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The Role of Cash Holdings in Reducing Investment –
Cash Flow Sensitivity: Evidence from a
Financial Crisis Period in an Emerging Market

by

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The role of cash holdings in reducing investment-cash flow sensitivity: Evidence from a financial crisis period in an emerging market

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Abstract

This paper investigates the relationship between financing constraints and investment-cash flow sensitivities by focusing on cash holdings of firms as the basic classification scheme to separate firms into financially constrained and unconstrained categories. The idea is that high cash reserves increase the ability of firms to undertake profitable investment opportunities. Our classification scheme is based on an optimal cash model, which helps us identify the firms that deviate significantly from their target cash ratio. We conduct the analysis for an emerging market, just before and during a financial crisis to test the hypothesis that the hedging role of cash is more critical in states of the world characterized by high asymmetric information and excessive costs of external finance. The results are in line with our expectations and show that constrained firms exhibit greater investment to cash flow sensitivities than unconstrained firms. Also, there is strong evidence that cash stands as an effective device for firms mainly, during the crisis period.

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1. Introduction

In the absence of capital market imperfections, such as contracting and information frictions, it is argued that there is no wedge between the cost of internal and external funds. All firms have equal and unrestricted access to external finance and hence firms can separate their investment and financing decisions. The assumption is that capital expenditures of a firm is completely a function of its investment opportunities where the supply of capital is infinitely elastic. However, in the presence of market imperfections there is no perfect substitution between internal and external funds. The cost of external finance will now be a function of the extent to which firms are subject to capital market imperfections. This, in turn, implies that firms will in general face an upward-sloping supply curve of external capital where its slope will be partly determined by capital market imperfections. An important implication of this is that firms that are subject to severe informational and agency problems will have restricted access to external finance and limited internal funds, and hence will have to pass up profitable investment opportunities in some states of the world. Such firms are called financially constrained and the availability of internal funds for them becomes crucial for investment.

The hypothesis that the sensitivity of investment expenditures of financially constrained firms to the availability of internal funds is higher than that of unconstrained firms has been investigated extensively. To test this hypothesis, several firm characteristics such as size, dividend, credit and bond ratings, and business affiliation have been put forward to identify financially constrained firms. Moreover, cash flow of firms has been used to proxy internal funds in an attempt to examine whether the investment sensitivity to cash flow is a useful measure for financial constraints.[1]

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[1] Despite a great deal of work on the investment-cash flow sensitivity there is no consensus among the studies regarding its usefulness as a proxy of financial constraints. On the one hand, several studies following Fazzari et

The primary objective of this paper, as well as its main contribution, is to investigate the role of cash reserves in determining corporate investment expenditures. Following Almeida et al. (2004), we argue that higher cash holdings generally increase firms' capacity to undertake profitable investment opportunities, even when they experience shortfalls in their cash flows. To the extent that this argument holds, firms that are likely to be financially constrained (e.g. due to greater exposure to capital market imperfections) are expected to accumulate cash to safeguard against future investment needs. In fact, Almeida et al. (2004) find that small firms, non-dividend payers, and those firms with lower credit and bond ratings tend to accumulate more cash out of cash flows. Likewise, Acharya et al. (2005) provide evidence that cash balances secure investment through hedging against cash flow deficits. The strong evidence provided by these studies suggests that financing constraints create a demand for greater cash balances in an attempt to reduce the impact of financing frictions and fluctuations in the availability of internal funds on investment.

Our approach in incorporating cash holdings in the empirical investment analysis has two distinct features. First, it acknowledges that cash reserves may be useful in determining whether firms are likely to be financially constrained and unconstrained. In this respect, cash is seen as an additional constraint criterion among the proxies that have been used in the existing literature. Second, we take the view that cash holding status of firms can also affect the impact of many of the proposed proxies on investment. That is, the extent to which investment expenditures of firms are determined by capital market imperfections, and hence financial constraints, may in turn depend on firms' cash balances. The former view simply

al. (1988), argue that investments of financially constrained firms are more sensitive to their cash flows (see, e.g., Hoshi et al., 1991 and Fazzari et al., 2000 among others). On the other hand, several subsequent studies oppose to this argument by showing that investment-cash flow sensitivity is stronger for financially unconstrained firms (see, e.g., Kaplan and Zingales, 1997, Kadapakkam et al., 1998, Cleary, 1999 and Kaplan and Zingales, 2000).

considers the cash status of firms as a financial constraint proxy whereas the latter allows cash to play a more substantial role in determining investment, namely a hedging role.

Our research strategy in addressing these features of cash is as follows. First, to see if cash acts as a financial constraint proxy we split firms into constrained and unconstrained groups using several firm characteristics including cash reserves and test if the sensitivity of investment to cash flow changes between the two groups of firms. Second, to investigate the hedging role of cash we first identify cash-poor and cash-rich firms and within each group we further split firms into constraint and unconstraint categories. In doing so, we use firm characteristics excluding cash, and repeat the same empirical investigation as above. More importantly, in determining cash-poor and cash-rich firms, we do not rely only on the distribution of cash reserves. We also estimate an optimal cash model by incorporating firm characteristics that capture the impact of capital market imperfections on the cost of external finance. Our argument is simple to follow. If, as argued in the recent literature, cash balances have a hedging role to play those firms that hold less than target cash balances will be more vulnerable against the fluctuations in cash flow and financial constraints. This approach has an important advantage over the use of cash distribution as it enables us to identify not only the firms holding lower cash but also those that undershoot their desired cash holdings.

This study also contributes to the existing literature by providing evidence on corporate investment in an emerging market, namely Turkey. Prior research on investment in emerging markets has concerned mainly with the impact of financial liberalization and development (see, e.g., Demirgüç-Kunt and Maksimovic, 1999; Gelos and Werner, 2002; and Laeven, 2003). There are, however, still important insights one would borrow from this literature into the relation between investment and financial constraints. It is argued that developed financial

systems are essential to transfer cheaper external funding to worthy firms by, for example, mitigating the difficulties assosiated with market imperfections. This, in turn, implies a negative relation between the cash flow sensitivity of investment and financial development (Love, 2003, Khurana et al., 2005). This further suggests that corporate investment policy in developed (developing) markets relies less (more) on the availability of internal funds. Additionally, poor investor protection, mostly associated with developing countries (La Porta et al., 1997 and 1998), leads firms to face more restrictions in accessing to external finance. We, hence, argue that, all else being equal, firms in less developed markets demand greater liquidity and the hedging role of cash reserves is more pronounced (also see Acharya et al., 2005 for a similar argument). To this end, given the absence or limited availability of alternative hedging devices such as financial derivatives, Turkey provides us with an ideal environment to investigate the role of cash holdings in determining corporate investment.

Last but not least, our analysis also enables us to examine the impact of financial crises on investment by studying corporate investment in a period during when a severe financial crisis took place in Turkey.[2] Adverse macro economic shocks not only hamper the central function of financial markets but also exacerbate adverse selection and moral hazard problems (Bernanke and Gertler, 1989). Thus, the hedging role of cash, if any, should be more prevalent during financial crises since the ability of firms to raise external finance is significantly lower due to a growing wedge between the cost of internal and external funds. Accordingly, we expect that the investment expenditures of firms with insufficient cash balances should be more sensitive to the availability of internal funds during a financial crises.

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[2] Financial crises which took place in Turkey in November, 2000 and in February, 2001 resulted in a dramatic rise in interest rates and a large devaluation of the Turkish lira. For example, in the subsequent two months following the February crisis the Turkish lira lost almost half of its value. The resulting recession was severe and the economy contracted by over 9 percent in 2001 (see Ozkan, 2005 for a detailed analysis of the financial crises in Turkey).

The empirical analysis of this paper provides a set of interesting results. Our major finding is that cash holdings can potentially work as an effective hedging device against fluctuations in cash flow. It seems that cash can be particularly important for firms that are likely to be financially constrained and/or during a financial crisis period. Not surprisingly, our analysis also reveals that financially constrained firms, identified by using firm characteristics such as size, dividend payouts, business affiliation and cash balances, generally exhibit greater investment-cash flow sensitivity than unconstrained firms. However, the evidence regarding this sensitivity is much stronger during the financial crisis period. That is, it seems that the reliance of financially constrained firms on internal finance increases during the financial crisis. More interestingly, our results suggest that cash holdings also influence the sensitivity of investment to cash flows. We find that the investment expenditures of cash-poor firms, in particular those firms that hold less than their desired cash balances, are very sensitive to the availability of internal funds during the financial crisis.

The rest of the paper is organized as follows. In section 2 we describe the empirical methodology used in this paper and, also, develop our empirical hypotheses. Section 3 explains the construction of the data set and provides several descriptive statistics for the main variables used in our study. Section 4 presents the empirical results, and finally section 5 provides concluding remarks.

2. Investment and Financial Constraints

In this section we briefly describe the empirical methodology utilized in our study and explain the approach used in determining constrained and unconstrained firms. In addition to the discussion as to the use of size, age, dividend payouts and business group affiliation as

financial constraint proxies, we discuss the extent to which cash balances of firms can be used as an additional financial constraint proxy.

2.1 The Investment Model and the Proxies for Financial Constraints

Following Fazzari et al. (1988), we investigate the relationship between investment and cash flow using the following model:

$$I_i = \alpha + \delta_1 CFLOW_i + \delta_2 Q_i + u_i \tag{1}$$

where I is ratio of investment expenditures in fixed assets to total assets, $CFLOW$ is the sum of earnings before interest, tax and depreciation over total assets and Q represents growth opportunities, measured by the ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets. The primary variable of interest in this model is cash flow. A positive and significant coefficient of $CFLOW$ suggests that firms primarily rely on internal rather than external funds for financing investment, which is taken as a signal of financial constraint. On the contrary, an insignificant estimated coefficient of $CFLOW$ is seen as evidence that firms are financially unconstrained.

We estimate model (1) for constrained and unconstrained firms separately to compare the sign and the significance of the estimated coefficient of $CFLOW$. However, to do so, we first split the sample into two groups of constrained and unconstrained firms on the basis of their size, dividend payouts, business affiliation and age. In choosing these financial constraint proxies we borrow insights from prior research on the subject. In the following, we provide a brief discussion on each of these characteristics.

Size: Following Gertler and Gilchrist (1994) and Kadapakkam et al. (1998), among others, we rank firms based on their size (proxied by the logarithm of total assets) and assign

to the financially constrained (unconstrained) group those firms whose size lies below (above) the median size value in the sample. The main argument here is that smaller firms are more likely to be financially constrained as they are subject to greater asymmetric information and agency problems, and therefore, have difficulties in accessing external finance.[3]

Age: Older firms have an established reputation in the market, which facilitates their access to external finance mainly because their relationships with their creditors are settled within a longer time span (Berger and Udell, 1995). To this end, we assign to the financial constrained (unconstrained) group those firms whose age lies below (above) the median age value in the age distribution.

Dividend: In the spirit of Fazzari et al. (1988) we use the dividend payout ratio as a segmenting variable to classify firms into constrained and unconstrained groups. We argue that dividend paying, as opposed to non-dividend paying firms, are less likely to be financially constrained since they are able to cut dividends whenever their ability to obtain external financing is impaired. However, this variable should be approached with caution in the sense that cutting dividends for the sake of liquidity may also have adverse signaling effects for the firm's stock in the market (see, e.g., Healy and Palepu, 1988).

Business group: We collect data on each firm's affiliation with other corporations and assign firms to the financial unconstrained (constrained) group if they belong (do not belong) to a business group. The underlying argument is that group membership helps relieving financial constraints (Hoshi et al., 1991). We believe that such a classification criterion is particulartly important for the case of Turkish firms, which have strong incentives to join business groups. For example, business group formations are particularly important for

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[3] In accord with this, Arslan and Erdogan (2005) indicate a positive relationship between leverage and size for Turkish firms.

emerging markets since they help generate an internal capital market that substitutes external capital markets by allocating funds from one segment to another (Yurtoglu, 2000). Besides, planning and decision making procedures for each firm become very centralized in Turkish business group firms, which helps diminish agency costs by ensuring a monitoring mechanism on management (Buğra and Üsdiken, 1995).

2.2 Cash Holdings and Financial Constraints

The role of cash holdings in determining corporate investment decision has been the subject of recent research in corporate finance (see, e.g., Almeida et al., 2004 and Acharya et al., 2005). The underlying argument is that cash stands as an effective hedging device for firms that are expected to be exposed to severe capital market imperfections. As noted earlier, in a frictionless capital market, investment expenditures are independent of firms' financial policies, including cash policies, because all firms have unrestricted access to external capital. However, capital markets suffer from several important imperfections including information asymmetry and agency costs, which lead to a wedge between the cost of internal and external funds. As a result, firms that are exposed to greater imperfections are also expected to hold larger cash reserves as cash holdings increase firms' ability to undertake investment when internal funds are insufficient and external finance is excessively costly.

Consistent with this argument, Almeida et al. (2004) show that financially constrained firms tend to increase their cash balances with increases in their cash flows. They analyze the cash holding behavior of firms by splitting firms into two groups, namely financially constrained and unconstrained ones, and test if the sensitivity of cash holdings to cash flow changes across the two sample partitions. In a subsequent work, Acharya et al. (2005) reach a similar conclusion by showing that financially constrained firms (i.e. those with higher

hedging needs) have a high propensity to save cash out of cash flows. Both studies are based

on the view that cash reserves increase the capacity and ability of firms to invest.

We use cash to split the sample into financially constrained and unconstrained groups.

Specifically, firms are classified as constrained (unconstrained) if the level of their cash

holdings falls below (above) the median value of cash in the sample. Although this

methodology is in line with prior research it does not consider the optimal cash behaviour of

firms. The explanations in the literature as to why firms hold cash imply that there is an

optimal cash policy for firms, which is determined by firm characteristics related to capital

market imperfections.[4] We, therefore, also estimate the desired level of cash holdings for each

firm. By doing so, we attempt to avoid situations in which, for example, we classify firms as

financially constrained, which are in fact holding an amount that is greater than optimal

(desired) cash. The modified classification methodology defines a firm as financially

constrained only if the firm's cash holdings are lower than its estimated target cash reserves.

For robustness purposes, we also adopt a stricter criterion, which requires firms to have both

lower than median cash holdings and undershoot their target.

We perform our task by estimating the following cash model, which captures capital

market imperfections and, therefore, is likely to provide useful insights on each firm's ability

to access external funds.

$$CASH_i = \alpha + \beta_1 CFLOW_i + \beta_2 STD_i + \beta_3 STD_i^2 + \beta_4 MKTBOOK_i +$$
$$\beta_5 INVESTMENT_i + \beta_6 SIZE_i + \beta_7 DIVIDEND_{i+} \beta_8 AGE_{i+}$$
$$+ \beta_9 BUSINESS\_GROUP_i + u_i, \qquad\qquad (2)$$

where *CASH* is cash and equivalents over total assets, *CFLOW* is the sum of earnings before

interest, tax and depreciation over total assets, *STD* is the ratio of short-term book debt to total

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[4] See, e.g., Opler et al. (1999) and Ozkan and Ozkan (2004) for a detailed discussion of the determinants of cash holdings.

assets, STD^2 is the square of STD, $MKTBOOK$ is the ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets, $INVESTMENT$ is measured as the ratio of investment in fixed assets to total assets. $SIZE$ is inflation adjusted natural logarithm of total assets, $DIVIDEND$ is a dummy variable and takes the value of one if the firm pays dividend and zero otherwise, AGE is the number of years the firm has been operating and $BUSINESS\ GROUP$ is a dummy variable and takes the value of one if the firm is affiliated to a business group and zero otherwise.

We expect cash flows to be positively related to cash reserves. Also, short term debt is expected to be negatively associated with cash balances since they can be used as a substitute for cash. However, as short term borrowing exceeds a certain level, the probability of financial distress and bankruptcy increases, leading to a higher level of cash balances to minimize the risk of costly bankruptcy.[5] The market-to-book ratio is expected to be positively related to cash balances since high growth firms hoard liquidity to exploit all potential growth options. Small and young firms need higher levels of cash reserves because they are subject to more information asymmetries. As a result, we expect the coefficients of the age and size variables to be negative. Dividends can either be positively or negatively associated with cash balances as previously explained. Finally, firms belonging to a business group are expected to hold less cash since they can also raise funds within their internal capital market.

As mentioned above, we estimate the cash model in equation 2 to determine the target cash level of each firm. The analysis is carried out using firm-level data in the pre-crisis period 1998 to 2000. By doing so, we are able to provide a snapshot of firms with regard to their cash reserves prior to the financial crisis. The difference between the estimated target cash and observed cash balances is taken as the deviation from the optimal cash behaviour.

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[5] See Diamond (1991) for risks associated with short term debt.

We assign firms to the financial constrained (unconstrained) group if their observed cash holdings are below (above) their target level. To put it differently, constrained firms are those that undershoot their target cash levels. Given that readily available cash balances help firms avoid costly external finance and grant them the ability to take the opportunity of valuable investments, we expect that the sensitivity of constrained firms' investment to cash flow will be higher in the following crisis period. To test such a hypothesis, we move to the second stage of our empirical analysis, which involves the estimation of the investment as a function of cash flow and growth opportunities, given in equation 1, both for undershooting (constrained) and overshooting (unconstrained) groups.

3. Data

In this study we use a sample of non-financial Turkish companies that are publicly traded on the Istanbul Stock Exchange (ISE) over the period 1998-2002 covering both the pre-crisis and the crisis periods. We use two data sources for the compilation of our sample. The balance sheet, income statement and footnotes on the reported financial statements as well as information on market value and dividend payments are obtained directly from the ISE website.[6] Data on business group affiliation and firm age are collected manually from the yearbook of ISE companies, published by the Department of Documentation of ISE at the end of each year. This yearbook provides information on the first level of shareholding for all publicly traded companies in Turkey as well as the year of establishment, lists of names of owners, the numbers of declared shares and the corresponding percentage of ownership for each owner. After matching these two databases and excluding the outliers, we end up with a

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[6] See www.imkb.gov.tr.

sample of around 220 firms for our empirical analysis. This represents 79.13% of 278 non-financial firms on the stock market.

Table 1 summarizes the key descriptive statistics of the variables used in our analysis. We report descriptive statistics separately for both the pre-crisis (1998-2000) and the crisis (2001-2002) periods.[7] In general, the descriptive statistics differ significantly across the two periods. We observe that the mean value of investment expenditures during the crisis period is about 20% lower than that of the pre-crisis period (0.064 vs. 0.079). On average, cash reserves of firms are also lower during the crisis period (i.e. the average levels of cash holdings are 0.104 and 0.091 for the pre-crisis and the crisis periods respectively). Not surprisingly, the average value of the cash flow ratio which is 0.115 in the pre-crisis period falls dramatically during the crisis to 0.036. Additionally, growth opportunities become scarcer during the crisis period, with the drop of market-to book ratio from 2.093 to 1.608. There is also a slight decline in the average size of firms for the period 2001-2002. The economic downturn also causes notable changes in the capital structure and dividend structure of firms. Specifically, the proportion of firms that pay dividends to their shareholders decreases from 59.5% to 39.7%. Moreover, firms become relatively more levered, in that the average level of total leverage increases almost by 6.3%. A similar pattern is observed for the case of short term debt, which is not surprising given the high correlation between short term debt and total leverage for Turkish firms.[8]

[Insert Table 1 here]

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[7] We picked up the years 2001 and 2002 as the crises period by considering the information on the investment behaviour of firms in the *Balance of Payments Report* (December, 2004, page 30) by Central Bank of the Republic of Turkey.

[8] *Regular Report on Turkey's Progress towards Accession* (October, 2004) prepared by Commission of European Communities stresses the predominant usage of short term debt among Turkish real sector firms.

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4. Empirical Results

This section starts by presenting the results of the univariate analysis. We then report the results of the investment model of equation 1 incorporating financial constraint proxies in the analysis including cash holdings. We proceed by presenting the results for the optimal cash model, which is used to classify firms into constrained and unconstrained categories. Finally, we use this classification to re-estimate the investment model, arguing that the optimal cash model, which incorporates capital market imperfections, is a more appropriate way to separate firms into constrained and unconstrained groups.

4.1 Univariate analysis

Table 2 presents univariate comparisons of descriptive statistics, namely mean, median and standard deviation, of several firm specific characteristics by cash holding quartile. The objective of this task is to examine whether firms with low cash reserves (firms in the first quartile) differ from firms with high cash reserves (firms in the fourth quartile) with respect to their investment, dividend and capital structure decisions, and several other firm specific characteristics, such as growth opportunities, age, size and business affiliation. We conduct this investigation for both the pre-crisis and the crisis period.[9]

The univariate results lead to some interesting inferences. As expected, there is evidence that cash-rich firms invest more than cash-poor firms. This is particularly true in the crisis period, when average investment increases monotonically with cash holdings. However, in the pre-crisis period the univariate relation between cash holdings and investment is not

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[9] It is worth noting that we end up with almost the same firms in each quartile across the two periods. It seems that cash status of firms remains stable over time.

monotonic in the sense that the average investment expenditures increase in the first three quartiles but drop significantly in the fourth quartile. Also, the mean difference of investment between the first and the fourth quartiles is not statistically significant for the pre-crisis period. The interesting finding regarding investment, though, refers to the fact that cash rich firms' investment is not affected across the two periods (i.e. the average investment of cash rich firms for the pre-crisis and crisis period are 0.082 vs. 0.080 respectively), while investment decreases for the groups of firms belong to all other quartiles. The latter finding is consistent with our earlier argument that cash holdings help firms safeguard against future investment needs.

The univariate results also indicate that cash flows increase monotonically with cash holdings. Another interesting finding refers to the market-to-book ratio. In the pre-crisis period, firms that have attractive growth options have also high cash reserves (i.e. the mean difference of market-to book ratio across the two quartiles is statistically significant at the 1% level). In the crisis period, however, we do not observe a clear picture but still cash rich firms are those with greater growth options.

[Insert Table 2 here]

Furthermore, the results reveal that, for both periods, cash-poor firms are generally smaller and younger than cash-rich firms. The proportion of firms that pays dividends, and also of those that are affiliated with other corporations, increases with cash holdings. However, the positive univariate relationship between cash holdings and the business group dummy is not statistically significant for the pre-crisis period. Finally, short term debt decreases monotonically across the four cash quartiles, a result which is in line with the

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interpretation that cash reserves and external short term debt work as substitute sources for financing corporate investment.

4.2 Regression results

Table 3 presents the results of our baseline regression, where investment is regressed on cash flow and growth opportunities. Our primary concern here is the relationship between investment and cash flow. We split firms into financially constrained and unconstrained categories with respect to their size, age, dividend payments and business affiliation. We then compare the sign and the significance of the sensitivity coefficients across the two sample partitions. Also, we perform the same task by classifying firms on the basis of their cash holdings. As discussed earlier, we expect that investment expenditures of those firms classified as financially constrained exhibit greater sensitivity to cash flow.

Results are reported for two periods, 1998-2000 (pre-crisis) and 2001-2002 (crisis period). Given the expected significant wedge between the cost of internal and external finance in the financial crisis period, investment expenditures of firms are predicted to display greater sensitivity to cash flow in the crisis period regardless of the classification variable. To estimate our model we use average values for each variable and an ordinary least squares approach with robust standard errors to allow for heteroscedasticity across firms. Also, we control for industry-specific effects by including industry dummies in our empirical specification (industry specific intercepts are not reported for brevity).

In general, the empirical findings presented in Table 3 support our expectations regarding the relationship between cash flow and investment. Starting with the case of *all* firms (specification 1), we find that the hypothesized positive and statistically significant impact of cash flow on corporate investment is observed only in panel B (i.e. the crisis

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period). This is consistent with the conjecture that cash flows are more binding on investment at times when capital market imperfections are likely to be more severe, which is expected to be the case during a financial crisis period. The corresponding coefficient for the pre-crisis period is positive but insignificant.

Moving to the role that financial constraints play on the relationship between cash flow and investment, our results suggest that the hypothesized positive and significant investment-cash flow sensitivities of financially constrained firms is supported mostly in the crisis period. Specifically, when we split firms on the basis of size, dividend payouts, business group affiliation and cash holdings, constrained firms display positive and statistically significant sensitivities for the crisis period. On the contrary, for the pre-crisis period, the significant positive cash flow effect is observed only under the business group classification (Panel A, specification 5). Inconsistent with expectations, we observe a positive and statistically significant coefficient of cash flow for financially unconstrained firms in the pre-crisis period when firms are split according to their size (Panel A, specification 2). Finally, we are unable to provide evidence of a significant impact of growth opportunities on the corporate investment decisions of Turkish firms.

In short, our first set of regression results are generally in line with our expectations that investment expenditures of financially constrained firms are more sensitive to the availability of internal funds and the sensitivity is stronger in the financial crisis period. The result regarding the main interest of this paper, though, refers to the impact of cash holdings on investment-cash flow sensitivity of firms. In the spirit of Almeida et al. (2004), after classifying firms into constrained and unconstrained categories with respect to their cash holdings, we find evidence that investment of constrained firms is more sensitive to internal

funds, which is consistent with our earlier argument that cash rich firms usually have greater financial flexibility to exploit investment opportunities when they arise. Our empirical findings significantly support this view, especially during the crisis period when the fluctuations in cash flow are likely to be greater and the cost premium of external finance is significantly high.

[Insert Table 3 here]

So far we have mainly investigated the role of cash holdings as a direct proxy for financial constraints in determining the investment decision of firms. However, cash holdings may also have a significant effect on the relationship between financial constraints and investment-cash flow sensitivity. To the extent that cash reserves are useful as a hedging device against both firm-specific and external shocks, the sensitivity of investment expenditures of financially constrained firms to cash flow should be reduced with larger cash balances. To put it differently, the benefit from large cash balances will be higher for financially constrained firms than for unconstrained firms. For example, mature unconstrained firms that pay dividends to their shareholders and/or belong to an affiliated group of corporations are less likely to benefit from large cash balances for investment purposes (Fazzari et al., 1988). On the contrary, financially constrained firms have restricted access to external finance and that is why they rely primarily on accumulated cash reserves to finance investment. Consequently, we hypothesise that the sensitivity of investment expenditures of financially constrained firms to changes in their cash flows should be more significant for cash-poor firms. As for cash-rich firms, the impact of financial constraints on investment,

measured by the investment-cash flow sensitivity, should be either significantly reduced or become insignificant.

In Table 4 we empirically test such a hypothesis by investigating investment behavior of firms only in the financial crisis period. We do so because, as discussed earlier, capital market imperfections are expected to be more severe during financial crises, leading to higher external finance premium and, hence, a greater need for cash reserves in financing investment. Initially, we split the sample into cash poor firms (those firms with below median value of cash holdings) and cash rich firms (those firms with above median value of cash holdings). The empirical results support our expectations. Starting with the results of cash-rich firms, the coefficient of cash flow for all cash rich firms is positive but insignificant (Panel B, specification 1). Furthermore, the fact that cash flow has no significant impact on investment remains unchanged when we split firms into constrained and unconstrained groups using size, age, dividend payouts and business group affiliation (models 2 to 5). The estimated coefficient is always insignificant though its sign becomes negative for financially constrained firms when we identify them using age.

[Insert Table 4 here]

Panel A presents the results for the cash poor firms. In line with our a priori prediction, we find that the effect of cash flow on investment is positive and significant for all cash-poor firms (specification 1). However, the coefficient of cash flow is positive and statistically significant for constrained firms only under the size and business group criteria (specifications 2 and 5). That is, when accumulated reserves are at low levels, small firms, which are known of having difficulties in accessing external finance, and firms that are not affiliated with a

business group seem to be relying highly on their internally generated funds to finance investment. The results do not support our hypothesis when age is used as a classification criterion. Surprisingly, the positive cash flow effect is observed for unconstrained firms under this classification.[10] Also, for the dividend classification scheme, the results point to a positive investment - cash flow sensitivity for the group of constrained firms, which is in line with our expectations. However, the estimated coefficient of cash flow in that model is statistically insignificant. Finally, in line with our earlier findings, the results do not point to a significant relation between growth opportunities and investment for our sample of firms regardless of their cash status.

Overall, the evidence reported in this table supports the view that cash balances of firms can act as an effective hedging device for firms during an economic downturn. Moreover, it seems that the hedging role of cash reserves is most valuable for financially constrained firms. These results support the argument of Acharya et al. (2005) that financial constraints create incentives for hedging and that cash constitutes an important hedging instrument as it enables constrained firms to invest more in states of the world in which borrowing capacity is low.

4.3 Deviations from the optimal cash level and the investment decision

In this section we use an optimal cash model as a basis to classify firms into financially constrained and unconstrained. To perform our task we use a two stage estimation procedure. In the first stage we estimate the cash holding model of equation 2 (see section 2.2) for the period 1998-2000 (pre-crisis period) and separate firms into constrained and unconstrained categories based on their deviation from the estimated optimal cash level. In the second stage

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[10] This result, together with the findings presented in Table 3, raise some doubts regarding the validity of an age variable for separating the firms into constrained and unconstrained, at least for the case of Turkey.

we estimate the investment equation 1 (see section 2.1) for the groups of constrained and unconstrained firms as identified by the optimal cash model.

Starting with the cash model of stage 1, we follow the cross sectional average methodology of Rajan and Zingales (1995) for the estimation. In particular, the dependent variable is measured in year 2000, while for all the independent variables average past values for years 1998 and 1999 are used to control for potential endogeneity problems. Such methodology also helps mitigate problems that may emanate from extreme values or short term fluctuations in one year. The cash regression includes industry dummies that control for industry membership.

In Table 5 we present the results regarding the empirical determinants of cash holdings of firms. The results show that cash flows are positively and highly significantly associated with cash balances. This result supports the view that firms accumulate more cash as cash flows increase. Also, the results point to a non-monotonic relationship between short term debt and cash holdings. Specifically, short term debt has initially a negative effect on cash reserves. We interpret this finding as evidence that, at low and intermediate levels, short term debt is used as a substitute of holding cash (Almeida, 2004). However, the coefficient of the square term of short term debt is positive and statistically significant. This finding is consistent with the view that an increase in the levels of short term debt causes an increase in the likelihood of financial distress, leading firms to accumulate cash reserves to minimize the risk of costly bankruptcy (see, e.g., Guney et al., 2006).

[Insert Table 5 here]

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The coefficient of the proxy for growth opportunities (MKTBOOK) is positive and statistically significant. That is, firms with more attractive growth opportunities tend to hold larger amounts of cash reserves in order not to be obliged to pass up valuable growth options in cases of low cash flows and costly external funds. The proxy for firm size has a negative and statistically significant coefficient (only at the 10% level though), which is again in line with the view that larger firms are subject to less severe asymmetric information problems and, therefore, have greater access to capital markets, leading to a lower required level of optimal cash (see, e.g., Ozkan and Ozkan, 2004; Opler et al., 1999). The rest of the coefficients of the cash model have the hypothesized sign but they are statistically insignificant. In summary, our results support the view that capital market imperfections seem to be playing an important role in determining cash holding incentives.

As mentioned above, we use the results from the cash model to split firms into financially constrained and unconstrained groups. To this end, we use the estimated residuals and assign firms to the financially constrained group if their observed cash holdings are below the estimated optimal cash level (i.e. the residual is negative). These firms are defined as undershooters. On the contrary, firms with a level of cash holdings that is above the optimal cash level (i.e. when the residual is positive) are assigned to the financially unconstrained group and defined as overshooters. It is again important to note that our cash model incorporates the capital market imperfections used earlier in determining whether firms were constrained or unconstrained.

Armed with this classification scheme for financial constraints, we move to the second stage of our estimation procedure, which involves the estimation of an investment model for the two group partitions. The empirical results of stage two are presented in panel A of Table

6 where we compare the sign and the significance of the coefficient of cash flow across undershooters and overshooters.[11] The results support our earlier findings that undershooters (i.e. constrained firms) firms indicate significantly greater investment - cash flow sensitivities.

As a robustness check, we repeat our analysis for stage 2 after using a stricter categorization criterion for classifying firms. Specifically, firms that simultaneously undershoot their optimal cash level and have a level of cash holdings that lies below the median value of cash in the cash distribution are called as extreme undershooters. Likewise, firms that simultaneously overshoot their optimal cash level and have a level of cash holdings that lies above the median value of cash in the cash distribution are called extreme overshooters. This approach of classifying the firms focuses only on the groups of firms that are very likely to be constrained and unconstrained and, in this way, minimizes the probability of drawing misleading inferences just due to misclassification. For example, the optimal cash model itself relies only on whether firms overshoot or undershoot their optimal cash level. However, firms that deviate from their optimal cash level do not necessarily fall above or below the sample median cash level. The results of such a task, as presented in panel B of Table 6, confirm our earlier findings that the investment of financially constrained firms (i.e. extreme undershooters) is more sensitive to cash flows than unconstrained firms (i.e. extreme overshooters).[12]

Overall, the results provide strong evidence that investment - cash flow sensitivity is greater for financially constrained firms. The evidence also supports the view that cash

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[11] The number of firms in Table 6 drops to 215 from 217 as reported in Table 5, since two firms disappear during the financial crisis period.
[12] The total number of firms for Panel B has dropped to 149 from 215, as in Panel A, since 66 firms could not satisfy the requirement that they are either above the target and the sample median or below the target and the sample median.

holdings are valuable to companies for hedging purposes, and especially during recession phases of the business cycle (e.g. during a financial crisis).

[Insert Table 6 here]

5. Conclusion

In this paper we examine how cash balances of firms affect their investment policy. By combining the literature on optimal choice of cash holdings with the literature on corporate investment, we are able to shed more light on the investment policy of firms in an emerging market. Moreover, by investigating the role of cash in determining investment during a financial crisis period, we are also able to emphasize an important aspect of cash, which has been explored partially in the literature. It seems that cash reserves of firms can be used effectively as a hedging device against the fluctuations in cash flow and financial constraints, which restrict the ability of firms to undertake profitable investment opportunities. When using cash holdings as a financial constraint proxy, we find that cash-poor firms' investment expenditures exhibit a greater sensitivity to cash flow changes. In line with this result, our results also reveal that the impact of financial constraints on investment also depends on the cash status of firms. That is, constrained firms that undershoot their optimal cash reserves suffer most from shortfalls in cash flows. On the contrary, the investment expenditures of firms that hold desired level of cash reserves, or overshoot their target holdings, are not sensitive to the availability of internal funds.

Our findings also provide insights into our understanding of the investment decisions of firms operating in an emerging market. We show that among the proposed financial constraint proxies, firm size and business group affiliation of firms are the significant characteristics of

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Turkish firms, which can be used to determine those firms that are likely to be financially constrained.

Obviously, the evidence documented in this paper is based on the analysis of firms in only one country. More analysis is needed to explore the role of cash reserves in determining corporate investment in emerging markets, in particular in those markets that experienced a financial crisis in the past. To do so, one needs to incorporate data covering both the pre-crisis and crisis periods across several countries. Such an analysis would also allow us to investigate the influence of country-specific characteristics on investment and the potential interactions between these characteristics and firm-specific ones. This is an area for future research.

References

Acharya V, Almeida H, Campello M. Is cash negative debt? A hedging perspective on corporate financial policies. London Business School IFA Working Paper Series 2005.

Almeida H, Campello M, Weisbach MS. The cash flow sensitivity of cash. Journal of Finance 2004; 59; 1777-1804.

Arslan Ö, Erdogan M. Determinants of capital structure: new evidence from an emerging market by using dynamic panel data. Eurasian Review of Economics and Finance 2005; 1; 1-9.

Berger AN, Udell GF. Relationship lending and lines of credit in small firm finance. Journal of Business 1995; 68; 351-381.

Bernanke BS, Gertler M. Agency costs, net worth, and business fluctuations. American Economic Review 1989; 79; 14-31.

Buğra A, Üsdiken B. Societal variations in state dependent organizational forms: the South Korean chaebol and Turkish holding company. EMOT Workshop; Helsinki, Finland 1995.

Central Bank of the Republic of Turkey. Balance of payments report. http://www.tcmb.gov.tr December, 2004.

Cleary S. The relationship between firm investment and financial status. Journal of Finance 1999; LIV; 673-692.

Commission of European Communities. Regular report on Turkey's progress towards accession. http://europa.eu.int/comm/enlargement/ report_2004/pdf/rr_tr_2004_en.pdf October, 2004.

Demirgüç-Kunt A, Maksimovic V. Institutions, financial markets, and firm debt maturity. Journal of Financial Economics 1999; 54; 295-336.

Diamond DW. Debt maturity structure and liquidity risk. Quarterly Journal of Economics 1991; 106; 709-737.

Fazzari S, Hubbard RG, Petersen B. Financing constraints and corporate investment. Brookings Papers on Economic Activity 1988; 2; 141–195.

Fazzari S, Hubbard RG, Petersen B. Investment-cash flow sensitivities are useful: a comment on Kaplan and Zingales. Quarterly Journal of Economics 2000; CXV; 707–712.

Gelos RG, Werner AM. Financial liberalization, credit constraints, and collateral: investment in the Mexican manufacturing sector. Journal of Development Economics 2002; 67; 1-27.

Gertler M, Gilchrist S. Monetary policy, business cycles, and the behavior of small manufacturing firms. Quarterly Journal of Economics 1994; 59; 309-340.

Guney Y, Ozkan A, Ozkan N. Additional international evidence on corporate cash holdings. Journal of Multinational Financial Management 2006 (Forthcoming).

Healy PM, Palepu KG. Market rationality and dividend announcements. Journal of Financial Economics 1988; 21; 149-176.

Hoshi T, Kashyap A, Scharfstein D. Corporate structure, liquidity, and investment: evidence from Japanese industrial groups. Quarterly Journal of Economic 1991; 106; 33–60.

Kadapakkam PR, Kumar PC, Riddick LA. The impact of cash flows and firm size on investment: The international evidence. Journal of Banking and Finance 1998; 22; 293-320.

Kaplan S, Zingales L. Do financing constraints explain why investment is correlated with cash flow? Quarterly Journal of Economics 1997; CXII; 169-215.

Kaplan S, Zingales L. Investment-cash flow sensitivities are not valid measures of financing constraints. Quarterly Journal of Economics 2000; 115; 169-215.

Khurana IK, Martin X, Pereira R. Financial development and the cash flow sensitivity of cash. Journal of Financial and Quantitative Analysis 2006 (Forthcoming).

Laeven L. Does financial liberalization reduce financing constraints? Financial Management 2003; Spring; 5-31.

La Porta R, Lopez-de-Silanes F, Shleifer A, Vishny R. Legal determinants of external finance. Journal of Finance 1997; 52; 1131-1150.

La Porta R, Lopez-de-Silanes F, Shleifer A, Vishny R. Law and finance. Journal of Political Economy 1998; 106; 1113-1155.

Love I. Financial constraints: international evidence from the structural investment model. Review of Financial Studies 2003; 16; 765-791.

Opler T, Pinkowitz L, Stulz R, Williamson R. The determinants and implications of corporate cash holdings. Journal of Financial Economics 1999; 52; 3–46.

Ozkan A, Ozkan N. Corporate cash holdings: an empirical investigation of UK companies. Journal of Banking and Finance 2004; 28; 2103-2134.

Ozkan FG. Currency and financial crises in Turkey 2000-2001: bad fundamentals or bad luck? World Economy 2005; 28; 541-572.

Rajan R, Zingales L. What do we know about capital structure? Some evidence from international data. Journal of Finance 1995; 50; 1421-1460.

Yurtoglu BB. Ownership, control and performance of Turkish listed firms. Empirica 2000; 27; 193-222.

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Table 1
Descriptive Statistics for key variables before and during the financial crisis in Turkey

	Panel A: Pre-crisis Period (1998-2000)					
	Mean	Min	25%	Median	75%	Max
INVESTMENT	0.079	0.002	0.031	0.062	0.108	0.367
CASH FLOW	0.115	-1.514	0.044	0.122	0.211	0.615
MKTBOOK	2.093	0.510	1.323	1.678	2.288	10.240
SIZE	6.906	5.472	5.823	6.897	7.197	8.626
AGE	26.18	0.5	17	26	33	88
DIVIDEND	0.595	0	0	1	1	1
BUSINESS GROUP	0.477	0	0	0	1	1
CASH HOLDING	0.104	0.000	0.020	0.055	0.153	0.854
LEVERAGE	0.552	0.022	0.404	0.576	0.703	1
SHORT TERM DEBT	0.430	0.022	0.291	0.402	0.555	1
	Panel B: Crisis Period (2001-2002)					
	Mean	Min	25%	Median	75%	Max
INVESTMENT	0.064	0	0.013	0.041	0.086	0.451
CFLOW	0.036	-1.505	-0.040	0.078	0.195	0.741
MKTBOOK	1.608	0.545	1.073	1.370	1.874	6.397
SIZE	6.854	5.516	6.398	6.852	7.201	8.647
AGE	28.53	2.5	18.5	28.5	35.5	90.5
DIVIDEND	0.357	0	0	0	1	1
BUSINESS GROUP	0.464	0	0	0	1	1
CASH HOLDING	0.091	0.000	0.014	0.108	0.590	0.754
LEVERAGE	0.587	0.017	0.372	0.593	0.796	1
SHORT TERM DEBT	0.457	0.016	0.267	0.423	0.615	1

Notes: This Table provides descriptive statistics for the main variables used in our analysis. *INVESTMENT* is measured as the ratio of investment in fixed assets to total assets. *CFLOW* is sum of earnings before interest, tax and depreciation over total assets. *MKTBOOK* ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets. *SIZE* is the inflation adjusted natural logarithm of total assets. *AGE* represents the number of years the firm has been operating. *DIVIDEND* is a dummy variable that takes the value of one if the firm pays dividend for that year and zero otherwise. *BUSINESS GROUP* is a dummy variable that takes the value of one if the firm is affiliated to a business group and zero otherwise. *CASH HOLDING* is the ratio of cash and equivalents to total assets. *LEVERAGE* is the ratio total debt to total assets. *Finally, SHORT TERM DEBT* is the ratio of short term book debt to total assets.

Table 2
Firm characteristics by cash holdings quartiles

	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	t-test	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	t-test
	Panel A: Pre-crisis Period (1998-2000)					*Panel B: Crisis Period (2001-2002)*				
CASH	0.010	0.036	0.092	0.278	-12.49***	0.004	0.025	0.075	0.289	-12.48***
	0.010	*0.032*	*0.086*	*0.223*		*0.003*	*0.024*	*0.075*	*0.212*	
	[0.006]	[0.011]	[0.026]	[0.150]		[0.003]	[0.009]	[0.023]	[0.169]	
INVESTMENT	0.064	0.074	0.097	0.082	-0.73	0.052	0.054	0.067	0.080	-2.03**
	0.055	*0.064*	*0.073*	*0.065*		*0.027*	*0.041*	*0.041*	*0.049*	
	[0.051]	[0.062]	[0.088]	[0.073]		[0.065]	[0.049]	[0.085]	[0.078]	
CFLOW	-0.036	0.087	0.144	0.264	-7.03***	-0.127	-0.026	0.078	0.212	-6.45***
	0.047	*0.085*	*0.127*	*0.265*		*-0.007*	*0.065*	*0.084*	*0.196*	
	[0.291]	[0.120]	[0.103]	[0.129]		[0.351]	[0.334]	[0.192]	[0.168]	
MKTBOOK	1.734	1.846	1.982	2.802	-3.77***	1.641	1.546	1.510	1.719	-0.43
	1.493	*1.500*	*1.749*	*2.128*		*1.365*	*1.232*	*1.323*	*1.465*	
	[1.054]	[1.059]	[0.988]	[1.867]		[0.957]	[0.880]	[0.617]	[0.920]	
SIZE	6.803	6.877	6.924	7.018	-2.18**	6.692	6.825	6.917	7	-2.76***
	6.842	*6.796*	*6.899*	*7.056*		*6.680*	*6.810*	*6.912*	*6.988*	
	[0.470]	[0.562]	[0.511]	[0.602]		[0.513]	[0.522]	[0.577]	[0.638]	
AGE	22.018	25.268	29.718	27.705	-2.48**	25.482	30.255	28.945	30.045	-2.07**
	22	*26.5*	*29*	*28*		*25.5*	*30.5*	*29.5*	*31.5*	
	[12.04]	[13.27]	[14.99]	[11.99]		[11.077]	[16.667]	[13.263]	[11.964]	
DIVIDEND	0.382	0.536	0.618	0.839	-5.47***	0.110	0.291	0.364	0.673	-7.35***
	0.000	*1.000*	*1.000*	*1.000*		*0.000*	*0.000*	*0.000*	*1.000*	
	[0.490]	[0.503]	[0.490]	[0.371]		[0.315]	[0.458]	[0.485]	0.474	
BUSINESS GROUP	0.455	0.375	0.564	0.518	-0.56	0.400	0.436	0.436	0.564	-1.72*
	0.000	*0.000*	*1.000*	*1.000*		*0.000*	*0.000*	*0.000*	*1.000*	
	[0.503]	[0.489]	[0.501]	[0.504]		[0.494]	[0.501]	[0.501]	[0.501]	
SHORT TERM DEBT	0.544	0.431	0.415	0.330	5.70***	0.567	0.504	0.431	0.328	5.49***
	0.543	*0.414*	*0.403*	*0.297*		*0.537*	*0.437*	*0.448*	*0.287*	
	[0.221]	[0.191]	[0.152]	[0.177]		[0.264]	[0.272]	[0.192]	[0.186]	

Notes: This table provides univariate mean comparisons of firm specific characteristics by cash holdings quartiles. It also provides median comparisons (italic format) and standard deviation comparisons (bracketed). CA*SH* is the ratio of cash and equivalents to total assets. *INVESTMENT* is measured as the ratio of investment in fixed assets to total assets. *CFLOW* is sum of earnings before interest, tax and depreciation over total assets. *MKTBOOK* ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets. *SIZE* is the inflation adjusted natural logarithm of total assets. *AGE* represents the number of years the firm has been operating. *DIVIDEND* is a dummy variable that takes the value of one if the firm pays dividend for that year and zero otherwise. *BUSINESS GROUP* is a dummy variable that takes the value of one if the firm is affiliated to a business group and zero otherwise. Finally*, SHORT TERM DEBT* is the ratio of short term book debt to total assets. For panel B, we use cash holdings as measured in 2000 to split the sample into quartiles. We are doing so in order our univariate analysis to be consistent with the multivariate one. However, the results do not change materially when we use the average value of cash for the period 2001-2002. The *t*-statistic is for the difference of means between the first and the fourth quartiles. Definitions for all the variables are provided in Table 1. ***, ** and * indicate coefficient is significant at the 1%, 5% and 10% level respectively.

Table 3

The Cash Flow Sensitivity of Investment: Baseline Regression Model

	Panel A:Pre-crisis perıod (1998-2000)					*Panel B: Crisis period (2001-2002)*				
Dependent Varıable	Independent Variables					Independent Variables				
INVESTMENT	CFLOW	MKTBOOK	CONSTANT	R^2	N	CFLOW	MKTBOOK	CONSTANT	R^2	N
1. ALL FIRMS	0.177	0.004	0.069	0.10	222	0.031	-0.000	0.063	0.12	224
	(0.68)	(1.21)	(8.37)***			(2.51)**	(-0.01)	(6.31)***		
2. SIZE										
Constrained	0.011	-0.004	0.085	0.08	111	0.050	-0.003	0.065	0.18	112
	(0.33)	(-0.54)	(5.10)***			(1.71)*	(-0.19)	(2.86)***		
Unconstrained	0.069	0.003	0.065	0.37	111	0.014	0.001	0.063	0.19	112
	(1.90)*	(0.71)	(6.68)***			(0.93)	(0.15)	(5.61)***		
3. AGE										
Constrained	-0.032	0.005	0.063	0.28	111	0.022	0.001	0.056	0.18	112
	(-1.51)	(0.77)	(4.78)***			(0.97)	(0.13)	(3.28)***		
Unconstrained	0.072	-0.001	0.080	0.11	111	0.025	-0.003	0.071	0.13	112
	(1.26)	(-0.23)	(5.73)***			(0.78)	(-0.33)	(4.42)***		
4. DIVIDEND										
Constrained	-0.000	0.004	0.070	0.24	90	0.033	0.002	0.060	0.20	144
	(-0.02)	(0.40)	(4.00)***			(2.19)**	(0.25)	(4.35)***		
Unconstrained	0.077	0.002	0.062	0.17	132	-0.001	0.001	0.066	0.11	80
	(1.30)	(0.59)	(4.88)***			(-0.01)	(0.18)	(2.78)***		
5. BUSINESS GROUP										
Constrained	0.113	-0.002	0.080	0.19	116	0.043	-0.001	0.072	0.18	120
	(3.24)***	(-0.58)	(7.57)***			(1.83)*	(-0.19)	(5.34)***		
Unconstrained	-0.044	0.014	0.049	0.22	106	0.023	0.006	0.043	0.19	104
	(-1.81)*	(2.11)**	(3.28)***			(1.61)	(0.70)	(2.88)***		
6. CASH HOLDING										
Constrained	0.014	0.002	0.066	0.15	111	0.047	0.002	0.062	0.21	112
	(0.47)	(0.34)	(5.82)***			(2.54)**	(0.27)	(4.10)***		
Unconstrained	-0.046	0.006	0.085	0.16	111	0.007	-0.009	0.079	0.13	112
	(-0.60)	(1.25)	(4.77)***			(0.15)	(-1.58)	(5.24)***		

Notes: This table shows the cash flow sensitivity of investments. The sample is divided into two partitions: pre-crisis period (1998-1999) and post crisis period (2001-2002). *INVESTMENT* is measured as the ratio of investment in fixed assets to total assets. *CFLOW* is sum of earnings before interest, tax and depreciation over total assets. *MKTBOOK* ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets. *SIZE* is the inflation adjusted natural logarithm of total assets. *AGE* represents the number of years the firm has been operating. *DIVIDEND* is a dummy variable that takes the value of one if the firm pays dividend for that year and zero otherwise. *BUSINESS GROUP* is a dummy variable that takes the value of one if the firm is affiliated to a business group and zero otherwise. *CASH HOLDING* is the ratio of cash and equivalents to total assets. Firms are classified into constrained and unconstrained categories with respect to their size, age, dividend ratio, business group and cash holdings as explained in section 2.1. All regressions include industry dummies. t-statistic values are reported in parentheses. We use consistent to heteroscedasticity standard errors. ***, ** and * indicate coefficient is significant at the 1%, 5% and 10% level respectively.

Table 4

The Cash Flow Sensıtıvıty of Investment across Cash-Poor and Cash-Rich firms: Crisis period (2001-2002)

| | *Panel A:Cash-Poor Firms* | | | | | *Panel B:Cash-Rich Firms* | | | | |
| Dependent Varıable | Independent Varıables | | | | | Independent Varıables | | | | |
INVESTMENT	CFLOW	MKTBOOK	CONSTANT	R^2	N	CFLOW	MKTBOOK	CONSTANT	R^2	N
1. ALL FIRMS	0.047	0.002	0.062	0.21	112	0.007	-0.009	0.079	0.13	112
	(2.54)**	(0.27)	(4.10)***			(0.15)	(-1.58)	(5.24)***		
2. SIZE										
Constraıned	0.062	0.004	0.063	0.33	56	0.015	-0.028	0.092	0.30	56
	(2.19)**	(0.16)	(1.50)			(0.51)	(-2.84)***	(5.22)***		
Unconstraıned	0.036	0.007	0.052	0.30	56	-0.035	-0.012	0.104	0.28	56
	(1.63)	(0.90)	(3.21)***			(-0.29)	(-1.61)*	(3.39)***		
3. AGE										
Constraıned	0.025	0.005	0.045	0.29	56	-0.033	-0.008	0.084	0.25	56
	(0.85)	(0.28)	(1.93)*			(-0.40)	(-0.69)	(3.78)***		
Unconstraıned	0.106	0.011	0.058	0.33	56	0.005	-0.010	0.080	0.15	56
	(2.48)**	(1.56)	(3.17)***			(0.09)	(-1.37)	(3.75)***		
4. DIVIDEND										
Constraıned	0.030	-0.001	0.064	0.29	91	0.056	-0.003	0.066	0.26	53
	(1.34)	(-0.07)	(2.79)***			(0.87)	(-0.45)	(4.46)***		
Unconstraıned	-0.916	0.033	0.136	0.57	21	0.010	-0.017	0.090	0.21	59
	(-0.85)	(1.09)	(1.13)			(0.12)	(-1.64)	(3.36)***		
5. BUSINESS GROUP										
Constraıned	0.071	-0.001	0.076	0.35	67	0.011	-0.011	0.088	0.15	53
	(2.40)**	(-0.20)	(4.34)***			(0.14)	(-0.71)	(2.54)**		
Unconstraıned	0.036	0.023	0.018	0.30	45	-0.005	-0.005	0.069	0.21	59
	(1.40)	(0.91)	(0.53)			(-0.08)	(-0.65)	(3.12)***		

Notes: This table shows the cash flow sensitivity of investments. The sample is divided in two partitions: cash poor firms (panel A), those firms with cash level that lies below the median value of cash in the cash distribution, and cash-rich firms, (Panel B), those firms with cash level that lies above the median value of cash in the cash distribution. *INVESTMENT* is measured as the ratio of investment in fixed assets to total assets. *CFLOW* is sum of earnings before interest, tax and depreciation over total assets. *MKTBOOK* ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets. *SIZE* is the inflation adjusted natural logarithm of total assets. *AGE* represents the number of years the firm has been operating. *DIVIDEND* is a dummy variable that takes the value of one if the firm pays dividend for that year and zero otherwise. *BUSINESS GROUP* is a dummy variable that takes the value of one if the firm is affiliated to a business group and zero otherwise. Firms are classified into constrained and unconstrained categories with respect to their size, age, dividend ratio, business group as explained in section 2.1. All regressions include industry dummies. t-statistic values are reported in parentheses. We use consistent to heteroscedasticity standard errors. ***, ** and * indicate coefficient is significant at the 1%, 5% and 10% level respectively

Table 5
Cross sectional regressions of cash holdings on several firm characteristics

Dependent Variable: *CASH HOLDINGS*

Independent variables	*Predicted*	*Coefficient*
CONSTANT	+/-	0.421 (2.49)**
CFLOW	+	0.235 (3.36)***
SHORT TERM DEBT	-	-0.557 (-3.51)***
SHORT TERM DEBT SQUARED	+	0.508 (3.35)***
MKTBOOK	+	0.117 (1.76)*
INVESTMENT	+	0.166 (0.12)
SIZE	-	-0.037 (-1.67)*
AGE	-	-0.001 (-0.86)
DIVIDEND	+/-	0.014 (0.57)
BUSINESS GROUP	+	0.015 (0.76)
Industry Dummies		**Yes**
R^2		0.39
Number of firms		217

Notes: This table presents cross-sectional regressions predicting cash holdings over the period 1998-2000. *CASH HOLDINGS,* the dependent variable, is the ratio of cash and equivalents to total assets. *CFLOW* is sum of earnings before interest, tax and depreciation over total assets. *SHORT TERM DEBT* is the ratio of short term book debt to total assets. *SHORT TERM DEBT SQUARED* is square value of *SHORT TERM DEBT. MKTBOOK* ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets. *INVESTMENT* is measured as the ratio of investment in fixed assets to total assets. *SIZE* is the inflation adjusted natural logarithm of total assets. *AGE* represents the number of years the firm has been operating. *DIVIDEND* is a dummy variable that takes the value of one if the firm pays dividend for that year and zero otherwise. *BUSINESS GROUP* is a dummy variable that takes the value of one if the firm is affiliated to a business group and zero otherwise. All regressions include industry dummies. t-statistic values are reported in parentheses. We use consistent to heteroscedasticity standard errors. ***, ** and * indicate coefficient is significant at the 1%, 5% and 10% level respectively.

Table 6

The Cash Flow Sensitivity of Investment

Dependent Variable : **INVESTMENT**

Independent Variables	*Panel A*		*Panel B*	
	Under-shooters	Over-shooters	Extreme Undershooters	Extreme Overshooters
CFLOW	0.042	0.032	0.044	-0.046
	(2.60)***	(1.55)	(1.83)*	(0.57)
MKTBOOK	0.001	-0.008	-0.004	-0.001
	(0.25)	(-1.38)	(-0.47)	(-0.11)
Constant	0.054	0.083	0.060	0.087
	(4.48)***	(5.51)***	(3.44)***	(3.78)***
Industry Dummies	**Yes**	**Yes**	**Yes**	**Yes**
R^2	0.20	0.12	0.24	0.17
Number of firms	124	91	82	67

Notes: This table shows the cash flow sensitivity of investments for the crisis period (2001-2002) after using an optimal cash model to classify firms into constrained and unconstrained categories. *INVESTMENT* is measured as the ratio of investment in fixed assets to total assets. *CFLOW* is sum of earnings before interest, tax and depreciation over total assets. *MKTBOOK* ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets. *Undershooters* (*Overshhoters*) are those firms whose actual cash level lies below (above) their optimal one. *Extereme Undershooters (Extreme Overshooters)* are those firms that not only deviate negatively (positively) from their cash targets but also hold cash that lies below (above) the median cash level in the cash distribution. All regressions include industry dummies. t-statistic values are reported in parentheses. For the estimation we use consistent to heteroscedasticity standard errors. ***, ** and * indicate coefficient is significant at the 1%, 5% and 10% level respectively.