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Financial Development and the Cash Flow Sensitivity of Cash

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Abstract

Prior research posits that market imperfections and the lack of institutions that protect investor interests create a divergence between the cost of internal and external funds, thereby constraining firms' ability to fund investment projects through external financing. Financial constraints force firms to manage their cash flows to finance potentially profitable projects. A related stream of research documents that financial constraints due to costly external financing are more pronounced in underdeveloped financial markets. We examine the influence of financial development on the demand for liquidity by focusing on how financial development affects the sensitivity of firms' cash holdings to their cash flows. Using firm-level data for 35 countries covering about 12,782 firms for the years 1994–2002, we find the sensitivity of cash holdings to cash flows decreases with financial development. We also consider additional implications of firms' cash flow sensitivity of cash with respect to firm size and business cycles. Overall, we provide new cross-country evidence of the role of financial development on financial constraints.

I. Introduction

An important question pursued in the finance and economics literature is whether financial development positively contributes to economic growth (Schumpeter (1911), Robinson (1952), Lucas (1988), King and Levine (1993), and Gomes (2002)).[1] A theoretical view underlying this line of inquiry is that financial development improves firms' access to lower cost external financing. Rajan and Zingales ((1998), p. 560) argue that well developed "financial markets and institutions help a firm overcome problems of moral hazard and adverse selection, thus reducing the firm's cost of raising money from outsiders." In contrast, these problems are exacerbated in less financially developed countries with weaker institutions that protect investor interests, thereby creating a wider wedge between

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[1]There are competing views on the direction of the causal link between financial development and economic growth. While Schumpeter (1911) stresses the positive influence of financial development on economic growth, Robinson (1952) posits reverse causality in that financial development is itself the consequence of economic growth. Lucas (1988) posits that financial development is merely a "sideshow" and therefore has limited influence on economic growth.

firms' internal and external costs of funds (La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997)). Consequently, theory anticipates firms in these countries to be financially constrained in that firm investments (and in turn firm growth) are more likely to be limited to available internal resources.

Extant research provides several pieces of evidence consistent with this prediction. For example, Rajan and Zingales (1998) find that industries that are reliant on external financing exhibit greater growth in financially developed countries. Similarly, Demirguc-Kunt and Maksimovic (1998) find that firm growth financed by long-term external debt and equity is positively associated with the level of a country's financial development.[2] More recently, Love (2003) finds that financial development affects firm investments through its impact on firms' costs of capital. Her results also support the view that financing constraints decrease with financial market development.

The objective of this paper is to examine the impact of financial market development on a firm's demand for liquidity. Keynes ((1936), p. 196) notes that "there is no necessity to hold idle cash to bridge over intervals if it can be obtained without difficulty at the moment when it is actually required." In other words, firm liquidity is significant when firms cannot easily raise funds through external financial markets. This is particularly important if liquid resources can help firms exploit potentially profitable projects. For example, Myers and Majluf (1984) note that market imperfections in the form of information asymmetry increase the cost of external financing. Given this setting, they note that internal liquid assets represent financial slack that firms can use to exploit investment opportunities. However, prior research also notes that holding cash can be costly and hence firms will "trade-off between low return earned on liquid assets and the benefit of minimizing the need for costly external financing" (Kim, Mauer, and Sherman (1998), p. 335).[3]

More recent research shifts the focus from cash holdings to the extent to which cash is saved from current period cash flows. Almeida, Campello, and Weisbach (2004) point out that firms facing financing constraints will save cash today to fund future investment opportunities. However, saving cash today may cause the firm to pass up profitable investment projects that may prove costly. As such, financially constrained firms will derive an optimal cash policy that trades off current investments against potentially profitable future investments. In contrast, financially unconstrained firms do not incur any costs for holding cash because no current period investments are sacrificed and they derive less benefit from holding cash. Viewed this way, liquidity management is less relevant for financially unconstrained firms.

[2]Other studies that link financial development and economic growth include Wurgler (2000) who finds that financial development improves the capital allocation by increasing the industry-level sensitivity of investment growth to value-added growth, and King and Levine (1993) who report cross-country evidence that suggests that financial development leads to economic growth by fostering productivity improvements. Related evidence on the influence of financial markets on economic growth include Bekaert, Harvey, and Lundblad (2001a), (2001b) who study the impact of financial market liberalization on economic growth.

[3]Another important stream of research posits that managers, acting contrary to the interests of shareholders, may hold excess cash. This allows managers to invest in negative NPV projects or to act against potential takeover through the market for corporate control (see, e.g., Jensen (1986), Harford (1999)).

Given the importance of liquidity to financially constrained firms, a key implication from this line of inquiry is that financially constrained firms will exhibit a systematic effort to save cash out of current period cash flows. This is consistent with the notion that firms will set aside cash today to meet future investment opportunities. In Almeida et al.'s (2004) parlance, financially constrained firms will exhibit higher cash flow sensitivity of cash. Conversely, theory does not anticipate any relation between cash and cash flows for financially unconstrained firms since liquidity management is not a significant issue for these firms.

In this paper, we evaluate a firm's marginal propensity to save cash in an international setting with differing levels of financial development. The question is noteworthy because theory implies liquidity management to be important in settings where external financing is costly. Specifically, in less developed financial markets where external financing is problematic, we predict a higher cash flow sensitivity of cash. Turning to financially developed countries, theory predicts an absence of a relation between a firm's cash holdings and its cash flows. As prior studies document, some firms find it difficult to raise funds even in financially advanced countries such as the U.S. (Fazzari, Hubbard, and Petersen (1988), Almeida et al. (2004)). Thus, we predict the level of financial market development to moderate the cash flow sensitivity of cash.

To empirically evaluate the influence of financial development on a firm's propensity to save cash out of its cash flows, we use 48,400 firm-year observations covering 12,782 firms from 35 countries.[4] The data is gathered from the Global Vantage Database and covers the time period 1994–2002. Overall, we find that the cash flow sensitivity of cash lowers with a country's level of financial development. This is consistent with the view that financial development eases financial constraints by improving a firm's access to lower cost external financing.

Prior research also notes that financial development requires a set of enabling legal institutions to support the growth of financial markets (La Porta et al. (1997)). Therefore, we inspect the robustness of the financial development result to the inclusion of a country's legal system with respect to investor protection laws. We find that the financial development effect on the cash flow sensitivity of cash persists even after controlling for the common/civil law dichotomy for the prevailing legal system in a country.

Recent research by Beck, Demirguc-Kunt, and Maksimovic (2004) examines at the micro level the impact of financial constraints due to the lack of financial development on firm growth. They find that the impact of financial underdevelopment is more financially constraining on small rather than large firms. Furthermore, Almeida et al. (2004) point out that small firms are also more likely to be financially constrained in more general settings. They note that "the argument for size as a good observable measure of financial constraints is that small firms are typically young, less well known, and thus more vulnerable to capital market imperfections (Almeida et al. (2004), p. 1790).

[4]We began with the 36 countries in Love (2003), but lack of data for Israeli firms reduced our sample to 35 countries: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Columbia, Denmark, Finland, France, Germany, Indonesia, India, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Pakistan, Philippines, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, U.K., U.S., and Venezuela.

In light of these findings, we examine whether the impact of financial development on the cash flow sensitivity of cash differs between small and large firms. As anticipated, we find that small firms exhibit greater cash flow sensitivity of cash in both financially developed and underdeveloped countries. Consistent with Beck et al.'s (2004) argument, we find that the impact of financial underdevelopment is greater for smaller firms.

To further examine the influence of financial development on a firm's marginal propensity to save cash out of current period cash flows, we investigate the firm's demand for liquidity over the business cycle. An economic downturn reduces current cash flows and improves the relative attractiveness of future investments in comparison to current investments. As such, theory posits firms will be motivated to save a greater proportion of their cash flows during an economic downturn, although this effect should be less pronounced for financially unconstrained firms. Our results indicate that a firm's tendency to save out of current period cash flows is greater during economic downturns. Specifically, when we use real gross domestic product (GDP) growth rates to reflect economic upturns and downturns, we find the cash flow sensitivity of cash to be higher during economic downturns compared to economic upturns.

Our study differs from prior work in this area in that we focus on the cash flow sensitivity of cash, whereas prior work explores the determinants of the level of cash holdings in an international setting. For example, Dittmar, Smith, and Servaes (2003) show that cash holdings are higher in countries with weak investor protection rights. They interpret this result as consistent with the agency cost explanation that investors in countries with poor investor protection cannot force managers to disgorge excessive cash balances. However, Pinkowitz, Stulz, and Williamson (2003) point out that Dittmar et al.'s finding is also consistent with managers acting in shareholders interest. Firms in countries with weak institutions are less stable and hence liquid assets become more important during periods of turmoil (Acemoglu, Johnson, and Robinson (2001)). Furthermore, Dittmar et al.'s finding is also consistent with the notion that firms may hold more cash in light of costly external financing—an explanation we pursue in this paper. Given that the focus on the level of cash holdings makes it difficult to distinguish among competing explanations, we avoid this issue by focusing on the cash flow sensitivity of cash that is posited to rise due to firms' external financing constraints.

Our study complements the recent work of Love (2003) who shows that financing constraints decrease with financial market development. Extant research (e.g., Almeida and Campello (2002), Alti (2003), Cleary (1999), Erickson and Whited (2000), Kaplan and Zingales (1997), and Poterba (1988)) questions the meaning of the cash flow sensitivities of investment on theoretical and empirical grounds. In this paper, we sidestep the interpretational issues involved with the sensitivity of investment cash flow relations. The contribution of our study is to document how the cash flow sensitivity of cash is associated with a country's financial market development. By documenting country-specific linkages between the development of financial markets and the cash flow sensitivity of cash, we show that financial development has first-order effects on a firm's liquidity management. Consistent with theory, we find that the cash flow sensitivity of cash is lower in financially developed countries. A lower cash flow sensitivity of cash

indicates that firms are less financially constrained and hence are saving less cash out of cash flows to meet future investment needs. The implication is that financial development improves firms' access to lower cost external financing.

The remainder of the paper is organized as follows. Section II develops the testable hypothesis. Section III describes the empirical model and variables. In Section IV, we describe the data sources and the sample. Section V presents the empirical results and Section VI concludes the paper.

II. Hypotheses Development

In the Modigliani and Miller (1958) world of frictionless capital markets, a firm's financing decision has no bearing on its investments. However, prior research posits that frictions in the form of adverse selection costs due to information asymmetry and agency costs create a divergence between the costs of external and internal funds, thereby constraining firms in their ability to fund investment projects.[5] Given this setting, Myers (1984) and Myers and Majluf (1984) suggest that cash holdings are beneficial because they enable firms to finance future investments that would have otherwise been given up due to costly external financing.[6,7] However, there is an opportunity cost to hold liquid assets because they provide a firm with a relatively low rate of return. In the presence of these opportunity costs, prior research focuses on determining the optimal level of cash holdings that minimizes these costs (Baumol (1952), Miller and Orr (1966), Constantinides (1976), and Frenkel and Jovanovic (1980)). In contrast, Opler, Pinkowitz, Stulz, and Williamson (1999) depict a trade-off model where firms trade off the costs and benefits of liquidity to derive the optimal cash holdings.

More recent research on the demand for liquidity shifts the focus from cash holdings to the extent to which cash is saved from firms' cash flows (Almeida et al. 2004). In part, the objective of this approach is to study the marginal propensity to save cash and how it relates to firms' current and future investments. To understand the underlying argument, suppose a firm's cash flows from its assets in place are not sufficient to fund all positive net present value (NPV) projects. Under such a scenario, the firm may be forced to hoard cash to finance future investments. However, this hoarding of cash is not without cost because this behavior may entail giving up positive NPV investments in the current period. This implies the presence of an optimal liquidity policy that allocates cash resources between current and future investments such that it maximizes firm value. In the absence of financing constraints, the management of a firm's cash resources is irrelevant because it can easily raise funds through external markets and holding cash does not yield any benefit.

[5] See Hubbard (1998) and Stein (2001) for a review of the literature.

[6] The evidence on the preference of firms toward internally generated funds as a primary means to finance investment expenditures dates back to Donaldson (1961).

[7] An underlying assumption is that managers maximize shareholder wealth so that investors are not concerned about managers' use of liquid assets to pursue their own objectives. A competing explanation is offered by Jensen (1986) who argues that excess cash flow is wasted on value-destroying spending because managers have an incentive to grow the asset base of the firm rather than distribute cash to shareholders. This view suggests a policy of encouraging cash flow payout to minimize inefficient investment spending.

The empirical implication from this line of inquiry is that financially constrained firms will increase their stocks of liquid assets in response to positive cash flow innovations. The argument here is that firms will hoard their excess cash in anticipation of future investments. In contrast to the positive relation between annual changes in cash holdings and operating cash flows of financially constrained firms, theory does not anticipate such a relation for financially unconstrained firms. Consistent with their model, Almeida et al. (2004) find that the sensitivity of cash holdings to cash flows is positive only for financially constrained firms.

Given the role of financing constraints on firms' liquidity management, we next turn to the impact of financial development on financing constraints. Theory posits that in perfect capital markets, there is no divergence between a firm's internal and external costs of funds. However, market imperfections in the form of information asymmetry and moral hazard can serve to increase the cost of external funds (Rajan and Zingales (1998)). However, this issue of costly external financing is not identical across countries. La Porta et al. (1997) document considerable variation in the development of financial markets across countries. Extant research posits that financial markets and their underlying institutions help overcome the costs associated with imperfections such as information asymmetry and thereby reduce the cost of raising external funds. Recent research provides both direct and indirect evidence that financial market development affects the cost of external financing (Love (2003), Rajan and Zingales (1998)).

If financial development serves to reduce the cost of external funds and eases firms' financing constraints, then we anticipate the cash flow sensitivity of cash to be less pronounced in financially developed countries relative to financially undeveloped countries.[8] This prediction can be expressed as the following hypothesis in the alternate form.

H1. Cash flow sensitivity of cash will be negatively related to a country's financial development, ceteris paribus.

We examine several extensions to this baseline prediction. We examine whether the cash flow sensitivity of cash varies across firm size. Recent research by Beck et al. (2004) finds that the smallest firms are most affected in the absence of easy access to low cost external financing. We group firms based on size and examine whether the size effect on the cash flow sensitivity of cash varies across countries classified by the level of financial development. We also examine whether the cash flow sensitivity of cash varies across business cycles. For financially constrained firms, Almeida et al. (2004) anticipate that the cash flow sensitivity would increase during economic downturns and decline during economic expansions. In contrast, firms not subject to financial constraints are less likely to exhibit any variation in cash flow sensitivity across economic regimes. Therefore, we focus on the cash flow sensitivity of cash during economic downturns and expansions.

[8] Stein (2001) notes that financial constraints may continue to exist even in financially developed markets such as the U.S.

III. Methodology and Data

Regression Model

To test the hypothesis we develop in Section II, we use a modified version of Almeida's (2004) model of cash holding behavior. Specifically, the model estimated in the paper is

$$\begin{aligned}(1)\qquad \Delta\text{CashHoldings}_{it} &= \alpha_{1j} + \alpha_{2t} + \alpha_{3c} + \beta_1 \text{SIZE}_{it} + \beta_2 \text{Q}_{it} \\ &+ \beta_3 \Delta\text{STD}_{it} + \beta_4 \text{CF}_{it}/\text{A}_{it-1} + \beta_5 (\text{CF}_{it}/\text{A}_{it-1}) * \text{DEV}_{ikt} + u_{it},\end{aligned}$$

where ΔCashHoldings is the ratio of annual change in holdings of cash and marketable securities to total assets, α_{1j} are industry-specific intercepts, α_{2t} are year-specific intercepts, α_{3c} are country-specific intercepts, SIZE is the natural log of assets (in millions of U.S. dollars), Q is the market value divided by the book value of assets, ΔSTD is the change in short-term debt to lagged total assets, CF/A is the ratio of operating cash flows (minus dividends) to lagged total assets, and DEV is a measure of financial market development.[9] The regression controls for country, year, and industry effects, while modeling the change in cash holdings as a function of four main effects (operating cash flows, Tobin's Q, SIZE, and ΔSTD) and an interaction of DEV with operating cash flows.

Since cash holding policies can vary across industries, we control for industry-specific factors through the use of industry dummies. Also, since the changes in cash holdings can vary across time, we address this issue by including year fixed effects. We also include country fixed effects to correct for country-level factors that influence firm-level cash holdings. By including country and fixed effects, our analysis follows the spirit of the approach pioneered by Rajan and Zingales (1998).[10] Rajan and Zingales (1998) note that the most effective way of correcting for country and industry characteristics is to use indicator variables for each country and industry and to focus on interactions with a country characteristic such as financial development. This approach is less subject to criticism about an omitted variable bias or model specification than traditional approaches.

Following Almeida et al. (2004), we also include a control for firm size, SIZE, which controls for economies of scale with respect to cash management. We also control for Tobin's Q to capture the value of long-term growth options that are available to the firm. A higher Q indicates greater future profitability and, as a consequence, a larger investment opportunity set. To the extent that firms will set aside cash today to meet future investment opportunities, a firm's cash policy

[9] The cash flow from operations in this paper is computed in accordance with Ali and Hwang (2000). The definition of accounting variables and the Global Vantage data mnemonic we use to obtain the data are as follows: cash flow from operations = earnings before extraordinary items (IB) + depreciation and amortization expense (DP) + change in deferred income taxes (ΔTXDB) + change in untaxed reserves (ΔRVUTX) + change in other liabilities (ΔLO) + minority interest (MII) − change in noncash working capital. Noncash working capital is defined as total current assets (ACT) less [cash and short-term investments (CHSTI) and Treasury stock shown as current assets (TSCA)] minus [total current liabilities (LT) less total amount of debt in current liabilities (DLC) and proposed dividends (PRODV)]. It is important to note that our measures of cash flows from operations accounts for working capital as a potential source of funding.

[10] Several recent cross-country studies (e.g., Beck and Levine (2002), Claessens and Laeven (2003), and Love (2003)) follow this approach.

should be positively influenced by the attractiveness of future investment opportunities. In our regression model, the variable Q is expected to have a positive sign. Following Almeida et al. (2004), we also include the changes in short-term debt as an explanatory variable because "short-term debt could be used as a substitute for cash or because firms may use short-term debt to build cash reserves" (p. 1791). Hence, we do not predict a sign for ΔSTD.

Almeida et al. (2004) argue that the variations in operating cash flows (a proxy for the availability of internal funds) affect changes in cash holdings for financially constrained firms. They find operating cash flows to have a positive and statistically significant impact on changes in cash holdings for firms classified as being ex ante financially constrained. Hence, the expected sign for the variable CF/A is positive.

Our test of H1 focuses on financial development and the argument is that firms are expected to hoard less cash out of operating cash flows in countries with a higher level of financial market development. Following Love (2003), we use an index of financial development, which is an average of five standardized indices obtained from the World Bank database as of 2002 including market capitalization over the GDP, total value traded over the GDP, total value traded over market capitalization, the ratio of liquid liabilities to the GDP, and the credit going to the private sector over the GDP.[11] The sum of the first three indices is coded as STKMKT and serves as a measure of stock market development. The sum of the last two indices is coded as FININT and reflects financial intermediary development. FD is the sum of STKMKT and FININT. A higher value of FD (STKMKT or FININT) indicates that a country's financial systems rely relatively more on market-oriented financing and financial intermediaries. The right side of Table 1 reports the value of the financial structure variables for each of the 35 countries in our study. The financial structure indices can have negative values because they are standardized to have mean zero and a standard deviation of one. The value of FD is highest for Switzerland (2.72) and lowest for Venezuela (-0.79).

Under H1, financial development influences the strength of association between the change in cash holdings and operating cash flows. Specifically, H1 predicts that financial development will attenuate the cash flow sensitivity of cash since it improves firms' access to lower cost external financing. Therefore, the expected sign on the interaction of DEV with operating cash flows is negative.

IV. Sample

Our initial sample consisted of firm-level observations from 36 countries. The countries covered are identical to those reported in Love (2003). However, due to data limitations we drop sample observations from Israel leaving us with 35 countries. Since our principal focus of analysis is at the firm level, we gathered firm-level data for both U.S. and non-U.S. firms from the Global Vantage database for the period 1994–2002. Consistent with prior studies, we exclude firms from the financial services industry (SIC codes between 6000 and 6999) (Opler et al.

[11] Some of the indices as of 2002 are missing for Australia, Pakistan, Sweden, and Venezuela. For these four countries, we use the indices as of 2000.

TABLE 1

Descriptive Statistics

Cash/Assets is the ratio of holdings of cash and marketable securities to total assets; ΔCashHoldings is the change of Cash/Assets between t and $t - 1$; CF/A is the ratio of operating cash flows (minus dividends) to total assets; SIZE is the natural log of assets (in millions of U.S. dollars); Tobin's Q is the market value divided by the book value of assets; ΔSTD is the change of the ratio of short-term debt to total assets between t and $t - 1$; and FD is a measure of financial development. STKMKT is the stock market development index that equals the sum of (standardized indices of) market capitalization over the gross domestic product (GDP), total value traded over the GDP, and total value traded over market capitalization; and FININT is the financial intermediary development index that equals the sum of (standardized indices of) the ratio of liquid liabilities to the GDP and the credit going to the private sector over the GDP. FD is the sum of STKMKT and FININT.

			Firm-Level Variable (median)						Financial Development		
Country	No. of Firm-Years	No. of Firms	Cash/ Assets	ΔCash Holdings	CF/A	SIZE	Tobin's Q	ΔSTD	FD	FININT	STKMKT
Argentina	78	25	0.042	0.000	0.063	7.212	0.970	−1.439	−0.44	−0.58	−0.30
Australia	1,147	287	0.082	0.002	0.062	5.534	1.496	−0.619	0.52	0.61	0.42
Austria	223	74	0.102	−0.012	0.073	5.880	1.172	−0.736	0.26	1.26	−0.74
Belgium	242	82	0.129	−0.002	0.089	5.978	1.507	−0.491	0.82	0.62	1.03
Brazil	58	29	0.146	−0.025	0.031	6.943	1.112	−0.503	−0.42	−0.33	−0.50
Canada	2,165	529	0.097	0.004	0.068	5.805	1.623	−0.125	0.54	0.59	0.50
Chile	190	82	0.049	0.002	0.086	6.094	1.185	−0.044	−0.20	0.04	−0.44
Colombia	34	14	0.056	0.003	0.045	6.552	0.805	−0.002	−0.67	−0.44	−0.90
Denmark	461	122	0.145	−0.010	0.089	5.485	1.349	−0.298	0.49	1.02	−0.05
Finland	339	106	0.116	−0.001	0.095	6.194	1.378	−0.335	0.95	0.27	1.63
France	1,390	500	0.127	−0.001	0.072	6.084	1.439	−0.253	0.73	0.85	0.61
Germany	1,700	528	0.101	−0.002	0.071	5.882	1.422	−0.508	1.11	1.52	0.69
India	546	233	0.047	0.003	0.084	5.553	1.749	−0.195	0.44	−0.07	0.95
Indonesia	310	114	0.141	0.006	0.004	5.498	1.390	−0.011	−0.41	−0.26	−0.55
Italy	467	162	0.121	−0.003	0.068	6.548	1.292	−0.032	0.56	0.75	0.38
Japan	11,312	2,835	0.171	0.000	0.025	6.177	1.174	−0.031	1.44	2.71	0.17
Korea	217	124	0.114	0.019	0.048	7.500	1.031	−0.004	1.73	0.90	2.56
Malaysia	1,304	390	0.107	0.003	0.055	5.130	1.488	−0.635	1.01	1.76	0.25
Mexico	221	67	0.079	−0.002	0.080	7.270	1.221	−0.184	−0.59	−0.53	−0.66
Netherlands	379	128	0.101	0.003	0.104	6.147	1.744	−0.626	1.79	2.14	1.45
New Zealand	153	56	0.043	−0.005	0.104	5.590	1.545	−1.443	0.34	1.07	−0.39
Norway	382	128	0.148	0.007	0.068	5.740	1.524	−0.488	0.16	0.43	−0.10
Pakistan	77	40	0.084	0.005	0.079	4.726	1.051	−0.078	1.19	−0.21	2.59
Philippines	142	71	0.090	0.000	0.033	5.256	1.167	−0.183	−0.29	−0.04	−0.54
Portugal	134	47	0.053	0.001	0.082	5.745	1.329	−0.535	0.93	2.13	−0.28
Singapore	830	247	0.145	0.008	0.047	5.235	1.334	−0.734	0.93	1.25	0.61
South Africa	304	100	0.108	0.001	0.113	6.533	1.576	−0.715	1.09	0.84	1.35
Spain	516	126	0.072	0.003	0.091	6.367	1.415	−0.901	1.80	1.36	2.25
Sweden	444	153	0.110	0.001	0.104	6.371	1.640	−0.441	0.91	−0.05	1.87
Switzerland	604	163	0.139	0.002	0.086	6.325	1.438	−0.831	2.72	2.14	3.31
Thailand	770	225	0.075	−0.005	0.035	4.617	1.110	−0.170	0.67	1.14	0.21
Turkey	69	34	0.120	0.003	0.105	5.606	2.395	0.003	0.06	−0.39	0.51
U.K.	4,638	1,219	0.108	0.004	0.090	5.497	1.770	−0.713	2.15	2.02	2.27
U.S.	16,536	3,624	0.122	0.008	0.076	6.011	1.896	−0.207	2.64	2.01	3.27
Venezuela	18	5	0.059	0.000	0.023	6.393	0.879	−3.526	−0.79	−0.69	−0.90
Mean	1,383	362	0.101	0.001	0.070	5.985	1.389	−0.515	0.69	0.74	0.64
Median	379	124	0.107	0.001	0.073	5.978	1.390	−0.441	0.67	0.75	0.42
Std.	3,309	757	0.035	0.007	0.027	0.662	0.312	0.642	0.90	0.94	1.20

(1999)). This industry is heavily regulated and hence subject to different incentives than the other sample firms. To enhance comparability across countries, we also require that firms prepare fully consolidated financial statements. To avoid the effect of extreme outliers, we delete observations if the value of firm-level variables (employed in the analysis) is less (more) than their 1st (99th) percentile value. The final sample consists of 48,400 firm-year observations covering 12,782 firms from 35 countries.

Table 1 reports the number of firm-year observations as well as the number of unique firms. This information is provided for all 35 sample countries. For each country, we also provide the median firm cash to assets ratio and other related variables that influence a firm's liquidity policy. Table 1 shows that there is wide

variation in the number of sample firms across countries. Specifically, the U.S., U.K., and Japan have more than 1,000 firms each, while the average number of firms for the rest of the countries is 124. To ensure that our results are not driven by a few countries with the highest number of observations, all reported regression results are based on weighted least squares (WLS) (which weigh each country equally so that firm-year observations receive more (less) weight in countries with fewer (more) firm-year observations).

The overall median cash to asset ratio is 10.7%. Japanese firms have a median cash to asset ratio of 17.1%, the highest among our sample countries. Overall, the figures for cash to asset ratio for firms in our sample resemble those reported by Dittmar et al. (2003). The median operating cash flows for each country are positive. In contrast, the median change in short-term debt to total assets is negative. SIZE as measured by the natural log of the book value of total assets (in millions of U.S. dollars) shows substantial variability across countries. The median value of Tobin's Q is 1.389 for our sample firms.

Table 2 reports cross-country correlations of the country averages for the key variables. The cross-country correlations between Tobin's Q and the FD metric and between Tobin's Q and operating cash flow are positive and statistically significant at the 0.01 level. All other cross-country correlations except those between ΔSTD and FD and between ΔSTD and CF/A are statistically significant at the 0.10 level. Unreported correlations among variables at the firm level are less than 0.40, indicating little threat of serious multicollinearity problems in the data. This is further evidenced by the fact that the variance inflation factors (VIFs) in the regression estimation are generally under 10.

TABLE 2

Cross-Country Correlations of Country-Level Financial Development and Country-Level Mean of Firm-Level Variables

CF/A is the ratio of operating cash flows (minus dividends) to total assets; Tobin's Q is the market value divided by the book value of assets; SIZE is the natural log of assets (in millions of U.S. dollars); ΔSTD is the change of the ratio of short-term debt to total assets between t and $t-1$; and FD is a measure of financial development. STKMKT is the stock market development index that equals the sum of (standardized indices of) market capitalization over the gross domestic product (GDP), total value traded over the GDP, and total value traded over market capitalization; and FININT is the financial intermediary development index that equals the sum of (standardized indices of) the ratio of liquid liabilities to the GDP and the credit going to the private sector over the GDP. FD is the sum of STKMKT and FININT. ***, **, * represent significance at the 1%, 5%, and 10% levels, respectively.

Variables	FD	CF/A	Tobin's Q	SIZE	ΔSTD
FD	1.00				
CF/A	0.06***	1.00			
Tobin's Q	0.18***	0.13***	1.00		
SIZE	0.03***	0.12***	−0.08***	1.00	
ΔSTD	0.01	0.01	−0.02***	0.09***	1.00

V. Empirical Results

A. Basic Model

Table 3 presents the WLS results using three different proxies of financial development. While models (1)–(3) estimate equation (1), models (4)–(6) modify equation (1) by adding an interaction of the common/civil law indicator variable

and operating cash flows.[12] La Porta et al. (1997), (1998) document that there are underlying differences between common and civil law traditions and the enforcement of laws that protect investors, and that these differences explain the development and structure of financial markets across countries. Therefore, the purpose of models (4)–(6) is to assess whether the results involving the financial development variables remain robust after including the interaction of the common/civil law indicator variable and operating cash flows.

TABLE 3

Weighted Least Squares Regression Results
(dependent variable: ΔCashHoldings)

The baseline model is $\Delta\text{CashHoldings}_{it}=\alpha_{1j}+\alpha_{2t}+\alpha_{3c}+\beta_1\text{SIZE}_{it}+\beta_2\text{Q}_{it}+\beta_3\Delta\text{STD}_{it}+\beta_4\text{CF}_{it}/\text{A}_{it-1}+\beta_5(\text{CF}_{it}/\text{A}_{it-1})*\text{DEV}_{ikt}+\text{u}_{it}$. The weights in the WLS estimations are equal to a value of 1 divided by the number of observations per country. These estimations correct the error structure in all firm-level regressions for heteroskedasticity and for within-period error correlation using the White-Huber estimator. The associated *t*-statistics are reported in parentheses. ΔCashHoldings is the annual change of Cash/Assets between t and $t-1$; SIZE is the natural log of assets (in millions of U.S. dollars); Tobin's Q is the market value divided by the book value of assets; ΔSTD is the change of the ratio of short-term debt to total assets between t and $t-1$; CF/A is the ratio of operating cash flows (minus dividends) to total assets; LAW is an indicator variable coded as 1 for countries with legal systems based on common law, 0 otherwise; DEV is a measure of financial development and is proxied by FD, STKMKT, and FININT; FD is the sum of STKMKT and FININT; STKMKT is the stock market development index that equals the sum of (standardized indices of) market capitalization over the gross domestic product (GDP), total value traded over the GDP, and total value traded over market capitalization; and FININT is the financial intermediary development index that equals the sum of (standardized indices of) the ratio of liquid liabilities to the GDP and the credit going to the private sector over the GDP; and the subscripts, i, t, and c represent firm, time, and country, respectively. ***, **, * represent significance at the 1%, 5%, and 10% levels, respectively, in one-tailed tests when the coefficient sign is predicted, two-tailed otherwise.

	Parameter Estimates (*t*-statistics in parentheses)					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	−0.0258 (−2.67)***	−0.0259 (−2.68)***	−0.0256 (−2.65)***	−0.0258 (−2.67)***	−0.0259 (−2.68)***	−0.0257 (−2.65)***
SIZE	0.0018 (7.73)***	0.0018 (7.73)***	0.0017 (7.71)***	0.0018 (7.73)***	0.0018 (7.72)***	0.0017 (7.71)***
Q	0.0065 (19.58)***	0.0065 (19.56)***	0.0065 (19.57)***	0.0065 (19.58)***	0.0065 (19.56)***	0.0065 (19.57)***
ΔSTD	0.0003 (2.67)***	0.0003 (2.67)***	0.0003 (2.68)***	0.0003 (2.67)***	0.0003 (2.67)***	0.0003 (2.68)***
CF/A	0.0523 (13.63)***	0.0513 (12.36)***	0.0505 (15.11)***	0.0518 (12.02)***	0.0518 (11.29)***	0.0502 (12.24)***
CF/A∗LAW				0.0012 (0.22)	0.0015 (0.27)	0.0008 (0.15)
CF/A∗FD	−0.0061 (−2.51)***			−0.0063 (−2.32)***		
CF/A∗FININT		−0.0053 (−1.90)**			−0.0051 (−1.65)**	
CF/A∗STKMKT			−0.0044 (−2.51)***			−0.0046 (−2.32)***
Country Year Industry	Included Included Included	Included Included Included	Included Included Included	Included Included Included	Included Included Included	Included Included Included
Adjusted R^2 N	0.03 48,400	0.03 48,400	0.03 48,400	0.03 48,400	0.03 48,400	0.03 48,400

For brevity, industry-specific, time-specific, and country-specific intercepts are not reported in Table 3. Analysis of the residuals indicates that the fixed effects model is successful in mitigating cross-sectional and serial correlations that could

[12]Legal systems are broadly categorized as either common law or civil law, with civil law countries further divided into three families of legal systems—German, French, and Scandinavian (David and Brierly (1985), Reynolds and Flores (1989)).

bias the reported *t*-statistics. Nevertheless, we use standard errors that adjust for clustering of observations.

Before we turn to the results pertaining to our testable hypothesis, we briefly discuss our findings on the control variables. The coefficient on SIZE is positive and statistically significant at the 0.01 level in all regression specifications. The coefficient on Tobin's Q is positive and statistically significant at the 0.01 level in all specifications. This finding is consistent with the extant view on the change in cash holdings/Tobin's Q relation. The coefficient on ΔSTD is positive and statistically significant at the 0.01 level, suggesting that sample firms use short-term debt to build cash reserves. The coefficient on CF_{it}/A_{it-1} is also positive and statistically significant at the 0.01 level in all specifications. This positive relation is consistent with the argument that firms save cash out of internal cash flows to finance future investments because of a wedge between the internal and external costs of funds. In models (4)–(6), the coefficients on the interaction of LAW and operating cash flow are not statistically significant at the 0.10 level.

Our main interest, in terms of H1, is the interaction variable between operating cash flows and the DEV metrics (FD, FININT, and STKMKT). H1 predicts that the cash flow sensitivity of cash is less pronounced in financially developed countries relative to financially undeveloped countries. The purpose of the interaction between operating cash flows and the financial development proxies is to examine whether the coefficient on operating cash flows is lower for firms in financially developed countries. Specifically, we examine whether financial development decreases the cash flow sensitivity of cash. The coefficients on the interaction of operating cash flow with the financial development proxies are negative and statistically significant at the 0.05 level in all models. It is noteworthy that FININT has a larger effect than STKMKT. This is not particularly surprising as Diamond (1996) points out that "banks and other financial intermediaries are the main source of external funds to firms" (p. 51) (also see Mayer (1990)). In the absence of theory, we can only conjecture that the development of financial intermediaries, as captured by FININT, contributes greatly to the easing of financial constraints due to costly external financing.

Overall, the results on the interaction of operating cash flow with the financial development proxies indicate that the magnitude of the coefficient on operating cash flows is smaller in countries with greater financial development. Furthermore, the inclusion of the LAW$*$operating cash flow interaction does not affect the results pertaining to the financial development proxies.[13]

[13] As a sensitivity test, we also use the antidirector rights index (ANTIDIR) developed by La Porta et al. (1997), (1998) to proxy for shareholder rights instead of the LAW variable. This ANTIDIR index is based on six specific elements of investor protection dealing with the ability of outsider investors to challenge the control of the firm by inside owners and directors. Country-level scores can range from zero to six based on the sum of six indicator variables that reflect shareholder rights: i) the ability to vote by mail, ii) the ability to gain control of shares during the shareholders' meeting, iii) the possibility of cumulative voting for directors, iv) the ease of calling an extraordinary shareholders' meeting, v) the availability of mechanisms allowing minority shareholders to make legal claims against directors, and vi) shareholders have preemptive rights that can be waived only by a shareholders' vote. Larger values of the antidirector rights index indicate that minority shareholders are better protected against expropriation by management and large shareholders. When we include CF/A$*$ANTIDIR and CF/A$*$FD into the model, the coefficient on CF/A$*$FD is still negative and statistically significant at the 0.01 level, while the coefficient on CF/A$*$ANTIDIR is statistically insignificant at the 0.10 level.

B. Robustness Tests

Additional tests are performed to address issues relating to model misspecification and measurement error in Tobin's Q. Table 4 presents regression results using alternative specifications. Following Almeida et al. (2004), we introduce lagged cash to assets and an interaction of operating cash flows and lagged cash to assets as additional control variables in models (1)–(3). The new interaction term is intended to allow the level of saving out of cash flows to vary with the level of cash reserves. The introduction of these additional variables yields no qualitative change in our basic finding, namely, the magnitude of the coefficient on operating cash flows is smaller in countries with greater financial development.

Fisman and Love (2003) point to the importance of trade credit in less financially developed countries. To the extent that trade credit may be more important in certain countries than others, we proxy trade credit by the level of accounts payable outstanding at the end of each year and include the level of accounts payable and its interaction with cash flow from operations into the basic model. Results of this alternative specification are reported in models (4)–(6) in Table 4. The results show that the cash flow sensitivity of cash is less pronounced for firms with higher levels of accounts payable. More importantly, the results of the financial development remain robust to the inclusion of the trade credit effect. That is, financial development continues to decrease the cash flow sensitivity of cash.

A potential problem with using Tobin's Q in a cross-country setting is that it may reflect not only the presence of growth opportunities, but also the market's perception of a firm's ability to exploit its growth options. For example, for two firms facing the same investment opportunity set, the unconstrained firm should have a higher Tobin's Q because the market knows that it will actually be able to act on the investment opportunity set. To address this issue, following Almeida et al. (2004), we reestimate equation (1) replacing Q with the actual ratio of future investment to current investment.[14] An advantage of using realized investments is that it sidesteps the issue of distinguishing between market evaluation of investment opportunities and a firm's ability to take advantage of these investment opportunities.[15] The results of this substitution are reported in models (7)–(9) of Table 4. As expected, the coefficient on the ratio of future investment to current investment is positive and statistically significant at the 0.01 level in models (7)–(9). More importantly, the statistical significance on the cash flow/financial development interaction continues to be statistically significant when the ratio of future investment to current investment is substituted for Tobin's Q.

Another issue in a cross-country study relates to the use of accounting numbers in computing Tobin's Q. Financial reporting practices differ across countries in our sample. To the extent that these practices differ, the quality of Tobin's Q is likely to vary across countries. Following La Porta et al. (2000), we replace

The results are similar when we substitute FININT (or STKMKT) for the FD variable in the sensitivity analysis. However, regression diagnostics as reflected by large VIFs point to collinearity as an explanation for the lack of significance for the CF/A∗ANTIDIR interaction terms.

[14] We compute realized investments by taking the difference in net fixed assets compared to the previous year and adding depreciation.

[15] A disadvantage of using realized investments as an alternative proxy is the possibility of reverse causality—if a firm has more cash, it is more likely to actually undertake more future investments.

TABLE 4

Augmented Weighted Least Squares Regression Results
(dependent variable: ΔCashHoldings)

The baseline model, $\Delta\text{CashHoldings}_{it} = \alpha_{1j} + \alpha_{2t} + \alpha_{3c} + \beta_1 \text{SIZE}_{it} + \beta_2 Q_{it} + \beta_3 \Delta\text{STD}_{it} + \beta_4 \text{CF}_{it}/\text{A}_{it-1} + \beta_5 (\text{CF}_{it}/\text{A}_{it-1}) * \text{DEV}_{ikt} + u_{it}$, is modified to sequentially include i) the main effect for lagged value of cash to assets (Lag_CASH/A) and its interaction with CF/A; ii) the main effect for the level of accounts payable scaled by total assets (APAY) and its interaction with CF/A; and iii) the ratio of one-year ahead future investments to current investments (FUT_INV/CUR_INV) as a substitute for Tobin's Q). The weights in the WLS estimations are equal to a value of 1 divided by the number of observations per country. These estimations correct the error structure in all firm-level regressions for heteroskedasticity and for within-period error correlation using the White-Huber estimator. The associated *t*-statistics are reported in parentheses. ΔCashHoldings is the annual change of Cash/Assets between t and $t-1$; SIZE is the natural log of assets (in millions of U.S. dollars); future and current investments are computed as the difference in net fixed assets compared to the previous year plus depreciation; ΔSTD is the change of the ratio of short-term debt to total assets between t and $t-1$; CF/A is the ratio of operating cash flows (minus dividends) to total assets; Lag_CASH is the one-year lagged value level of cash holding to total assets; DEV is a measure of financial development and is proxied by FD, STKMKT, and FININT; FD is the sum of STKMKT and FININT; STKMKT is the stock market development index that equals the sum of (standardized indices of) market capitalization over the gross domestic product (GDP), total value traded over the GDP, and total value traded over market capitalization; and FININT is the financial intermediary development index that equals the sum of (standardized indices of) the ratio of liquid liabilities to the GDP and the credit going to the private sector over the GDP. ***, **, * represent significance at the 1%, 5%, and 10% levels, respectively, in one-tailed tests when the coefficient sign is predicted, two-tailed otherwise.

	Parameter Estimates (*t*-statistics in parentheses)								
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	−0.0259* (−2.68)**	−0.0259 (−2.59)***	−0.0257 (−2.66)***	−0.0251 (−2.58)***	−0.0251 (−2.58)***	−0.0251 (−2.58)***	−0.0204 (−2.96)***	−0.0206 (−1.97)**	−0.0201 (−1.94)**
SIZE	0.0018 (7.77)***	0.0018 (7.77)***	0.0018 (7.75)***	0.0018 (7.68)***	0.0018 (7.68)***	0.0018 (7.66)***	0.0013 (5.67)***	0.0013 (5.68)***	0.0013 (5.65)***
Q	0.0065 (19.57)***	0.0065 (19.56)***	0.0065 (19.56)***	0.0065 (19.56)***	0.0065 (19.55)***	0.0065 (19.55)***			
FUT_INV/CUR_INV							0.0004 (2.36)***	0.0004 (2.36)***	0.0004 (2.36)***
ΔSTD	0.0003 (2.60)***	0.0003 (2.61)***	0.0003 (2.62)***	0.0003 (2.65)***	0.0003 (2.65)***	0.0003 (2.66)***	0.0003 (2.70)***	0.0003 (2.69)***	0.0003 (2.71)***
CF/A	0.0521 (13.58)***	0.0512 (12.33)***	0.0503 (15.04)***	0.0586 (12.72)***	0.0578 (15.82)***	0.0569 (13.49)***	0.0607 (14.03)***	0.0621 (12.89)***	0.0577 (15.69)***
Lag_CASH/A	−0.0001 (−6.30)***	−0.0001 (−6.30)***	−0.0001 (−6.29)***						
CF/A∗Lag_CASH/A	0.0002 (1.30)	0.0002 (1.33)	0.0002 (1.31)						
APAY/A				−0.0008 (−0.19)	−0.0007 (−0.16)	−0.0009 (−0.21)			
CF/A∗APAY/A				−0.0587 (−2.51)***	−0.0599 (−2.57)***	−0.0585 (−2.50)***			
CF/A∗FD	−0.0061 (−2.51)***			−0.0058 (−2.42)***			−0.0061 (−2.50)***		
CF/A∗FININT		−0.0054 (−1.92)**			−0.0052 (−1.84)**			−0.0074 (−2.47)***	
CF/A∗STKMKT			−0.0044 (−2.50)***			−0.0043 (−2.41)***			−0.0043 (−2.16)***
Country	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year	Included	Included	Included	Included	Included	Included	Included	Included	Included
Industry	Included	Included	Included	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02
N	48,400	48,400	48,400	48,400	48,400	48,400	48,400	48,400	48,400

Tobin's Q with the past growth rate in sales. As La Porta et al. (2000) point out, this measure has "the advantage of being roughly independent of accounting practices, but has the disadvantage of relying on the past as a proxy for the future" (p. 11). Unreported results using the past growth rate in sales as a substitute for Tobin's Q are very similar to those reported in Table 3 (or Table 4).

C. Model with Controls for Firm Size

We also reestimate regression equation (1) by incorporating the interaction of operating cash flows with firm size. Almeida et al. (2004) use firm size as a proxy for financial constraint and find that small firms (as opposed to large firms) exhibit cash flow sensitivity of cash. The implication in terms of our analysis is that we need to rule out the possibility that the financial development effect on the cash flow sensitivity of cash documented in Tables 3 and 4 is not driven by the size effect. Hence, we control for the interaction between operating cash flows and SIZE.

Panel A of Table 5 reports the results of these additional specifications.[16] In column (1), the coefficient on the interaction CF∗SIZE is negative and statistically significant at the 0.01 level, suggesting that larger firms exhibit lower sensitivity of cash flow to cash. When we add the CF∗FD interaction to the model, the coefficients on both interactions, CF∗SIZE and CF∗FD, are negative and statistically significant at the 0.01 level. This result suggests that the estimated FD effect on the cash flow sensitivity of cash as reported in Table 3 cannot be attributed to differences in firm size, as both interactions, CF∗SIZE and CF∗FD, remain significant at the 0.01 level. Overall, the results of these additional tests indicate that the inferences with respect to H1 remain unaltered by the inclusion of CF∗SIZE as an additional interaction variable.

Prior research posits that financial constraints are more binding on small rather than large firms. Therefore, theory anticipates greater sensitivity of cash holdings to cash flows for these firms. To address this issue, we first classify the sample observations into two groups using the median values of book value of total assets for all firms in the sample. Sample observations with firm size higher than the median value are termed large firms, and those below the median value are termed small firms. Thus, we condition on size, and partition the observations within the large and small subsamples into two categories based on the median value of the FD variable where higher values of FD reflect more financial development. We then create indicator variables, D1, D2, and D3, that take the value of one for firms in the High FD/Small SIZE, Low FD/Large SIZE, and Low FD/Small SIZE groups, respectively, and zero otherwise, and estimate the model,

$$
\begin{aligned}
(2) \qquad \Delta \text{CashHoldings}_{it} \;=\; & \alpha_{1j} + \alpha_{2t} + \alpha_{3c} + \beta_1 \text{Q}_{it} + \beta_2 \Delta \text{STD} + \beta_3 \text{D1}_{it} \\
& + \beta_4 \text{D2}_{it} + \beta_5 \text{D3}_{it} + \beta_6 \text{CF}_{it}/\text{A}_{it-1} + \beta_7 \text{CF}_{it}/\text{A}_{it-1} * \text{D1}_{it} \\
& + \beta_8 \text{CF}_{it}/\text{A}_{it-1} * \text{D2}_{it} + \beta_9 \text{CF}_{it}/\text{A}_{it-1} * \text{D3}_{it} + \text{u}_{it},
\end{aligned}
$$

where all variables are as defined before, and High FD/Large SIZE is the omitted category.

Panel B of Table 5 reports the results of estimating model (2) as a WLS regression. Specifically, the cash flow sensitivity of cash for the three groups split by asset size and FD are of interest. The overall cash flow sensitivity of cash coefficient is positive for each of the four subgroups and it is the largest for the Low FD/Small SIZE group. This is consistent with the notion that small firms in

[16] Unreported results based on STKMKT and FININT are qualitatively similar to those reported in Table 5 based on the FD variable.

low FD countries exhibit the greatest cash flow sensitivity of cash. In addition, the incremental cash flow sensitivity of cash is higher for each of the three (High FD/Small SIZE, Low FD/Large SIZE, and Low FD/Small SIZE) groups relative to the High FD/Large SIZE group. An F-statistic to test whether the coefficient of 0.0277 on (CF/A)∗D3 is larger than the coefficient of 0.0165 on (CF/A)∗D2 is statistically significant at the 0.05 level. Overall, the results indicate that the impact of financial development on the cash flow sensitivity of cash varies between small and large firms, which is consistent with the notion that smaller firms are more likely to face binding financial constraints. More importantly, our results suggest that the size and financial development effects are independent.

D. Country by Country Analysis

So far in our empirical analysis, we pool firm-year observations across countries and over time to assess the relation between cash flow sensitivity of cash and

TABLE 5

Robustness Test for the SIZE Effect
(dependent variable: ΔCashHoldings)

The baseline model is $\Delta\text{CashHoldings}_{it} = \alpha_{1j} + \alpha_{2t} + \alpha_{3c} + \beta_1\text{SIZE}_{it} + \beta_2\text{Q}_{it} + \beta_3\Delta\text{STD}_{it} + \beta_4\text{CF}_{it}/\text{A}_{it} + \text{u}_{it}$ where interaction of CF/A with SIZE and CF/A with FD are supplemented. The weights in the WLS estimations are equal to a value of 1 divided by the number of observations per country. These estimations correct the error structure in all firm-level regressions for heteroskedasticity and for within-period error correlation using the White-Huber estimator. The associated t-statistics are reported in parentheses. ΔCashHoldings is the annual change of Cash/Assets between t and $t - 1$; SIZE is the natural log of assets (in millions of U.S. dollars); Tobin's Q is the market value divided by the book value of assets; ΔSTD is the change of the ratio of short-term debt to total assets between t and $t - 1$; CF/A is the ratio of operating cash flows (minus dividends) to total assets; FD is a measure of financial development and is the sum of STKMKT and FININT; STKMKT is the stock market development index that equals the sum of (standardized indices of) market capitalization over the gross domestic product (GDP), total value traded over the GDP, and total value traded over market capitalization; and FININT is the financial intermediary development index that equals the sum of (standardized indices of) the ratio of liquid liabilities to the GDP and the credit going to the private sector over the GDP. ***, **, * represent significance at the 1%, 5%, and 10% levels, respectively, in one-tailed tests when the coefficient sign is predicted, two-tailed otherwise.

Panel A.

	Parameter Estimates (t-statistics in parentheses)	
Variable	1	2
Intercept	−0.0279 (−2.88)***	−0.0282 (−2.91)***
SIZE	0.0024 (9.55)***	0.0024 (9.61)***
Tobin's Q	0.0067 (20.03)***	0.0067 (20.08)***
ΔSTD	0.0003 (2.65)***	0.0003 (2.61)***
CF/A	0.0913 (11.68)***	0.0989 (11.84)***
CF/A∗SIZE	−0.0094 (−6.26)***	−0.0094 (−6.28)***
CF/A∗FD		−0.0062 (−2.57)***
Country Year Industry	Included Included Included	Included Included Included
Adjusted R^2 N	0.03 48,400	0.03 48,400

(continued on next page)

TABLE 5 (continued)

Robustness Test for the SIZE Effect
(dependent variable: ΔCashHoldings)

The baseline model is $\Delta\text{CashHoldings}_{it} = \alpha_{1j} + \alpha_{2t} + \alpha_{3c} + \beta_1 Q_{it} + \beta_2 \Delta\text{STD}_{it} + \beta_3 D1_{it} + \beta_4 D2_{it} + \beta_5 D3_{it} + \beta_6 CF_{it}/A_{it-1} + \beta_7 CF_{it}/A_{it-1} * D1_{it} + \beta_8 CF_{it}/A_{it-1} * D2_{it} + \beta_9 CF_{it}/A_{it-1} * D3_{it} + u_{it}$. The weights in the WLS estimations are equal to a value of 1 divided by the number of observations per country. These estimations correct the error structure in all firm-level regressions for heteroskedasticity and for within-period error correlation using the White-Huber estimator. The associated *t*-statistics are reported in parentheses. ΔCashHoldings is the annual change of Cash/Assets between t and $t-1$; high and low FD group includes firms from countries with FD values greater than 0.67, and less than 0.67, respectively. Large and small firms have book values of assets greater than $346.36 million and less than $346.36 million, respectively. D1, D2, and D3 are indicator variables that are coded as 1 for firms in the High FD/Small SIZE, Low FD/Large Size, and Low FD/Small size group, respectively, and 0 otherwise. Tobin's Q is the market value divided by the book value of assets; ΔSTD is the change of the ratio of short-term debt to total assets between t and $t-1$; CF/A is the ratio of operating cash flows (minus dividends) to total assets; FD is a measure of financial development and is the sum of STKMKT and FININT; STKMKT is the stock market development index that equals the sum of (standardized indices of) market capitalization over the gross domestic product (GDP), total value traded over the GDP, and total value traded over market capitalization; and FININT is the financial intermediary development index that equals the sum of (standardized indices of) the ratio of liquid liabilities to the GDP and the credit going to the private sector over the GDP. ***, **, * represent significance at the 1%, 5%, and 10% levels, respectively, in a two tailed test.

Panel B.

Variable	Parameter Estimates (*t*-statistics in parentheses)
Intercept	−0.0096 (−1.01)
Tobin's Q	0.0065 (19.47)***
ΔSTD	0.0003 (2.99)***
D1(high FD and small size)	−0.0044 (−4.42)***
D2(low FD and large size)	0.0043 (2.89)***
D3(low FD and small size)	0.0001 (1.00)
CF/A	0.0284 (4.95)***
CF/A∗D1	0.0205 (3.07)***
CF/A∗D2	0.0165 (1.66)*
CF/A∗D3	0.0277 (3.63)***
F-statistic to test: $\beta_7 = \beta_9$	1.37
F-statistic to test: $\beta_8 = \beta_9$	4.78**
Country	Included
Year	Included
Industry	Included
Adjusted R^2	0.03
N	48,400

financial development. We address the fact that the number of observations differs between countries by using WLS estimation. To the extent that this does not completely resolve the issue of differing observations across countries, one can argue that our results are influenced by firm-level observations from a few dominant countries. To address this criticism, we measure the cash flow sensitivity of cash for each country. Specifically, we estimate the following regression for each country,

$$\Delta\text{CashHoldings}_{it} = \alpha_{1j} + \alpha_{2t} + \beta_1 \text{SIZE}_{it} + \beta_2 Q_{it} + \beta_3 \Delta\text{STD}_{it} + \beta_3 \text{CF}_{it}/\text{A}_{it-1} + u_{it}, \quad (3)$$

where all variables are as defined before. We then use the country-specific cash coefficient (β_3) and regress it on the country-level index of FD and median firm size (AVG_SIZE) in a country,

$$\beta_3 = \gamma_0 + \gamma_1 \text{FD} + \gamma_2 \text{AVG\_SIZE}. \tag{4}$$

The main hypothesis is $\gamma_1 < 0$, that is, the cash flow coefficients are decreasing with financial development.[17] The OLS regression results in a coefficient on FD of -0.0472, significant at the 0.05 level with an adjusted R^2 of 0.04. Overall, this result suggests that high financial development countries have lower cash flow sensitivity of cash. Given the higher cost of external financing in financially underdeveloped countries, our evidence points to the importance of liquidity management in these countries. More importantly, we show that our country by country regression yields inferences that are similar to those based on our main pooled cross section regressions.

E. Cash Flow Sensitivity and Business Cycles

To examine the robustness of our findings of the country by country analysis, we also examine the cash flow sensitivity across business cycles. As noted previously, the underlying theory we examine in this paper posits that firms will manage their cash in response to financial constraints. Business cycles affect the profitability of a firm's investments as well as a firm's ability to generate cash flows. For example, recessionary periods reduce current period cash flows and also influence the relative profitability of current investments in comparison to future investments. As a result, firms may hoard more cash during recessionary periods. Therefore, our country-level results with respect to the financial development effect on the cash flow sensitivity of cash could potentially reflect different stages in the countries' business cycles rather than the average financial development effect.

To test this proposition, we use the real GDP growth rate as a proxy for business cycles. Following Almeida et al. (2004), we also include changes in inflation and changes in basic interest rates to control for contemporaneous innovations affecting the cost of money. Table 6 reports the results of reestimating equation (3) by including each of these additional variables. The coefficients on GDP_g reflecting additional cash flow sensitivity of cash during an upturn is negative and statistically significant at the 0.05 level. This results are consistent with the notion that firms exhibit less cash flow sensitivity of cash during economic upturns and vice versa. More importantly, the coefficient on FD variables is negative and statistically significant at the 0.05 level, suggesting that high financial development countries have lower cash flow sensitivity of cash after controlling for other influences.

[17] Love (2003) points out that single-country regressions are not as efficient as cross-country regressions because they necessitate estimation of a larger number of coefficients compared to a pooled cross-country model.

TABLE 6

Country-Level Analysis
(dependent variable: Cash flow sensitivity of cash)

The base line model is $\text{Sensitivity}_{ct} = \alpha + \beta_1 \text{AVG\_SIZE}_{ct} + \beta_2 \text{FD}_c$ with additional control for GDP_g, Inflation_r, and Interest_r. Sensitivity_{ct} is country-level cash flow sensitivity of cash estimated by regressing Δ in cash holdings on the industry and time fixed effect, SIZE, Q, CF/A, and STD. AVG_SIZE_{ct} is the median of the natural log of assets (in millions of U.S. dollars) for each year from each country. FD is a measure of financial development and is the sum of STKMKT and FININT; STKMKT is the stock market development index that equals the sum of (standardized indices of) market capitalization over the gross domestic product (GDP), total value traded over the GDP, and total value traded over market capitalization; and FININT is the financial intermediary development index that equals the sum of (standardized indices of) the ratio of liquid liabilities to the GDP and the credit going to the private sector over the GDP. GDP_g is the real annual growth rate of GDP. Inflation_r is the change in inflation based on the consumer price index, and Interest_r is the change in basic interest rates in a country. ***, **, * represent significance at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variable	Parameter Estimates (t-statistics in parentheses)
Intercept	0.0434 (0.42)
AVG_SIZE	0.0251 (1.31)
FD	−0.0466 (−2.13)**
GDP_g	−0.0103 (−2.34)**
Inflation_r	−0.0068 (−3.25)***
Interest_r	−0.0106 (−1.74)*
Adjusted R^2	0.05
N	141

VI. Conclusion

There is increasing evidence that financial development supports economic growth. An important underlying argument here is that financial development eases firms' access to lower cost external financing. In the presence of costly external financing, a firm's investments will be constrained to its internal cash flows and hence result in lower economic growth. This paper sheds further light on the external financing channel argument by examining the relation between financial development and a firm's cash flow sensitivity of cash.

Since Keynes (1936), economic theory suggests that financial constraints will create a demand for liquidity. One implication of this argument is that financially constrained firms will save out of current cash flows to meet future investment needs. However, hoarding cash in the current period may result in a firm foregoing current period investments for potentially profitable future investments. An optimal liquidity policy will take into consideration the relative profitability of both current and future investments. Empirically, this line of inquiry predicts that financially constrained firms' holdings of liquid assets would increase when cash flows are higher, and thus their cash flow sensitivity of cash would be positive. In contrast, unconstrained firms' cash flow sensitivity of cash is anticipated to display no systematic relation between firms' cash holdings and cash flows. To the extent that financial development reduces financing constraints, we predict the cash flow sensitivity of cash will moderate with the level of financial market development.

Consistent with our prediction, we find that the cash flow sensitivity of cash decreases with a country's level of financial development. Stated differently, we find firms from financially underdeveloped countries exhibit a greater marginal propensity to save cash out of their current period cash flows. This is consistent with the view that financial development eases financing constraints by improving firms' access to lower cost external financing.

Overall, our findings complement prior research that posits financial underdevelopment imposes constraints by raising the cost of external financing. In this paper, we extend this line of inquiry by examining the influence of financial development on firms' liquidity management. Our results highlight the importance of firm liquidity in a cross-country setting when there is divergence between firms' internal and external costs of funds.

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