial Structure of the Listed Companies in the Manufacturing Sector

	1997	1998	1999	2000	2001
Liabilities (% of total assets)	76.7	68.7	57.4	57.1	54.4
Short-term Borrowing (% of total assets)	18.2	13.2	7.2	8.9	7.7
Long-term Borrowing (% of total assets)	14.7	9.9	7.3	6.1	5.5
Equity Capital (% of total assets)	23.3	31.3	42.6	42.9	45.6
Debt-to-Equity Ratio	3.29	2.20	1.35	1.33	1.19
Net Income (% of equity capital)	-0.7	2.5	11.2	6.8	1.7
Growth rate of real tangible assets (%)	21.6	1.7	0.6	-2.1	-8.0
Number of Firms	455	408	423	424	439

Source: Korea Listed Companies Association, "Annual Report of KSE Companies (CD-ROM)", 2002. Some listed companies are excluded if they 1) did not report, 2) changed their types of business, 3) were disqualified by a public auditor, or 4) had impaired capital.

Table A2
Cross Tabulation by Firm Classifications

	Small	Large	Young firms	Old firms	Chaebol	Non- chaebol
Small	N.A.					
Large						
Young Firms	139	70	N.A.			
Old Firms	70	139				
Chaebol	7	56.5	19	44.5	N.A.	
Non-chaebol	202	152.5	190	164.5		
Number of Firms	*209*	*209*	*209*	*209*	*63.5*	*354.5*

Note: From the sample of 418 manufacturing firms listed on the Korean Stock Exchange. An "N.A." in the diagonal elements indicates not applicable self-pointing cases for the cross tabulation. The chaebol classification can change over time. In other words, a firm that belonged to a chaebol before the crisis may not be classified as a chaebol-affiliate in the post-crisis period. There are two possible cases. The chaebol itself may be dropped out of the official FTC list or the firm may have ended its affiliation with the chaebol.

Appendix B

K: Capital stock at the beginning of the year measured by properties and equipments including land and others. i.e. fixed capital which includes buildings and structures, machinery and equipments, instruments and tools, and land.

I: Investment during the year

K at the end of year – K at the beginning of year

CF: Cash flow during the year

Cash at the end of year – Cash at the beginning of year

C: Stock of cash at the beginning of year

Q: Market value / Book value

Market value = market value of common stock + Short-term and Long-term liabilities

where, market value of common stock = price * number of outstanding shares

Book value = book value of common stock + Short term liabilities + Long term liabilities

where, book value of common stock = Shareholders' equity – Intangible assets

S: Sales amount during the year (NS)

Dummy Variables

dcpa = 1 if the financial statements are qualified by CPA; 0 otherwise

difa = 1 if the firm is under issues for administration; 0 otherwise

dchg = 1 if the firm has been changed the reporting period; 0 otherwise

dloss = 1 if the firm records net loss after tax in the year; 0 otherwise

dcf = 1 if the firm has negative cash flow in the year; 0 otherwise

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