Firms from Financially Developed Economies Do Not Save Less

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Abstract

Contrary to evidence in Khurana et al. (2006), I find that firms from financially developed economies do *not* have systematically smaller propensities to save out of cash flow. This new result occurs for two interrelated reasons. First, cash flow uncertainty affects saving propensities at least as much as do external finance constraints. Second, although financial development eases external finance constraints, it also contributes to greater cash flow uncertainty through more innovation and higher asset intangibility. This cross-country result holds for financially constrained firms and those with greater cash flow uncertainty. The inverse relation between financial development and saving propensities can hold *only* for unconstrained firms and those with lower uncertainty. Liberalization of stock markets further bolsters the results.

Keywords: Corporate propensity to save/dissave; external finance constraints; cash flow uncertainty; financial development; *q* measurement error.

JEL Codes: G15, G31.

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Prior literature offers contrasting conclusions regarding firms' propensity to save/disburse funds out of cash flow. Almeida et al. (2004) show that because of their restricted access to external finance, financially constrained firms save out of current cash flow to fund future investment, while unconstrained firms generally do not. In contrast, Riddick and Whited (2009) show that cash flow uncertainty is at least as important as the cost of external finance in determining saving propensities. They therefore conclude that saving propensities cannot serve as a good measure of finance constraints, and further argue that measurement bias in Tobin's *q* contributes to a lack of clarity in earlier work.

A natural test of Almeida et al. (2004) is the relation between firms' saving propensities and a country's financial development because financial development should ease finance constraints, firms in countries with more developed capital markets and stronger institutions should not need to save as much out of cash flow. Khurana et al. (2006) show evidence that saving propensities significantly decrease with financial development. However, they and other studies (Baum et al., 2011; Kusnadi and Wei, 2011) do not control for measurement bias in Tobin's *q* and, more importantly, do not consider the role of cash flow uncertainty in explaining saving propensities.

The hypothesis I test in this paper is that a country's financial development does *not* systematically attenuate firms' saving (strengthen dissaving) propensities. My motivation is twofold:

[1] It is now known from the work of Riddick and Whited (2009) that cash flow uncertainty influences saving propensities more than do external finance constraints. The authors argue that "the effect of uncertainty on the propensity to save out of cash flow is empirically at least as strong as the effect of finance constraints" (p.1764). Although firms'

propensity to save, in part, contains information about finance constraints, it also contains information about cash flow uncertainty. Ergo, the saving propensity alone is not a good measure of the cost of external finance.[1]

[2] It is also known that although financial development eases finance constraints by improving firms' access to external funds (Rajan and Zingales, 1998; Love, 2003), it also contributes to greater cash flow uncertainty (Brown and Petersen, 2009; Moshirian et al., 2017). Financial development often associates with the presence of a large and growing number of publicly traded innovative firms with massive intangible capital and growth opportunities but often negative and highly uncertain cash flows. These firms should have greater saving (smaller dissaving) propensities.

My paper consists of two parts. The first part replicates the results in Khurana et al. (2006) in their data sample and my backfilled sample (the period 1994-2002). It shows that their original result, the inverse relation between financial development and saving propensities, holds *only* for firms with low financing costs and those with low cash flow uncertainty. That is, their result holds for large, mostly profitable, financially unconstrained firms with a predictable stream of cash flow. Further, for firms facing greater financing constraints and greater cash flow uncertainty, the relation between financial development and saving propensities becomes positive and often statistically significant. It is exactly the opposite of what Khurana et al. (2006) claim and not in line with Almeida et al. (2004)'s argument.

[1] **Appendix 1** reports the replication of a study by Riddick and Whited (2009). More broadly, the authors conclude that propensities to save cannot be used as a summary measure "of any of the other multitude of real and financial factors that affect these propensities" (p.1764).

The second part of the paper tests the hypothesis in a large representative sample of firms from 43 countries for the period 1990-2015 (Holderness, 2016a, 2016b). I support the hypothesis with the following findings:

[1] I estimate the volatility of cash flow autoregressive AR(1) residuals, which is the measure of cash flow uncertainty, for all sample, manufacturing, and mature firms in each industry-country-year. The volatilities of cash flow residuals are 0.14 and 0.09, respectively, for all sample firms from financially developed and underdeveloped economies. Similar differences, albeit smaller in magnitude, hold for manufacturing and mature firms. This result is interesting per se because it indicates that cash flow uncertainty is considerably higher in economies classified as financially advanced.

I then estimate the volatility of cash flow autoregressive residuals for financially constrained and unconstrained firms in each industry-country-year. Depending on the proxy for finance constraints, the volatility of cash flow AR(1) residuals for constrained firms from financially developed economies ranges from 0.18 to 0.21, while that for constrained firms from underdeveloped economies ranges from 0.10 to 0.14. This is evidence that constrained firms in the financially developed world have higher cash flow uncertainty. Similar results, albeit with smaller magnitudes, hold for unconstrained firms.

[2] Furthermore, I estimate the AR(1) process for cash flow firm by firm. The time-series patterns of the autoregressive cash flow coefficient are somewhat similar between financially developed and underdeveloped economies. The cash flow predictability declined globally over time. However, the cash flow generation is more uncertain in the group of financially developed economies; their cash flow AR(1) coefficients are significantly lower. Specifically, for all sample firms from developed (underdeveloped) economies, the

coefficients are approximately 0.25 and 0.15 (0.60 and 0.35) in the early and later sample years, respectively. Similar results hold for manufacturing firms but not for mature firms. Mature firms have globally more predictable income; their cash flows are difficult to differentiate based on the level of a country's financial development.

[3] OLS results indicate either greater saving propensities for financially developed economies or no differential propensities between developed and underdeveloped economies. Similarly, the q measurement-error corrected results indicate either smaller dissaving propensities for financially developed economies or no differential propensities between developed and underdeveloped economies. Because the results are consistent in both OLS and error-corrected regressions, they are not simply driven by q measurement error and its correction. Further, my paper shows that the results are robust to the sample composition (non-U.S. and mature firms), model specification (dynamic and reduced-form models), estimation method (weighted vs. unweighted data), legal origin (common vs. civil-law countries), external sources of savings (debt and equity issues), proxy for investment opportunities (the ratio of future investment to current investment and the growth rate in revenue), alternative sets of fixed effects, and alternative definitions of the saving (the three-year change in savings) and cash flow (Ali and Hwang, 2000) variables.

[4] Importantly, the evidence holds in the subsamples of financially constrained firms (those that are small, pay no dividends, repurchase no shares, and have high Whited-Wu and Hadlock-Pierce indices). If constraints in financing were a dominant force explaining variations in saving propensities, one would expect to document exactly the opposite results for constrained firms: smaller OLS and larger negative error-corrected saving propensities in countries with greater financial development. However, as I argue in this paper, constraints in

financing are not a dominant force, and a favorable financial and institutional environment thus cannot attenuate the response of saving (strengthen the response of dissaving) to cash flow.

As discussed above in the replication part, the inverse relation between financial development and saving propensities can *only* be found in the subsamples of financially unconstrained firms. However, it makes little sense to attribute this result to the effect of finance constraints on saving propensities (Almeida et al., 2004).

[5] I test the relation between financial development and saving propensities in the subsamples of firms with high and low cash flow uncertainty. To this end, I sort sample firms by their volatility of the residuals from a first-order AR(1) autoregression of cash flow. The high-volatility group displays a positive and statistically significant relation between saving propensities and financial development, whereas the low-volatility group displays a negative or nonsignificant relation between the two. The results here indicate a positive correlation between cash flow uncertainty and financial development. Therefore, saving propensities increase with, or at least remain unresponsive to, financial development.

As discussed above in the replication part, saving propensities decrease with financial development only in a relatively small cohort of firms with low cash flow uncertainty. However, again, it is problematic to attribute this result to the effect of finance frictions because firms with more predictable income are less exposed to constraints in external financing.

[6] I explore the mechanism through which (i) financial development increases cash flow uncertainty for firms, and (ii) this increase in uncertainty counteracts the relaxation in finance constraints and thus mitigates the attenuation effect of financial development on saving

propensities. To this end, I propose a 2SLS test in which cash flow uncertainty is instrumented by financial development measures (the first stage), and then saving propensities are regressed on the instrumented uncertainty (the second stage). In the first stage, financial development significantly increases cash flow uncertainty. In the second stage, cash flow uncertainty significantly increases saving propensities. Therefore, the 2SLS analysis provides additional support for the argument: financial development affects cash flow uncertainty, which in turn affects firms' saving propensities.

[7] The last but not the least piece of the investigation examines the effect of stock market liberalization, which is a formal regulatory change after which foreign investors officially have the opportunity to invest in domestic securities, on firms' demand for internal liquidity. Using liberalization as an exogenous shock to the development of local finance, it is possible to obtain a firmer grasp on whether firms' saving propensities reflect a country's financial development. My sample consists of 16 developing economies that liberalized their stock markets between 1986 and 1995 and 6 other economies that did not liberalize. I estimate saving propensities for each group of economies (in the full sample and the subsample of financially constrained firms) and find that market liberalization has an effect of easing firms' liquidity appetite in the full sample, but not in the subsample of constrained firms. Financial market liberalization did not induce constrained firms to save less (spend more).

To measure the firm's investment opportunity set, I employ Tobin's q. This variable capitalizes the value of cash to the firm. However, it is likely to contain a substantial measurement error. To address this widespread econometric problem, I use a method for obtaining consistent estimates in the presence of measurement bias (Erickson et al., 2014). This method runs a linear error-in-variables regression with identification from the higher-

order cumulant estimators. Thus, in addition to the OLS estimators, all regressions are run using the cumulant estimators. In doing so, I ensure that the results are based on an approach that addresses the impact of biases stemming from unobserved variation in investment opportunities. Other sources of endogeneity, such as simultaneity and omitted variables, are discussed later in the paper. Also, the approach employed in this study is not subject to the Holderness (2016a, 2016b) critique. It uses firm-level (not country-level aggregate) data with a rich set of controls for firm-specific influences, such as firm size or growth opportunities, and is robust to weighting by country.

This paper fits into the literature on corporate saving. This work is most closely related to the studies of Khurana et al. (2006) and Kusnadi and Wei (2011), whose main findings suggest the importance of financial development and investor protection in easing the effect of finance constraints on firms' saving propensities. My study primarily documents that financial development has no systematic attenuation effect on saving propensities. This new result occurs because cash flow uncertainty, which is often higher for more innovative firms in developed economies, strongly influences the propensity to save/disburse funds out of cash flow. Because this propensity is not a summary measure of finance constraints, it should not gauge the benefits of financial development. Although a country's financial development and the quality of its institutions reduce the severity of firms' "true" frictions in raising external funds, they are unlikely to exert a meaningful influence on firms' saving propensities. In future work, researchers should be careful about applying financial development straightforwardly to the marginal propensity to save.

The paper is also related to the literature on cash reserves and financial development (Dittmar et al., 2003; Pinkowitz et al., 2006; Kalcheva and Lins 2007; McLean and Zhao, 2018,

among others). The results in this strand of the literature echo my results in that firms from low-cost developed economies use their established access to external finance to save a large portion of issuance proceeds. That is, firms from financially developed economies tend to save more, not less, from external sources. My results on the internal source of savings complement their evidence. More broadly, the paper is also related to the growing literature on the allocation of cash flow across various uses (Gatchev et al., 2010; Chang et al., 2014), in which the propensity to save is used to gauge the effect of finance constraints.

The paper proceeds as follows. The following section develops the hypothesis. Section 2 describes the data and the identification strategy. Section 3 presents the replication results. Section 4 presents the main (extension) results. The last section concludes.

1. Hypothesis development and brief literature review

Almeida et al. (2004) develop a simple model of a firm's demand for internal liquidity and propose a new measure, namely, the *cash flow sensitivity of cash*, which they argue better reflects the effect of external finance constraints than other common measures. Their model predicts that saving can be sensitive to cash flow in the presence of frictions in financing. A firm anticipating constraints in the future should respond to those potential constraints by saving cash out of its cash flow today. Their empirical results support this prediction.

In contrast, Riddick and Whited (2009) examine a firm's liquidity demand with a stochastic, dynamic model and *q* measurement-error consistent estimators. Their model predicts that the firm can counteract movements in cash flow with opposite movements in saving. This negative propensity to save occurs because a positive productivity shock causes increases in both cash flow and the marginal product of capital. A substitution effect then induces the firm to use some of its cash assets to acquire more productive assets, that is, to

dissave and invest. Riddick and Whited (2009) further note that when a regressor (Tobin's *q*) has measurement error, the signs of the other perfectly measured regressors (cash flow) may change. Thus, in the saving regression, the coefficient on cash flow is positive if there is no correction for measurement error in *q* (the firm saves out of cash flow), whereas it is negative after correction for measurement bias (the firm dissaves out of cash flow).

Although the results of the two studies are noticeably different, they share a common conclusion with respect to firms' constraints in financing: in the saving regression, the cash flow coefficient for the constrained firms, whatever its sign, exceeds that for the unconstrained firms. In particular, the positive OLS coefficient on cash flow is larger for the constrained firms (Almeida et al., 2004), whereas the negative error-corrected coefficient is smaller for the constrained firms (Riddick and Whited, 2009). These findings suggest that the firm saves more/dissaves less out of its cash flow when the cost of external finance is higher.

Importantly, Riddick and Whited (2009) note the confounding effects of finance constraints and cash flow (or income) uncertainty on the size of the cash flow coefficient in the saving model. In their model, constrained firms are predicted to have larger negative coefficients. However, in the presence of highly uncertain income, the negative error-corrected coefficient on cash flow is smaller (firms with high income uncertainty tend to disburse less cash). Because constrained firms also have more uncertain income, their cash flow coefficients are in fact *less* negative. This finding indicates that the effect of cash flow uncertainty on the saving propensity dwarfs the effect of finance constraints. Although the saving propensity contains some information about finance constraints, cash flow uncertainty strongly affects

this one correlation for it to be used as a measure of finance constraints or, more broadly, of any of the other economic forces. I replicate this important result in **Appendix 1**.[2]

Using *only* the argument of Almeida et al. (2004), Khurana et al. (2006) test the link between financial development and saving propensities to document the negative relation between them. Kusnadi and Wei (2011) examine the importance of legal investor protection in mitigating the effect of finance constraints on saving propensities. Baum et al. (2011) show that a country's financial system, in both its structure and level of development, influences the saving propensities of constrained firms. These studies take the stance that the marginal propensity to save out of cash flow is a good measure of finance constraints. This is an important point because the connection to financial development makes sense only if the saving propensity is *mostly* driven by the severity of finance frictions. Still, this necessary condition does not hold. None of these studies considers the role of cash flow uncertainty in explaining saving propensities. Additionally, these studies do not control for measurement error in Tobin's *q*, which summarizes information about the attractiveness of future growth prospects and thus capitalizes the current value of holding cash for the firm.

I revise the existing argument that a country's financial development systematically attenuates a firm's propensity to save (or, equivalently, strengthens a firm's propensity to dissave) out of its cash flow. The motivation is as follows. On the one hand, firms from financially developed economies are supposedly less constrained than their counterparts from underdeveloped economies. Established capital markets and their institutions help a firm overcome problems of information asymmetry and moral hazard and thereby reduce the cost

[2] Other confounding forces include the rate of capital depreciation, the curvature of the production function, and fixed and quadratic adjustment costs. The latter three parameters capture the effects of production technology.

of raising external funds (Rajan and Zingales, 1998; Love, 2003). On the other hand, firms from financially developed economies, as opposed to their peers from underdeveloped economies, operate with more intangible capital. Both tangible and intangible capital are conceived as inputs in production, and they contribute to firm income. The uncertainty associated with intangible capital is significantly higher than that associated with tangible capital; thus, intangible capital is usually expensed and written off of the firm's balance sheet. Given that intangible capital arises as a dominant component of production in developed economies, cash flow becomes more uncertain (Hansen et al., 2005; Moshirian et al., 2017).[3]

Furthermore, financial development led to a dramatic change in the characteristics of the typical listed firm in the U.S. and other advanced economies. For instance, in the U.S., the creation of the NASDAQ – launched in 1971 and repeatedly improved thereafter (the creation of the NMS) – gave growth firms access to a stock exchange. The rise of venture/private equity capital also contributed to innovation and assisted young firms in gaining access to public capital markets. These and similar institutional innovations dramatically altered the composition of capital markets, industries, and overall economies. The "new economy" firms have become the largest players in securities markets; they now prevail in many industries. Eventually, financial development entails that there is a large and growing number of publicly traded innovative firms with massive intangible capital and growth opportunities but often negative and highly uncertain cash flows (Brown and Petersen, 2009; Brown et al., 2009).

[3] Over time, financially developed countries have experienced a large structural transformation. In the early periods (1950s-70s), capital-intensive firms with massive tangible assets prevailed in their economies. In later periods (1980s-2000s), however, the importance of tangible capital has declined. Research-intensive and service-oriented firms have emerged, and production technologies and product markets have changed. The "new economy" firms now produce newer products that do not rely heavily on tangible capital. According to the IMF, at the macro level, the ratio of fixed capital formation to GDP in OECD countries decreased from 25% in the 1970s to 22% in the 2000s and below 18% in 2015. In contrast, financially underdeveloped economies are still heavily tilted towards tangible productive capital.

Because cash flow uncertainty matters more for saving propensities than finance constraints and because firms from financially developed economies often yield more uncertain cash flows, the response of saving to cash flow should not be systematically attenuated by a country's financial development and its institutional quality. This prediction can be expressed as the following hypothesis:

H: *Firms' propensity to save (dissave) out of cash flow does not systematically decrease (increase) with a country's financial development.*

2. Research design and data

2.1. Data, model, and variables

International data are from the S&P's Compustat Global. U.S. data are from the S&P's Compustat North America. I use both unbalanced datasets covering the years 1990 to 2015. The full sample consists of 427,468 firm-years from 43 countries. Firms operating in the financial, utilities, and public administration sectors are excluded. The data sample does not include observations for which there are no data on total and tangible assets, cash holdings, sales revenue, capital expenditures, and operating income. The observations for years in which total assets and sales revenue are nonpositive are also removed.

The empirical approach builds on saving regressions, as in Almeida et al. (2004) and Bao et al. (2012).

$$\Delta Cash_{i,t} = \alpha_i + \alpha_t + \beta_0 + \beta_1 CF_{i,t} + \beta_2\left(CF_{i,t} * Neg_{i,t}\right) + \beta_3 Neg_{i,t} + \beta_4\left(CF_{i,t} * \Psi\right) + \beta_5 \Psi + \beta_6 q_{i,t} + \beta_7 \mathbf{Z}_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where $\Delta Cash$ (saving) is the change in cash holdings (Δche) scaled by total assets (at). CF (cash flow) is calculated as income before extraordinary items (ib) plus depreciation and amortization (dp), scaled by total assets. The propensity to save/dissave out of cash flow is

obtained from $\partial\Delta Cash/\partial CF$. Tobin's q is the ratio of the market value of assets (*csho* times *prccf* (or *cshoc* times *prccd*) minus *ceq* plus *at*) to the book value of assets (*at*). The main interest, in terms of the tested hypothesis, is the interaction term between cash flow and financial development measures ($CF * \Psi$). The measures are discussed in the next section.[4]

Neg is an indicator variable that is equal to unity if cash flow is negative and zero otherwise. Its interaction term with cash flow determines how saving varies with the sign of cash flow. **Z** is a vector of control variables that includes the natural log of total assets (*Size* or *at*), capital expenditures (*CapEx* or *capx*), acquisition spending (*ACQ* or *aqc*), the change in net working capital (ΔNWC or Δ(*act* minus *che* minus *tsca* minus *lct* plus *dlc* and plus *prodv*)), dividends (*DIV* or *dvt*), and the change in short-term debt (ΔSD or Δdlc). The controls are scaled by total assets. The model in Eq. (1) includes firm (α_i) and year (α_t) fixed effects to account for unobserved heterogeneity and time effects. The regression variables are winsorized at the 1% and 99% levels. The variables are summarized in **Table 1**.

To ensure that the main results are not driven by a few countries with the highest number of firm-year observations, all cross-country regressions are based on weighted data. The weights are equal to a value of unity divided by the number of firm-years in a country. This approach weighs each country equally so that firm-years receive more (less) weight in countries with fewer (more) firm-years. The standard errors are clustered at the firm level.

2.2. Financial development measures

To differentiate economies according to their level of financial development, I employ a number of classification schemes. First, I use an indicator variable (*DEV*) that is equal to unity

[4] To ensure that managers' discretionary dividend policies do not affect the volatility of cash flow, I do not subtract cash dividends from cash flow. Instead, I include cash dividends as a stand-alone control variable.

if an economy is classified as financially developed by major market data providers, namely, the Dow Jones, the Financial Times and London Stock Exchange Group, Morgan Stanley, Russell Investments, and Standard and Poor's (23 economies), and is equal to zero otherwise (20 economies). Developed economies must meet criteria under several categories, namely, high-income economies, regulatory environment, openness to foreign ownership, ease of capital movement, and efficiency of market institutions (**Table 2**).

Second, I use the average of the World Economic Forum Financial Development Index over the years 2008 to 2012 (the only years reported) and rank each country in the sample according to its average (*WEF*). I then create a categorical variable (*WEFI*) that is equal to unity, 0.5 or zero if a country's *WEF* lies, respectively, in the top, middle, or bottom third of the ranking. A value of unity corresponds to financially developed economies, while lower values are associated with underdeveloped economies. According to this classification, the sample consists of 14 financially developed and 26 underdeveloped economies. Sri Lanka, Taiwan, and New Zealand have missing observations. Seven pillars of financial development are used to construct the index, namely, the institutional environment, financial stability, development of capital markets, banking and nonbanking intermediation, and capital availability (**Appendix 2**).

Third, I adopt the aggregate measure of financial development from Love (2003), which is the sum of five indices obtained from the World Bank database, including the stock market capitalization over GDP, total value traded over GDP, total value traded over market capitalization, the ratio of liquid liabilities to GDP, and the credit going to the private sector over GDP. The indices are computed per country-year. Each index is standardized to have a mean of zero and a standard deviation of one. The sum of the first three indices is coded as

STKMKT. The sum of the last two indices is coded as *FININT*. *FD* is the sum of *STKMKT* and *FININT*. The aggregate measure reflects the stock market and financial intermediary development (**Table 2**).

Fourth, I include the legal origin variable from La Porta et al. (1998) (*LAW*). An indicator variable is equal to unity for English common-law countries (15 economies) and zero for French, German or Scandinavian civil-law countries (28 economies). The differences in the legal systems can explain the development of domestic capital markets. Generally, the common-law countries offer stronger legal protection to minority investors than do countries with other legal traditions (**Table 2**).

Last, I follow Gupta and Yuan (2009), who investigate the effect of stock market liberalization on industry growth in developing economies. Liberalization is a regulatory change after which foreign investors have the official right to invest in domestic securities. Gupta and Yuan's sample consists of 27 economies that liberalized stock markets between 1986 and 1995. Through matching, I end up with 16 mostly developing economies that liberalized stock markets between 1986 and 1995 and 6 economies that did not liberalize in that period (**Appendix 3**).

As shown in **Table 3**, the proposed measures of financial development are strongly correlated with each other. Therefore, they should accurately capture the overall level of a country's financial development.

2.3. Proxies for external finance constraints and cash flow uncertainty

I use four popular schemes to sort firms into financially constrained and unconstrained categories: firm size, cash payout, the Whited-Wu (WW) index, and the Hadlock-Pierce (HP)

index.[5] I apply each scheme individually to the firm as well as all schemes together. First, the size of the firm, as measured by its sales or assets, is often used as an indicator of the cost of raising external funds. Large and mature firms are considered to have better access to external funds than small and young firms (Gilchrist and Himmelberg, 1995; Hennessy and Whited, 2007). Consequently, firms with an asset size above the 67th percentile (below the 33rd percentile) of the size distribution for 2-digit SIC industry *f* in country *c* and year *t* are considered financially unconstrained (constrained).

Second, Fazzari et al. (1998) posit that finance constraints are more binding for firms not paying cash dividends. Consequently, dividend-paying and stock-repurchasing (non-dividend-paying and non-stock-repurchasing) firms are treated as financially unconstrained (constrained). The rankings are obtained on an annual basis.

Third, the index developed by Whited and Wu (2006) estimates the likelihood that a firm faces finance frictions. The index is constructed for the sample firms according to the following linearization:

$$WW_{i,t} = -0.091CF_{i,t} - 0.062DIVPOS_{i,t} + 0.021TLTD_{i,t} - 0.044Size_{i,t} + 0.102ISG_{i,t} - 0.035SG_{i,t} \quad (2)$$

CF and *Size* are defined as before. *DIVPOS* is an indicator that takes the value of unity if a firm pays dividends or repurchases its stock and zero otherwise. *TLTD* is the ratio of long-term debt to assets. *ISG* is the firm's three-digit industry sales growth. *SG* is the firm's sales growth. Firms with index values above the 67th percentile (below the 33rd percentile) of the index distribution for 2-digit SIC industry *f* in country *c* and year *t* are considered financially constrained (unconstrained).

[5] I omit the Kaplan–Zingales (1997) index because this measure is endogenously determined with firm saving. I also do not consider bond and commercial paper ratings, because too few firms in the international sample have them.

Last, the alternative index of Hadlock and Pierce (2010) is used to measure finance constraints based on firm age and size.

$$HP_{i,t} = -0.737Size_{i,t} + 0.043Size_{i,t}^{2} - 0.040Age_{i,t} \quad (3)$$

Size is as defined earlier. *Age* is the number of years the firm has been on Compustat Global/North America with a stock price. Firms with index values above the 67th percentile (below the 33rd percentile) of the index distribution for 2-digit SIC industry *f* in country *c* and year *t* are treated as financially constrained (unconstrained).

To differentiate the sample firms according to their degree of cash flow uncertainty, I estimate the standard deviation of the residuals from a first-order panel autoregression of *CF* firm by firm (Riddick and Whited, 2009). Firms with residual volatilities in the top (bottom) three deciles of the distribution for 2-digit SIC industry *f* in country *c* are considered to have high (low) income uncertainty.

2.4. Identification strategy

The identification strategy is built on the interaction between cash flow and financial development measures. It is fair to treat the level and evolution of a country's financial development as fairly exogenous to the firm's liquidity choices. There should be little concern about reverse causality bias. Additionally, the model specification in Eq. (1) includes a rich set of firm and year fixed effects. This is a bare minimum to reduce the concern regarding omitted variable bias. This issue is further addressed in the robustness test section. Below, I discuss a classical error-in-variables problem – measurement error in *q*.

Tobin's *q* is an empirical proxy for a firm's investment opportunity set. Given the coefficient bias that *q* measurement error can cause, it may be difficult to draw a meaningful conclusion solely based on the OLS-estimated cash flow coefficient and its interaction with

financial development measures. Finding valid instruments for the mismeasured regressor is also problematic, particularly given Erickson and Whited's (2012) evidence that using irrelevant or other mismeasured regressors as instruments can lead to misleading statistical inferences. To address this econometric issue, I refer to the measurement-error remedy of Erickson et al. (2014), which is asymptotically equivalent to the moment estimators in Erickson and Whited (2000, 2002). The panel regression considers the estimation of a linear error-in-variables model:

$$Y_i = X_i\beta + Z_i\alpha + \mu_i \tag{4}$$

$$x_i = X_i + \varepsilon_i, \tag{5}$$

in which Y_i is the dependent variable (saving), X_i is a vector of unobservable regressors, Z_i is a vector of perfectly measured regressors (cash flow and controls), and μ_i is the regression disturbance. x_i is the proxy for X_i, and ε_i is the measurement error. In this case, X_i is the unobservable marginal q, and x_i is the empirical average (Tobin's) q. By substituting (5) into (4), we have $Y_i = x_i\beta + Z_i\alpha + v_i$, where $v_i = \mu_i - \beta\varepsilon_i$. The correlation between x_i and v_i causes the estimate of β to be biased downward. Because there is a positive correlation between the mismeasured average q and cash flow, the q measurement error causes the coefficient of cash flow to be biased upward.

To control for poorly measured q and inflated cash flow estimates, the error-in-variables regression can implement the cumulant or moment estimators. The cumulant estimators represent an advance beyond the moment estimators. Overidentified moments require numerical minimization and starting values for this minimization, but cumulants are linear and have a closed-form solution. They do not require any information beyond that contained in the observable regressors. This feature of cumulants eliminates the selection of

starting values for the estimated parameters, which is important given the sensitivity of moments to starting values. Hence, I run all regressions using the OLS and higher-order cumulant estimators.

The order number is an empirical choice. An order of five is a reasonable value.[6] The R^2 of the measurement equation, which is an index of measurement quality (τ^2), is reported. The *tau* index ranges between 0 and 1, with zero indicating a worthless proxy and one indicating a perfect proxy. A low quality of *q* (below 0.5) is expected in the saving regression, where measurement bias stems from a large conceptual gap between the empirical Tobin's *q* and the "true" unobserved investment opportunities.

3. Replication of Khurana, Martin and Pereira (2006)

I am able to exactly replicate the baseline results in Khurana et al. (2006) (Table 3, p.797), using their data sample and regressors.[7] The replication results are tabulated in Panel A of **Table 4**. I confirm the magnitude and significance of their coefficient estimates in the *full sample*. Most importantly, however, I show that their full sample results are driven by financially unconstrained (large-size) firms and those with low income uncertainty (low volatility of autoregressive cash flow residuals). Specifically, the coefficient estimates on the interaction term between cash flow and the aggregate financial development measure (*CF* • *FD*) are -0.035 (t = -7.20) and -0.016 (t = -2.50), respectively, in the subsamples of large firms

[6] The minimum value is three, which corresponds to an exactly identified estimator by Geary (1942). Very high values are not recommended because the computational time for these models is exponential. The estimation results are robust to the order of four to seven (unreported).

[7] I thank Inder K. Khurana, Xiumin Martin, and Raynolde Pereira for sharing their data sample. I can replicate the sign, magnitude and significance of their estimated coefficients with (i) non-robust standard errors and (ii) the weights equal to one divided by *the square root* of the number of observations per country. However, when I apply Huber-White robust standard errors and the weights equal to one divided by the number of observations per country (as reported in their paper), the statistical significance of the estimated coefficients often drops below the 10% level in two- and one-tailed tests. The authors acknowledge the errors in reporting results and assert that significance at the 10% level holds with alternative weighting schemes.

and those with low income uncertainty. Conversely, the coefficient estimates are 0.002 (t = 0.56) and 0.004 (t = 1.01), respectively, in the subsamples of small firms and those with high uncertainty. Similar results hold for the other two financial development measures (*CF* • *STKMKT* and *CF* • *FININT*). I therefore can conclude that Khurana et al. documented the inverse relation between financial development and saving propensities because their data sample overrepresents large and medium firms with relatively low financing constraints and low income uncertainty.[8]

Next, I attempt to reproduce the results in Khurana et al. (2006) in my data sample. I reasonably closely follow their sampling criteria, model specifications, estimation methods, and definitions of variables. Specifically, I implement the following steps:

- The data are gathered from the S&P's Compustat Global/North America databases as of 2015 and cover the period 1994-2002;
- The replication sample consists of firm-level observations from 32 countries;[9]
- Financial firms with SIC codes between 6000 and 6999 are excluded;
- The regression models the change in cash holdings as a function of four effects (operating cash flow, Tobin's *q*, firm size, and the change in short-term debt) and an interaction of financial development measure with cash flow;
- The regression controls for country, year and industry fixed effects;
- The definitions of the regression variables are borrowed from the original study. The cash flow variable is computed as in Ali and Hwang (2000);

[8] The mean asset size of their sample firms is $US1.4 bln.
[9] Khurana et al.'s sample consists of firm observations from 35 countries, whereas my replication sample is based on data from 32 countries. The countries with missing data are Argentina, Colombia and Venezuela. Because there is a very low number of observations for these countries in both samples, I omit them.

– The aggregate financial development index (*FD*) and its two constituents (*STKMKT* and *FININT*) are obtained from the World Bank database. The financial development indices are measured per country-year;
– All regression results are based on weighted least squares (the weights are equal to a value of unity divided by the number of observations per country).

The resulting replication/reproduction sample consists of 105,022 firm-year observations and far exceeds that in Khurana et al. (2006) (48,400 firm-years). My sample (sourced from S&P's Compustat Global/North America) includes a much larger number of medium and small firms. Khurana et al. instead relied on the 2002 FTP version of S&P's Compustat Global. This version covered mostly large- and mid-cap firms. The coverage of Compustat Global has, however, dramatically improved over time. The database has been backfilled with more firms of different sizes and more firm-year observations. As such, the more recent data used in my study are of better quality, but these data were not naturally available to Khurana et al. at the time of their study.

Panel B of **Table 4** reports the estimation results returned from the full sample, the subsamples of financially constrained and unconstrained firms (sorted by asset size) and firms with high and low income uncertainty (sorted by the volatility of autoregressive cash flow residuals). Similar to the above conclusion, the baseline results in Khurana et al. (2006) hold *only* in the subsamples of firms with low financing constraints and those with low income uncertainty (both firm characteristics are correlated). The inverse relation between a country's financial development and saving propensities does not hold in the subsamples of firms with greater financing constraints and those with greater cash flow uncertainty. The inverse relation does not hold in the full sample either. As such, the evidence in Khurana et al. (2006) is

relevant to large, mostly profitable, financially unconstrained firms with a predictable stream of cash flow. However, it makes little sense to attribute this evidence to the effect of finance constraints on saving propensities and to the hypothesis developed in Khurana et al. (2006).[10] Again, their sample firms were probably not much constrained and not much exposed to income uncertainty, possibly able to raise financing globally and generate stable income continuously.

Importantly, in the subsample of firms with greater cash flow uncertainty and those with greater financing constraints, the relation between financial development and saving propensities becomes positive and often statistically significant. Again, it is exactly the opposite of what Khurana et al. (2006) claim.

4. Analysis

I now use a large representative panel of international firms (from 43 countries) and an extended sample period (the years 1990 to 2015) to test the hypothesis, subject the evidence to a number of robustness tests, and explore the underlying mechanism.

4.1. Financial development and cash flow uncertainty

To support the hypothesis, I first need to show that firms from financially/institutionally developed economies, compared to their peers from underdeveloped economies, are more exposed to cash flow uncertainty. First, I estimate the standard deviation of cash flow autoregressive AR(1) residuals for all sample, manufacturing (SIC codes between 2000 and 3990) and mature firms (those that exist through the entire sample period) in each 2-digit SIC industry-country-year. The upper panel of **Table 5** reports the volatilities. The volatilities of

[10] Recall that, according to Almeida et al.'s (2004) argument, *only* financially constrained firms save from current cash flow to fund future investment, while unconstrained firms generally do not.

cash flow residuals are 0.14 and 0.09 for sample firms from developed and underdeveloped economies, respectively (column 1). Similar differences, albeit smaller in magnitude, are documented for manufacturing firms (column 2) and mature firms (column 3). This result is interesting per se because it indicates that cash flow uncertainty is considerably higher in economies classified as financially advanced.

I then estimate the standard deviation of cash flow autoregressive residuals for financially constrained and unconstrained firms in each 2-digit SIC industry-country-year. This simple test shows how the degree of cash flow uncertainty differs across constrained and unconstrained firms in economies with differing levels of financial development. The lower panel of **Table 5** reports the volatilities. Depending on the proxy for finance constraints (columns 1 to 4), the volatility of cash flow AR(1) residuals for constrained firms from developed economies ranges from 0.18 to 0.21, while that for constrained firms from underdeveloped economies ranges from 0.10 to 0.14. When I apply the (four) constraint proxies together to the firm (column 5), the volatility of cash flow residuals is 0.29 for the constrained firms from developed economies but is only 0.15 for those from underdeveloped economies. Similar results, albeit with smaller magnitudes, hold for financially unconstrained firms. Thus, the degree of cash flow uncertainty is greater for firms categorized as constrained and, more importantly, for firms from economies classified as financially advanced.

Second, I estimate the AR(1) process for cash flow firm by firm. **Figure 1** plots the results. The time-series patterns of the autoregressive cash flow coefficient are somewhat similar between developed and underdeveloped economies. The cash flow predictability declined globally over time. However, the cash flow AR(1) coefficient is significantly lower in the group of financially developed economies. Specifically, for all sample firms from

developed (underdeveloped) economies, the coefficients are nearly 0.25 and 0.15 (0.60 and 0.35) in the early and later sample years, respectively. Similar results hold for manufacturing firms but not for mature firms. Mature firms have globally more predictable income; their cash flows are therefore difficult to differentiate based on the level of a country's financial development. In sum, the time-series patterns support the cross-sectional patterns in that the cash flow generation is more uncertain in financially advanced economies. It immediately implies that firms from these economies should not have systematically smaller saving (or greater dissaving) propensities.

4.2. Financial development and saving/dissaving propensities

Using financial development metrics, I now test whether saving/dissaving propensities are significantly different for economies with greater financial development. To this end, I first estimate the model in Eq. (1) in the full (extension) sample. **Table 6** reports the OLS and measurement-error consistent estimation results. The following is a brief overview of the results for the cash flow, *q*, and other control variables. The OLS estimate of the cash flow coefficient (β_1 in Eq. (1)) is positive and significant at better than the 1% level. The fact that the *q*-sensitivity of saving is not economically meaningful (<0.01) is not surprising, given that *q* is downward biased in OLS. When I apply the cumulant estimators, the coefficient on cash flow is negative and significant at better than the 1% level. The coefficient is simply shifted downward from its inflated counterpart in OLS. The effect of treating measurement error can also be seen in the estimated coefficient on *q*, which is many times higher than its OLS counterpart. This effect can be explained by the bias in the OLS regression, which in this case is large because of the low estimates for τ^2 (<0.3). Additionally, correcting for measurement error improves the regression R-squared value. The cash flow coefficient is positive in a

negative cash flow environment (β_2 in Eq. (1)). Facing negative cash flow shocks, the firm tends to tap its cash reserves, that is, to dissave. The estimated coefficients for *ΔNWC, DIV, CapEx,* and *ACQ* are negative, while the coefficient for *ΔSD* is positive and all are significant at better than the 1% level. These results are expected.

The main focus – in relation to the testable hypothesis – is the interaction term between cash flow and financial development measures (β_4 in Eq. (1)). The OLS coefficient on the interaction term concludes greater saving propensities for financially developed economies. The OLS coefficient ranges from below 0.01 (t = 2.27) up to 0.08 (t = 7.05). Similarly, the *q* error-corrected coefficient on the interaction term indicates either smaller negative saving (smaller dissaving) propensities for financially developed economies or no differential propensities between developed and underdeveloped economies. The *q* error-corrected coefficient ranges from effectively zero (z = -0.72) to 0.02 (z = 2.80). If constraints in financing were a dominant force explaining variations in saving propensities, one would expect to document exactly the opposite results: smaller OLS and larger negative error-corrected saving propensities in countries with greater financial development. However, constraints in financing are not the dominant force, a favorable climate of financial and institutional development contributes to greater cash flow uncertainty and therefore cannot attenuate (strengthen) the response of saving (dissaving) to cash flow.

It is also worth noting here that although the correction for *q* measurement error is important and this correction changes the statistical inferences in the analysis related to the firm's saving policy, it does not by itself lead to the main conclusion of this paper. Because the results are consistent in both OLS and error-corrected regressions, they do not simply rely on measurement error correction. Instead, the results are driven by economically motivated

forces – the degree of cash flow uncertainty and, to a lesser degree, the severity of external finance constraints.

4.3. Financial development and saving/dissaving propensities: robustness checks

I now subject the baseline estimates discussed above to a number of robustness checks to address potential concerns about model specification, sample design, and other estimation issues. I report only the main variables of interest in **Table 7**.

The first panel of Table 7 reports the results returned from a subsample of non-U.S. firms. U.S. firms constitute 24% of the sample. One could argue that the results are disproportionally affected by U.S. firms. Although all the regressions are based on weighted data, I test this argument by excluding U.S. firms from the sample. The estimates returned from the subsample of non-U.S. firms mimic the original findings, suggesting that the U.S. firms do not disproportionally affect the evidence.[11]

The second panel of Table 7 reports the results estimated from the modified regression model. The model in Eq. (1) is modified to add the common/civil-law indicator variable (*LAW*) and its interaction with cash flow. La Porta et al. (1998) show that there are underlying differences between law traditions and the enforcement of laws that protect investors and that these differences explain the development of financial markets. The purpose of this test is to assess whether the results involving the financial development metrics remain robust after including the interaction of the law variable and cash flow. I find that the financial development effect on saving/dissaving propensities does not change after controlling for the common/civil-law dichotomy for the prevailing legal system in a country. Additionally, the

[11] A different technique I experiment with replaces weighted least squares with unweighted least squares. The untabulated results are qualitatively similar to the reported results.

coefficient on the interaction of the law dichotomy with cash flow is indistinguishable from zero. This finding echoes that in Holderness (2016a).

Next, I augment the model in Eq. (1) by including additional external sources of savings, namely, the change in long-term debt (ΔLD) and equity issues net of repurchases (*Equity*), and their respective interactions with the financial development measures. One possibility is that once external sources of savings are accounted for, firms in developed economies may exhibit different saving/dissaving propensities. The third panel of Table 7 tabulates the results. The additional sources and uses of savings do not significantly change the evidence pertaining to financial development.

In the fourth panel of Table 7, I adopt an alternative definition of the dependent variable, which is a 3-year change in cash (measured from *t-1* to *t+2*). I use the long-term change in cash variable because firms may choose to allocate cash flow to cash reserves with a plan to spend them in the following years. Alternatively, firms may decide to expand their cash reserves. In both cases, the cash flow coefficient could be misstated in the baseline contemporaneous regressions. I find that the cash flow allocation to/from cash reserves increases with the measurement horizon. Both OLS and error-corrected saving propensities increase in absolute value with the saving horizon. Further, this test affirms that the results regarding the relation between financial development and saving propensities are not affected by the length of the saving horizon.

In the fifth panel, I report the results returned from the subsample of mature firms. Mature firms have more predictable income because they are larger and better established. Mature firms are less constrained in financing. As such, their saving decisions should not be much affected by the uncertainty in cash flow or frictions in financing. If this conjecture is

correct, then there should be little or no effect of financial development on mature firms' saving propensities. I test this conjecture and document no systematic differences in saving policies between mature firms from financially developed economies and those from underdeveloped economies.

In the last panel of Table 7, I consider two additional proxies for a firm's investment opportunity set, namely, the rate of sales revenue growth and the ratio of future investment to current investment. Together with Tobin's *q*, the additional proxies are supposed to better capture the unobservable effect of growth opportunities. Indeed, the coefficient estimate on sales revenue growth is positive and significant at better than the 1% level. Its estimated magnitude indicates that sales revenue growth can be a valid predictor of future investment. The investment ratio is also statistically significant, but its economic significance is not so meaningful. After controlling for a firm's future growth prospects, saving (dissaving) propensities significantly increase (decrease) with financial development.

In untabulated results, I perform a number of additional robustness checks. First, I further address issues related to omitted variable bias. The model in Eq. (1) is extended to include the lagged cash-to-assets ratio and the lagged dependent (saving) variable. The negative coefficient estimates on both variables suggest that firms with ex-ante large cash balances have smaller (larger) incentives to save (dissave). The introduction of these additional control variables yields no significant changes in the main findings. Second, I consider a reduced-form model specification (Riddick and Whited, 2009). The model includes only a small set of regressors, namely cash flow, firm size, and Tobin's *q*. The omission of the other major sources and uses of cash does not considerably alter the coefficient estimates of the interaction term between cash flow and financial development. Third, I use an alternative

definition of the cash flow variable (Ali and Hwang, 2000).[12] The estimated coefficient on the interaction term between cash flow and financial development becomes nonsignificant in all tests performed. This result can be partially explained by the inclusion of non-cash items in the definition of cash flow, which reflects managers' discretionary choices rather than the characteristics of the cash flow process. Last, the cross-country patterns of firms' saving/dissaving propensities remain unchanged when I replace the set of firm and year fixed effects with two alternative sets (industry and year, country and year fixed effects). The complete set of fixed effects ensures that this approach reasonably addresses the concern of omitted variable bias. Overall, a rich battery of robustness tests discussed in this section ensures that the reported results are sufficiently robust to support the hypothesis.

4.4. Financial development and saving/dissaving propensities: financially constrained vs. unconstrained firms

It is natural at this point to examine the hypothesis separately in the subsamples of financially constrained and unconstrained firms. The results I have documented so far could stem from the fact that the tests are not carried out based on firms' exposure to external finance constraints. Because a country's financial system and its development should influence saving/dissaving propensities for constrained firms but leave unconstrained ones mostly unaffected, testing propensities for both groups of firms could lead to an erroneous conclusion. To sharpen the results obtained previously, I now separate the constrained firms from the unconstrained ones.

[12] Cash flow from operations = earnings before extraordinary items (*ib*) + depreciation and amortization (*dp*) – total dividends (*dvt*) + change in deferred income taxes (Δ*txdb*) + change in untaxed reserves (Δ*rvutx*) + change in other liabilities (Δ*lo*) + minority interest (*mii*) – change in non-cash working capital (Δ*NWC*).

Table 8 reports the regression results. To save space, I report only the main variables of interest. The subsamples of financially constrained and unconstrained firms are built using four classification schemes, namely, firm size, cash payout, the WW index, and the HP index. Across all individual schemes in Panel A (constrained firms), the OLS coefficient on the interaction term between cash flow and financial market development indicates a somewhat positive association between the two. Similarly, the coefficient on the interaction term returned from the cumulant equations is either significantly positive or null. The results remain largely the same if I apply all constraint criteria together to the firm; that is, the firm has to be classified as being small, paying no dividends, repurchasing no shares, and having high WW and HP indices. The tests provide some evidence in support of the notion that financial/institutional development does not attenuate (strengthen) saving (dissaving) propensities, even in the subsamples of firms constrained in financing.

The attenuation effect of financial development on saving propensities can *only* be found in the subsamples of unconstrained firms (Panel B). However, as discussed in the replication part above, it makes little sense to attribute this result to the effect of finance constraints on saving propensities.

4.5. Financial development and saving/dissaving propensities: firms of different degrees of cash flow uncertainty

The argument presented in this paper is that financial development increases cash flow uncertainty, and this increase in uncertainty dwarfs the effect of finance constraints and, eventually, the attenuation effect of financial development on saving propensities. To account for the impact of cash flow uncertainty on the relation between financial development and saving/dissaving propensities, I test the hypothesis in the subsamples of firms with high and

low income uncertainty. To this end, I sort the sample firms by the volatility of their cash flow autoregressive residuals. The sorting is performed in each 2-digit SIC industry-country. I exclude the middle third and compare saving propensities across the top (high-income uncertainty firms) and bottom (low-income uncertainty firms) thirds. **Table 9** reports the results. The response of saving propensities to financial development remains positive and statistically significant in the high-income uncertainty group, whereas it is negative or nonsignificant in the low-income uncertainty group. Similar to the results reported in the replication part, the results here clearly indicate a positive association between the degree of cash flow uncertainty and the level of financial development. Thus, saving propensities increase with, or at least remain unresponsive to, financial development. Saving propensities decrease with financial development *only* in a small cohort of firms with low income uncertainty. However, and again, it is problematic to attribute this result to the effect of financing frictions because firms with more predictable income are usually less constrained.

4.6. Financial development and saving/dissaving propensities: an instrumental variables analysis of the underlying mechanism

Here, I explore the mechanism through which (i) financial development increases the uncertainty in cash flows for firms, and (ii) this increase in uncertainty counteracts the relaxation in finance constraints and thus mitigates the attenuation effect of financial development on firms' savings propensities. To this end, I propose a 2SLS analysis with instrumental variables.

Table 10 reports the 2SLS results. In the first-stage regression, firms' cash flow uncertainty (σ_{CF}) is instrumented by the financial development measures. Because of the multicollinearity between the measures, *DEV*, *WEFI*, and *FD* are combined through two

principal components, namely, PC(1) and PC(2). In the second-stage regression, the instrumented cash flow uncertainty ($\widehat{\sigma_{CF}}$) is regressed against firms' saving propensities ($\partial\Delta Cash/\partial CF$). Columns (1) and (2) report the results returned from the approach in which saving propensities and cash flow uncertainty (the standard deviation of cash flow autoregressive residuals by firm) are computed for each country in the sample. I end up with 38 country observations, for which the three main measures of financial development are available. Columns (3) and (4) report the results returned from the alternative approach in which saving propensities and cash flow uncertainty (the standard deviation of cash flow autoregressive residuals by industry-country-year) are computed for each country-year. I end up with 878 country-year observations. The tests of endogeneity and overidentifying restrictions are also reported.

In the first-stage regression, financial development significantly increases cash flow uncertainty. In the second-stage regression, the (instrumented) cash flow uncertainty significantly increases saving propensities. The diagnostic tests are satisfactory in all regressions. Therefore, the 2SLS analysis provides additional support for the proposed mechanism.

Last, there may be an issue with q measurement error: the bias in the first-stage regression may affect the coefficient estimates in the second-stage regression. However, because the estimation results are consistent in both OLS and error-corrected regressions, the statistical inferences obtained from the 2SLS analysis should still be informative.

4.7. Stock market liberalization and saving/dissaving propensities

Although financial development measures are designed by global institutions or borrowed from the literature, it is still possible that they are not entirely accurate. Given the broad

definition of financial development, it should not be surprising that there is still no single perfect measure. Thus, in addition to the baseline measures, I use a new setting to test the hypothesis. Specifically, I investigate the effect of stock market liberalization, which is a regulatory change after which foreign investors have the opportunity to invest in domestic securities, on local firms' demand for internal liquidity. For this purpose, I introduce an indicator variable (*LIB*) that is equal to unity if a country liberalized its stock market between 1986 and 1995 and zero otherwise (Gupta and Yuan, 2009). Its interaction with cash flow determines how saving/dissaving propensities vary with stock market liberalization. My sample includes 16 economies that liberalized their stock markets and 6 economies that did not liberalize. I estimate saving propensities for each group of economies (in the full sample and the subsample of financially constrained firms) over the entire sample period.

Table 11 presents the results. I find that stock market liberalization has an effect of easing firms' liquidity appetite in the full sample, but not in the subsample of constrained firms. In OLS regression, I accept the null of no differential saving propensities between the group of economies that provided foreign access to the domestic capital market and the rest of the sample. In the error-in-variables regression, dissaving propensities are in fact smaller in the group of economies that provided market access to foreign investors. Financial market liberalization did not induce constrained firms to save less (spend more).

5. Conclusion

One economic hypothesis states that because financially constrained firms save more out of current cash flow to meet future investment needs, their propensities to save should decrease with a country's financial development. The underlying reasoning is that the development of financial markets and the legal protection of investors should alleviate finance constraints.

An alternative economic hypothesis suggests that cash flow uncertainty increases saving propensities. If cash flow uncertainty matters more for saving propensities than constraints in financing, then saving propensities cannot be a good measure of finance constraints. My paper shows that the development of financial markets and institutional environment (i) contributes to cash flow uncertainty, possibly through firm innovation and intangibility of assets, and (ii) does not systematically attenuate saving (strengthen dissaving) propensities. Additionally, an empirical problem arises from a mismeasured Tobin's *q*. After I correct the bias induced by the *q* measurement error, the statistical inferences in the application related to the firm saving policy change.

My study replicates the inverse relation between financial development and saving propensities (Khurana et al., 2006) and shows that this inverse relation does not hold universally but holds *only* for large, profitable, financially unconstrained firms with a predictable stream of income. Most importantly, the inverse relation does not hold for financially constrained firms and those with high income uncertainty.

The key takeaway of this paper is that financial and institutional development, which is an efficient mechanism to mitigate firms' "true" finance constraints, does not necessarily and invariably translate into lower saving propensities. The marginal propensity to save is not a valid indicator for the benefits of financial development; this is the setting in which the financial development hypothesis should be least applicable.

References

Ali, A., and L. Hwang. 2000. "Country-specific factors related to financial reporting and the value relevance of accounting data". *Journal of Accounting Research*. 38(1): 1–21.

Almeida, H., M. Campello, and M. Weisbach. 2004. "The cash flow sensitivity of cash". *Journal of Finance*. 59(4): 1777–1804.

Bao, D., K. Chan, and W. Zhang. 2012. "Asymmetric cash flow sensitivity of cash holdings". *Journal of Corporate Finance*. 18: 690–700.

Baum, C., D. Schafer, and O. Talavera. 2011. "The impact of the financial system's structure on firms' financial constraints". *Journal of International Money and Finance*. 30: 678–691.

Brown, J., S. Fazzari, and B. Petersen. 2009. "Financing innovation and growth: cash flow, external equity, and the 1990s R&D boom". *Journal of Finance*. 64(1): 151–185.

Brown, J. and B. Petersen. 2009. "Why has the investment–cash flow sensitivity declined so sharply? Rising R&D and equity market developments". *Journal of Banking and Finance*. 33(5): 971–984.

Chang, X., S. Dasgupta, G. Wong, and J. Yao. 2014. "Cash flow sensitivities and the allocation of internal cash flow". *Review of Financial Studies*. 27: 3628–3657.

Dittmar, A., J. Mahrt–Smith, and H. Servaes. 2003. "International corporate governance and corporate cash holdings". *Journal of Financial and Quantitative Analysis*. 38: 111–133.

Erickson, T. and T. Whited. 2000. "Measurement error and the relation between investment and q". *Journal of Political Economy*. 108(5): 1027–1057.

Erickson, T. and T. Whited. 2002. "Two-step GMM estimation of the errors-in-variables model using high-order moments". *Econometric Theory*. 18: 776–799.

Erickson, T. and T. Whited. 2012. "Treating measurement error in Tobin's q". *Review of Financial Studies*. 25(4): 1286–1329.

Erickson, T., C. Jiang, and T. Whited. 2014. "Minimum distance estimation of the errors-in-variables model using linear cumulant equations". *Journal of Econometrics*. 183(2): 211–221.

Fazzari, S., R. Hubbard, and B. Petersen. 1988. "Financing constraints and corporate investment". *Brookings Papers on Economic Activity*. 1: 141–195.

Gatchev, V., T. Pulvino, and V. Tarhan. 2010. "The interdependent and intertemporal nature of financial decisions: an application to cash flow sensitivities". *Journal of Finance*. 65: 725–763.

Geary, R. 1942. "Inherent relations between random variables". *Proceedings of the Royal Irish Academy*. A 47: 63–76.

Gilchrist, S. and C. Himmelberg. 1995. "Evidence on the role of cash flow for investment". *Journal of Monetary Economics*. 36(3): 541–572.

Gupta, N. and K. Yuan. 2009. “On the growth effect of stock market liberalizations”. *Review of Financial Studies*. 22(11): 4715–4752.

Hansen, L., J. Heaton, and N. Li. 2005. “Intangible risk” In: Corrado, C., J. Haltiwanger, and D. Sichel (Eds.). Measuring Capital in the New Economy. University of Chicago Press.

Hennessy, C. and T. Whited. 2007. “How costly is external financing? Evidence from a structural estimation”. *Journal of Finance*. 62(4): 1705–1745.

Holderness, C. 2016. “Law and ownership reexamined”. *Critical Finance Review*. 5(1): 41–83.

Holderness, C. 2016. “Problems using aggregate data to infer individual behavior: Evidence from law, finance, and ownership concentration”. *Critical Finance Review*. 5(1): 1–40.

Kalcheva, I. and K. Lins. 2007. “International evidence on cash holdings and expected managerial agency problems”. *Review of Financial Studies*. 20: 1087–1112.

Kaplan, S. and L. Zingales. 1997. “Do investment-cash flow sensitivities provide useful measures of financing constraints?” *Quarterly Journal of Economics*. 112(1): 169–215.

Khurana, I., X. Martin, and R. Pereira. 2006. “Financial development and the cash flow sensitivity of cash”. *Journal of Financial and Quantitative Analysis*. 41(4): 787–807.

Kusnadi, Y. and K.C. John Wei. 2011. “The determinants of corporate cash management policies: evidence from around the world”. *Journal of Corporate Finance*. 17(3): 725–740.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny. 1998. “Law and finance”. *Journal of Political Economy*. 106(6): 1113–1155.

Love, I. 2003. “Financial development and financing constraints: international evidence from the structural investment model”. *Review of Financial Studies*. 16(3): 765–791.

McLean, R. and M. Zhao. 2018. “Cash savings and capital markets”. *Journal of Empirical Finance*. 47: 49-64.

Moshirian, F., V. Nanda, A. Vadilyev, and B. Zhang. 2017. “What drives investment–cash flow sensitivity around the world? An asset tangibility perspective”. *Journal of Banking and Finance*. 77: 1–17.

Pinkowitz, L., R. Stulz, and R. Williamson. 2006. “Does the contribution of corporate cash holdings and dividends to firm value depend on governance? A cross–country analysis”. *Journal of Finance*. 61: 2725–2521.

Rajan, R. and L. Zingales. 1998. “Financial dependence and growth”. *American Economic Review*. 88(3): 559–586.

Riddick, L. and T. Whited. 2009. “The corporate propensity to save”. *Journal of Finance*. 64(4): 1729–1766.

Table 1: Definition of Variables

Variable	Definition	Source
$\Delta Cash$	Change in cash holdings (Δche)	S&P's Compustat Global, S&P's Compustat North America
CF	Income before extraordinary items plus depreciation and amortization (*ib* + *dp*)	
Neg	Indicator variable that is equal to unity if cash flow (*CF*) is negative and zero otherwise	
q	Market value of assets (*csho* x *prccf* (*cshoc* x *prccd*) - *ceq* + *at*) to the book value of assets (*at*)	
Size	Natural log of total assets (*at*)	
ΔNWC	Change in non-cash net working capital (Δ(*act* - *che* - *tsca* - *lct* + *dlc* + *prodv*))	
DIV	Cash dividends (*dvt*)	
CapEx	Capital expenditures (*capx*)	
ACQ	Acquisition spending (*aqc*)	
ΔSD	Change in short-term debt (Δdlc)	
$\Delta Cash$, *CF*, ΔNWC, *DIV*, *CapEx*, *ACQ*, and ΔSD are deflated by total assets (*at*)		

DEV	Indicator variable that is equal to unity if an economy is classified as financially developed by the Dow Jones, FTSE, MSCI, Russell Investments, and S&P, and is equal to zero otherwise (per country)	Market data providers
WEF	World Economic Forum Financial Development Index, 2008-2012 (average)	World Economic Forum
WEFI	Categorical variable that is equal to unity (financially developed economy), 0.5 or zero (underdeveloped economy) if a country's *WEF* lies in the top, middle or bottom third of the ranking, respectively	World Economic Forum
STKMKT	Sum of standardized indices of stock market capitalization over GDP, total value traded over GDP, and total value traded over market capitalization (per country-year)	World Bank, IMF
FININT	Sum of standardized indices of liquid liabilities over GDP and the credit going to the private sector over GDP (per country-year)	World Bank, IMF
FD	Sum of *STKMKT* and *FININT* (per country-year)	World Bank, IMF
LAW	Indicator variable that is equal to unity for English common-law countries and zero for French, German or Scandinavian civil-law countries (per country)	La Porta et al. (1998)

Table 2: Summary Statistics

		Firm characteristics											Financial development measures						
Country	Obs.	$Cash_{i,t}$	$\Delta Cash_{i,t}$	$CF_{i,t}$	$Neg_{i,t}$	$q_{i,t}$	$Size_{i,t}$	$\Delta NWC_{i,t}$	$DIV_{i,t}$	$CapEx_{i,t}$	$ACQ_{i,t}$	$\Delta SD_{i,t}$	DEV_c	WEF_c	$WEFI_c$	$STK\ MKT_{c,t}$	$FIN\ INT_{c,t}$	$FD_{c,t}$	LAW_c
Australia	16,720	0.22	-0.01	-0.13	0.50	1.99	3.82	0.00	0.02	0.08	0.01	0.00	1	5.01	1	0.96	0.77	1.73	Common
Austria	1,367	0.13	-0.02	0.06	0.11	1.27	6.29	-0.01	0.01	0.05	0.01	-0.01	1	4.23	0.5	-1.62	0.31	-1.31	Civil
Belgium	1,718	0.13	-0.01	0.07	0.11	1.50	6.45	-0.01	0.01	0.05	0.01	-0.02	1	4.48	1	-1.09	0.07	-1.02	Civil
Brazil	3,144	0.13	0.00	0.03	0.20	3.18	7.23	0.00	0.01	0.05	0.00	0.00	0	3.50	0	-0.80	-1.24	-2.04	Civil
Canada	1,932	0.18	0.00	-0.04	0.35	1.92	5.78	0.00	0.01	0.08	0.02	0.00	1	5.01	1	0.85	1.54	2.39	Common
Chile	1,611	0.07	0.00	0.07	0.09	2.93	10.6	0.00	0.00	0.06	0.00	0.00	0	3.64	0.5	-1.00	-0.75	-1.75	Civil
China	26,278	0.21	0.03	0.06	0.08	2.56	7.71	0.01	0.01	0.06	0.00	0.01	0	4.02	0.5	-	-	-	Civil
Denmark	2,124	0.15	0.00	0.05	0.16	1.81	6.93	0.00	0.01	0.05	0.01	0.00	1	4.44	0.5	-0.38	0.63	0.25	Civil
Egypt	892	0.14	0.00	0.09	0.10	1.47	6.85	0.01	0.01	0.04	0.00	0.01	0	3.13	0	-1.43	-1.07	-2.51	Civil
Finland	2,137	0.14	-0.01	0.07	0.13	1.53	5.74	-0.01	0.02	0.05	0.01	-0.01	1	4.23	0.5	1.30	-0.59	0.70	Civil
France	10,776	0.15	-0.01	0.04	0.16	1.50	5.79	-0.01	0.00	0.04	0.01	-0.01	1	4.66	1	0.18	0.00	0.19	Civil
Germany	10,899	0.16	0.00	0.04	0.18	1.54	5.26	-0.01	0.01	0.04	0.01	0.00	1	4.65	1	0.58	0.27	0.85	Civil
Greece	2,796	0.09	-0.01	0.03	0.26	1.29	5.43	-0.02	0.01	0.03	0.00	0.00	0	3.12	0	-1.08	0.36	-0.73	Civil
Hong Kong	2,052	0.19	0.01	0.04	0.19	1.44	7.98	0.00	0.02	0.04	0.01	0.00	1	5.14	1	9.04	5.81	14.8	Common
India	20,809	0.08	0.01	0.06	0.16	1.51	8.25	0.01	0.01	0.06	0.00	0.01	0	3.35	0	0.08	-0.95	-0.87	Common
Indonesia	4,625	0.12	0.00	0.06	0.18	2.15	13.1	0.01	0.00	0.06	0.00	0.00	0	3.00	0	-1.60	-1.98	-3.58	Civil
Ireland	960	0.16	0.01	0.03	0.23	1.63	5.39	0.00	0.01	0.05	0.01	0.00	1	4.31	0.5	-1.54	0.75	-0.79	Common
Israel	2,747	0.22	0.00	0.01	0.21	2.30	5.62	0.00	0.01	0.04	0.01	0.00	1	3.90	0.5	-0.76	-0.20	-0.96	Common
Italy	3,436	0.12	-0.02	0.04	0.18	1.32	7.54	-0.02	0.01	0.04	0.01	-0.02	1	3.97	0.5	0.96	-0.33	0.64	Civil
Japan	72,315	0.19	0.00	0.04	0.13	1.28	10.5	0.00	0.01	0.02	0.00	0.00	1	4.84	1	0.73	4.69	5.41	Civil
Korea	23,800	0.16	0.01	0.02	0.22	1.20	12.0	0.01	0.01	0.05	0.00	0.01	0	4.20	0.5	2.70	0.45	3.15	Civil
Malaysia	12,796	0.13	0.01	0.04	0.19	1.29	5.63	0.00	0.01	0.04	0.01	0.00	0	4.23	0.5	0.24	1.54	1.78	Common
Mexico	1,495	0.09	0.00	0.07	0.10	1.45	9.33	0.00	0.00	0.05	0.01	0.00	0	3.15	0	-1.81	-2.42	-4.23	Civil
Netherlands	2,904	0.11	0.00	0.08	0.11	1.69	6.27	-0.01	0.02	0.05	0.02	0.00	1	4.85	1	1.05	0.80	1.85	Civil
New Zealand	1,505	0.10	0.00	0.02	0.20	1.82	4.92	0.00	0.02	0.05	0.01	0.00	1	-	-	-1.94	1.07	-0.87	Common
Norway	2,663	0.16	0.00	0.01	0.26	2.08	6.99	0.00	0.01	0.07	0.01	0.00	1	4.48	1	-0.30	-0.17	-0.47	Civil
Pakistan	2,732	0.08	0.01	0.09	0.14	1.30	8.39	0.01	0.02	0.06	0.00	0.01	0	2.82	0	-0.02	-2.12	-2.15	Common
Philippines	1,745	0.12	0.01	0.05	0.21	1.84	8.27	0.00	0.01	0.05	0.01	0.00	0	3.02	0	-1.55	-1.47	-3.02	Civil
Poland	4,341	0.11	0.01	0.04	0.19	1.59	4.83	0.01	0.00	0.06	0.00	0.01	0	3.35	0	-1.57	-1.35	-2.91	Civil
Portugal	850	0.06	-0.02	0.06	0.14	1.17	7.39	-0.01	0.01	0.04	0.00	-0.02	1	3.76	0.5	-0.98	1.06	0.08	Civil

Table 2: Summary Statistics (continued)

		Firm characteristics										Financial development measures						
Country	Obs.	$Cash_{i,t}$	$\Delta Cash_{i,t}$	$CF_{i,t}$	$Neg_{i,t}$	$q_{i,t}$	$Size_{i,t}$	$\Delta NWC_{i,t}$	$DIV_{i,t}$	$CapEx_{i,t}$	$ACQ_{i,t}$	$\Delta SD_{i,t}$	DEV_c	WEF_c	$WEFI_c$	$STK\ MKT_{c,t}$	$FIN\ INT_{c,t}$	$FD_{c,t}$	LAW_c
Russia	934	0.10	0.01	0.08	0.14	2.22	9.65	0.00	0.00	0.07	0.01	0.00	0	3.25	0	-1.16	-1.50	-2.66	Civil
Singapore	8,112	0.19	0.01	0.04	0.19	1.31	5.20	0.00	0.01	0.05	0.01	0.00	1	5.06	1	2.36	1.16	3.52	Common
South Africa	3,778	0.12	0.01	0.09	0.12	1.54	7.16	0.01	0.01	0.06	0.01	0.00	0	3.67	0.5	1.06	0.31	1.38	Common
Spain	2,118	0.09	-0.02	0.07	0.12	1.47	7.99	-0.01	0.01	0.04	0.01	-0.02	1	4.44	0.5	1.50	1.00	2.49	Civil
Sri Lanka	1,644	0.08	0.01	0.07	0.12	1.46	7.92	0.01	0.01	0.05	0.00	0.01	0	-	-	-2.19	-2.02	-4.20	Common
Sweden	5,490	0.17	0.00	-0.02	0.31	2.04	6.41	0.00	0.02	0.03	0.02	0.00	1	4.61	1	1.52	-0.16	1.37	Civil
Switzerland	3,411	0.17	0.00	0.07	0.11	1.65	6.35	0.00	0.01	0.04	0.02	0.00	1	4.85	1	3.08	3.01	6.10	Civil
Taiwan	17,817	0.21	0.01	0.06	0.15	1.44	8.38	0.00	0.00	0.05	0.00	0.00	0	-	-	-	-	-	Civil
Thailand	6,890	0.11	0.01	0.08	0.13	1.40	7.97	0.01	0.01	0.05	0.00	0.00	0	3.48	0	0.11	1.17	1.28	Common
Turkey	2,796	0.10	0.00	0.06	0.20	1.95	7.19	0.01	0.01	0.05	0.00	0.00	0	3.18	0	0.79	-1.68	-0.89	Civil
UK	24,327	0.15	0.00	0.01	0.24	1.82	4.36	0.00	0.02	0.05	0.01	0.00	1	5.28	1	1.13	1.77	2.90	Common
US	103,698	0.18	0.01	-0.01	0.28	2.05	5.06	0.00	0.01	0.06	0.02	0.00	1	5.30	1	3.29	1.33	4.62	Common
Vietnam	2,284	0.14	0.01	0.09	0.06	1.13	13.4	0.02	0.00	0.06	0.00	0.02	0	2.99	0	-	-	-	Civil
Mean		0.14	0.00	0.04	0.18	1.70	7.28	0.00	0.01	0.05	0.01	0.00		4.07		0.27	0.25	0.51	
Median		0.13	0.00	0.05	0.16	1.54	6.99	0.00	0.01	0.05	0.01	0.00		4.21		0.10	0.29	0.13	
St.dev.		0.04	0.01	0.04	0.08	0.45	2.18	0.01	0.01	0.01	0.01	0.01		0.75		2.02	1.70	3.42	

Description: The table reports the summary statistics for the regression variables used in the model in Eq. (1). The table includes country-level means of individual-firm characteristics and financial development measures. The regression variables are defined in Table 1. The subscripts denote country *c*, firm *i*, and year *t*. Obs. is the number of firm-year observations.

Interpretation: There is a large sample of firms (427,468 firm-year observations over the period 1990-2015) from 43 countries with different levels of financial development.

Table 3: Pairwise Comparison of Financial Development Measures

Financial development measure		WEF_c	$WEFI_c$	$STK\ MKT_{c,t}$	$FIN\ INT_{c,t}$	$FD_{c,t}$
$DEV_c = 1$	Developed	4.61	0.82	0.87	1.07	1.93
$DEV_c = 0$	Underdeveloped	3.39	0.14	-0.54	-0.87	-1.41
		DEV_c	WEF_c	$STK\ MKT_{c,t}$	$FIN\ INT_{c,t}$	$FD_{c,t}$
$WEFI_c = 1$	Developed	1	4.87	1.67	1.49	3.16
$WEFI_c = 0.5$	Underdeveloped	0.62	4.08	0.12	0.35	0.47
$WEFI_c = 0$	Underdeveloped	0	3.18	-0.84	-1.19	-2.03

Description: The table reports the pairwise comparisons (by means) of financial development measures. The financial development measures are defined in Table 1. The subscripts denote country *c* and year *t*.

Interpretation: Different measures of financial development are strongly correlated with each other. They should accurately gauge the overall level of a country's financial development.

Table 4: Replication of a Study of the Influence of Financial Development on Saving Propensities (Khurana, Martin and Pereira, 2006)

Panel A: Data sample of Khurana et al. (2006)
(S&P's Global Vantage FTP version, as of 2002)

Dependent variable: $\Delta Cash_{i,t}$	*STK MKT*$_c$	*FIN INT*$_c$	*FD*$_c$
(1) Full sample (Table 3, p.797)			
$CF_{i,t} \bullet \Psi$	**-0.004**	**-0.005**	**-0.006**
	(-2.51)	**(-1.90)**	**(-2.51)**
$CF_{i,t}$	0.051	0.051	0.052
	(15.1)	(12.4)	(13.6)
$q_{i,t}$	0.007	0.007	0.007
	(19.6)	(19.6)	(19.6)
Obs.	48,400	48,400	48,400
(2) Financially unconstrained firms			
$CF_{i,t} \bullet \Psi$	**-0.023**	**-0.030**	**-0.035**
	(-6.70)	**(-5.71)**	**(-7.20)**
$CF_{i,t}$	0.055	0.064	0.067
	(9.07)	(8.42)	(9.57)
$q_{i,t}$	0.006	0.006	0.006
	(11.3)	(11.2)	(11.4)
Obs.	15,960	15,960	15,960
(3) Financially constrained firms			
$CF_{i,t} \bullet \Psi$	**0.003**	**-0.002**	**0.002**
	(1.03)	**(-0.34)**	**(0.56)**
$CF_{i,t}$	0.057	0.063	0.058
	(9.65)	(8.77)	(8.68)
$q_{i,t}$	0.006	0.006	0.006
	(10.3)	(10.3)	(10.3)
Obs.	15,975	15,975	15,975
(4) Firms with low income uncertainty			
$CF_{i,t} \bullet \Psi$	**-0.017**	**-0.001**	**-0.016**
	(-3.70)	**(-0.11)**	**(-2.50)**
$CF_{i,t}$	0.054	0.034	0.051
	(5.90)	(3.06)	(5.01)
$q_{i,t}$	0.008	0.008	0.008
	(12.8)	(12.5)	(12.7)
Obs.	13,828	13,828	13,828
(5) Firms with high income uncertainty			
$CF_{i,t} \bullet \Psi$	**0.004**	**-0.001**	**0.004**
	(1.51)	**(-0.05)**	**(1.01)**
$CF_{i,t}$	0.026	0.032	0.026
	(4.57)	(4.30)	(3.99)
$q_{i,t}$	0.007	0.007	0.007
	(9.33)	(9.32)	(9.33)
Obs.	13,818	13,818	13,818

Panel B: Backfilled sample.
(S&P's Compustat Global/North America, as of 2015)

Dependent variable: $\Delta Cash_{i,t}$	$STK\ MKT_{c,t}$	$FIN\ INT_{c,t}$	$FD_{c,t}$
(1) Full sample			
$CF_{i,t} \bullet \Psi$	**0.001**	**0.008**	**0.002**
	(0.40)	**(1.59)**	**(1.13)**
$CF_{i,t}$	0.164	0.164	0.163
	(23.6)	(25.0)	(23.5)
$q_{i,t}$	0.004	0.004	0.004
	(5.31)	(5.27)	(5.28)
Obs.	105,022	105,022	105,022
(2) Financially unconstrained firms			
$CF_{i,t} \bullet \Psi$	**-0.002**	**-0.004**	**-0.002**
	(-0.37)	**(-0.48)**	**(-0.57)**
$CF_{i,t}$	0.187	0.186	0.187
	(13.8)	(14.4)	(13.9)
$q_{i,t}$	0.003	0.003	0.003
	(2.09)	(2.06)	(2.08)
Obs.	36,185	36,185	36,185
(3) Financially constrained firms			
$CF_{i,t} \bullet \Psi$	**0.001**	**0.009**	**0.002**
	(0.24)	**(1.26)**	**(0.71)**
$CF_{i,t}$	0.171	0.170	0.169
	(16.0)	(17.1)	(15.8)
$q_{i,t}$	0.005	0.005	0.005
	(4.06)	(4.06)	(4.05)
Obs.	32,681	32,681	32,681
(4) Firms with low income uncertainty			
$CF_{i,t} \bullet \Psi$	**-0.039**	**-0.029**	**-0.028**
	(-2.95)	**(-1.81)**	**(-3.71)**
$CF_{i,t}$	0.069	0.052	0.061
	(2.25)	(1.79)	(2.07)
$q_{i,t}$	0.004	0.003	0.003
	(2.35)	(2.25)	(2.31)
Obs.	29,938	29,938	29,938
(5) Firms with high income uncertainty			
$CF_{i,t} \bullet \Psi$	**0.006**	**0.013**	**0.006**
	(1.37)	**(1.76)**	**(1.92)**
$CF_{i,t}$	0.186	0.189	0.184
	(14.5)	(16.4)	(14.8)
$q_{i,t}$	0.005	0.005	0.005
	(2.39)	(2.46)	(2.43)
Obs.	26,840	26,840	26,840

Description: The table reports the results of the replication of a study of the influence of financial development on saving propensities (Khurana et al., 2006). Panel A reports the results returned from the data sample used in Khurana et al. (sourced from the FTP version of S&P's Compustat Global, as of 2002). Panel B reports the results returned from my data sample (sourced from the S&P's Compustat Global and North America databases, as of 2015). In both panels, firms are either sorted by asset size (financially unconstrained and constrained firms) or the volatility of autoregressive cash flow residuals (firms with low and high income uncertainty). The sample period is from 1994 to 2002. The definitions of the regression variables are either borrowed from Khurana et al. (panel A) or as defined in Table 1 (panel B). *CF* (cash flow) is computed in accordance with Ali and Hwang, 2000. Ψ is a country's financial development measure (*STKMKT*, *FININT*, and *FD*). The financial development measures are either obtained as of 2002 (panel A) or computed per each country-year (panel B). The *t*-statistics are reported in parentheses. The subscripts denote country *c*, firm *i*, and year *t*. Obs. is the number of firm-year observations.

Interpretation: The inverse relation between financial development and saving propensities can be replicated *only* in the subsamples of financially unconstrained firms and those with low income uncertainty. The findings contradict the claim of Khurana et al. (2006) and the argument of Almeida et al. (2004).

Table 5: Cash Flow Uncertainty in Financially Developed and Underdeveloped Economies

Panel A: Cash flow uncertainty in the full data sample, and subsamples of manufacturing and mature firms

Financial development measure		(1)	(2)	(3)
$DEV_c = 1$	Developed	0.14	0.13	0.11
$DEV_c = 0$	Underdeveloped	0.09	0.09	0.09
$WEFI_c = 1$	Developed	0.14	0.13	0.11
$WEFI_c = 0.5$ or 0	Underdeveloped	0.09	0.09	0.09
$FDI_{c,t} = 1$	Developed	0.14	0.13	0.10
$FDI_{c,t} = 0$	Underdeveloped	0.09	0.08	0.08

Panel B: Cash flow uncertainty in the subsamples of financially constrained and unconstrained firms

	Constrained firms					**Unconstrained firms**				
	Small firm	*DIV* = 0	High *WW*	High *HP*	All schemes	Large firm	*DIV* > 0	Low *WW*	Low *HP*	All schemes
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
$DEV_c = 1$	0.19	0.21	0.21	0.20	0.29	0.07	0.08	0.09	0.08	0.06
$DEV_c = 0$	0.10	0.11	0.14	0.10	0.14	0.05	0.04	0.07	0.09	0.04
$WEFI_c = 1$	0.19	0.21	0.21	0.19	0.29	0.07	0.08	0.09	0.08	0.06
$WEFI_c = 0.5$ or 0	0.10	0.11	0.15	0.10	0.15	0.06	0.04	0.07	0.09	0.04
$FDI_{c,t} = 1$	0.18	0.20	0.21	0.18	0.29	0.07	0.07	0.09	0.09	0.06
$FDI_{c,t} = 0$	0.10	0.11	0.14	0.12	0.16	0.06	0.05	0.08	0.07	0.04

Description: Panel A reports the standard deviation of the residuals from a first-order panel autoregression of cash flow returned from the full data sample (column 1), the subsample of manufacturing firms (column 2), and the subsample of mature firms (column 3). Panel B reports the standard deviation of the residuals returned from the subsamples of financially constrained and unconstrained firms. The standard deviations are estimated in each 2-digit SIC industry-country-year. Four schemes are used to sort firms into financially constrained and unconstrained categories: firm size, cash payout (*DIV*), the Whited-Wu (*WW*) index, and the Hadlock-Pierce (*HP*) index. The schemes are applied to the firm individually (columns 1 to 4) and together (column 5). The financial development measures (*DEV*, *WEFI*, and *FD*) are defined in Table 1. *FDI* is equal to unity if a country's *FD* index lies above the sample median in year *t* and zero otherwise. Across all measures, a value of unity corresponds to financially developed economies, while lower values correspond to underdeveloped economies.

Interpretation: Cash flow uncertainty is higher in financially developed economies. This result holds in the full data sample, the subsamples of manufacturing and mature firms, and the subsamples of financially constrained and unconstrained firms.

Table 6: Financial Development and Saving/Dissaving Propensities: Extension Using More Controls and Larger Sample

Dependent variable: $\Delta Cash_{i,t}$	DEV_c	$WEFI_c$	$FD_{c,t}$	DEV_c	$WEFI_c$	$FD_{c,t}$
	OLS			Cumulants		
$CF_{i,t} \bullet \Psi$	**0.08**	**0.08**	**0.00**	**0.02**	**0.02**	**-0.00**
	(7.05)	**(5.77)**	**(2.27)**	**(2.80)**	**(1.52)**	**(-0.72)**
$CF_{i,t}$	0.25	0.25	0.29	-0.31	-0.31	-0.28
	(20.3)	(17.8)	(23.9)	(-22.7)	(-19.5)	(-21.9)
$CF_{i,t} \bullet Neg_{i,t}$	-0.11	-0.11	-0.10	0.68	0.68	0.67
	(-7.94)	(-7.57)	(-6.53)	(47.2)	(45.9)	(44.9)
$q_{i,t}$	0.00	0.00	0.00	0.09	0.09	0.09
	(1.76)	(1.72)	(1.07)	(102.4)	(101.2)	(98.3)
$Size_{i,t}$	0.01	0.01	0.01	0.00	0.00	0.00
	(22.4)	(22.3)	(22.3)	(29.1)	(28.8)	(22.8)
$\Delta NWC_{i,t}$	-0.12	-0.11	-0.10	-0.21	-0.21	-0.20
	(-14.5)	(-13.2)	(-12.2)	(-43.6)	(-41.1)	(-38.5)
$DIV_{i,t}$	-0.17	-0.16	-0.18	-0.64	-0.63	-0.67
	(-6.61)	(-5.85)	(-6.52)	(-22.6)	(-21.5)	(-23.3)
$CapEx_{i,t}$	-0.27	-0.26	-0.26	-0.21	-0.21	-0.20
	(-29.4)	(-28.5)	(-27.0)	(-32.0)	(-30.7)	(-29.3)
$ACQ_{i,t}$	-0.28	-0.30	-0.28	-0.30	-0.29	-0.29
	(-17.9)	(-19.0)	(-17.6)	(-32.7)	(-31.8)	(-33.1)
$\Delta SD_{i,t}$	0.27	0.28	0.27	0.18	0.18	0.18
	(36.0)	(36.1)	(34.4)	(37.5)	(36.1)	(34.8)
τ^2	-	-	-	0.27	0.27	0.29
R^2	13.3%	13.4%	13.4%	21.7%	21.7%	20.3%
Obs.	427,468	406,502	381,089	427,468	406,502	381,089

Description: The table reports the OLS and measurement-error consistent results estimated from the model in Eq. (1). The sample period is from 1990 to 2015. The regression variables are defined in Table 1. Ψ is a country's financial development measure (*DEV*, *WEFI*, and *FD*). The OLS *t*-statistics and cumulant *z*-statistics are reported in parentheses. The subscripts denote country *c*, firm *i*, and year *t*. The index of *q* measurement quality (τ^2) and the regression-adjusted R^2 are reported at the bottom of the table. Obs. is the number of firm-year observations.

Interpretation: There is no evidence that financial development attenuates saving (strengthens dissaving) propensities. If anything, the positive sign on $CF \bullet \Psi$ indicates the opposite.

Table 7: Financial Development and Saving/Dissaving Propensities: Robustness Checks

Dependent var.: $\Delta Cash_{i,t}$	DEV_c	$WEFI_c$	$FD_{c,t}$	DEV_c	$WEFI_c$	$FD_{c,t}$
	OLS			Cumulants		
(1) Non-U.S. firms						
$CF_{i,t} \bullet \Psi$	**0.08**	**0.08**	**0.00**	**0.04**	**0.04**	**0.00**
	(6.83)	**(5.52)**	**(1.94)**	**(4.73)**	**(3.17)**	**(2.90)**
$CF_{i,t}$	0.26	0.25	0.29	-0.23	-0.24	-0.16
	(20.3)	(18.0)	(23.6)	(-14.7)	(-13.1)	(-10.8)
$CF_{i,t} \bullet Neg_{i,t}$	-0.12	-0.12	-0.10	0.58	0.58	0.52
	(-8.16)	(-7.78)	(-6.73)	(32.7)	(31.2)	(28.3)
$q_{i,t}$	0.00	0.00	0.00	0.09	0.09	0.08
	(0.68)	(0.61)	(-0.03)	(67.4)	(66.5)	(59.4)
Obs.	323,770	302,804	277,391	323,770	302,804	277,391
(2) Common/civil-law countries						
$CF_{i,t} \bullet \Psi$	**0.08**	**0.08**	**0.00**	**0.03**	**0.03**	**-0.00**
	(6.98)	**(5.72)**	**(1.82)**	**(3.57)**	**(2.26)**	**(-0.46)**
$CF_{i,t} \bullet LAW_c$	0.00	-0.01	0.01	-0.01	0.00	0.00
	(-0.22)	(-0.67)	(1.21)	(-1.40)	(-0.36)	(0.44)
$CF_{i,t}$	0.25	0.25	0.28	-0.33	-0.34	-0.29
	(19.7)	(17.7)	(22.0)	(-23.7)	(-21.2)	(-21.3)
$CF_{i,t} \bullet Neg_{i,t}$	-0.11	-0.11	-0.10	0.70	0.70	0.67
	(-7.85)	(-7.48)	(-6.55)	(48.2)	(47.0)	(45.4)
$q_{i,t}$	0.00	0.00	0.00	0.10	0.09	0.09
	(1.76)	(1.71)	(1.10)	(102.8)	(101.7)	(99.2)
Obs.	427,468	406,502	381,089	427,468	406,502	381,089
(3) Additional sources of savings						
$CF_{i,t} \bullet \Psi$	**0.08**	**0.09**	**0.00**	**0.06**	**0.05**	**-0.00**
	(7.69)	**(6.39)**	**(2.57)**	**(8.06)**	**(4.80)**	**(-1.06)**
$CF_{i,t}$	0.42	0.42	0.46	-0.15	-0.19	-0.11
	(35.6)	(31.5)	(40.7)	(-8.46)	(-9.60)	(-8.71)
$CF_{i,t} \bullet Neg_{i,t}$	-0.25	-0.25	-0.23	0.54	0.59	0.57
	(-19.1)	(-18.5)	(-17.3)	(26.4)	(27.6)	(37.8)
$q_{i,t}$	0.00	0.00	0.00	0.08	0.09	0.08
	(-9.45)	(-8.73)	(-9.46)	(39.0)	(41.1)	(74.1)
$\Delta LD_{i,t}$	0.37	0.42	0.38	0.32	0.40	0.30
	(41.7)	(42.3)	(56.8)	(38.0)	(35.4)	(49.3)
$Equity_{i,t}$	0.49	0.49	0.58	0.33	0.34	0.34
	(39.4)	(32.7)	(65.6)	(35.1)	(26.8)	(59.3)
Obs.	427,025	406,062	380,670	427,025	406,062	380,670

(4) Alternative definition of the dependent variable ($\Delta Cash_{[t-1,\ t+2]}$)						
$CF_{i,t} \bullet \Psi$	**0.01**	**-0.02**	**0.00**	**0.00**	**-0.06**	**0.01**
	(0.49)	**(-0.57)**	**(0.98)**	**(0.11)**	**(-1.44)**	**(2.31)**
$CF_{i,t}$	0.40	0.43	0.39	-1.00	-0.98	-1.05
	(13.4)	(13.0)	(13.6)	(-27.0)	(-21.0)	(-29.2)
$CF_{i,t} \bullet Neg_{i,t}$	-0.39	-0.40	-0.38	1.59	1.63	1.61
	(-12.2)	(-12.3)	(-11.4)	(41.4)	(40.5)	(39.7)
$q_{i,t}$	0.02	0.02	0.01	0.26	0.26	0.25
	(9.44)	(9.44)	(8.05)	(106.1)	(105.3)	(97.4)
Obs.	362,067	343,741	320,989	362,067	343,741	320,989
(5) Mature firms						
$CF_{i,t} \bullet \Psi$	**0.02**	**0.07**	**0.01**	**-0.04**	**-0.04**	**-0.00**
	(0.81)	**(1.81)**	**(1.94)**	**(-2.24)**	**(-1.29)**	**(-0.75)**
$CF_{i,t}$	0.29	0.28	0.30	-0.20	-0.20	-0.23
	(9.15)	(7.77)	(10.7)	(-6.75)	(-5.41)	(-8.24)
$CF_{i,t} \bullet Neg_{i,t}$	-0.18	-0.20	-0.19	0.58	0.58	0.57
	(-5.28)	(-5.86)	(-5.49)	(18.0)	(18.3)	(17.7)
$q_{i,t}$	0.00	0.00	-0.01	0.08	0.08	0.08
	(-3.07)	(-2.76)	(-3.26)	(34.6)	(35.2)	(34.3)
Obs.	149,606	148,845	139,494	149,606	148,845	139,494
(6) Additional proxies for investment opportunities						
$CF_{i,t} \bullet \Psi$	**0.03**	**0.06**	**0.00**	**0.04**	**0.05**	**-0.00**
	(4.79)	**(6.54)**	**(1.95)**	**(5.75)**	**(4.13)**	**(-0.55)**
$CF_{i,t}$	0.23	0.20	0.25	-0.31	-0.31	-0.25
	(27.7)	(19.2)	(31.8)	(-23.6)	(-20.4)	(-20.0)
$CF_{i,t} \bullet Neg_{i,t}$	-0.02	-0.02	-0.02	0.64	0.63	0.60
	(-2.04)	(-1.76)	(-1.81)	(45.2)	(43.9)	(42.1)
$q_{i,t}$	0.01	0.01	0.01	0.08	0.08	0.07
	(29.2)	(28.6)	(26.7)	(79.0)	(77.5)	(70.3)
$Sales\ growth_{i,t}$	0.03	0.03	0.03	0.09	0.10	0.10
	(38.0)	(37.1)	(35.2)	(57.0)	(57.6)	(58.9)
$FutInv/CurInv_{i,t}$	0.00	0.00	0.00	0.00	0.00	0.01
	(20.3)	(20.2)	(18.5)	(7.05)	(8.55)	(12.8)
Obs.	365,259	345,253	320,278	365,259	345,253	320,278

Description: The table reports the OLS and measurement-error consistent results estimated from the modified models or using alternative subsamples. The first panel reports the results estimated from the model in Eq. (1) in the subsample of non-U.S. firms. In the second panel, the model in Eq. (1) is modified to include the common/civil-law indicator variable (*LAW*) and its interaction term with cash flow. In the third panel, the model in Eq. (1) is modified to include the change in long-term debt (ΔLD) and net equity issues (*Equity*), and their interaction terms with financial development measures. In the fourth panel, the 3-year change in cash variable (measured from *t-1* to *t+2*) is used as the dependent variable. The fifth panel reports the results estimated from the model in Eq. (1) in the subsample of mature firms. In the last panel, the model in Eq. (1) is modified to include additional proxies for a firm's investment opportunity set, namely, the rate of sales revenue growth (*Sales growth*) and the ratio of future capital investment (*t+1*) to current capital investment (*t*) (*FutInv/CurInv*). The sample period is from 1990 to 2015. The regression variables are defined in Table 1. Ψ is a country's financial development measure (*DEV*, *WEFI*, and *FD*). The OLS *t*-statistics and cumulant *z*-statistics are reported in parentheses. The subscripts denote country *c*, firm *i*, and year *t*. Obs. is the number of firm-year observations. For brevity, the table reports only the main variables of interest.

Interpretation: In all robustness tests, financial development does not attenuate saving (strengthen dissaving) propensities. The results are consistent with those reported in Table 6.

Table 8: Financial Development and Saving/Dissaving Propensities: Financially Constrained and Unconstrained Firms

Panel A: Financially constrained firms

Dependent variable: $\Delta Cash_{i,t}$	Obs.	$CF_{i,t}$	$CF_{i,t} \bullet \Psi$	$q_{i,t}$	R^2	$CF_{i,t}$	$CF_{i,t} \bullet \Psi$	$q_{i,t}$	R^2
(1) Small		OLS				Cumulants			
DEV_c	139,158	0.29	**0.04**	0.01	16.4%	-0.17	**0.06**	0.09	20.4%
		(20.1)	(3.95)	(19.0)		(-9.06)	(6.12)	(49.3)	
$WEFI_c$	132,245	0.25	**0.07**	0.01	16.4%	-0.17	**0.04**	0.09	20.5%
		(15.0)	(5.44)	(18.5)		(-7.96)	(2.93)	(48.6)	
$FD_{c,t}$	123,940	0.31	**0.00**	0.01	17.1%	-0.13	**0.00**	0.09	18.9%
		(22.0)	(1.22)	(17.9)		(-7.13)	(2.03)	(58.9)	
(2) No payout									
DEV_c	210,419	0.24	**0.06**	0.01	13.0%	-0.28	**0.07**	0.09	21.6%
		(22.4)	(8.13)	(24.6)		(-16.9)	(8.83)	(67.8)	
$WEFI_c$	192,804	0.20	**0.10**	0.01	12.6%	-0.29	**0.07**	0.09	21.7%
		(15.6)	(9.68)	(23.8)		(-15.0)	(5.95)	(64.8)	
$FD_{c,t}$	174,441	0.27	**0.01**	0.01	13.0%	-0.20	**0.01**	0.09	20.3%
		(23.7)	(4.78)	(22.1)		(-12.6)	(6.62)	(65.3)	
(3) High WW index									
DEV_c	122,123	0.28	**0.04**	0.01	17.0%	-0.17	**0.08**	0.09	21.1%
		(16.8)	(4.85)	(20.2)		(-8.27)	(8.39)	(50.2)	
$WEFI_c$	116,153	0.24	**0.08**	0.01	17.0%	-0.18	**0.07**	0.10	21.3%
		(12.9)	(5.84)	(19.9)		(-7.64)	(4.86)	(49.1)	
$FD_{c,t}$	107,930	0.30	**0.00**	0.02	17.7%	-0.10	**0.00**	0.09	20.0%
		(18.3)	(2.27)	(19.5)		(-4.96)	(2.88)	(60.4)	
(4) High HP index									
DEV_c	122,284	0.24	**0.06**	0.02	17.8%	-0.26	**0.01**	0.10	25.2%
		(14.0)	(5.36)	(22.1)		(-11.5)	(0.72)	(54.4)	
$WEFI_c$	116,313	0.19	**0.10**	0.02	17.9%	-0.25	**-0.02**	0.10	25.2%
		(9.51)	(5.97)	(21.7)		(-9.30)	(-0.87)	(52.8)	
$FD_{c,t}$	108,084	0.29	**0.00**	0.02	19.0%	-0.23	**-0.00**	0.10	24.0%
		(18.0)	(0.25)	(21.2)		(-10.8)	(-2.30)	(65.1)	
(5) All schemes									
DEV_c	49,390	0.24	**0.08**	0.02	16.8%	-0.27	**0.06**	0.10	23.8%
		(8.47)	(4.80)	(15.3)		(-8.08)	(3.68)	(28.3)	
$WEFI_c$	46,259	0.21	**0.11**	0.02	16.9%	-0.28	**0.03**	0.10	23.9%
		(6.44)	(5.01)	(15.0)		(-7.09)	(1.20)	(26.3)	
$FD_{c,t}$	42,856	0.30	**0.00**	0.02	17.8%	-0.12	**0.00**	0.09	22.0%
		(10.9)	(0.88)	(14.4)		(-4.11)	(3.26)	(28.8)	

Panel B: Financially unconstrained firms

Dependent variable: $\Delta Cash_{i,t}$	Obs.	$CF_{i,t}$	$CF_{i,t} \bullet \Psi$	$q_{i,t}$	R^2	$CF_{i,t}$	$CF_{i,t} \bullet \Psi$	$q_{i,t}$	R^2
(1) Large		OLS				Cumulants			
DEV_c	139,265	0.27	**-0.05**	0.01	14.1%	-0.30	**-0.06**	0.08	20.7%
		(20.0)	(-3.55)	(14.2)		(-13.2)	(-3.53)	(51.8)	
$WEFI_c$	132,416	0.25	**-0.03**	0.01	13.8%	-0.32	**-0.04**	0.08	20.4%
		(15.2)	(-1.54)	(13.9)		(-11.5)	(-1.62)	(51.7)	
$FD_{c,t}$	124,094	0.24	**-0.00**	0.01	13.8%	-0.30	**-0.01**	0.07	19.2%
		(19.2)	(-1.47)	(12.8)		(-14.3)	(-2.55)	(50.1)	
(2) Payout									
DEV_c	217,049	0.32	**-0.02**	0.01	21.3%	-0.40	**-0.09**	0.09	20.5%
		(22.9)	(-1.60)	(13.1)		(-14.7)	(-3.57)	(63.1)	
$WEFI_c$	213,698	0.30	**-0.00**	0.01	21.4%	-0.44	**-0.03**	0.09	20.3%
		(17.7)	(-0.22)	(13.2)		(-13.5)	(-0.90)	(63.7)	
$FD_{c,t}$	206,648	0.29	**0.00**	0.01	21.4%	-0.48	**-0.00**	0.09	18.3%
		(27.2)	(0.95)	(12.4)		(-23.1)	(-2.48)	(59.0)	
(3) Low WW index									
DEV_c	122,123	0.30	**-0.09**	0.01	26.0%	-0.27	**-0.12**	0.08	25.3%
		(19.4)	(-5.68)	(16.1)		(-10.6)	(-4.97)	(61.6)	
$WEFI_c$	116,153	0.28	**-0.08**	0.01	25.8%	-0.30	**-0.07**	0.08	24.9%
		(14.2)	(-3.51)	(15.7)		(-8.77)	(-2.20)	(61.4)	
$FD_{c,t}$	107,930	0.26	**-0.01**	0.01	26.6%	-0.29	**-0.01**	0.08	23.6%
		(17.9)	(-4.05)	(14.6)		(-12.6)	(-3.62)	(59.8)	
(4) Low HP index									
DEV_c	122,283	0.33	**-0.06**	0.01	13.6%	-0.19	**-0.08**	0.07	16.1%
		(23.3)	(-4.48)	(8.48)		(-7.79)	(-6.37)	(32.5)	
$WEFI_c$	116,312	0.31	**-0.04**	0.01	13.3%	-0.18	**-0.09**	0.07	15.9%
		(17.8)	(-2.15)	(8.16)		(-6.32)	(-4.45)	(33.0)	
$FD_{c,t}$	108,083	0.29	**-0.00**	0.01	13.0%	-0.23	**-0.00**	0.07	14.5%
		(21.6)	(-1.43)	(7.67)		(-9.44)	(-2.03)	(31.8)	
(5) All schemes									
DEV_c	41,224	0.35	**-0.13**	0.00	15.4%	-0.66	**-0.02**	0.08	15.5%
		(8.24)	(-2.84)	(3.03)		(-8.68)	(-0.33)	(22.4)	
$WEFI_c$	40,698	0.35	**-0.13**	0.00	15.4%	-0.75	**0.09**	0.08	15.3%
		(7.27)	(-2.53)	(3.04)		(-8.40)	(1.11)	(22.4)	
$FD_{c,t}$	39,098	0.27	**-0.01**	0.00	14.5%	-0.65	**-0.01**	0.07	13.7%
		(11.0)	(-2.57)	(2.51)		(-11.8)	(-1.13)	(20.7)	

Description: The table reports the OLS and measurement-error consistent results estimated from the model in Eq. (1) in the subsamples of financially constrained (panel A) and unconstrained (panel B) firms. Four schemes are used to classify firms as financially constrained and unconstrained: firm size, cash payout, the Whited-Wu (*WW*) index, and the Hadlock-Pierce (*HP*) index. The schemes are applied to the firm individually (panels 1 to 4) and together (panel 5). The sample period is from 1990 to 2015. The regression variables are defined in Table 1. Ψ is a country's financial development measure (*DEV*, *WEFI*, and *FD*). The OLS *t*-statistics and cumulant *z*-statistics are reported in parentheses. The subscripts denote country *c*, firm *i*, and year *t*. Obs. is the number of firm-year observations. For brevity, the table reports only the main variables of interest.

Interpretation: Among financially constrained firms, saving (dissaving) propensities are higher (lower) in developed economies. Among financially unconstrained firms, saving (dissaving) propensities are lower (higher) in developed economies. The results are generally consistent with those reported in Table 4.

Table 9: Financial Development and Saving/Dissaving Propensities:
Firms of Different Degrees of Cash Flow Uncertainty

Dependent variable: $\Delta Cash_{i,t}$	Obs.	$CF_{i,t}$	$CF_{i,t} \bullet \Psi$	$q_{i,t}$	R^2	$CF_{i,t}$	$CF_{i,t} \bullet \Psi$	$q_{i,t}$	R^2
High-income-uncertainty firms			OLS				Cumulants		
DEV_c	146,596	0.27	**0.03**	0.02	13.5%	-0.17	**0.04**	0.09	22.0%
		(23.5)	(5.04)	(25.6)		(-8.69)	(4.83)	(62.0)	
$WEFI_c$	139,404	0.23	**0.07**	0.02	13.4%	-0.16	**0.03**	0.09	22.1%
		(18.1)	(7.20)	(25.3)		(-7.77)	(2.82)	(60.5)	
$FD_{c,t}$	130,751	0.28	**0.00**	0.02	13.7%	-0.13	**0.00**	0.09	20.9%
		(24.1)	(4.07)	(24.1)		(-6.94)	(1.90)	(60.7)	
Low-income-uncertainty firms			OLS				Cumulants		
DEV_c	147,007	0.28	**-0.01**	0.00	11.4%	-0.46	**-0.18**	0.09	17.2%
		(16.9)	(-0.49)	(7.71)		(-12.1)	(-5.11)	(36.7)	
$WEFI_c$	139,798	0.25	**0.03**	0.00	11.2%	-0.47	**-0.14**	0.09	17.1%
		(11.9)	(1.14)	(7.41)		(-10.2)	(-3.13)	(37.6)	
$FD_{c,t}$	131,074	0.28	**-0.00**	0.00	11.8%	-0.51	**-0.02**	0.08	14.4%
		(20.9)	(-2.03)	(6.14)		(-15.9)	(-3.87)	(34.6)	

Description: The table reports the OLS and measurement-error consistent results estimated from the model in Eq. (1) in the subsamples of firms with high and low cash flow uncertainty. Firms are sorted by the standard deviation of the residuals from the AR(1) process for cash flow. The sorting is performed in each 2-digit SIC industry-country. Firms in the top (bottom) third of the distribution are classified as firms with high (low) cash flow uncertainty. The sample period is from 1990 to 2015. The regression variables are defined in Table 1. Ψ is a country's financial development measure (*DEV*, *WEFI*, and *FD*). The OLS *t*-statistics and cumulant *z*-statistics are reported in parentheses. The subscripts denote country *c*, firm *i*, and year *t*. Obs. is the number of firm-year observations. For brevity, the table reports only the main variables of interest.

Interpretation: Among firms with high income uncertainty, saving (dissaving) propensities are higher (lower) in developed economies. Among firms with low income uncertainty, saving (dissaving) propensities are lower (higher) in developed economies. The results are generally consistent with those reported in Table 4.

Table 10: Financial Development and Saving/Dissaving Propensities: An IV Analysis of the Underlying Mechanism

Dependent variable (1st stage): σ_{CF}	(1)	(2)	(3)	(4)
PC(1)	**0.01**	**0.01**	**0.01**	**0.01**
	(2.10)	**(2.18)**	**(9.53)**	**(9.39)**
PC(2)		-0.01		0.00
		(-0.96)		(0.76)
R^2	7.7%	6.6%	8.7%	8.7%

Dependent variable (2nd stage): $\partial\Delta Cash_{i,t}/\partial CF_{i,t}$	(1)	(2)	(3)	(4)
$\widehat{\sigma_{CF}}$	**2.86**	**2.50**	**1.59**	**1.55**
	(1.84)	**(1.83)**	**(3.92)**	**(3.87)**
Wooldridge test (p-value)	0.01	0.04	0.00	0.00
Sargan test (p-value)	-	0.36	-	0.30
Obs.	38	38	878	878

Description: The table reports the 2SLS-IV regression results. In the first-stage regression, firms' cash flow uncertainty (σ_{CF}) is instrumented by the financial development measures. *DEV*, *WEFI*, and *FD* measures are combined via two principal components, namely, PC(1) and PC(2). In the second-stage regression, the instrumented cash flow uncertainty ($\widehat{\sigma_{CF}}$) is regressed against firms' saving propensities ($\partial\Delta Cash/\partial CF$). Columns (1) and (2) report the results returned from the approach in which saving propensities and cash flow uncertainty (the standard deviation of cash flow autoregressive residuals by firm) are computed for each country in the sample. Columns (3) and (4) report the results returned from the alternative approach in which saving propensities and cash flow uncertainty (the standard deviation of cash flow autoregressive residuals by industry-country-year) are computed for each country-year. The diagnostic tests of endogeneity (Wooldridge test) and overidentifying restrictions (Sargan test) are reported.

Interpretation: Financial development significantly increases cash flow uncertainty, which in turn increases firms' saving propensities.

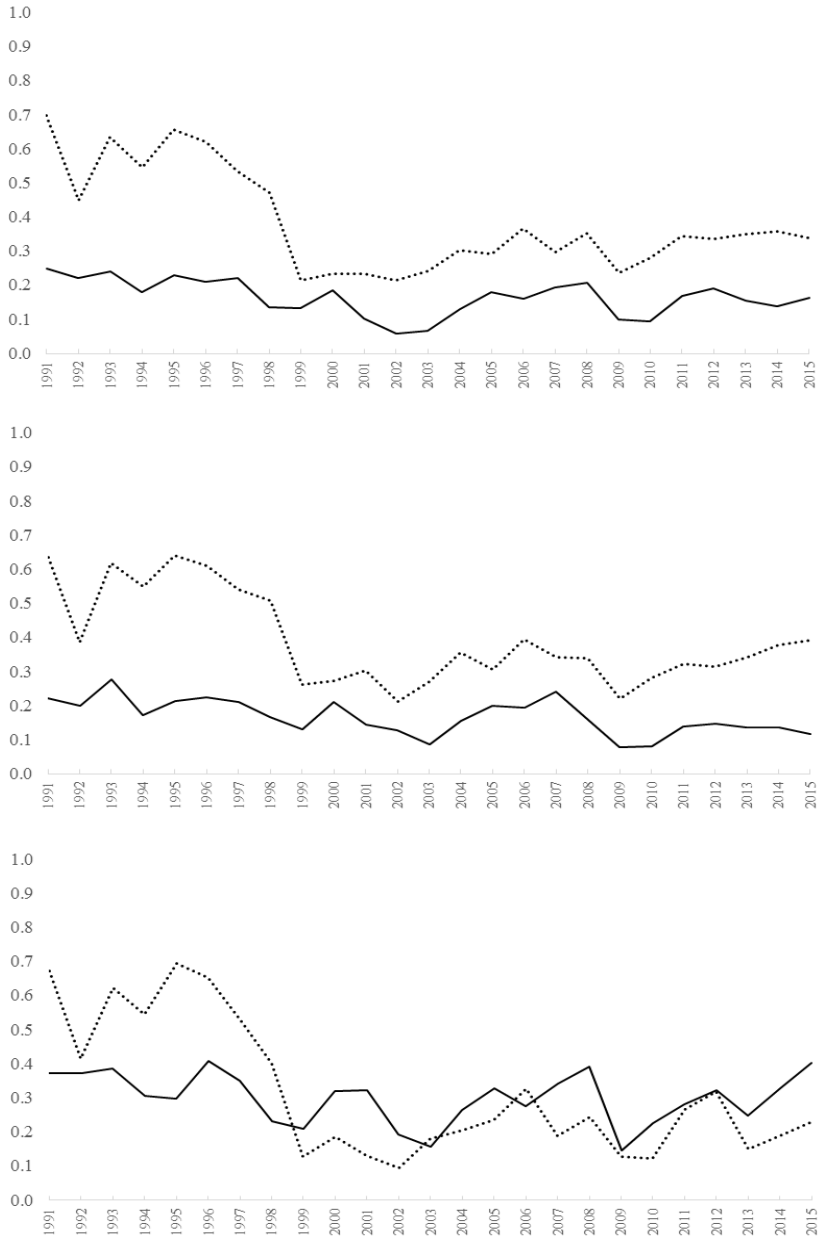
Table 11: Stock Market Liberalization and Saving/Dissaving Propensities

Dependent variable: $\Delta Cash_{i,t}$	N	$CF_{i,t}$	$CF_{i,t} \bullet LIB_c$	$q_{i,t}$	R^2	$CF_{i,t}$	$CF_{i,t} \bullet LIB_c$	$q_{i,t}$	R^2
		OLS				Cumulants			
Full sample	146,804	0.35	**-0.04**	0.00	12.3%	-0.19	**-0.03**	0.09	14.8%
		(16.8)	(-2.16)	(-5.23)		(-7.58)	(-2.13)	(28.9)	
Financially constrained firms	15,235	0.34	**-0.00**	0.00	24.7%	-0.32	**0.07**	0.11	18.9%
		(3.63)	(-0.06)	(-0.46)		(-2.85)	(1.96)	(6.64)	

Description: The table reports the OLS and measurement-error consistent results estimated from the model in Eq. (1), in which an indicator variable (*LIB*) and its interaction term with cash flow are included. *LIB* is equal to unity if a country liberalized its stock market between 1986 and 1995 and zero otherwise. The sample includes 16 economies that liberalized their markets and 6 economies that did not liberalize. The regression results are returned from the full data sample and the subsample of financially constrained firms, in which four constraint schemes (firm size, cash payout, the Whited-Wu index, and the Hadlock-Pierce index) are applied together to the firm. The sample period is from 1990 to 2015. The regression variables are defined in Table 1. The OLS *t*-statistics and cumulant *z*-statistics are reported in parentheses. The subscripts denote country *c*, firm *i*, and year *t*. Obs. is the number of firm-year observations. For brevity, the table reports only the main variables of interest.

Interpretation: Stock market liberalization did not induce financially constrained firms to save less (spend more).

Figure 1: Autoregressive Cash Flows



Description: The figure plots the yearly coefficients estimated from the OLS regression of cash flow on its own lagged value. The upper, middle and lower charts plot the coefficient estimates returned, respectively, from the full data sample, the subsample of manufacturing firms, and the subsample of mature firms. The solid line corresponds to financially developed economies, while the dotted line corresponds to underdeveloped economies. The *DEV* classification scheme is used to differentiate economies according to their level of financial development. The figure spans the period from 1991 to 2015.

Interpretation: Except for mature firms, the cash flow generation process is more uncertain in financially developed economies.

Appendix 1: Replication of a Study by Riddick and Whited (2009)

The purpose of this appendix is to replicate the main findings by Riddick and Whited (2009) in the large international panel of firms (from 43 countries for the period 1990-2015). To this end, I modify the baseline model in Eq. (1) by removing the financial development measure (Ψ) and its cross-product term with cash flow ($CF_{i,t} * \Psi$). The set of other regression variables remains unchanged. The main variable of interest is the propensity to save/disburse funds out of cash flow (β_1 in Eq. (1)).

First, I estimate saving propensities for firms classified as financially constrained and unconstrained. I use two schemes to sort firms into financially constrained and unconstrained categories: firm size and cash payout. These classification schemes are defined in section 2.3. The set of constrained firms displays a stronger response of saving to cash flow than does the set of unconstrained counterparts. The OLS estimate of the cash flow coefficient varies between 0.23 (t = 34.7) and 0.27 (t = 32.1) for constrained firms and between 0.17 (t = 27.7) and 0.18 (t = 24.2) for unconstrained firms. The difference between the two sets is significant at better than the 1% level. When I apply the *q* measurement-error consistent (higher-order cumulant) estimators, the coefficient on cash flow is negative and significant at better than the 1% level. The set of constrained firms displays a smaller negative response of saving to cash flow than does the set of unconstrained firms. The error-corrected estimate of the cash flow coefficient varies between -0.15 (z = -8.67) and -0.24 (z = -15.2) for constrained firms and between -0.33 (z = -17.5) and -0.46 (z = -24.9) for unconstrained firms. The difference between the two sets is significant at better than the 1% level. This result is similar to that in OLS inasmuch as the cash flow coefficient for the constrained firms *exceeds* that for the unconstrained firms. The error-corrected coefficient is simply shifted downward from its inflated counterpart in OLS.

Second, I estimate saving propensities for firms classified as having high and low income (cash flow) uncertainty. To differentiate firms according to their degree of income uncertainty, I estimate the standard deviation of the residuals from a first-order panel autoregression of cash flow firm by firm. The high-uncertainty group (the top third of the volatility distribution) has a cash flow coefficient that is significantly different both from zero and from the coefficient in the low-uncertainty group (the bottom third of the volatility distribution). In particular, the OLS coefficient on cash flow is 0.25 (t = 29.1) in the former group, whereas it is 0.21 (t = 28.1) in the latter group. The difference is significant at better than the 1% level. The error-corrected coefficient on cash flow is less negative for firms in the high-uncertainty group (-0.12, z = -7.26) than for firms in the low-uncertainty group (-0.50, z = -15.1). The difference is significant at better than the 1% level.

Finally, I confirm that income uncertainty matters *more* for saving than finance constraints by testing a modified regression model with a constraint dummy (small firms or firms paying no dividends and repurchasing no shares), a dummy for low income uncertainty (the bottom third of the volatility distribution), the cross-product term of each of these dummies with cash flow, the cross-product term of the two dummies with each other, and the triple cross-product term of both of these dummies with cash flow. I find a positive OLS coefficient on cash flow and a positive coefficient on its cross-product term with the constraint dummy. I further find a negative error-corrected coefficient on cash flow and a positive coefficient on its cross-product term with the constraint dummy. The cross-product of cash flow with the dummy for low income uncertainty returns a consistently negative coefficient in all tests performed. One piece of evidence is of particular importance: it concerns the *sum* of the coefficients on the three cross-product terms with cash flow. It measures the *net* effect of being constrained and having low income uncertainty. The OLS summary coefficient is indistinguishable from zero, whereas the error-corrected summary

coefficient is either nonsignificant or significantly negative. Omitting firms with high income uncertainty from the constrained group leaves almost no differential saving propensities between this smaller constrained group and the rest of the sample. This result suggests that in the saving regression, the effect of income (cash flow) uncertainty dwarfs the effect of external finance constraints. The key point here is that both forces affect the cash flow coefficient and that regardless of its sign, this coefficient cannot be used as a good measure of finance constraints. Overall, I replicate the main findings by Riddick and Whited (2009) in the large international panel of firms.

Appendix 2: World Economic Forum Financial Development Index

Country	WEF 2008	WEF 2009	WEF 2010	WEF 2011	WEF 2012	*WEF*	*WEFI*
Australia	4.98	5.13	5.01	4.93	5.01	5.01	1
Austria	4.55	4.28	4.20	4.11	4.01	4.23	0.5
Belgium	4.56	4.50	4.65	4.38	4.30	4.48	1
Brazil	3.28	3.46	3.53	3.61	3.61	3.50	0
Canada	5.26	4.96	4.98	4.86	5.00	5.01	1
Chile	3.79	3.60	3.53	3.61	3.69	3.64	0.5
China	4.09	3.87	4.03	4.12	4.00	4.02	0.5
Denmark	-	4.64	4.30	4.30	4.53	4.44	0.5
Egypt	3.32	3.33	3.24	2.99	2.78	3.13	0
Finland	4.45	4.24	4.12	4.11	4.24	4.23	0.5
France	5.25	4.57	4.63	4.44	4.43	4.66	1
Germany	5.28	4.54	4.49	4.33	4.61	4.65	1
Greece	-	-	-	-	3.12	3.12	0
Hong Kong	5.23	4.97	5.04	5.16	5.31	5.14	1
India	3.63	3.30	3.24	3.29	3.29	3.35	0
Indonesia	3.31	2.90	2.90	2.92	2.95	3.00	0
Ireland	4.72	4.39	4.20	4.10	4.14	4.31	0.5
Israel	4.14	3.69	3.85	3.86	3.94	3.90	0.5
Italy	4.38	3.98	3.95	3.85	3.69	3.97	0.5
Japan	5.28	4.64	4.67	4.71	4.90	4.84	1
Korea	4.55	3.91	4.00	4.13	4.42	4.20	0.5
Malaysia	4.48	3.97	4.20	4.24	4.24	4.23	0.5
Mexico	3.21	3.06	3.07	3.16	3.25	3.15	0
Netherlands	5.22	4.85	4.73	4.71	4.73	4.85	1
New Zealand	-	-	-	-	-	-	-
Norway	4.66	4.38	4.31	4.52	4.52	4.48	1
Pakistan	3.46	2.85	2.62	2.58	2.61	2.82	0
Philippines	3.03	2.84	2.97	3.13	3.12	3.02	0
Poland	3.27	3.27	3.33	3.45	3.41	3.35	0
Portugal	-	-	-	-	3.76	3.76	0.5
Russia	3.40	3.16	3.21	3.18	3.30	3.25	0
Singapore	5.15	5.03	5.03	4.97	5.10	5.06	1
South Africa	4.00	3.48	3.53	3.64	3.71	3.67	0.5
Spain	4.90	4.40	4.42	4.24	4.22	4.44	0.5
Sri Lanka	-	-	-	-	-	-	-
Sweden	4.75	4.48	4.60	4.51	4.71	4.61	1
Switzerland	5.23	4.91	4.71	4.63	4.78	4.85	1
Taiwan	-	-	-	-	-	-	-
Thailand	3.82	3.35	3.37	3.32	3.55	3.48	0
Turkey	3.30	3.03	3.18	3.14	3.27	3.18	0
UK	5.83	5.28	5.06	5.00	5.21	5.28	1
US	5.85	5.12	5.12	5.15	5.27	5.30	1
Vietnam	3.03	3.00	3.03	2.98	2.92	2.99	0

Description: *WEF* is the average value of the World Economic Forum Financial Development Index over the years 2008 to 2012. *WEFI* is equal to unity, 0.5 or zero if a country's *WEF* value lies, respectively, in the top, middle or bottom third of the ranking. New Zealand, Sri Lanka, and Taiwan have missing observations.

Appendix 3: Stock Market Liberalization

Country	Liberalization year
Brazil	1991
Chile	1992
Egypt	1992
Greece	1987
India	1992
Indonesia	1989
Israel	1993
Korea	1992
Malaysia	1988
Mexico	1989
Pakistan	1991
Philippines	1991
Portugal	1986
Sri Lanka	1990
Thailand	1987
Turkey	1989
Non-liberalizing countries (1986-1995)	
China	-
Poland	-
Russia	-
South Africa	-
Taiwan	-
Vietnam	-

Description: *Liberalization year* refers to the year of a formal regulatory change after which foreign investors have the opportunity to invest in domestic equity securities. The sample consists of 16 economies that liberalized stock markets between 1986 and 1995 and 6 economies that did not liberalize between those years.