The Impact of Financial Structure on Firms' Financial Constraints: A Cross-Country Analysis☆

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Abstract

We estimate firms' cash flow sensitivity of cash to empirically test how the financial system's structure and activity level influence their financial constraints. For this purpose we merge Almeida et al. (2004), a path-breaking design for evaluating a firm's financial constraints, with Levine (2002), who paved the way for comparative analysis of financial systems around the world. We conjecture that a country's financial system, both in terms of its structure and its level of development, should influence the cash flow sensitivity of cash of constrained firms but leave unconstrained firms unaffected. We test our hypothesis with a large international sample of 80,000 firm-years from 1989 to 2006. Our findings reveal that both the structure of the financial system and its level of development matter. Bank-based financial systems provide constrained firms with easier access to external financing. (JEL Classification Numbers: G32, G30)

Key words: financial constraints, financial system, cash flow sensitivity of cash

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1. Introduction

For many years, financial theory has stressed the role of financial constraints on firms' behavior, but it has rarely considered how obstacles to external financing may vary across different financial systems. Although stock markets can play a very important role in meeting firms' financing needs, a strong and solid banking system may be a workable alternative to meet firms' external funding requirements. Different corporate governance systems, different regimes of investor protection, and different corporate financing structures may all significantly influence agency conflicts, recognized as obstacles to external financing. Thus, the structure and the extent of the financial system of a specific country may be key determinants of the financial constraints that its firms face.

Anecdotal evidence documents significant differences in the structure of the financial macroeconomic environment. For instance, in 2005 the ratio of private credit by deposit money banks to GDP in Germany (1.23) is 2.5 times higher than the same indicator in the USA (0.48). Exactly the opposite is observed if we consider the stock market capitalization to GDP ratio for the same year: these indicators for USA and Germany equal 1.35 and 0.43, respectively. A natural question arises: in which countries are firms less likely to face obstacles in their access to external financing?

To address this issue, we begin by observing the liquidity policy of firms and relating it to the degree of financial frictions. While the traditional definition of financial constraints defined in terms of investment–cash flow sensitivity is highly controversial (e.g. Fazzari et al. (1988) and Kaplan and Zingales (1997)), we follow the recently developed approach of Almeida et al. (2004). They consider a firm as financially constrained if it accumulates cash out of its cash flow. Second, we interact cash flow with proxies for the country-specific financial structure. The latter measures reflect the relative importance (measured by activity or size) of the stock market compared to that of the banking system (Levine (2002)). Finally, we consider whether our results are robust after controlling for the level of development of the financial system.

We employ annual firm-level manufacturing sector data obtained from Global COMPUSTAT. The data provide detailed financial information for 6,970 firms located in 36 countries over the 1988–2006 period. This dataset is matched to country-level financial data from Beck et al. (2000) which are utilized to compute financial structure and financial development proxies.

The results of the paper can be summarized as follows. Our empirical model quantifies the degree to which the effects of cash flow on cash may be strengthened or weakened by the structure of the financial system. We observe that companies located in market-based financial systems are more likely to be financially constrained. In contrast to earlier research such as Levine (2002), we find a significant role for financial structure while the level of financial development maintains its significance in explaining financial frictions. Hence, reduction of financial constraints, the main mechanism for turning stimuli from the financial sector into economic growth, depends on both the structure and the development of the financial system.

In the next section, we briefly review the financial constraints literature. Section 3 presents our empirical model and describes the data. The empirical results in Section 4 show that financial structure and development are important determinants of the degree of financial frictions. Section 5 concludes.

2. Literature Review

Researchers have expended considerable effort in trying to understand the nature of financial constraints faced by firms. Information asymmetry, moral hazard and agency conflicts negatively affect the firm's borrowing capacity, which may cause an underinvestment problem. Fazzari et al. (1988) initiate a new stream of literature on financial constraints and propose to employ a measure of investment-cash flow sensitivity as a gauge of financial frictions. If firms' access to external capital markets is limited, their reliance on internal resources implies that internally generated cash flows will influence their investment path.[1]

However, Kaplan and Zingales (1997) argue that these results are controversial, as they find that "those firms classified as less financially constrained exhibit a significantly greater investment–cash flow sensitivity than those firms classified as more financially constrained" (p.169).[2] This debate was further fueled by the investigations of Fazzari et al. (2000) and Kaplan and Zingales (2000). Doubts about the measurement of financial constraints brought forth Almeida and Campello (2002) and Moyen (2004), which broaden the analysis from the traditional cash flow–investment paradigms.

The innovative approach of Almeida et al. (2004) is based on the concept that scrutiny of the firm's financial management should indicate financial market imperfections earlier and more clearly than the observed path of capital investment expenditures, which typically exhibits time-to-build lags. In the presence of financial frictions, savings out of a firm's generated cash flow reflects the tradeoff between present and future investment opportunity that constrained firms face. Along these lines they study the relationship between the firm's generated cash flow and its cash balances. Data on US firms reveal that financially constrained firms exhibit a relatively higher propensity to save cash out of their cash flows.

A natural question is, therefore, whether the results of Almeida et al. (2004) are country-specific. Country-comparison studies on the relation between financial constraints and the financial environment are few in number and are exclusively based on the traditional proxy for external financing restrictions: the cash flow sensitivity of capital investment expenditures. For instance, Mairesse et al. (1999) examine the cash flow

[1]See also Gilchrist and Himmelberg (1996) and Hoshi et al. (1991).

[2]For instance, see also Cleary (1999), Gomes (2001), and Cummings et al. (2006).

sensitivity of equipment and R&D investments of American, French and Japanese companies. They find that both types of investment are more strongly affected by cash flow for US companies operating in a market-based financial environment compared to the firms located in the bank-based (Japanese) or mixed (French) financial systems. Similar evidence is found in results from Bond et al. (1999)) for German (bank-based) and British (market-based) financial systems. In addition, Bond et al. (2003) confirm the finding of a higher cash flow sensitivity (stronger financing restrictions) in market-based financial systems employing data for Belgian, French, German and British companies. However, to the best of our knowledge, evidence on how the financial architecture affects a less ambiguous indicator for the existence of financial constraints—the cash flow sensitivity of cash—has not been produced.[3]

The above discussion suggests a scarcity of rigorous evidence on financial constraints in economies with different financial architecture. Most of the previous research has been implemented using US data and much less is known about other countries. A particularly interesting issue is whether the severity of obstacles in credit markets is correlated with the degree of a country's financial development. Previous research has shown that financial development has an effect on the severity of financial constraints facing firms (Love (2003)), but there have been very few firm-level studies investigating the joint effect of structure and development on the degree of financial frictions.[4,5] A proper inquiry into this issue requires a cross-country approach based on similar empirical methodologies.

[3]See Levine (2002) for a detailed review of the literature describing differences of market-based and bank-based financial systems.

[4]Using firm level data, Demirgüç-Kunt and Maksimovic (2002) find that financial development is robustly linked with access to external markets, but there is no support for either the bank-based or market-based view.

[5]Khurana et al. (2006) study the linkage between financial development and the cash flow sensitivity of cash, but they do not focus on the nature of a more highly developed financial system as we do in this study.

3. Empirical Implementation

3.1. Model Design

To investigate whether firms' obstacles in obtaining external funds are affected by the country's financial system we must model how financial constraints are related to indicators of financial system structure. Almeida et al. (2004) develop a basic econometric model which links firms' stocks of cash to their cash flow. A firm is considered as *financially constrained* if it builds up its stock of cash out of its cash flow. Their theoretical and empirical model is well suited for our purpose after augmenting their basic specification with country-level attributes of financial markets. Our regression model is thus:

$$\begin{aligned} \Delta CashHoldings_{it} &= \zeta + \alpha \, CashFlow_{it} + \delta \, Structure_{it} \\ &+ \beta \, (CashFlow_{it} \times Structure_{it}) + X\gamma + \theta_i + \epsilon_{it} \end{aligned} \tag{1}$$

where i indexes the firm, t the year, $\Delta CashHoldings$ is the change in cash and short term securities normalized by total assets; $CashFlow$ is the ratio of cash flow, defined as income before extraordinary items plus depreciation, to total assets;[6] and $Structure$ is a measure of financial system structure directly introduced into the specification and interacted with $CashFlow$. A vector of firm characteristics (X) includes a set of controls (described below) and year fixed effects, while θ_i is a firm fixed effect. Finally, ϵ is an idiosyncratic error term assumed to possess the usual desirable characteristics. The key coefficients of interest, α and β from Equation (1), jointly determine the degree of financial constraints for firms operating in countries with different financial structures. Depending on the measure of financial structure, a firm is considered as financially constrained if its liquidity ratio is responsive to cash flows

[6] We replace missing values for income before extraordinary items by operating income minus operating expenses.

($\partial(\Delta CashHoldings)/\partial CashFlow = \alpha + \beta\ Structure_{it} > 0$). In contrast, unconstrained firms are not expected to show a statistically significant relationship between the liquidity ratio and cash flow ($\alpha + \beta\ Structure_{it} = 0$).

Following Levine (2002), we make use of two different measures of financial structure: *StructureActivity* and *StructureSize*. The first indicator, *StructureActivity*, measures the activity of stock markets relative to that of banks. It equals the natural logarithm of the total value traded ratio (stock market total value traded/GDP) to the bank credit ratio (private credit from deposit money banks/GDP). The second indicator, *StructureSize*, proxies the relative size of stock markets. It is measured as the natural log of the market capitalization ratio (stock market capitalization/GDP) to the bank credit ratio.[7]

The elements of X are intended to control for a firm's financial characteristics that influence their managers' liquidity policy. The choice of variables is motivated by prior research on the determinants of cash holdings (e.g., Opler et al. (1999) and Harford (1999)), subject to data availability. To control for economies of scale in cash management, we include the natural log of assets, *Size*, as a measure of firm size. As Global COMPUSTAT does not include the information needed to construct Tobin's Q (e.g., number of shares outstanding and stock price), we employ the ratio of future investment to current investment, *LeadInvestment*, as a measure of the firm's investment opportunities.[8] Additionally, the decision to hold cash crucially depends on current capital investment (*Investment*), changes in net working capital (ΔNWC) and changes in short term debt ($\Delta ShortDebt$). While both net non-cash working capital and short term debt measures could be considered as cash substitutes, firms could reduce liquid

[7] Other measures of banking system size (e.g., total banking assets) yield qualitatively similar results.

[8] For firm i in year t, $LeadInvestment_{it} = (Investment_{i,t+1} + Investment_{i,t+2})/Investment_{it}$. We measure $Investment_{it}$ as additions to fixed capital net of disposals. To deal with possible violations of exogeneity of this measure, we estimate the equation with IV-GMM using two lags of investment as instruments.

assets because of increased capital investment. These three firm specific characteristics are normalized by total assets.

3.2. Data

We require both firm-level data and data on countries' financial structure to implement the empirical modeling described in the previous section. This section presents the main properties of the data, while Appendix 1 reports data sources.

The firm-level data are drawn from Standard and Poor's Global COMPUSTAT database. The strengths of the data are the use of consistent financial report information across a large number of countries and 18 years' coverage. Our sample contains about 80,000 firm-years from 1989 through 2006. The exchange rate (local currency units per US dollar) from the World Bank's *World Development Indicators* (WDI) is used to convert financial data into US dollars. A number of sample selection criteria are applied. We only consider firms who have not undergone substantial changes in their composition during the sample period (e.g., participation in a merger, acquisition or substantial divestment). As these phenomena are not observable in the data, we calculate the growth rate of each firm's total assets and sales, and trim the annual distribution of these growth rates exceeding 100%. Second, we remove all firms that have fewer than three observations over the time span. Finally, all firm-specific variables are winsorized at the 2% level. We employ the winsorized data to reduce the potential impact of outliers upon the parameter estimates.

Our final data set contains 67,292 firm-years pertaining to 6,970 firms with complete data for all variables used in the analysis. Descriptive statistics for the firm-year observations entering the analysis are presented in Table 2. The average (median) liquidity ratio ($Cash$) for our sample is 13.07% (8.49%) and the average (median) value of the $CashFlow$ ratio is 11.42 (9.09). These values of $CashFlow$ are comparable to those in Table 2 of Acharya et al. (2007).

The country-level measures that we use in our empirical analysis are constructed from the Financial Structure Database of Beck et al. (2000), updated in 2007.[9] The initial data are from 1960 to 2006. For each country-year, we compute two different measures of financial structure: *StructureActivity*, log(total value traded ratio/bank credit ratio) and *StructureSize*, log(market capitalization ratio/bank credit ratio). The data reveal clear heterogeneity in the financial structures of 36 countries (see Table 1). In particular, the average lowest values of *StructureSize* are shown for countries which are known for their well established and traditionally strong banking systems (e.g. Austria and Germany), while the highest value of the measure is observed for the US, which is a clear example of a market-based economy. Similar patterns are revealed for the *StructureActivity* proxy. These observations give us confidence that the selected indicators capture the essence of the differences in financial structure between countries. While these two measures of structure are similar, with a correlation coefficient of 0.84, there are differences in the rankings. For instance, several countries (e.g. Chile) have high market capitalization and quite low turnover, indicating a preponderance of thinly traded assets. Therefore, the *StructureSize* measure is perhaps more questionable as it does not take into account the activity level of financial markets, but only the value of assets which may be traded.

[INSERT TABLES 1,2 HERE]

In addition, Table 2 reports information on the main variable of interest: the liquidity ratio, or ratio of cash holdings to total assets. As anticipated, there are considerable variations in liquidity ratios across countries. The highest average liquidity ratio (19%) is maintained by Israeli companies, while the lowest (5%) is found for companies headquartered in Portugal, Chile and Colombia.

The empirical literature investigating firms' capital structure behavior has utilized

[9] These data were accessed from http://go.worldbank.org/X23UD9QUX0 in March 2008.

various indicators of financial constraints. In line with previous research (e.g., Fazzari et al. (1988), Gilchrist and Himmelberg (1996)) we assume that small firms and firms with low (or zero) dividend payout ratios are those most likely to face binding financial constraints. Conversely, larger firms and those with high dividend payout ratios are much less likely to face credit rationing. Accordingly, we partition the sample by the magnitude of firms' size (total assets) and dividend payout ratio. These sample splits are based on firms' average values of the characteristic lying below the 30^{th} or above the 70^{th} percentile of their country's empirical distribution for that year. For instance, a firm with total assets above the 70^{th} percentile of the distribution for country j in year t will be classed as large, while a firm with total assets below the 30^{th} percentile in that country-year will be classed as small. As such, the classifications are not mutually exhaustive. Table 3 reveals that patterns in several of the descriptive statistics remain the same if sub-categories are explored separately. For instance, the ratio of cash holdings to total assets is considerably higher for smaller and low-dividend-payout firms, while their cash flow ratio is noticeably lower than that of their larger or high-dividend-payout counterparts.

[INSERT TABLE 3 HERE]

Given these assumptions about firms' classifications, we test whether firms in the classes expected to face binding financial constraints show a higher sensitivity of cash to cash flow.

4. Empirical Findings

4.1. Basic Specification

We analyze the differentials in financing constraints with respect to the nature of the financial system by estimating Equation (1). The results obtained using the two measures of financial structure are presented in Tables 4 and 5.

[INSERT TABLE 4 HERE]

Table 4 shows estimates with $StructureActivity$ as a proxy of financial structure. The first two columns report results for small and large firms, respectively. Based on the point estimates, smaller (constrained) firms are highly sensitive to the changes in cash flow, while larger, unconstrained firms display a considerably lower sensitivity. The greater sensitivity of small firms supports the conjecture that smaller firms are more likely to be financially constrained, in line with results reported by Almeida et al. (2004). The direct effect of the $StructureActivity$ measure is negative and insignificant, but the indirect effects of the measure, interacted with $CashFlow$, are significantly positive, increasing the cash flow sensitivity for small firms in more market-oriented financial systems. We find an interesting contrast in the results for subsamples defined by low (constrained) and high (unconstrained) payout ratios, reported in columns 3 and 4. Cash flow is only relevant for low-payout firms, who also exhibit sensitivity to the financial structure proxy (direct effect). This measure has no significant effect on high-payout firms. The indirect effect is operative for low-payout firms, with those in market-based economies exhibiting considerably larger sensitivity to cash flow than their counterparts in bank-based economies. This finding may indicate that the observed financial constraints on high-payout firms (the direct effect) gradually weakens for firms in more bank-based economies.

[INSERT TABLE 5 HERE]

Table 5 reports results employing the $StructureSize$ measure of financial structure. As in Table 4, the first two columns present estimate for small (constrained) and large (unconstrained) firms, respectively. Again, liquidity policies of both categories of firms are sensitive to cash flows. However, that sensitivity is almost triple as large for the small firms, confirming that this category of firms faces tighter financial constraints. The last two columns report results for high-payout and low-payout firms, respectively. Our data reveal that low-payout firms' liquidity display sensitivity to cash flows, unlike their high-payout counterparts. In addition, the interaction term ($CF \times StructureSize$)

is significant for financially constrained firms, but insignificant for their unconstrained counterparts. This evidence buttresses our findings from the size subsamples and further strengthens support for the hypothesis that bank-based financial systems provide easier access to external financing.

In order to gauge the sensitivity of cash flow as the financial structure measure changes across the sample space, we calculate selected percentiles of the empirical *Structure* distributions (using the point and interval estimates from Tables 4–5) and plot the impact of cash flow on $\Delta CashHoldings$. That is, for each measure we report $\partial(\Delta CashHoldings)/\partial(CashFlow)$ as the *Structure* measure changes.[10] The point estimates and 95% confidence interval for each derivative are displayed in Figures 1 and 2. Even a casual inspection of these derivatives shows that financial structure has important effects on constrained firms' liquidity, and varies considerably across countries with different financial architecture. In particular, one can see that an increase in the firm-level cash flow measure leads to an increase in cash holdings, with that effect strengthened for financially constrained firms in market-based systems with higher values of *StructureActivity* or *StructureSize*. When we turn to interpreting the effects of the cash flow sensitivity of cash for those firms hypothesized to be financially unconstrained, we find that their cash management is largely insensitive to cash flow. Furthermore, their sensitivity to their country's financial architecture is essentially nil.
[INSERT FIGURES 1,2 HERE]

Our results are also in line with pecking order theory (Myers (1977)), which suggests that firms prefer internal financing and try to maintain a stable dividend. If their generated cash flow is higher than capital expenditure, the firm may invest in liquid assets, and *vice versa*. However, in this setup the cash–cash flow sensitivity is mainly determined by managers' preferences to pay stable dividends. That is not testable in

[10] Tables of numerical values underlying the graphs are available from the authors upon request.

the context of our study.

4.2. Models augmented with Financial Development

A concern with the regression results shown in Tables 4 and 5 is that they may present an incomplete picture, as not only the structure but also the level of a country's financial development will affect the severity of financial constraints that firms face (e.g., Love (2003)). Our further analysis is based on the specifications introduced in the previous section which we augment with a variable measuring the level of financial development of the countries covered in the Global COMPUSTAT dataset. Following Levine (2002), we employ two proxy measures for the strength of financial institutions. The first measure, $FinanceActivity$, is defined as log(bank credit ratio $\times$ total value traded ratio), while the second proxy, $FinanceSize$, is calculated as log(market capitalization ratio $\times$ bank credit ratio).[11] We present the descriptive statistics for these variables by country in Table 1.

Table 6 reports the results of estimating Equation (1) augmented by each of the $Finance$ variables, alone and interacted with $CashFlow$ (CF). For ease of presentation, we only report the coefficients that are of direct interest.[12] In Panel A, we show results for the $FinanceActivity$ measure. First, for all subsamples, the coefficients on the $FinanceActivity$ measure are negative and insignificant. The estimated coefficients imply direct effects of financial development on firms' cash management which could be explained by the transactions motive for cash holdings. Manufacturing companies, facing difficulties in access to external funding, accumulate liquid assets as a cash buffer stock. The interaction term, $CF \times FinanceActivity$, is negative and significant for those firms which are *a priori* labeled as financially constrained. This result confirms the findings of Love (2003) who underlines the importance of financial development to

[11] Employing the private credit ratio (the value of financial intermediary credits to the private sector / GDP) instead of the bank credit ratio yields qualitatively similar results.

[12] Full results of the estimations are available from the authors upon request.

address obstacles in external financing. Turning to the effects of financial structure, we note that the coefficients of the *StructureActivity* variable are positive but insignificant. However, in contrast to the findings of Demirgüç-Kunt and Maksimovic (2002), we find that both financial structure and financial development play crucial roles in access to external funding for financially constrained firms given the sizable interaction effects.
[INSERT TABLE 6 HERE]

Panel B of Table 6 shows the outcome of estimating the cash flow sensitivity of cash using *FinanceSize* as a proxy for financial development. The results from this analysis lead to nearly identical inferences about the difference in financial system as those drawn from Panel A. Our findings for the importance of *StructureSize* in mediating the effects of cash flow are evident in these models.

The evidence in Tables 4–6 indicate the existence of tighter financial constraints for firms operating in market-based financial systems and a negative relationship between financial development and the severity of financial constraints. In a theoretical study, Chakraborty and Ray (2006) suggest that a bank-based financial system encourages participation in production activities and provides funding to a larger number of entrepreneurs. Taking into account that monitoring is able to resolve some of the agency problems associated with raising funds, firms may enjoy better access to funds when monitored by banks rather than by the market. As argued by Allen and Gale (2000), banks have a comparative advantage in selecting investment projects based on established technologies. This feature is typical of the manufacturing firms which we study.

5. Conclusions

By taking into account country-level financial architecture, we advance our understanding of differences in the severity of the financial constraints facing firms. We approach the empirical challenge in light of the recently proposed theoretical framework developed by Almeida et al. (2004), in which a firm is considered as financially constrained if it retains cash out of its cash flow. We augment the cash holdings–cash flow sensitivity link with country-level indices of relative development of the stock market to the development of the banking system. This approach is applied to annual data obtained from Global COMPUSTAT for 6,970 manufacturing firms from 36 countries over the period 1989–2006. This firm-level dataset is merged with financial data from Beck et al. (2000) which provide country-level measures of financial structure.

Our empirical analysis of the data provides several interesting findings. In light of the negative conclusions of earlier research, we infer that financial architecture plays a crucial role in reducing obstacles to firms' access to finance in external markets. Using two definitions of financial constraints and two different measures of relative financial market organization, we find that the sensitivity of firms' cash holdings to their cash flow is significantly higher for firms operating in market-based economies. The data also suggest that the influence of financial structure is important even after controlling for the level of financial development. However, we must emphasize that these conclusions must be taken with caution against the backdrop of the current financial crisis. In more normal times, bank-based systems may be more successful in relaxing firms' financing constraints. However, this may also allow firms to become leveraged to a dangerous degree in times of financial stress. A crucial element of financial stability, as we have seen in many countries' bailout programmes, is ready access to the equity markets, whether equity stakes are private or public. In that context, market-based systems may have an advantage in times of extreme financial stress, as equities markets have generally been able to cope more successfully with financial pressures than have banks. In this context, both types of financial architecture have clear pros and cons.

Our findings on the importance of financial architecture are unique in light of previous studies, which have not shown such diverse and significant effects. As an important extension of the financial frictions literature, we identify variations in the cash flow sensitivity of cash holdings in different financial systems. These variations are robust to the inclusion of measures of investment opportunities, size, and cash substitutes. Given these results, further exploration along these lines could shed considerable light on the interactions between the attributes of financial system and firm liquidity when gauging the degree and impact of financial frictions.

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Appendix 1: Data construction

The following variables are used in the annual empirical study.

Global COMPUSTAT Industrial and Commercial Annual database:
data10: Operating expenses
data12: Depreciation and amortization
data14: Operating income
data34: Cash dividends total
data60: Cash and short term investment
data75: Current assets
data89: Total assets
data96: Short term borrowing
data104: Current liabilities
data145: Additions to fixed capital
data177: Income before extraordinary items

Financial Structure database:
Bank credit ratio: Ratio of deposit money bank claims on domestic nonfinancial real sector (*International Financial Statistics* (IFS) lines 22, a through d) to total financial claims on nonfinancial real sector (sum of IFS lines 12, 22, and 42, a through d and 42h).

Market capitalization ratio: Ratio of value of listed shares to GDP, calculated using the following deflation method: $(0.5) * [F_t/P_{et} + F_{t-1}/P_{et-1}]/[GDP_t/P_{at}]$ where F is stock market capitalization, P_e is end-of period consumer price index (CPI) (IFS line 64M..ZF or, if not available, 64Q..ZF), and P_a is average annual CPI (IFS line 64..ZF). The data are drawn from Standard and Poor's *Emerging Market Database* and *Emerging Stock Markets Factbook*. Data on GDP in US dollars are drawn from the electronic version of *World Development Indicators*.

Total value traded: Ratio of total shares traded on the stock market exchange to GDP.

World Development Indicators database:
PA.NUS.FCRF: Official exchange rate (Local currency unit per US$, period average)

Table 1: Sample Composition, 1989–2006

Country	*Structure Activity*	*Structure Size*	*Finance Activity*	*Finance Size*	*Cash/ TotalAssets*	N
Australia	-0.64	-0.02	-1.11	-0.50	0.09	967
Austria	-2.87	-1.85	-2.92	-1.91	0.10	424
Belgium	-1.86	-0.17	-2.54	-0.85	0.12	499
Brazil	-0.64	0.21	-3.23	-2.38	0.12	676
Canada	-0.60	0.14	-1.70	-0.96	0.10	1,659
Chile	-1.93	0.46	-3.04	-0.65	0.05	344
Colombia	-3.13	-0.20	-6.50	-3.57	0.05	100
Denmark	-0.90	-0.34	-1.77	-1.21	0.14	749
Finland	-0.21	0.28	-1.17	-0.68	0.10	649
France	-0.89	-0.46	-1.17	-0.74	0.12	2,623
Germany	-1.03	-1.03	-0.85	-0.85	0.09	3,086
Greece	-0.50	0.16	-1.81	-1.16	0.09	226
Hong Kong, China	0.03	0.69	0.91	1.57	0.15	386
Hungary	-0.67	-0.27	-3.00	-2.60	0.10	69
India	0.12	0.18	-2.52	-2.46	0.06	1,299
Ireland	-1.31	-0.47	-1.65	-0.58	0.11	234
Israel	-1.29	-0.50	-1.82	-1.04	0.19	216
Italy	-0.95	-0.73	-1.68	-1.45	0.11	782
Japan	-1.01	-0.45	-0.80	-0.24	0.15	15,478
Korea, Rep.	0.38	-0.53	-0.03	-0.94	0.13	815
Malaysia	-0.61	0.48	-0.74	0.35	0.11	2,739
Netherlands	-0.46	-0.25	-0.20	0.01	0.09	827
New Zealand	-1.94	-0.90	-1.90	-0.86	0.06	149
Norway	-0.97	-0.67	-1.81	-1.50	0.15	441
Pakistan	0.52	-0.57	-2.39	-3.48	0.14	165
Poland	-1.55	-0.52	-4.29	-3.27	0.07	103
Portugal	-1.88	-1.16	-1.97	-1.25	0.05	172
Singapore	-0.28	0.37	-0.24	0.41	0.15	1,158
South Africa	-0.65	0.85	-1.55	-0.05	0.12	268
Spain	-0.36	-0.52	-0.62	-0.77	0.08	580
Sweden	0.19	0.38	-0.90	-0.61	0.13	929
Switzerland	-0.01	0.15	0.93	1.10	0.15	1,145
Thailand	-0.89	-0.67	-1.14	-0.92	0.07	1,473
Turkey	0.86	0.52	-2.73	-3.07	0.14	171
United Kingdom	-0.52	0.05	-0.15	0.42	0.12	4,629
United States	0.91	0.94	-1.00	-0.97	0.15	21,061
Total	-0.23	0.13	-0.97	-0.61	0.13	67,291

Note: N is the number of firm-years. Other variables are defined in the text.

Table 2: Descriptive Statistics, 1989–2006

Variable	N	$p25$	$p50$	$p75$	μ	σ
$\Delta CashHoldings$	67,249	-0.0206	0.0008	0.0260	-0.0014	0.0939
$CashHoldings$	67,257	0.0303	0.0849	0.1791	0.1307	0.1425
$CashFlow$	67,291	0.0285	0.0909	0.1718	0.1142	0.2370
$StructureSize$	66,183	-0.4634	0.1108	0.7519	0.1278	0.7361
$StructureActivity$	66,091	-1.0204	-0.2903	0.3898	-0.2277	1.0820
$CF \times StructureSize$	66,183	-0.0441	0.0035	0.0798	0.0016	0.1797
$CF \times StructureActivity$	66,091	-0.1080	-0.0147	0.0581	-0.0659	0.2927
$FinanceSize$	66,183	-1.2173	-0.4893	-0.1744	-0.6090	0.8025
$FinanceActivity$	66,091	-1.6055	-0.7851	-0.3153	-0.9668	0.9877
$CF \times FinanceSize$	66,183	-0.1094	-0.0336	0.0076	-0.0501	0.2559
$CF \times FinanceActivity$	66,091	-0.1819	-0.0537	0.0024	-0.1178	0.3604
$LeadInvestment$	67,291	0.8345	1.5041	10.0000	4.0302	4.1432
$Size$	67,279	4.2600	5.4557	6.7285	5.4596	1.9497
$Investment$	61,458	0.0215	0.0413	0.0703	0.0535	0.0483
ΔNWC	66,824	-0.0317	0.0050	0.0414	0.0021	0.0909
$NetWorkingCapital$	66,854	-0.0141	0.0856	0.1909	0.0660	1.9859
$\Delta ShortDebt$	66,472	-0.0122	0.0000	0.0111	-0.0034	0.0598
$ShortTermDebt$	66,626	0.0000	0.0333	0.1162	0.0832	0.3074

Notes: $p25$, $p50$, $p75$ are the quartiles of the variables, N is the number of firm-years, while μ and σ are their means and standard deviations. $CashHoldings$ is cash and short term securities, $CashFlow$ (CF) is income before extraordinary items plus depreciation and amortization, $ShortDebt$ is short term borrowing, $Investment$ is additions to fixed capital, NWC is net non-cash working capital proxied by current assets minus current liabilities minus cash and equivalents, $Size$ is the log of total assets. All firm-specific variables except $Size$ and $LeadInvestment$ are normalized by total assets.

Table 3: Descriptive Statistics for Subsamples, 1989–2006

Variable	μ	σ	N	μ	σ	N
A: Size subsamples						
	Small			Large		
$\Delta CashHoldings$	-0.01	0.13	20,659	0.00	0.07	20,580
$CashHoldings$	0.16	0.17	20,662	0.11	0.11	20,583
$CashFlow$	0.08	0.30	20,672	0.14	0.19	20,591
$LeadInvestment$	4.36	4.22	20,672	3.77	4.09	20,591
$Size$	3.48	1.25	20,672	7.39	1.51	20,591
$Investment$	0.05	0.05	18,769	0.06	0.05	18,887
ΔNWC	-0.00	0.12	20,644	0.00	0.07	20,274
$NetWorkingCapital$	0.04	3.56	20,650	0.05	0.14	20,291
$\Delta ShortDebt$	-0.01	0.07	20,430	-0.00	0.05	20,344
$ShortTermDebt$	0.10	0.53	20,483	0.07	0.09	20,381
B: Payout ratio subsamples						
	Low			High		
$\Delta CashHoldings$	-0.01	0.12	23,555	-0.00	0.07	17,714
$CashHoldings$	0.16	0.18	23,561	0.12	0.12	17,714
$CashFlow$	0.05	0.28	23,571	0.13	0.18	17,716
$LeadInvestment$	4.02	4.13	23,571	3.74	4.05	17,716
$Size$	4.96	1.80	23,569	6.03	1.98	17,716
$Investment$	0.05	0.05	22,030	0.05	0.04	16,361
ΔNWC	-0.01	0.11	23,481	0.00	0.07	17,502
$NetWorkingCapital$	0.02	3.34	23,494	0.10	0.18	17,515
$\Delta ShortDebt$	-0.00	0.07	23,270	-0.00	0.05	17,495
$ShortTermDebt$	0.09	0.50	23,343	0.06	0.09	17,530

Note: Subsamples are defined in terms of the empirical distribution for each country and year. N is the number of firm-years. μ and σ represent mean and standard deviation respectively.

Table 4: Sensitivity of $\Delta CashHoldings$ to $CashFlow$ with Financial Structure Activity

	Firm Size		Payout Ratio	
	Small	Large	Low Payout	High Payout
	(1)	(2)	(3)	(4)
$CashFlow$	0.097***	0.025**	0.106***	-0.024
	(0.024)	(0.010)	(0.013)	(0.063)
$StructureActivity$	-0.015	0.001	-0.001	0.023
	(0.009)	(0.002)	(0.004)	(0.021)
$CF \times StructureActivity$	0.095***	0.012*	0.073***	-0.018
	(0.023)	(0.007)	(0.014)	(0.045)
$Lead\ Investment$	0.093**	0.012	0.027	0.160
	(0.047)	(0.008)	(0.023)	(0.118)
$Size$	0.139**	0.020***	0.064***	0.178*
	(0.059)	(0.007)	(0.024)	(0.096)
$Investment$	1.277*	0.057	0.133	2.082
	(0.731)	(0.088)	(0.328)	(1.710)
ΔNWC	-0.213***	-0.159***	-0.169***	-0.393***
	(0.049)	(0.028)	(0.021)	(0.091)
$\Delta ShortDebt$	-0.058	-0.030	-0.068**	-0.339
	(0.069)	(0.034)	(0.029)	(0.207)
N	12,139	13,904	14,269	11,452
J	0.1259	0.8401	0.7773	0.5852
C	0.0014	0.0285	0.0605	0.9627

Note: Each equation, estimated by IV-GMM with fixed firm effects, includes year dummy variables. Asymptotic cluster-robust standard errors are reported in parentheses. J is the p-value of Hansen's J test of overidentifying restrictions. C is the p-value of Hayashi's GMM-distance test of endogeneity of $LeadInvestment$. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Sensitivity of $\Delta CashHoldings$ to $CashFlow$ with Financial Structure Size

	Firm Size		Payout Ratio	
	Small	Large	Low Payout	High Payout
	(1)	(2)	(3)	(4)
$CashFlow$	0.063**	0.022**	0.077***	-0.015
	(0.027)	(0.009)	(0.013)	(0.056)
$StructureSize$	-0.012	-0.005	-0.000	0.013
	(0.020)	(0.003)	(0.008)	(0.032)
$CF \times StructureSize$	0.153***	0.022**	0.111***	0.017
	(0.035)	(0.010)	(0.018)	(0.059)
$LeadInvestment$	0.096**	0.012	0.026	0.161
	(0.048)	(0.008)	(0.023)	(0.118)
$Size$	0.142**	0.019***	0.064***	0.179*
	(0.061)	(0.007)	(0.025)	(0.096)
$Investment$	1.318*	0.053	0.129	2.102
	(0.756)	(0.086)	(0.332)	(1.718)
ΔNWC	-0.221***	-0.159***	-0.173***	-0.396***
	(0.050)	(0.028)	(0.021)	(0.093)
$\Delta ShortDebt$	-0.063	-0.029	-0.070**	-0.342
	(0.070)	(0.034)	(0.029)	(0.209)
N	12,155	13,919	14,285	11,467
J	0.1241	0.8050	0.8189	0.5875
C	0.0015	0.0334	0.0627	0.9647

Note: Each equation, estimated by IV-GMM with fixed firm effects, includes year dummy variables. Asymptotic cluster-robust standard errors are reported in parentheses. J is the p-value of Hansen's J test of overidentifying restrictions. C is the p-value of Hayashi's GMM-distance test of endogeneity of $LeadInvestment$. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Sensitivity of $\Delta CashHoldings$ to $CashFlow$: Models Augmented by Financial Development Measures

	A: $StructureActivity$ and $FinanceActivity$ measures			
	Firm Size		Payout Ratio	
	Small	Large	Low Payout	High Payout
$CashFlow$	0.066**	0.026***	0.063***	-0.018
	(0.027)	(0.009)	(0.014)	(0.067)
$StructureActivity$	0.030	0.001	0.023	0.041
	(0.030)	(0.004)	(0.017)	(0.041)
$CF \times StructureActivity$	0.114***	0.010	0.100***	-0.024
	(0.025)	(0.012)	(0.014)	(0.060)
$FinanceActivity$	-0.056	-0.000	-0.029	-0.024
	(0.039)	(0.004)	(0.023)	(0.036)
$CF \times FinanceActivity$	-0.041*	0.003	-0.058***	0.008
	(0.025)	(0.012)	(0.016)	(0.057)
N	12,139	13,904	14,269	11,452
J	0.1296	0.8380	0.8301	0.5820
C	0.0009	0.0292	0.0443	0.9576

	B: $StructureSize$ and $FinanceSize$ measures			
	Firm Size		Payout Ratio	
	Small	Large	Low Payout	High Payout
$CashFlow$	0.044	0.024***	0.047***	-0.001
	(0.028)	(0.008)	(0.013)	(0.058)
$StructureSize$	0.017	-0.003	0.015	0.027
	(0.030)	(0.004)	(0.013)	(0.039)
$CF \times StructureSize$	0.159***	0.019	0.116***	0.010
	(0.036)	(0.012)	(0.018)	(0.061)
$FinanceSize$	-0.066	-0.008	-0.042	-0.050
	(0.044)	(0.005)	(0.027)	(0.047)
$CF \times FinanceSize$	-0.028	0.007	-0.060***	0.027
	(0.028)	(0.014)	(0.015)	(0.064)
N	12,155	13,919	14,285	11,467
J	0.1305	0.8071	0.9544	0.5844
C	0.0009	0.0303	0.0479	0.9917

Note: Each equation, estimated by IV-GMM with fixed firm effects, includes $Size$, $Lead\ Investment$, $Investment$, ΔNWC, and $\Delta ShortDebt$ and year dummy variables. Asymptotic cluster-robust standard errors are reported in parentheses. J is the p-value of Hansen's J test of overidentifying restrictions. C is the p-value of Hayashi's GMM-distance test of endogeneity of $LeadInvestment$. * significant at 10%; ** significant at 5%; *** significant at 1%.

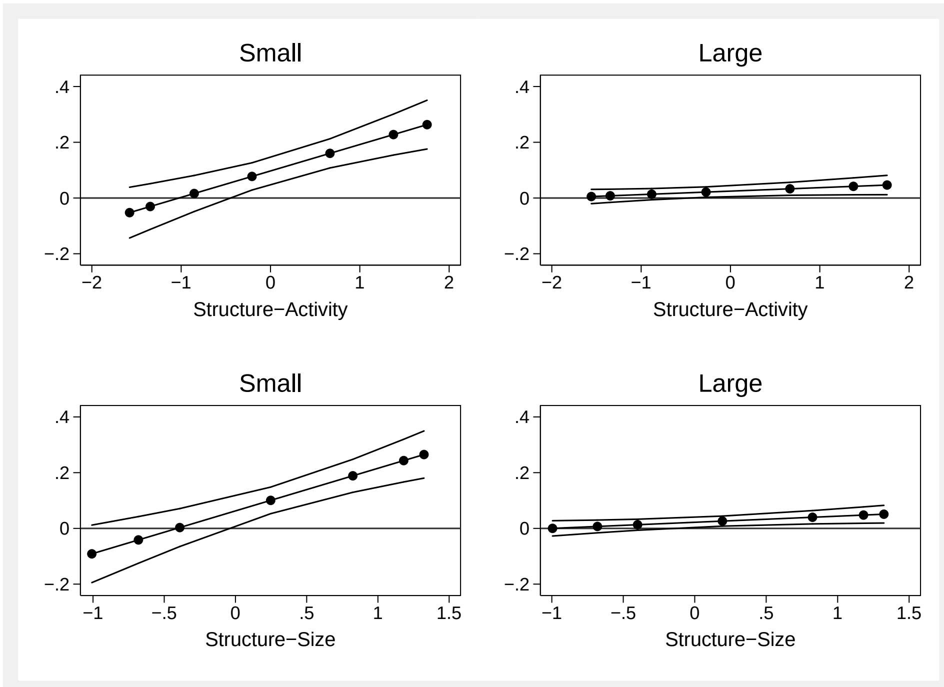

Figure 1: Cash flow sensitivity of $\Delta CashHoldings$ by size groups.

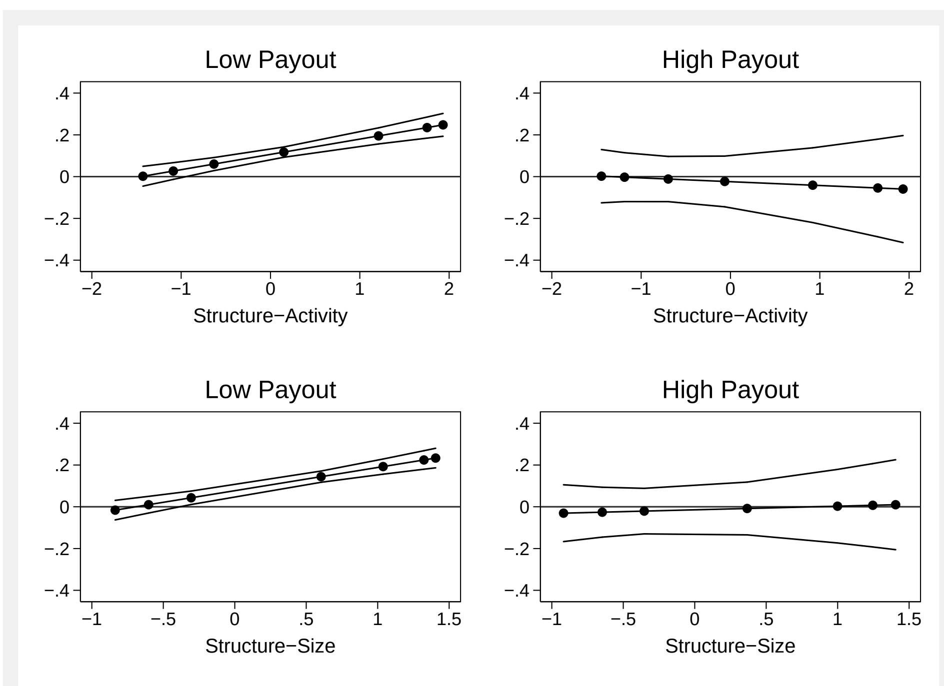

Figure 2: Cash flow sensitivity of $\Delta CashHoldings$ by payout ratio groups.