FIRM LEVEL CASH FLOW SENSITIVITY OF CASH AND CORPORATE GOVERNANCE

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July 2011

Abstract

We construct a new measure of firm-level "cash flow sensitivity of cash" using a correlated random effects estimation model. This measure is able to incorporate unobservable, time-invariant firm characteristics in the analysis of firm's cash flows, in addition to the traditional observable, firm specific characteristics (e.g. governance, growth opportunities, and the degree of financial constraints). Thus, the use of this measure can significantly improve the assessments of the impact of firm individual characteristics and cash stock piling activities on firm value and firm's investment policies. We empirically implement this measure and methodology using proxies for the level of firm's financial constraints, agency conflicts, and governance, and the tangibility of assets. We find that stronger governance reduce the propensity of firms to stockpile cash. Furthermore, and consistent with this result, stronger governance in financially constrained firms induce lower level of investments and higher payouts to stock holders. This situation is not observed in unconstrained firms and may have important effects on firm values. Our new proposed methodology to compute cash flow sensitivity may play a central role in future empirical research expanding upon this new dimension of governance, as reflected in the power struggle between management and shareholders, particularly in relation to financing constraints and cash accumulation policies.

Keywords: Firm level cash flow sensitivity, governance, agency problems, underinvestment, Correlated Random Effects regression.

JEL classifications: G31, G34

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I. Introduction

A growing literature is devoted to the study of how and why firms accumulate assets of rapid liquidation. In the context of imperfect capital markets, financially constrained firms must forego otherwise attractive projects if the price at which capital is available to them is sufficiently high that the NPV of these projects is negative. For such firms, financial slack, commonly interpreted as additional cash holdings, serves to ease or alleviate the external constraints imposed on managerial investment decisions (Myers and Majluf (1984)). In the presence of asymmetric information, financial slack provides one potential way to adopt new projects when firms are unable to credibly reveal their investment opportunity set to external capital markets. Thus, financial slack or cash flow generation and a firm's investment opportunity set are intrinsically related creating an endogeneity problem. To avoid this endogenity, Almeida, Campello, and Weisbach (2004) estimate a model of the firm's cash flow sensitivity of cash holdings-"propensity to save cash out of cash inflows." They implement a groupwise cash flow sensitivity measure and find that firms in the financially constrained group exhibit a positive cash flow sensitivity of cash[1]. However, using a group wise cash flow sensitivity measure may lead to an upward bias particularly when unobservable firm characteristics are correlated with cash flow sensitivity of cash.

In this paper we develop a firm-level measure of the cash flow sensitivity allowing for heterogeneity in the observed level of agency conflicts among firms within a given level of shareholder rights. Our measure allows us to capture cash flow sensitivity variation between firms taken into account any possible set of firm's financial characteristics as well as unobservable firm fixed-effects. Our approach to analyze the value of cash considers the

[1] In this scenario, financial slack is created by foregoing current investment projects in favor of future opportunities.

mechanism through which cash is accrued at the firm level, thus allowing us to investigate how firm characteristics affect the level of cash a firm can hold. Thus, our firm-level measure of cash flow sensitivity is able to capture the relationship between corporate governance, cash savings and cash usage, and firm characteristics. We believe that this measure can significantly improve the assessments of the impact of firm individual characteristics and cash stock piling activities on the firm value and investment policies.

We empirically implement this measure and methodology for the 15 year sample period between 1990 and 2005. As a first approach and following recent literature in the area, we use proxies for the level of firm's financial constraints, agency conflicts, governance, and the tangibility of assets. We find that financially constrained firms exhibit a greater cash flow sensitivity of cash than unconstrained firms. We also find that firms tend to save less cash out of cash flows as shareholder power increases, as measured by the Gompers, Ishii, and Metrick (2003) governance index. We note that among the financially constrained firms in our sample, well-governed firms have lower industry-adjusted capital expenditures and higher industry-adjusted payout ratios than weak-governance firms.[2] Thus, it appears that on average, shareholders force managers to disgorge cash despite the external financial constraints facing their firms. We interpret this as indicative of a possible underinvestment problem. Accordingly, a higher valuation of cash in firms with strong governance may partially be the result of a high marginal value of cash, which arises from a suboptimal level of cash necessary for efficient investment.

It is not immediately clear why shareholders would choose to restrict the cash saving activities of financially constrained firms by forcing managers to disgorge cash. In a context of

[2] In the paper, we refer to well governed firms as firms with a low G index- the Gompers, Ishii, and Metrick governance index. It should be noted that this index actually measures the balance of power between shareholders and insiders of the firm. Accordingly, along the paper, it is possible to read "well governed firms" as "firms with stronger shareholder power".

hidden manager types and informational asymmetries between insiders and outsiders, it could be the case that influential stockholders prefer to restrict the amount of cash available to all managers rather than risk expropriation or misuse of liquid assets in some firms. This second-best solution will dominate if monitoring and actively enforcing an optimal cash accrual policy is prohibitively costly to shareholders. Thus, shareholders may prefer to induce an underinvestment problem in some firms in order to avoid an even greater value loss in other firms resulting from expropriation. We believe this is a very relevant topic for further research.

The remainder of the paper is organized as follows: Section II motivates our study in light of the existing literature. Section III introduces our firm-specific cash flow sensitivity measure, presents its empirical implementation and summarizes the results. Section IV presents our conclusions.

II. Existing Literature and Motivation

If capital markets are imperfect, the cost of external funds may exceed the cost of firms' internally generated funds. Accordingly, some firms may be unable to obtain funds necessary to fully take advantage of available investment opportunities, achieving a less than first-best investment level. Faulkender and Wang (2006) document that the marginal value of cash is greater for constrained firms than for unconstrained firms in the U.S. Denis and Sibilkov (2009) confirm this relation and show that it can be explained by a greater marginal value of investment by constrained firms. Fazzari, et al. (1988) show that the investment policy of financially constrained firms depends on the availability of internally generated funds. Empirical estimation of this relationship is problematic, however, since cash may be correlated with investment prospects. Almeida et al. (2004) circumvent this potential endogeneity issue by estimating firms' propensity to save cash out of internally generated cash flows, which they refer to as firms' cash flow sensitivity of cash. They show that financially constrained firms exhibit a significantly positive cash flow sensitivity, while unconstrained firms do not.

Although accumulation of cash allows constrained firms to capitalize on future positive NPV projects, it also increases the probability that management will engage in perquisite consumption before those opportunities arise (Jensen (1986), Myers and Rajan (1998)). Thus, Jensen (1986) claims that shareholders may pressure firms to reduce cash holdings due to managements' propensity to waste free cash flows. Myers and Rajan (1998) argue that liquid assets can be diverted by managers at lower cost than other assets. Harford, Mansi, and Maxwell (2008) and Dittmar and Mahrt-Smith show that managers of cash-rich, poorly governed firms tend to invest cash inflows in ways that decrease subsequent operating performance and firm value. In contrast, managers of well-governed firms use cash flows for investments that increase firm value. Dittmar and Mahrt-Smith (2007) show that strong corporate governance, measured by the G Index or by institutional blockholdings, helps to reduce the value loss of excess cash reserves in financially unconstrained firms.

Yun (2008) shows that managers increase cash holdings relative to lines of credit when the disciplinary threat of takeovers decreases, and this relation is stronger among poorly governed firms. Pinkowitz, et al. (2006) document a wedge between the value of a dollar inside the firm versus outside the firm. Additionally, several recent studies have shown that shareholder rights are negatively related to the level of firm cash holdings. On average, investors in poor investor protection countries value firm cash holdings at a discount to those of firms in good investor protection countries. Dittmar, Mahrt-Smith, and Servaes (2003) find that cash holdings are significantly higher in countries with poor investor protection than in countries with good investor protection. Firm-level cash holdings are valued less in countries with weak shareholder protection than in countries with strong shareholder rights (Pinkowitz, Stulz, and Williamson (2006)). In the U.S., firm-level cash holdings are valued less in firms with weak shareholder power relative to firms with strong shareholder power (Dittmar and Mahrt-Smith (2007)). Separate studies introduce agency problems into the relation between cash holdings, investment, and firm value. Kalcheva and Lins (2007) also document that in countries with poor investor protection, firm value decreases as controlling shareholders hold more cash, but increases as firms pay out greater dividends. Collectively, the evidence is consistent with the hypothesis that poorly protected shareholders are unable to force managers to disgorge cash. These findings imply that effective governance structures may serve to reduce cash holdings in firms on average.[3]

By implementing a firm-level estimate of cash flow sensitivity, in which cash saving policies are endogenously determined, we provide a measure capable of providing a novel dimension of corporate governance that captures the relationship between cash saving policies, use of cash, and other firm characteristics that can be used to assess the impact of cash flow sensitivity on firm value and firm's investments policies. We believe we provide a valuable methodology for further research in this area.

III. Empirical Methodology

A. Econometric Specification

[3] However, the value implication from this activity is unclear. While for unconstrained firms the pressure of strong shareholders on management to reduce cash holdings can certainly be beneficial, for constrained firms it might induce an underinvestment problem, causing a negative impact on firm value. A policy aimed at reducing the amount of liquid assets in the hands of managers in constrained firms may reflect the attempt of influential shareholders to reduce the potential for expropriation when monitoring managerial activity is costly. This can occur when the costs of actively enforcing an optimal cash accrual policy in all firms outweighs the benefits from a lower level of expropriation in some firms.

In their seminal paper, Almeida, et al. (2004) consider the following specification:

(1.1) $$\Delta CH_{it} = a_0 + a_1 CF_{it} + a_2 Q_{it} + a_3 Size_{it} + \mu_{it}$$

where cash holdings, *CH*, is defined as cash plus marketable securities divided by total assets; cash flows, *CF*, equals income before extraordinary items and depreciation, minus dividends, divided by total assets; *Q* is Tobin's q; and *Size* is measured by the natural logarithm of total assets. Their estimate of cash flow sensitivity, $\hat{a}_1$, corresponds to $\frac{\partial \Delta CH}{\partial CF}$ in equation (1.1). They estimate $\hat{a}_1$ separately for two subgroups of firms, classified according to their degree of financial constraints.[4] They find that this coefficient is positive and significant for constrained firms, while it is not statistically different from zero for unconstrained firms. However, they do not estimate a firm-level measure of cash flow sensitivity. In this sense, it is plausible that some firms in the unconstrained group have high cash flow sensitivity, even though for firms in this category as a whole, and on average, this measure is statistically indistinguishable from zero.

We hypothesize that cash flow sensitivity depends further on a set of observable and unobservable firm characteristics. We modify the basic empirical specification (1.1) to include interactions of cash flows with variables likely to affect cash flow sensitivity. In this way, we obtain a measure of the cash stockpiling activity of firms that depends on these variables.

To illustrate this, let X_{it} be the (1x k) vector of observable regressors, including the interaction of variables likely to affect cash flow sensitivity with cash flows:

(1.2) $$\Delta CH_{it} = X_{it}\alpha + e_{it}$$

4 They use five different proxies for financial constraints: payout policy, asset size, bond ratings, commercial paper (CP) ratings, and the KZ index (Kaplan and Zingales, 1997).

where α is a (k x 1) vector of parameters. Let X_{it}^* be the vector of the subset of regressors for which there are cash flow interactions and let α^* be the corresponding vector of parameters. By differentiating equation (1.2) with respect to cash flows, CF, a first measure of firm cash flow sensitivity, $\hat{S}_{it}^{ols}$, can be formed in the following manner:

$$\text{(1.3)} \qquad \frac{\partial\left(\Delta CH_{it}\right)}{\partial CF_{it}} \equiv \hat{S}_{it}^{ols} = X_{it}^{*}\hat{\alpha}^{*}$$

It should be noted that specification (1.2) corresponds to a pooled OLS estimation and, therefore, disregard the panel structure of the data. If this model is well specified, the estimated residuals should not be serially correlated. If they are, the error term for each firm could contain a time invariant omitted factor, which implies that the estimated coefficients would be biased and inconsistent due to an omitted factor problem. It follows that $\hat{S}^{ols}$ would be probably biased itself. An AR(1) test on the estimated residuals of the firms can be used to test the null hypothesis of no serial correlation in the error term against the alternative of an AR(1) structure. This test has power against higher orders of serial correlation (Wooldridge, 2002).

If serial correlation in the error term is present, a natural way to proceed would be to estimate sensitivity using standard firm fixed effects estimation techniques. However, fixed effects estimation is not feasible if cash flow sensitivity depends on firms' unobservable time invariant characteristics. Consider an equation to estimate firms' cash flow sensitivity which includes a time invariant unobservable firm effect intercept, c_i , and a time invariant unobservable firm effect slope with respect to cash flows, d_i :

$$\text{(1.4)} \qquad \Delta CH_{it} = c_i + X_{it}\alpha + CF_{it} \cdot d_i + e_{it}$$

It should be clear that differencing equation (1.4) to eliminate unobservable firm effects will not effectively eliminate d_i, and the OLS estimation of the *within model* is not feasible. Alternatively, we consider the estimation of (1.4) by a *Correlated Random Effects Model (CRE)*, also known as the *Chamberlain Approach* (Chamberlain, 1982).

Now, since Correlated Random Effects models are generally used in the context of balanced panel data specifications, and our data is highly unbalanced, we take the average for each cross- sectional variable through time. That is, we define:

(1.5) $$\overline{X}_i = \sum_{t=1}^{T_i} \frac{X_{it}}{T_i}$$

where T_i is the number of periods for which firm i has valid data. We then take the linear projection of c_i and d_i onto the average across time of the variables in X_{it} :

(1.6) $$c_i = \psi + \overline{X}_i\lambda + \omega_i$$

(1.7) $$d_i = \Phi + \overline{X}_i\delta + \nu_i$$

where λ and δ are (k x 1) vectors of parameters and ψ and Φ are scalar parameters. Replacing (1.6) and (1.7) in (1.4), we obtain:

(1.8) $$\Delta CH_{it} = \psi + \overline{X}_i\lambda + X_{it}\alpha + \Phi CF_{it} + \overline{X}_i \cdot CF_{it}\delta + r_{it}$$

where $r_{it} = e_{it} + \omega_i + CF_{it}\nu_i$. Given the definition of a linear projection and under the strict exogeneity assumption r_{it} will be uncorrelated with the regressors in equation(1.8).

Stacking the data for firm i, it is straightforward to see that:

(1.9) $$\begin{bmatrix} \Delta CH_{i1} \\ \vdots \\ \Delta CH_{iT_i} \end{bmatrix} = \begin{bmatrix} 1 & CF_{i1} & \overline{X}_i & CF_{i1} \cdot \overline{X}_i & X_{i1} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & CF_{iT_i} & \overline{X}_i & CF_{iT_i} \cdot \overline{X}_i & X_{iT_i} \end{bmatrix} \cdot \begin{bmatrix} \psi \\ \Phi \\ \lambda \\ \delta \\ \alpha \end{bmatrix} + \begin{bmatrix} r_{i1} \\ \vdots \\ r_{iT_i} \end{bmatrix}$$

Pooled OLS of (1.9) yields parameter estimates $\hat{\psi}$, $\hat{\Phi}$, $\hat{\lambda}$, $\hat{\delta}$, and $\hat{\alpha}$. Then, a firm-specific cash flow sensitivity measure, $\hat{S}^{CRE}$, based on observable and unobservable firm characteristics can be defined as:

$$\hat{S}_{it}^{CRE} = X_{it}^{*}\hat{\alpha}^{*} + \hat{d}_{i} = X_{it}^{*}\hat{\alpha}^{*} + \hat{\Phi} + \overline{X}_{i}\hat{\delta} \quad (1.10)$$

B. Determinants of cash flow sensitivity

As documented by Almeida et al. (2004), cash flow sensitivity depends on the degree of firms' financial constraints. We include a constraints index, *CI*, in our empirical specification to capture the degree of firms' financial constraints. We define *CI as* the sum of three dummy variables that represent common proxies for financial constraints:

$$CI_{it} = Dum\_SP_{it} + Dum\_payout_{it} + Dum\_size_{it} \quad (1.11)$$

The dummy variable *Dum_SP* takes a value of one if a firm has no Standard & Poor's public debt ratings (short-term domestic issuer credit rating, long term domestic issuer credit rating, or subordinated debt rating) during the entire sample period. We also sort firms into deciles according to their payout ratio (dividends and stock repurchases divided by operating income) and size (logarithm of total assets). Firm-year observations that fall in the bottom three deciles of the payout or size sorting are considered financially constrained, while those that fall in the top three deciles are categorized as financially unconstrained. We then define the dichotomy variables *Dum_payout* and *Dum_size* that take a value of one if the firm is financially constrained and zero otherwise. Note that *CI* can take values between 0 and 3, with a value of 0 for least constrained firms and 3 for most constrained firms. Note also that according to this scheme, firms may change their constraint classification status from year to year.

In their base specification, Almeida, et al. (2004) consider Tobin's q and size, measured by the natural logarithm of total assets, as controls in the estimation of cash flow sensitivity. We consider some other possible factors on the level of financial constraints of a firm. For example, the amount and quality of growth opportunities should also affect the degree of financial constraints a particular firm faces. A firm with abundant growth opportunities is more likely to be cash flow sensitive than a firm with few growth opportunities. It is likely that the *CI* captures part of this effect. However, it is possible that firms classified as unconstrained by the index be cash flow sensitive. For instance, the corporate culture of a firm might encourage the funding of investment projects with internally generated funds. Accordingly, the better the investment opportunity set of this firm, the higher will be its cash flow sensitivity. To capture this effect, we include for each firm a measure of the growth opportunities of its corresponding industry. We proxy for industry growth opportunities with industry median Tobin's *q*, where industry is defined at the two-digit SIC level. Tobin's *q* is defined as the product of common stock price and shares outstanding at the end of the corresponding fiscal year, plus total assets, minus the book value of common equity, all divided by total assets. We use firms' industry median Tobin's *q* to proxy for growth opportunities, rather than firm specific Tobin's *q*, because an industry (aggregate) measure of the set of investment opportunities of the corresponding firm should be less affected by other effects *q* may be proxing for.[5]

As another determinant of cash flow sensitivity we consider the quality of firms' governance mechanisms, proxied by the Gompers, et al. (2003) *G* index. If the cash flow sensitivity of cash has an impact on firm value, influential stockholders should attempt to maximize the value of the firm with respect to this variable. We consider $G^* = 24 - G$ as a more

[5] For instance, *q* may proxy not only for the investments opportunities of a firm but also for overpricing. We expect that for the Tobin´s *q* of the industry as a whole, the under pricing and over pricing effects should cancel out.

intuitive measure of corporate governance quality, so that higher values of G^* indicate stronger shareholder power.

The ratio of intangibles to total assets, *intangibles*, is included as a determinant of cash flow sensitivity, as intangibles may be correlated with asymmetric information problems that impact a firm's ability to raise external capital (Myers and Majluf(1984)). We define cash flows, *CF*, as income before extraordinary items plus amortization and depreciation, divided by total assets.

C. Data Summary

Our sample begins with all Compustat firms during 1990-2005 for which information on the Governance index is also available from the IRRC. Since the index is only available for 1990, 1993, 1995, 1998, 2000, 2002, and 2004 during our sample period, we assume that firms' governance index values remain constant up to three years forward. We exclude from the analysis financials and utilities, firms for which the value of assets is negative, firms with negative cash holdings, and firms for which the value of cash holdings is greater than the value of total assets. These exclusions are common in previous literature (Almeida, et al. (2004); Dittmar and Mahrt-Smith (2007); Denis and Sibilkov (2007)). This results in an initial sample of 2,022 firms with 13,058 firm year observations. Unless otherwise noted, all financial information is drawn from Compustat.

D. Measuring cash flow sensitivity

We first consider an econometric specification analogous to equation (1.2). Since cash flow sensitivity corresponds to $\frac{\partial \Delta CH}{\partial CF}$, we interact all firm-level variables likely to affect sensitivity with cash flows. In this way, we obtain a sensitivity measure dependent on observable firm characteristics. All interaction variables are also included as stand-alone variables to ensure that any significance found for the interactions is not due to the individual effects of these variables. As a first step, and following the above discussion, we estimate the following regression for our cross section of firm–year observations using pooled OLS:

$$\begin{aligned}(1.12)\qquad \Delta CH_{i,t} &= \beta_1 + \beta_2 CF_{it} + \beta_3 CF_{it} \cdot CI_{it} + \beta_4 CF_{it} \cdot Q_{it}^{ind} + \beta_5 CF_{it} \cdot G_{it}^{*} + \beta_6 CF_{it} \cdot Intangibles_{it} \\ &+ \beta_7 CI_{it} + \beta_8 Q_{it}^{ind} + \beta_9 G_{it}^{*} + \beta_{10} Intangibles_{it} + \beta_{11} Size_{it} + u_{it}\end{aligned}$$

As noted before, estimating an equation like (1.12) using pooled OLS disregards potential unobserved heterogeneity in the cross-sectional data. By differentiating equation (1.12) with respect to cash flows, *CF*, our constructed measure of firm cash flow sensitivity, $\hat{S}_{it}^{ols}$, is formed in the following manner:

$$(1.13)\qquad \frac{\partial\left(\Delta CH_{it}\right)}{\partial CF_{it}} \equiv \hat{S}_{it}^{ols} = \hat{\beta}_2 + \hat{\beta}_3 CI_{it} + \hat{\beta}_4 Q_{it}^{ind} + \hat{\beta}_5 G_{it}^{*} + \hat{\beta}_6 Intangibles_{it}$$

Column (1) of Table 1 presents results from pooled OLS estimation of equation (1.12). Since we use the estimated coefficients $\hat{\beta}_2$ through $\hat{\beta}_6$ to construct $\hat{S}_{it}^{ols}$, we provide labels corresponding to equation (1.13) to the left of our estimates. For example, the coefficient for cash flows, *CF*, corresponds to the constant $\hat{\beta}_2$ in equation (1.13). In the table, the variables used to numerically construct our measure of cash flow sensitivity have been shaded.

[Table 1 around here]

Before interpreting any result obtained from the estimation of equation (1.12) it is important to test whether the model is well specified. If the pooled OLS specification is dynamically complete in the conditional mean, then the estimated residuals should not be serially correlated. As explained before, if they are, the error term for each firm could contain a time invariant omitted factor. In this sense, unobservable firm characteristics could lead to a higher cash flow sensitivity of cash; for instance, a corporate culture of not taking on debt or a highly risk adverse management team that does not like debt in the firm's capital structure. If these characteristics are relatively stable over time, they will systematically affect the residual of an OLS specification.

We test the null hypothesis of no serial correlation in the error term against the alternative of an AR(1) structure. This test has power against higher orders of serial correlation (Wooldridge, 2002). To perform the test, we follow a two stage least squares estimation strategy. In the first stage, we obtain the pooled OLS residuals from regression (1.12), and in the second stage we re-estimate this equation including, for each firm-year observation, the lagged residual from the first stage estimation. In unreported regressions, we find that the coefficient of the lagged residual is -0.22 with a t-value of -10.80, significant at any standard level of significance. This suggests the residuals obtained from the pooled OLS estimation are serially correlated and, therefore, the model is not dynamically complete. This implies that the estimated coefficients, and therefore $\hat{S}^{ols}$, are biased and inconsistent.

This result suggests the use of panel data techniques to estimate cash flow sensitivity. However, and as explained in the *Econometric Specification* sub section, fixed effects estimation is not feasible if cash flow sensitivity depends on firms' unobservable time invariant characteristics.

To see this, consider an equation to estimate firms' cash flow sensitivity which includes a time invariant unobservable firm effect intercept, c_i , and a time invariant unobservable firm effect slope with respect to cash flows, d_i , just as in specification (1.4):

$$\Delta CH_{it} = c_i + CF_{it} \cdot d_i + \alpha_3 CF_{it} \cdot CI_{it} + \alpha_4 CF_{it} \cdot Q_{it}^{ind} + \alpha_5 CF_{it} \cdot G_{it}^{*} + \alpha_6 CF_{it} \cdot Intangibles_{it} + \alpha_7 CI_{it} + \alpha_8 Q_{it}^{ind} + \alpha_9 G_{it}^{*} + \alpha_{10} Intangibles_{it} + \alpha_{11} Size_{it} + e_{it} \quad (1.14)$$

Then, a firm level measure of cash flow sensitivity may be defined as:

$$\frac{\partial \left(\Delta CH_{it} \right)}{\partial CF_{it}} \equiv \hat{d}_i + \hat{\alpha}_3 CI_{it} + \hat{\alpha}_4 Q_{it}^{ind} + \hat{\alpha}_5 G_{it}^{*} + \hat{\alpha}_6 Intangibles_{it} \quad (1.15)$$

As can be seen, the interaction of cash flows and the coefficient for the firm effects, d_i, is required to obtain a measure of cash flow sensitivity that explicitly depends on unobservable firm characteristics. However, as already pointed out, since d_i is not observable, a sensitivity measure based on (1.15) is not possible to obtain using standard panel data specifications.

We consider the estimation of (1.14) by a *Correlated Random Effects Model (CRE)*. Specifically, for the set of variables we are considering, the analogous to equation (1.10) would be given by:

$$\hat{S}_{it}^{CRE} = \hat{\alpha}_3^{*} CI_{it} + \hat{\alpha}_4^{*} Q_{it}^{ind} + \hat{\alpha}_5^{*} G_{it}^{*} + \hat{\alpha}_6^{*} Intangibles_{it} + \hat{d}_i \quad (1.16)$$

Column (2) in Table 1 presents the correlated random effects coefficient estimates for equation (1.14). Firm effects coefficients are not reported due to space constraints. The corresponding coefficient labels associated with equation (1.15) are shown to the left of their respective estimates. $\hat{\Phi}$ is part of the estimated firm fixed effects, d_i. We form the cash flow sensitive of cash based on the *CRE* model, $\hat{S}^{CRE}$, given in equation (1.16).

As can be seen, the coefficient for the interaction between cash flows and the constraints index is positive and significant at the 10% level, and with a magnitude that is twenty times more than the coefficient obtained using pooled OLS. This result is consistent with existing empirical evidence that suggests constrained firms exhibit higher cash flow sensitivity (Almeida et al. (2004)). Regarding the effect of growth opportunities on firm level cash flow sensitivity, the coefficient for the interaction between cash flows and the industry median q is positive and significant at the 1% level, with a coefficient estimate almost four times of that obtained using pooled OLS estimation. This is consistent with the conjecture that firms with a more attractive set of investment opportunities are more likely to face some degree of financial constraints and, consequently, resort to internally generated funds.

The interaction between cash flows and G^* is negative and significantly different from zero at the 1% level; furthermore, the point estimate is 30 times larger in absolute value than that obtained using pooled OLS, which turns out to be not significant. The correlated random effects model results suggest that better governance mechanisms – or more powerful shareholders - reduce cash flow sensitivity at the firm level. Since a reduced cash flow sensitivity of cash leads to a lower accumulation of cash holdings at management's disposal, this result is consistent with the previous literature on international shareholder rights and the cash holdings of firms (Pinkowitz, et al. (2006); Dittmar, et al. (2003)).

Finally, as expected, intangibles are strongly and positively associated with cash flow sensitivity, with the coefficient for the intangibles-cash flow interaction achieving significance at the 1% level and being more than twice the coefficient obtained from pooled OLS estimation. The results obtained from the estimation of the correlated random effects model suggest that firm level cash flow sensitivity depends on firm characteristics, with investment opportunities and governance mechanisms playing a primary role in the determination of firms' cash accumulation policies.

E. Robustness of the firm level cash flow sensitivity measure

An effective measure of cash flow sensitivity should capture the difference between constrained and unconstrained firms documented in prior literature. We perform mean and median analyses in Table 2 to determine whether constrained firms exhibit a greater cash flow sensitivity ($\hat{S}^{CRE}$) than unconstrained firms.[6] In panel A, we classify firms as financially unconstrained if their constraints index equals zero (top three payout ratio and size deciles, and has S&P credit rating), and as financially constrained if their constraint index equals 3 (bottom three payout ratio and size ratios, and has no S&P credit rating). Panel A reveals that $\hat{S}^{CRE}$ performs well in documenting that constrained firms exhibit higher cash flow sensitivity than unconstrained firms. This effect is significant, with p-values of less than 1% in Wilcoxon Two-Sample, Kruskal-Wallis, and Median Two-Sample tests.

[Table 2 around here]

Given that $\hat{S}^{CRE}$ is partially determined by the *CI* index in equation (1.14) , it might be argued that the results presented in Panel A are driven by the way in which we construct the estimated cash flow sensitivity measure. To deal with this possible shortcoming, we classify firms according to two other variables that may proxy for the firms' degree of financial constraints and that are not involved in the computation of $\hat{S}^{CRE}$: dividends per share, *DPS*, in Panel B, and the dividend yield, *DY*, in Panel C. Based on Cleary (1999), we classify a firm as financially constrained in any given year if its dividends per share are lower than the previous year's dividends per share, or if it has not paid dividends at all during the sample period. A firm

[6] In Table 2 the sensitivity estimates are winsorized at the 1% and 99% tails.

is classified as financially unconstrained in any given year if it has increased or has kept constant its dividends per share with respect to the previous year.[7] A similar criterion is applied to the dividend yield variable. Results in Panels B and C are qualitatively the same as those presented in Panel A, confirming that our measure of cash flow sensitivity is able to capture the difference in cash stockpiling activities between constrained and unconstrained firms.

From the previous analysis two questions arise naturally: First, why does a balance of power favoring shareholders, as reflected in a higher value of G^*, lead to a reduction in the cash flow sensitivity, and therefore, in the cash holdings of firms? And second, how can strong shareholders reduce the amount of cash at managers' disposal?

Regarding the first question, we propose the following explanation: since cash holdings are more easily expropriated by managers than other assets, powerful shareholders may exert pressure on management to disperse accumulated cash holdings. When the cost of monitoring and active enforcement is sufficiently high, shareholders may prefer to uniformly reduce cash reserves instead of investing the necessary resources to effectively monitor and control the use of cash on hand. This represents a second-best solution, since the first-best solution of cash management is unattainable; however, it avoids a third-best outcome whereby managers consume large amounts of liquid assets. In this sense, a base level of cash disbursement keeps managers "honest." Consistent with this hypothesis, existing empirical literature finds that powerful shareholders impose restrictions on the amount of liquid assets in the hands of managers (Dittmar, et. al. (2003)). Regarding the second question, the amount of cash at managers' disposal can be reduced by encouraging regular dividend payments, stock repurchases, or adopting a greater debt burden. These activities will have an impact on other

[7] Cleary (1999) classifies firms that have kept dividends per share constant (yet different from zero) as either constrained or unconstrained firms based on additional criteria. I instead classify these firms simply as unconstrained.

corporate policies, such as the investment and dividends policies, particularly for firms that are constrained and thus require internally generated cash to invest.

To explore this issue further we double-sort our sample firms by financial constraint status and *G** in Table 3. Firms in the lowest (highest) *G** tercile are classified as firms with weak (strong) governance. We then compare the industry- adjusted capital expenditures scaled by total assets of the firms in these groups. As shown in Panel A, the Kruskal-Wallis Test for the null hypothesis of equal means across all groups is strongly rejected. Unconstrained firms invest more than their constrained counterparts, regardless of their governance classification. Controlling for financial constraints, the mean capital expenditures of weak governance firms and strong governance firms does not differ significantly for unconstrained firms (p-value = 0.69). For the constrained subgroup, however, strong governance firms have a lower level of capital expenditures than weak governance firms. The mean capital expenditures to assets ratios between these groups of firms are different from each other at the 3% level of significance. This situation might induce an underinvestment problem in constrained firms with the consequent impact on the value of these firms. If this outcome is preferable to a situation in which constrained firms are not forced to disgorge cash is a relevant topic for further research.

[Table 4 around here]

In Panel B of Table 4 we analyze whether the disbursement of cash holdings, scaled by total assets, is related to the strength of governance mechanisms in constrained or unconstrained firms. We define *Total Cash Disbursement* as interest expense plus the purchase of common and preferred stock plus cash dividends. The Kruskal-Wallis test for the null hypothesis of equality of means among groups is strongly rejected. Accordingly, firm cash disbursement policy is not independent of the degree of financial constraints and/or the strength of governance mechanisms. As expected, total cash disbursement is significantly higher in unconstrained firms than in constrained firms, regardless of the strength of governance mechanisms. For unconstrained firms, we document no statistical difference in total cash disbursement between weak governance and strong governance firms.

In contrast, constrained firms with strong governance exhibit higher total cash disbursement than constrained firms with weak governance. The average industry-adjusted total cash disbursement to total assets ratio is 125% higher in high governance firms, the difference being significant at the 10% level according to a Wilcoxon Two-Sample test. This evidence supports the argument that strong shareholders exert pressure on management to disperse accumulated cash holdings, which in turn is consistent with a potential underinvestment problem in constrained firms with strong corporate governance mechanisms.

IV. Conclusions

We develop and test a measure of firm-level cash flow sensitivity that incorporates unobservable firm effects and observable firm-specific characteristics such as growth opportunities and governance structure. We find that estimators incorporating fixed panel data effects strongly outperform other sensitivity measures that ignore unobservable heterogeneity in firm characteristics.

Our results confirm prior findings that financially constrained firms exhibit a higher degree of cash flow sensitivity than unconstrained firms. Future theoretical and empirical research should expand upon this new dimension of governance as reflected in the power struggle between management and shareholders, particularly in relation to financing constraints and cash accumulation policies.

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Table 1: Cash flow sensitivity estimation

This table presents the results of firm level cash flow sensitivity estimation. Column (1) provides results from pooled OLS estimation. Column (2) provides results from correlated random effects estimation. The dependent variable is change in cash holdings, where cash holdings are defined as cash plus marketable securities, divided by the value of assets. Cash flows, *CF*, are defined as income before extraordinary items plus amortization and depreciation, divided by total assets. *CI* is a constraints index based on S&P credit ratings, firm size and firm payout ratios. *Ind. Q* corresponds to industry median Tobin's q, where industry is defined at the 2 digit SIC level. Q is defined as the product of the price at the end of the corresponding fiscal year and the number of common shares outstanding at that date, plus total assets, minus the book value of common equity, divided by total assets. $G^* = 24 - G$, where G is the Gompers, Ishii and Metrick (2003) index. *Intangibles* is the ratio of intangible assets to total assets. The variables used to form the measures of cash flow sensitivity from the regression results have been shaded. Cash flow sensitivity obtained from pooled OLS estimation is given by:

$$\hat{S}_{it}^{ols} = \hat{\beta}_2 + \hat{\beta}_3 CI_{it} + \hat{\beta}_4 Q_{it}^{ind} + \hat{\beta}_5 G_{it}^* + \hat{\beta}_6 Intangibles_{it} .$$

Cash flow sensitivity obtained from correlated random effects estimation (CRE) is given by:

$$\hat{S}_{it}^{CRE} = \hat{\alpha}_3^* CI_{it} + \hat{\alpha}_4^* Q_{it}^{ind} + \hat{\alpha}_5^* G_{it}^* + \hat{\alpha}_6^* Intangibles_{it} + \hat{d}_i .$$

Firm effects d_i are not shown. The symbols *, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively, using a 2-tail test. P-values are in parentheses.

Variable		(1) Pooled OLS			(2) CRE	
Intercept		-0.0060			0.0278	
		(0.6894)			(0.1023)	
CF	$\hat{\beta}_2$	-0.0513		$\hat{\Phi}$	**-0.4905**	***
		(0.3130)			**(0.0000)**	
CF x CI	$\hat{\beta}_3$	0.0037		$\hat{\alpha}_3$	**0.0858**	*
		(0.7398)			**(0.0786)**	
CF x ind. Q	$\hat{\beta}_4$	**0.0172**	*	$\hat{\alpha}_4$	**0.0639**	***
		(0.0614)			**(0.0099)**	
CF x G*	$\hat{\beta}_5$	-0.0013		$\hat{\alpha}_5$	**-0.0401**	***
		(0.6393)			**(0.0006)**	
CF x intangibles	$\hat{\beta}_6$	**0.1034**	**	$\hat{\alpha}_6$	**0.2235**	***
		(0.0377)			**(0.0036)**	
CI		0.0034			**0.0102**	*
		(0.1656)			**(0.0663)**	
ind. Q		-0.0046			**-0.0150**	***
		(0.0929)			**(0.0076)**	
G*		-0.0003			**0.0043**	**
		(0.5564)			**(0.0228)**	
Intangibles		**-0.0553**	***		**-0.1202**	***
		(0.0000)			**(0.0000)**	
Size		**0.0031**	**		0.0042	
		(0.0129)			(0.2778)	
N		3526			3514	
F		**7.43**	***		**5.66**	***
		(0.0000)			**(0.0000)**	
R-Square		2.07%			4.33%	

Table 2: Mean and median cash flow sensitivity: financially constrained vs. unconstrained firms

This table presents mean and median analysis of cash flow sensitivity between financially unconstrained and financially constrained firms. In Panel A, firms are classified as financially constrained or financially unconstrained according to *CI*, the constraints index, which is based on S&P credit ratings, firm size and firm payout ratios. In Panel B, firms are classified based on dividends per share: a firm is classified as financially constrained in any given year if its dividends per share are lower than the previous year dividends per share, or if it has not paid dividends at all during the sample period. A firm is classified as financially unconstrained in any given year if it has increased or has kept constant its dividends per share with respect to the previous year. In Panel C, firms are classified based on dividend yield: a firm is classified as financially constrained in any given year if its dividend yield is lower than the previous year's dividend yield, or if it has not paid dividends at all during the sample period. A firm is classified as financially unconstrained in any given year if it has increased or has kept constant its dividend yield with respect to the previous year. The Wilcoxon two-sample test, the Kruskal-Wallis test, and a median two sample test between financially constrained and financially unconstrained firms are presented for cash flow sensitivity estimates. All sensitivity estimates are winsorized at the 1% and 99% levels.

Constraint Status	N	Mean	Median	Wilcoxon Two-Sample Test		Kruskal-Wallis Test		Median Two-Sample Test	
Panel A: Financial Constraints by CI index									
Unconstrained	950	-0.063	-0.068	Z	p-value	Chi-Square	p-value	Z	p-value
Constrained	1,081	0.012	0.006	-21.945	0.0000	481.598	0.0000	-18.475	0.0000
Difference		0.076	0.073						
Panel B: Financial Constraints by Dividends per Share									
Unconstrained	1,504	-0.053	-0.056	Z	p-value	Chi-Square	p-value	Z	p-value
Constrained	1,945	-0.012	-0.013	-15.829	0.0000	250.560	0.0000	-13.237	0.0000
Difference		0.041	0.043						
Panel C: Financial Constraints by Dividend Yield									
Unconstrained	922	-0.053	-0.060	Z	p-value	Chi-Square	p-value	Z	p-value
Constrained	2,556	-0.022	-0.024	-10.841	0.0000	117.524	0.0000	-9.233	0.0000
Difference		0.031	0.035						

Table 3: Impact of governance on capital expenditures and total cash disbursement

This table presents mean analysis of the industry-adjusted capital expenditures ratio and industry-adjusted total cash disbursement to total assets ratio for subsamples of firms classified according to the strength of their corporate governance and their degree of financial constraints. The capital expenditures ratio corresponds to capital expenditures divided by total assets. Total cash disbursement is defined as interest expense plus the purchase of common and preferred stock plus cash dividends, all divided by total assets. Firms are classified as financially constrained and financially unconstrained according to *CI*, the constraints index, which is based on S&P credit ratings, firm size and firm payout ratios. For each of these categories firms are sorted according to their *G** index. Firms in the lowest (highest) tercile according to this sorting are classified as firms with weak (strong) governance mechanisms. Panel A reports the industry-adjusted capital expenditures analysis and Panel B reports the industry-adjusted total cash disbursement over total assets analysis. The Wilcoxon two-sample test and Kruskal-Wallis test for equality of means across groups are provided.

Panel A: Industry-Adjusted Capital Expenditures

		Low Governance	High Governance	High Gov *minus* Low Gov	Wilcoxon Two-Sample Test	
Unconstrained		N = 1,048	N = 424		|Z|	p-value
		0.016	0.015	-0.001	0.40	0.690
Constrained		N = 458	N = 966		|Z|	p-value
		0.015	0.013	-0.002	2.22	0.027
Unconstrained *minus* Constrained		0.001	0.002		**Kruskal-Wallis Test for Equality of Means**	
Wilcoxon Two	|Z|	1.93	3.94		χ^2	p-value
Sample Test	p-value	0.054	0.000		34.16	0.000

Panel B: Industry-Adjusted Total Cash Disbursement

		Low Governance	High Governance	High Gov *minus* Low Gov	Wilcoxon Two-Sample Test	
Unconstrained		N = 1,050	N = 403		|Z|	p-value
		0.049	0.054	0.006	0.51	0.611
Constrained		N = 464	N = 883		|Z|	p-value
		0.004	0.005	0.002	1.66	0.097
Unconstrained *minus* Constrained		0.045	0.049		**Kruskal-Wallis Test for Equality of Means**	
Wilcoxon Two	|Z|	23.52	20.14		χ^2	p-value
Sample Test	p-value	0.000	0.000		1126.08	0.000