Financing Frictions and the Substitution Between Internal and External Funds*

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Abstract

There is ample empirical evidence of a negative relation between internal funds (profitability) and the demand for external funds (e.g., debt issuance). This negative relation has been interpreted as evidence for external financing costs arising from capital market frictions such as asymmetric information (e.g., in support of the pecking order theory). We show, however, that the negative effect of internal funds on the demand for external financing is concentrated among firms that are *least likely* to face high external financing costs (i.e., firms that distribute large amounts of dividends, that are large, and whose bonds and commercial papers are rated). For firms in the other end of the spectrum (low payout, small, and unrated), external financing is insensitive to internal funds. These cross-firm differences hold separately for debt and outside equity financing, and are magnified in the aftermath of macroeconomic movements that tighten financing constraints (macroeconomic recessions). We argue that the greater degree of complementarity between internal funds and external finance for constrained firms is a consequence of the interdependence of their financing and investment decisions. Our findings also suggest that the negative relation between internal funds and external financing should not be interpreted as evidence for the pecking order theory, and appears more consistent with adjustment cost-based arguments such as those in Strebulaev (2007).

Key words: Capital structure, external financing, pecking order, financial constraints, transaction costs, investment, business cycles.

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1 Introduction

Corporate managers in the US and Europe claim that maintaining "financial flexibility" is the primary objective of their firms' financial policies (see Graham and Harvey (2001) and Bancel and Mittoo (2002)). Their stated policies are consistent with the goal of ensuring funding for present and future investment undertakings in a world where financing frictions force firms to pass up profitable opportunities. In spite of this observation, empirical work on capital structure tends to overlook the interplay between corporate investment and financing decisions. Most recent papers take investment as *exogenous* to financial policy, and focus on issues such as the relative costs of issuing debt versus equity (e.g., Shyam-Sunder and Myers (1999) and Fama and French (2002, 2005)), market timing (Baker and Wurgler (2002)), security return dynamics (Welch (2004)), and the relevance of elements of the tradeoff theory; taxes and financial distress costs (Hovakimian et al. (2001)).[1] While these issues are undoubtedly important for our understanding of corporate financial policies, the literature often abstracts from crucial aspects influencing the supply and demand for external funds across firms: capital market imperfections and real investment demand.

In this paper we study the implications of investment–financing interactions for external financing decisions. To understand those interactions, we focus on one of the key stylized facts of the empirical capital structure literature, namely the finding that more profitable firms demand less external finance. In contrast to the extant literature (e.g., Myers (1993) and Fama and French (2002)), we argue that this finding should not be interpreted as evidence for external financing costs arising from asymmetric information (à la pecking order theory). Our main argument is simple. If the negative relation between internal funds and the demand for external financing is due to external financing costs, then this relation should be more strongly negative in situations in which external financing costs are high. Remarkably, we show new, robust evidence that this negative relation is concentrated among firms that are *least likely* to face strong financing frictions. We argue that the negative relation between profits and external financing that we observe for financially unconstrained firms is consistent with the relevance of adjustment costs in issuance decisions (Strebulaev (2007)). At the same time, our evidence suggests that the greater complementarity between internal and external funds among constrained firms arises from the effect of *endogenous* investment on external financing decisions.

To illustrate our basic argument, consider first a situation in which firms face little or no frictions when raising funds for positive NPV projects (i.e., firms are "financially unconstrained"). In particular, these firms are less likely to suffer from asymmetric information. For an unconstrained

[1] Earlier papers on financial policy attribute a more prominent role to the interplay between investment and financing, as exemplified by Jensen and Meckling's (1976) risk-shifting and Myers's (1977) debt-overhang ideas.

firm, investment spending is exogenous to financing — investment it is only determined by the availability of profitable opportunities. In the absence of other considerations, theory does not pin down the relation between profitability and external financing demand among such firms (cf. M&M irrelevance argument). Recent theories, however, suggest that internal funds might be negatively related to external financing demand even if firms are financially unconstrained. For example, Strebulaev (2007) shows that a dynamic tradeoff model with small adjustment costs can generate a negative cross-sectional relation between profitability and leverage, due to the presence of inactive firms (those that optimally choose not to adjust their capital structure) in the cross-section.[2] In particular, small adjustment costs can also generate a negative relation between profitability and issuance activity: profitable firms may choose, on the margin, to finance investments with internal funds so as to save on flotation costs. If external financing costs that stem from market imperfections are negligible, the relation between internal funds and external financing is either undetermined or (more likely) negative because of adjustment costs.

Consider, in contrast, the case of firms that face higher costs of external financing either because of asymmetric information, incomplete contractibility, or agency-related issues (e.g., "financially constrained" firms). The standard pecking order argument would suggest that financially constrained firms should display an even more negative relation between the availability of internal funds and the demand for external finance, relative to comparable unconstrained firms. Presumably, constrained firms should be even less likely to tap the external capital markets: for a given level of investment, profitable constrained firms require less external financing, and should show lower security issuance activity. Crucially, this argument implicitly assumes that investment is determined *before* the firm decides the optimal amount of debt and equity to issue. In other words, the standard pecking order argument ignores the possibility that the firm's investment choice might become *endogenous* to external financing decisions *precisely when* external financing costs are high.

We argue that the relation between internal funds and external financing is fundamentally affected by the endogeneity of investment when firms are financially constrained. Three different, yet related effects shape that relation.

First, notice that a constrained firm deals with a fundamental tradeoff: using internally generated funds to (a) reduce the demand for external financing or (b) increase current capital expenditures. This tradeoff arises from the fact that a financially constrained firm's investment is, by definition, lower than desired levels. A constrained firm may use internal funds for additional capital spending, rather than reducing its use of external financing, given the high opportunity cost of investment. Secondly, notice that a firm that is financially constrained worries not only about the funding of

[2] Hennessy and Whited (2005) and Lewellen and Lewellen (2006) argue that tax considerations can also generate a negative relation between profitability and external financing. See also Chen and Zhao (2005).

current investments, but also future ones. The need to fund future investments under credit constraints increases the firm's demand for liquid assets such as cash and working capital. This effect also decreases the firm's propensity to use internal funds to reduce external financing. Lastly, high costs of external finance create a direct complementarity between the generation of internal funds and the firm's capacity to raise external finance. To wit, a constrained firm with high internal funds can direct some of those funds to investments in pledgeable assets, which in turn increase the firm's collateral and its ability to raise additional external funds. Those new external funds allow for further investment in pledgeable assets, amplifying the positive effect of internal funds on the demand for external financing ("credit multiplier").[3]

All of these effects point to the same direction. Following increases in profitability, a financially constrained firm may not reduce its demand for external funds. The constrained firm can have better uses for the additional profits (higher investment and/or cash holdings), and could find it optimal to *increase* its demand for external financing precisely at times when profitability is high. These arguments suggest that, in contrast to the standard pecking order argument, constrained firms should display a *less* negative relation between the availability of internal funds and the demand for external funds, relative to similar firms that do not face strong financing frictions. This complementarity between internal funds and external financing arises from the interdependence of financing and investment decisions.

To test these arguments, we empirically examine the relation between financial constraints and the sensitivity of external financing to internal cash flows. We do so by looking at firms' propensity to resort to external funding sources (debt and equity issuance) in response to innovations in profitability (cash flows). Using a large sample of firms over thirty years, we estimate that propensity for various subsamples partitioned on the basis of the likelihood that firms have constrained/unconstrained access to external finance. Following standard literature, we consider four alternative firm characteristics in identifying constrained and unconstrained subsamples: payout policy, asset size, bond ratings, and commercial paper ratings.

Under each one of our constraint criteria, we find that the cash flow sensitivity of external financing is negative and statistically significant for the subsample of financially unconstrained firms, but indistinguishable from zero for the subsample of constrained firms. Importantly, all cross-constraint-type differences in internal–external funding sensitivities are statistically and economically significant. The patterns that we observe in our base tests remain after various robustness checks involving changes in empirical specifications, variable construction methods, sampling restric-

[3] Bernanke and Gertler (1989) and Kiyotaki and Moore (1997) provide a full-blown characterization of the credit multiplier. Firm-level evidence of the credit multiplier can be found in the recent work of Hennessy et al. (2006) and Almeida and Campello (2007).

tions, and econometric techniques.

Our findings do not support those interpretations of the data that are usually associated with standard pecking order tests. Because the negative relation between profits and external financing is concentrated among financially unconstrained firms, it is unlikely that asymmetric information is the driver of this negative relation. In contrast, since even financially unconstrained firms face capital structure adjustment costs, our findings are consistent with the presence of those costs (see Strebulaev (2007)). Crucially, our findings suggest that the endogeneity of investment is a key factor behind external financing activities under financing constraints, as evidenced by the greater complementarity between internal and external financing that we document for constrained firms. As we discuss later, our constrained sample results are surprising as they cannot be explained away by standard capital structure theories.

Besides performing robustness checks on the reliability of our empirical estimates, we report a number of additional tests supporting the underlying logic that links endogenous investment to external financing decisions. First, we show evidence that the complementarity between internal and external funds is particularly pronounced for constrained firms with highly liquid (or "tangible") assets. As we argue in Section 5.1, the credit multiplier mechanism that links the generation of internal funds and the firm's capacity to raise external finance should be particularly pronounced for those firms whose assets are highly tangible. These findings provide additional evidence that a credit multiplier mechanism is behind the cross-sectional differences that we uncover in the paper. Second, using a system-regression framework, we show that the same firms that avoid using cash flows to reduce external financing demand systematically allocate a large portion of their profits into assets that can be used to smooth out the investment process (such as cash and other working capital items). Results from these system-regressions support the conjecture that internal and external financing policies are determined jointly with investment spending under financing frictions. Finally, we show evidence that differences in external financing–cash flow sensitivities across constrained and unconstrained firm samples are magnified during macroeconomic recessions; that is, precisely at times when financing constraints are likely to be tightened. These differences-in-differences estimations further address potential concerns with spurious biases affecting our panel estimations.

We follow the recent capital structure literature in that we focus on firms' marginal financing decisions — the issuance of new external financial claims — to learn about financial policy-making (e.g., Shyam-Sunder and Myers (1999) and Frank and Goyal (2003)). Note, however, that papers in that literature are generally concerned with firms' choice between debt *versus* equity. In contrast, we focus on the total financing that firms raise in the capital markets; i.e., new debt *and* equity issues, and examine the substitution between internal and external funds. Nevertheless, we also look at how debt and equity financing (separately) respond to variations in cash flows. We find that the differences across constrained and unconstrained firms that we have identified hold irrespective of firms' preferred source of marginal outside financing: the cash flow sensitivities of *both* debt and equity financing are significantly more negative for financially unconstrained firms.

One study that is directly related to ours is Lemmon and Zender (2004), who look at the external financing patterns of firms sorted according to whether or not they have easy access to the capital markets; i.e., have rated bonds. Differently from our study, however, those authors focus on the determinants of the debt versus equity decision, running "financing-deficit"-type regressions across samples of constrained and unconstrained firms. Based on cross-sectional differences in the estimates returned from these regressions, Lemmon and Zender conclude that some of the patterns observed in the data can be reconciled by the pecking order theory. Consistent with our analysis, Faulkender and Petersen (2006) show that financing constraints — proxied by the absence of a bond rating — are a key determinant of firms' capital structure. Faulkender and Petersen argue that observed leverage ratios endogenize issues related to the supply of funds by outside creditors.

Finally, our study has connections with the literature on real investment under financial constraints (see Hubbard (1998) for a review). We add to the financial constraints literature by providing *prima facie* evidence that firms often presumed to be financially constrained — those that pay little or no dividends to investors, those that are small, and those whose debt instruments are not rated — indeed access the capital markets (and save funds) in ways that are consistent with the presence of frictions in the availability of funding for their investments.

The remainder of the paper is organized as follows. In the next section we develop the argument that relates endogenous investment to the sensitivity of external financing to internal funds. Section 3 describes our sampling and empirical methods. Sections 4 and 5 present our main empirical findings. Section 6 concludes the paper.

2 Endogenous Investment and the Substitution between Internal and External Financing

The empirical capital structure literature documents a negative association between firm profitability and external financing. While most of the literature focuses on the relation between profitability and leverage levels (e.g., Rajan and Zingales (1995)), the negative association between the availability of internal funds and the use of external finance also holds for flow measures of external financing. Leary and Roberts (2005), for example, find that firms that have high cash flows or high cash balances are less likely to issue (and are more likely to retire) both debt and equity.

Leary and Roberts (2005), like much of the literature, interpret the existing findings as evidence supporting the pecking order theory (see, e.g., Myers (1993) and Fama and French (2002)). According to the pecking order argument, firms prefer to finance investments with internal funds, because asymmetric information increases external financing costs (Myers and Majluf (1984) and Myers (1984)). A preference for internal over external funds would then generate a negative relation between internal cash flows and external financing: more profitable firms require less external financing, and should thus show lower security issuance activity. This observed negative relation would seem inconsistent with standard arguments based on the tradeoff theory of capital structure, which predicts that because of tax shields more profitable firms should use external funds (i.e., debt) to finance investments (see, e.g., Graham (2000)).

Recent literature, however, suggests that the negative relation between profitability and external financing could be due to the presence of (possibly small) adjustment costs (see Strebulaev (2007)). Arguably, all firms face some direct flotation costs when accessing external markets, which lead to relatively infrequent refinancing decisions. Strebulaev presents strong evidence that the presence of firms that do not readjust their capital structure (inactive firms) in random samples generates the well known negative cross-sectional relation between profits and leverage ratios. In his paper, leverage ratios decrease mechanically with profitability for inactive firms, given that equity values are positively related to profitability. Transaction costs can also generate a negative relation between profitability and issuance activity. In particular, profitable firms may choose, on the margin, to finance investments with internal funds so as to save on transaction costs.[4]

In addition to standard adjustment costs, some firms are also subject to potentially more substantial costs of external financing. These distinct, additional costs arise from issues such as agency problems, informational asymmetries, contracting imperfections, and lack of collateral. We call these costs *financing constraint costs*. Financing constraint costs, when considered on top of small adjustment costs, can lead to pronounced distortions in the firm's investment policy. As a result, for firms subject to financial constraint costs (financially constrained firms), investment and financing decisions become interconnected. For example, a constrained firm's ability to access debt financing at a fair cost might depend on the amount of collateral that the firm can provide to lenders, which in turn depends on the amount of investment that the firm can make.

Interactions between investment and financing have been largely ignored in the standard tests of the pecking order argument. Consistent with the assumption of exogenous (unconstrained) investment, various previous papers use capital expenditures as an explanatory variable in the right-hand

[4] Hennessy and Whited (2005) and Lewellen and Lewellen (2006) also offer an explanation for the negative relation between profits and external financing that is not based upon asymmetric information. In their work, debt-related tax benefits are less attractive when the firm can finance investments with internal funds, because internal financing allows the firm to defer taxes on payments to equity holders. As a consequence, more profitable firms may optimally issue less external finance (i.e., debt) than firms that are less profitable (which must choose between debt and outside equity).

side of regressions that explain capital structure (as part of the firm's "financing deficit"). This testing approach, which follows from Shyam-Sunder and Myers (1999), implicitly assumes that *observed* investment is equal to *desired* investment even when the firm faces capital market frictions. In contrast to this, we argue that the endogeneity of financing and investment decisions influence the substitution between internal and external funds. To develop these implications in greater detail, we draw on the literature that examines the impact of capital markets imperfections on investment decisions.

First, if firms' investments are lower than desired levels because of capital markets imperfections (i.e., if firms are financially constrained), then their spending should be related to the availability of internal funds. Essentially, firms with high internal funds will find it advantageous to direct some of those funds towards incremental investment — which have high marginal product — as opposed to cutting down on external financing. Conversely, if internal funds decrease, a constrained firm might be forced to cut down investment because the alternative — i.e., leaving investment constant and raising additional external funds — might not be feasible. This investment–financing tradeoff works to mitigate any potential substitution effect between external and internal funds.

This first mechanism underlies the tests of financing constraints first proposed by Fazzari et al. (1988), and motivates a large empirical literature in economics and finance (see Hubbard (1998) and Stein (2003) for comprehensive reviews of early literature, and Rauh (2006) for recent empirical evidence). It is important to note that recent research has pointed to difficulties with the strategy of looking at the empirical correlation between real and financial variables, stemming from measurement problems in the control for investment opportunities (see, e.g., Erickson and Whited (2000), Gomes (2001), and Cummins et al. (2006)). Our test design avoids the explicit modeling of real variables, and our estimations recognize the possibility that well-known biases could underlie inferences with the sorts of empirical models we estimate (see Sections 4 and 5). Among other expedients, we adopt empirical strategies that directly address the measurement error problem (e.g., Cummins et al. (2006) instruments).

The second mechanism is related to the effect of future investment on current financing choices. A firm that faces costly external financing should worry not only about current investment needs, but also about future ones. One way that the firm can secure future investment spending is by increasing its holdings of cash, securities, and other liquid assets that can be used to smooth out the investment process (e.g., working capital). For constrained firms, holdings of liquid assets are an additional competing use of internal funds. In other words, firms that face high costs of external financing may find it optimal to direct cash flows towards liquid assets when they observe high profitability (see Fazzari and Petersen (1993) and Almeida et al. (2004) for evidence). Conversely, if profitability is low, constrained firms may draw down their stocks of liquid assets to avoid raising costly external financing. The optimal management of liquid assets is another reason why constrained firms should display a lower propensity to use cash flows towards the reduction of external financing.

In order to test whether external financing and liquid asset holdings are simultaneously determined, we estimate a system of regressions in which both these variables are endogenous (see Section 5). This approach allows us to test the hypothesis that those firms that avoid using external financing to absorb changes in internal funds *also* direct internal funds towards holdings of liquid assets.[5]

The third mechanism affecting the substitution between internal and external financing is related to the firm's capacity to raise external finance. Constrained firms' ability to raise external financing is likely to covary positively with variations in internal cash flows, either because external financing costs decrease when cash flows are high (Bernanke and Gertler (1989)), or because the value of collateral increases with internal cash flows (Kiyotaki and Moore (1997)). Following a positive income shock, firms invest more, therefore increasing their holdings of tangible assets. These assets create new collateral, which in turn allow the firm to raise more external finance ("credit multiplier"). The credit multiplier mechanism suggests that internal funds and external finance should become more complementary for firms that are financially constrained. This mechanism provides yet another reason why the relation between internal funds and external finance should be *less negative* than what one would expect in the absence of an endogenous link between investment and financing decisions.

Our empirical analysis also explores the rationale behind the credit multiplier by identifying situations in which this mechanism is more likely to become important. First, the credit multiplier mechanism should be stronger for firms that have more tangible assets, because an increase in cash flow will have a greater impact on collateral value for this group of firms (see Almeida and Campello (2007)). Accordingly, internal funds and external finance should be even more complementary for constrained firms that have highly tangible assets (see Section 5.1). Second, prior research also suggests that the credit multiplier matters more during recessions and monetary contractions, when financing constraints are more likely to bind (see, e.g., Kashyap et al. (1994), Gertler and Gilchrist (1994), and Calomiris et al. (1995)). Accordingly, we examine the extent to which the sensitivity of external financing to internal funds varies with the business cycle for different types of firms (see Section 5.3). Presumably, it is more likely that internal funds and external finance become complementary under economic conditions that are associated with tighter financing constraints.

The theories of interest for our analysis (pecking order, adjustment costs, and endogenous investment driven by financing constraints) have distinct predictions for the substitutability between

[5] Our tests on liquid asset holdings draw on Almeida et al. (2004). However, while Almeida et al. use only cash on the left-hand side of their empirical models, the tests of this paper use a broader measure of liquid asset holdings that also include working capital items (such as inventory and accounts receivables). This modification is important to consider because cash and working capital can be close substitutes (see, for example, Bates et al. (2006)).

internal and external funds across constrained and unconstrained firm samples. Let's summarize these predictions.

Unconstrained Firms. The adjustment costs argument suggests that even in the absence of high costs of external financing there should be a negative relation between profitability and the use of external finance (cf. Strebulaev (2007)). The presence of adjustment costs — which are relevant for all firms — implies that the relation between profitability and external financing might be negative for financially unconstrained firms: on the margin, these firms finance their profitable investment projects with internal (as apposed to external) funds, thereby economizing on transactions costs. Neither the pecking order nor financial constraints arguments make clear predictions about financially unconstrained firms, since these firms should be characterized by low asymmetry of information and exogenous investment. Greater substitutability between internal and external funds for unconstrained firms would be more consistent with the adjustment costs arguments.

Constrained Firms. The standard pecking order story with exogenous investment would suggest that the relation between profits and external financing should become more strongly negative when firms are financially constrained, since these firms are more likely to suffer from information asymmetry. In contrast, as discussed above, if investment and external financing are endogenously determined, then internal funds and external finance should become more complementary, relative to a situation in which firms are financially unconstrained. The predictions of the adjustment cost argument for the constrained samples depend on whether adjustment costs are higher or lower for constrained firms. We are unaware of any evidence suggesting that constrained firms have lower adjustment costs. On the contrary, the existing empirical literature suggests that adjustment costs are higher for the types of firms that are typically classified as financially constrained.[6,7] Greater complementarity between internal and external funds for constrained firms would be more consistent with evidence of an endogenous link between investment and financing decisions.

To provide evidence for these arguments we perform the following sets of tests:

(1) Single-Equation Tests: We relate the sensitivity of external financing (debt and equity issuance) to innovations in profitability (cash flows), both for constrained and unconstrained

[6] For example, Altinkilic and Hansen (2000) find that smaller and riskier firms face higher adjustment costs for both debt and outside equity (see also Kim et al. (2003)). Fischer et al. (1989) argue that because small issues incur larger proportional adjustment costs, and because issue size is correlated with firm size, small firms should have higher adjustment costs. They report evidence that the range of observed debt ratios is higher for small firms, which is consistent with higher adjustment costs. On the other hand, Corwin (2003) does not find a clear link between SEO underpricing and firm size.

[7] As suggested by the referee, one possibility is that if constrained firms are forced to use more short-term debt relative to unconstrained ones, then they will also refinance their capital structure more frequently and might behave as if they had lower adjustment costs. We provide an explicit test of this hypothesis in Section 4.2.

firms. If investment and external financing are jointly determined, then we expect this sensitivity to be less negative for constrained firms than for unconstrained firms.

(2) System-Equation Tests: We relate both external financing and liquid asset holdings to innovations in cash flows in a system of seemingly unrelated regressions (SUR), separately for constrained and unconstrained firms. If investment and external financing are jointly determined, then the same set of constrained firms that display a less negative sensitivity of external financing to cash flow innovations should also display a more positive sensitivity of liquid asset holdings (cash, inventory, etc.) to cash flows, relative to unconstrained firms.

(3) Credit Multiplier Tests: We examine whether asset tangibility affects the sensitivity of external financing to innovations in profitability both for constrained and unconstrained firms. If investment and external financing are jointly determined, then we expect tangibility to increase the complementarity between internal and external funds for constrained firms, but not for unconstrained ones.

(4) Differences-in-Differences Tests: We examine the time-series properties of the cash flow sensitivity of external financing of constrained and unconstrained firms. If investment and external financing are jointly determined, then the sensitivity should become more positive for constrained firms (greater complementarity) during periods in which financial constraints are more likely to bind (e.g., economic recessions). We expect no such pattern for unconstrained firms.

3 Sample and Methodology

3.1 Sample

To test our predictions we use a sample of firms taken from COMPUSTAT's P/S/T, Full Coverage, and Research annual tapes over a three-decade window from 1971 to 2001.[8] Our sampling disregards observations from financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental enterprises (SICs greater than 8000). We require firms to provide valid information on their total assets, sales, debt, market capitalization, and operating income (cash flows). We deflate all series to 1971 dollars.

Our data selection criteria and variable construction approach follows that of Almeida et al. (2004), who study the impact of financing constraints on the management of internal funds, and

[8]We start collecting our sample from 1971 because the flow of funds data is not available prior to that year. The tests of this paper only consider security issuance activities that generate *actual* flows of funds from the financial markets into the firm (and vice-versa). Our results are immune to Fama and French's (2005) criticism that existing studies in the literature fail to account for events that change a firm's observed capital structure — such as mergers and granting of stocks to managers — but produce no cash flows to the firm.

that of Frank and Goyal (2003), who look at external financing decisions. Following Almeida et al., we discard from the raw data those firm-years for which the value of assets is less than $5 million, and those displaying asset growth exceeding 100%.[9] We further request that firm annual sales exceed $1 million in order to minimize the sampling of distressed firms. We use the flow of funds account series detailed in Frank and Goyal to construct our empirical proxies. Differently from those authors, however, we do not trim any of the variables at their extreme percentiles. Instead we place limits on variables' distributions based on economic intuition. For instance, we eliminate firm-years for which debt exceeds total assets (near-bankruptcy firms), and those whose market-to-book asset ratio (or Q, our basic proxy for investment opportunities) is either negative or greater than 10 (see Gilchrist and Himmelberg (1995)).

Our final sample consists of observations from 10,031 individual firms (72,851 firm-years). Table 1 reports summary statistics for the main variables used in our tests. Since our sampling approach and variable construction criteria follow the literature, it is not surprising that the numbers we report in Panel A (statistics for the whole sample) resemble those found in related studies (see, e.g., Frank and Goyal (2003) and Lemmon and Zender (2004)). In the interest of brevity, we omit the discussion of the descriptive statistics of our (standard) sample.

– insert Table 1 here –

3.2 Methodology

Our goal is to provide evidence on the relation between internal funds and external finance for constrained and unconstrained firms. In order to do this, we need to specify an empirical model relating firms' issuance of external financing instruments and cash flows, and also to empirically identify financially constrained and unconstrained firms. We tackle these two issues in this section.

3.2.1 Empirical Models of External Financing

We use two alternative specifications to empirically model the cash flow sensitivity of external financing. The first specification is a parsimonious one, in addition to firm size, it only includes proxies for variables that we believe will capture information related to the primitives of our story: cash flows and investment opportunities. Define *ExternalFinancing* as the ratio of the total net equity issuances (COMPUSTAT's item #108 – item #115) plus net debt issuances (item #111 – item #114) to total book value of assets (item #6). *CashFlow* is defined as the ratio of earnings

[9] The first screen eliminates from the sample those firms with severely limited access to the public markets; the internal–external funding interplay that we examine requires the firm to have active (albeit potentially constrained) access to funds from the financial markets. The second screen eliminates those firm-years registering large jumps in their business fundamentals; these are typically indicative of major corporate events.

before extraordinary items plus depreciation and amortization (item #123 + item #125) to total book assets. Our proxy for investment opportunities, Q, is computed as the market value of assets divided by the book value of assets, or (item #6 + (item #199 × item #25) − item #60 − item #74) / (item #6). Our baseline empirical model can be written as:

$$ExternalFinancing_{i,t} = \alpha_1 CashFlow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \sum_i firm_i + \sum_t year_t + \varepsilon_{i,t}, \quad (1)$$

where *Size* is the natural log of sales (item #12), and *firm* and *year* absorb firm- and time-specific effects, respectively.

We focus on the effect of cash flows on the issuance of financing instruments, as captured by α_1 in Eq. (1). In addition, financing decisions should also be influenced by the attractiveness of future investment opportunities. Noting the difficulty in empirically measuring those opportunities, our baseline model uses Q to capture information about the value of long-term growth options that are available to the firm. We, however, acknowledge the limitations of empirical Q and later propose alternative specifications that sidestep those limitations. We include firm size in our baseline specification because accessing external funds may entail fixed costs; on the margin, the larger firms within a given subset of firms could be more favorably predisposed to substitute between internal and external funds due to economies of scale. Finally, we explicitly control for biases stemming from unobserved individual heterogeneity and time idiosyncrasies by expunging firm- and time-fixed effects from our sample. In fitting the data, we allow residuals to be correlated within years using the "sandwich" (or Huber-White) variance/covariance matrix estimator.

An alternative estimate of the cash flow sensitivity of external financing is obtained from a specification in which a firm's decision to issue public securities in face of cash flow innovations takes into account the firm's pre-existing *stock* of internal funding/wealth and its ex-ante financial structure. Here, we borrow insights from the literature on investment demand (e.g., Fazzari and Petersen (1993) and Schiantarelli and Sembenelli (2000)), on liquidity demand (Almeida et al. (2004)), and on capital structure (e.g., Rajan and Zingales (1995)), and model the annual net issuances also as a function of the beginning-of-the-year stock of cash and liquid securities (*CashHoldings*), accounts receivables and inventory items (*Inventory*), gross plant, property and equipment (*PPE*), and debt/equity ratios (*Debt/Equity*):

$$\begin{aligned} ExternalFinancing_{i,t} = \; & \alpha_1 CashFlow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} \\ & + \alpha_4 CashHoldings_{i,t-1} + \alpha_5 Inventory_{i,t-1} \\ & + \alpha_6 PPE_{i,t-1} + \alpha_7 Debt/Equity_{i,t-1} \\ & + \sum_i firm_i + \sum_t year_t + \varepsilon_{i,t}. \end{aligned} \quad (2)$$

We control for pre-existing stocks of cash holdings and other working capital items because a firm can use these alternative components of internal wealth to accommodate shocks to cash flows. As in previous research, a firm's stock of fixed assets and its lagged capital structure enter as additional determinants of the amount of new external financing that it obtains.[10]

In estimating Eq. (2), we explicitly recognize the endogeneity of corporate policies such as the accumulation of assets (e.g., cash) that can be quickly liquidated in order to absorb cash flow shocks as well as pre-existing capital structure. We do so in a GMM framework. Identifying instruments for endogenous regressors is never an obvious task, but the combination of some economic introspection and thorough testing of the validity and relevance of the selected set of instruments will help ensure the reliability of our GMM estimates. In particular, we conjecture that past lags of the included variables will convey only negligible (if any) additional information to what is already contained in the right-hand side of (2); yet those same lags should be reasonably correlated with the included regressors. Accordingly, we use lags two and three of the included endogenous regressors (*CashHoldings*, *Inventory*, *PPE*, and *Debt/Equity*) in addition to the exogenous regressors (*CashFlow*, *Q*, and *Size*) as instruments in (2). *Instrument validity* is checked via Hansen's (1982) J-statistic, which in light of our instrument set, reduces to a $\chi^2(4)$ statistic. *Instrument relevance* can be determined from the excluded instruments' squared partial correlations, which are essentially the partial F-statistics from the first stage regressions of the endogenous regressors on the excluded instruments in the system (see Bound et al. (1995)).[11]

3.2.2 Financial Constraints Criteria

Testing the implications of our model requires separating firms according to *a priori* measures of the financing frictions that they face. There are a number of plausible approaches to sorting firms into "financially constrained" and "financially unconstrained" categories. We do not have strong priors about which approach is best and use a of variety alternative schemes to partition our sample:

- Scheme #1: In every year over the 1971 to 2001 period, we rank firms based on their payout ratio and assign to the financially constrained (unconstrained) group those firms in the bottom (top) three deciles of the annual payout distribution. We compute the payout ratio as the ratio of total distributions (dividends and repurchases) to operating income. The intuition that financially constrained firms have significantly lower payout ratios follows from Fazzari et al.

[10] All variables are scaled by total assets, with the exception of *Debt/Equity*. Accordingly, *CashHoldings* is computed as the COMPUSTAT's item #1 divided by item #6. *Inventory* is equal to item #2 plus item #3, divided by item #6. *PPE* is item #8 divided by item #6. *Debt/Equity* is item #9 plus item #34, divided by item #216.

[11] Eq. (2) has four variables that we take to be endogenous. In establishing instrument relevance in the regressions below, we only report the lowest of the four first-stage F-statistics — i.e., in order to ensure robustness, we gauge the quality of our instruments based on the *weakest* of their associated test statistics.

(1988), among many others, in the financial constraints literature.[12] In the capital structure literature, Fama and French (2002) use payout ratios as a measure of difficulties firms may face in assessing the financial markets.

- Scheme #2: We rank firms based on their asset size over the 1971 to 2001 period, and assign to the financially constrained (unconstrained) group those firms in the bottom (top) three deciles of the size distribution. The rankings are again performed on an annual basis. This approach resembles that of Gilchrist and Himmelberg (1995), who also distinguish between groups of financially constrained and unconstrained firms on the basis of size. Fama and French (2002) and Frank and Goyal (2003) also associate firm size with the degree of external financing frictions. The argument for size as a good observable measure of financial constraints is that small firms are typically young, less well known, and thus more vulnerable to capital market imperfections.

- Scheme #3: We retrieve data on firms' bond ratings and categorize those firms that never had their public debt rated during our sample period as financially constrained. Given that unconstrained firms may choose not to use debt financing and hence not obtain a debt rating, we only assign to the constrained subsample those firm-years that both lack a rating and report positive debt (see Faulkender and Petersen (2006)).[13] Financially unconstrained firms are those whose bonds have been rated during the sample period. Related approaches for characterizing financial constraints are used by Gilchrist and Himmelberg (1995) and Lemmon and Zender (2004). The advantage of this measure over the former two is that it gauges the *market*'s assessment of a firm's credit quality. The same rationale applies to the next measure.

- Scheme #4: We retrieve data on firms' commercial paper ratings and categorize as financially constrained those firms that never display any ratings during our sample period. Observations from those firms are only assigned to the constrained subsample in the years a positive debt is reported. Firms that issued commercial papers receiving ratings at some point during the sample period are considered unconstrained. This approach follows from the work of Calomiris et al. (1995) on the characteristics of commercial paper issuers.

[12] The deciles are set according to the distribution of the payout ratio reported by the firms (rather than according to the distribution of the reporting firms), which yields an unequal number of observations being assigned to each of our constraint groups. For example, since many firms have a zero payout ratio, we have more payout-constrained firms than unconstrained ones. Our approach ensures that we do not assign firms with low payouts to the financially unconstrained group, and that firms with similar payouts are assigned to the same group.

[13] Firms with no bond rating and no debt are considered unconstrained, but our results are not affected if we treat these firms as neither constrained nor unconstrained. We use the same criterion for firms with no commercial paper rating and no debt in scheme #4 below. In the robustness checks, we restrict the sample to the period where firms' bond ratings are observed every year (from 1986 to 2001), allowing firms to migrate across constraint categories.

Panel B of Table 1 reports summary statistics separately for constrained and unconstrained subsamples. The cross-sample differences between constrained and unconstrained firms are consistent with expectations and with other papers in the literature. For example, constrained firms have lower cash flows, higher Qs, are smaller, hold higher amounts of cash, and have less tangible assets.

Table 2 reports the number of firm-years under each of the eight financial constraint categories used in our analysis. According to the payout scheme, for example, there are 30,947 financially constrained firm-years and 22,530 financially unconstrained firm-years. The table also shows the extent to which those classification schemes are correlated. For example, out of the 30,947 firm-years considered constrained according to payout, 13,637 are also constrained according to size, while a much lower number, or 5,027 firm-years, are considered unconstrained. The remaining firm-years represent payout-constrained firms that are neither constrained nor unconstrained according to size. In general, there is a positive correlation among the four measures of financial constraints. For example, most small (large) firms lack (have) bond ratings. Also, most small (large) firms have low (high) payout policies. However, the table also makes it clear that these cross-group correlations are far from perfect. It should be difficult to find consistent results across all of these partition schemes unless they capture some dimension of a common financing constraint phenomenon.

– insert Table 2 here –

4 Baseline Empirical Findings

We start our analysis by estimating Eq. (1) over our entire sample (pooling together financially constrained and unconstrained firms). We do so with the goal of verifying that well-documented patterns in the relation between firm profitability and external financing are present in our data. This first test returns the following estimates (t-statistics in parenthesis):

$$ExternalFinancing_{i,t} = \underset{(-4.79)}{-0.0269} \times CashFlow_{i,t} + \underset{(4.36)}{0.0038} \times Q_{i,t} + \underset{(7.32)}{0.0081} \times Size_{i,t}, \quad R^2 = 0.35. \quad (3)$$

The coefficient associated with $CashFlow$ displays the usual, negative association between external financing and profitability. That coefficient is very similar, for example, to the profitability coefficients reported by Leary and Roberts (2005) in their issuance/retirement regressions for debt and equity securities (see Table V in their paper). In other words, despite differences in specification, our testing framework reproduces the standard negative relation between profitability and external financing. We now turn to the cross-sectional and time-series properties of the internal–external funding relation.

4.1 Substitution between Internal and External Funds: Constrained versus Unconstrained Firms

Table 3 presents the results from the estimation of our baseline regression model (Eq. (1)) within each of the constrained/unconstrained partition schemes described in the last section. A total of eight estimated equations are reported in the table (4 constraint criteria $\times$ 2 constraint categories). Under *each one* of the constraint criteria considered, the set of financially unconstrained firms display *significantly negative* sensitivities of external financing to cash flow — these sensitivities are all significant at better than 1% test level. In economic terms, the estimates in the table suggest that for each dollar of internal cash flow shortfall (normalized by assets), an unconstrained firm will seek for up to 27 cents in new external financing. In sharp contrast, the estimated external financing–cash flow sensitivities in the constrained samples are *much less negative* (around 1 or 2 cents), and always statistically insignificant. Wald tests for difference in sensitivities between constrained and unconstrained firms are significant at better than the 1% level for the payout and commercial paper ratings criteria, and at 3% for the size and bond ratings measures. The coefficients on the control variables also conform to our expectations. An increase in investment opportunities makes it more likely that both sets of firms will seek external funding, while bigger firms generally issue more securities.

– insert Table 3 here –

Table 4 reports the results we obtain by fitting Eq. (2) to the data. The model is estimated via GMM. The external financing–cash flow sensitivity estimates show the same patterns reported in Table 3 as we include controls for alternative internal funding sources and add proxies for capital stock and pre-existing financial structure. The cash flow sensitivity estimates are all negative and highly significant for constrained firms and small, statistically insignificant for the set of constrained firms. Differences in external financing–cash flow sensitivities across constrained and unconstrained samples are significant at better than the 1% level for *all* criteria. The coefficients for the other regressors attract either statistically insignificant estimates (e.g., PPE) or significant estimates of the expected sign (e.g., Q).

– insert Table 4 here –

In the last two columns of Table 4 we report the diagnostic test statistics associated with our instrumental set. As it turns out, those instruments are well-suited for the equations we estimate. For instance, note that the *lowest* p-value associated with Hansen's (1982) test of overidentifying restrictions is as high as 20%. Moreover, the *lowest* partial F-statistic from the (first-stage) regression of the endogenous regressors on the set of excluded instruments is highly significant in each of the models estimated. These diagnostic test statistics suggest that our instruments are valid and relevant.

Our results suggest that a negative relation between internal funds and external financing holds for the subsample of firms that are least likely to face high financing costs. These findings are consistent to what one would expect if unconstrained firms' financing decisions were influenced by the adjustment costs argument. In the subsample of financially constrained firms, however, the negative relation between internal and external financing is significantly mitigated. This pattern is inconsistent with the standard pecking order explanation for the substitutability between internal funds and external finance, which is based precisely on costly external financing. As we discuss in Section 2, the endogeneity of investment that is induced by financing constraints is a potential explanation for the greater complementarity between internal and external finance among constrained firms.

Given that we find an insignificant relation between internal funds and external finance for constrained firms, one might wonder whether our findings could be explained by an M&M-type argument. In particular, if M&M holds only for constrained but not for unconstrained firms, we could observe a non-systematic relation (statistically equal to zero) between profits and external financing for constrained firms. While it is difficult to test for this null-M&M hypothesis directly, we believe it is unlikely to explain our findings given the body of evidence that such firms do not behave in the M&M fashion. For example, the firms that we classify as constrained seem to engage in optimal liquidity and inventory management (Almeida et al. (2004) and Fazzari and Petersen (1993)), and their investment is particularly sensitive to the availability of internal funds (e.g., Rauh (2006)); behaviors that are consistent with credit market imperfections. Below, we also attempt to provide additional evidence that supports our preferred interpretation of the empirical evidence. Before we do so, we present some results to verify the robustness of the cross-sectional patterns reported in Tables 3 and 4.

4.2 Robustness

In this section we perform our basic tests using alternative model specifications, proxy construction methods, sampling procedures, and econometric techniques. This battery of checks should provide evidence that our empirical estimates are robust.

4.2.1 Base Checks

Our baseline model uses Q to capture otherwise unobservable information about firm investment opportunities. One issue we have to consider is whether including Q in our regressions will bias the inferences that we can make about cash flow sensitivities. Such concerns have become a topic of debate in previous papers on financial constraints — namely, those focusing on investment–cash flow sensitivities — as evidence of higher cash flow sensitivities of constrained firms has been ascribed to measurement problems with Q (see, e.g., Erickson and Whited (2000)). Similar issues could arguably plague our results. For example, if profitability captures information about investment opportunities that are not well captured by Q, then the complementarity between profitability and external financing could be simply due to a positive correlation between profitability and investment opportunities. To wit, when investment opportunities are high firms need to invest more and raise more external funds. In turn, we propose alternative ways of checking whether our inferences are robust to measurement issues in our proxy for investment opportunities.

The first row of Table 5 displays the results we obtain from using the approach suggested by Cummins et al. (2006): we use financial analysts' forecasts of earnings as an instrument for Q in an IV estimation of our baseline model. As in Polk and Sapienza (2003), we employ the median forecast of the two-year ahead earnings scaled by lagged total assets to construct the earnings forecast measure. The earnings data are taken from IBES, where extensive coverage only starts in 1986. The results from these IV regressions show that our main results are actually strengthened when explicitly address the potential for attenuation biases associated with poorly-measured Qs.

Another way of tackling the empirical limitations of Q is to use alternative proxies for investment opportunities. One simple approach is to include investment in the regression. However, since investment is a decision variable, we would like to include in the regression only the component of investment that is explained by factors that are outside of the firm's control. To do this, we look for industry drivers of investment spending, in particular, aggregate industry demand. Accordingly, we introduce in our baseline model the projection of investment on two lags of the observed growth sales in the firm's main three-digit SIC activity. In unreported tables, we check that this proposed instrumentation passes standard tests of instrument relevance and validity. Row 2 of Table 5 reports the coefficients associated with the variables in our baseline model once we use IV methods and add investment to our estimations. As one can see from that table, our results continue to hold steadily across the subsamples of constrained and unconstrained firms.

An alternative approach which is common in the financial constraints literature is to use R&D expenditures as a proxy for investment opportunities (see, among others, Graham (2000) and Fama and French (2002)).[14] In row 3 of Table 5 we report results from the estimation of our baseline model after we replace Q with the ratio of R&D expenditures (COMPUSTAT's item #46) to total assets. This seems to produce very few changes in our baseline estimates, with our previous inferences continuing to hold for all of the sample splits. Taken together, the results in the first three

[14] Unfortunately, R&D expenditures, too, are arguably measured with some degree of error. However, it is not the case that those errors should necessarily vary along the lines of financial constraints, systematically biasing our estimates in a way that favors our previous inferences. Noteworthy, our results are the same whether we eliminate from the estimations those observations reporting missing data for R&D expenditures or replace those missing data with zero and add an indicator variable for these observations to the specification (as we report below).

rows of Table 5 suggest that our baseline results are unlikely to be driven by unobserved variation in investment opportunities.

In the fourth row of Table 5 we report the estimates for external financing–cash flow sensitivities that are returned when we eliminate IPO-years from the sample. As discussed in Frank and Goyal (2003) and Lemmon and Zender (2004), the year in which a firm becomes public is characterized by unusual equity issuance activity. It has also been noted that many of the IPOs of the 1990s were particularly unprofitable. These observed regularities could "hard-wire" an empirical association between cash flows and issuance activity, which we want to expunge from our estimates. As in Lemmon and Zender, we identify IPO-years by determining the first year in which a firm appears in our sample (other than the first year of the sampling period). Results in row 4 of Table 5 make it clear that our conclusions are unaffected by concerns with IPO observations.

Recent work by Strebulaev and Yang (2007) shows that zero (and near-zero) leverage firms have markedly different behaviors from proxy firms when it comes down to equity issuance (Table XI in their paper) and debt taking (Table XII). As those authors propose, there are a host of explanations that could potentially motivate those behaviors. Thus, it is interesting to see if our results hold once we control for the presence of these firms in the data. Similar to Strebulaev and Yang, we find a sizable number of zero-leverage firms in our sample of manufacturers; a total of 7,929 (or 9% of our raw sample). We examine whether our results hold steadily in two different ways. The first is to add an explicit control for the zero-leverage firms by way of a dummy variable. The second, is by way of re-estimating our baseline regressions eliminating zero-leverage firms for our sample. Row 5 of Table 5 reports this last set of estimations (we find similar results when we use the first approach). As one can find in row 5 of that table, our results hold after we control for zero-leverage firms in our sample.

As a crude attempt to address the issue of heteroskedasticity, researchers often 'scale' the variables included in models such as that of Eq. (1). We chose to scale all of our variables by the book value of assets both because this is the most popular choice of scaler and because it coincides with the denominator of our basic proxy for investment opportunities (Q). However, note that the choice of scaler may have undesirable consequences for the estimations whenever the scaler is economically linked to the variables in the model (Frank and Goyal (2003) also note this issue). It is not obvious how to circumvent this problem, but we can demonstrate that our results do not hinge on our particular choice of scaler. Following Fama and French (2002), the sixth row of Table 5 reports results from the estimation of Eq. (1) when all variables (except Q and *Size*) are scaled by the *market value* of assets. Our cash flow sensitivity estimates hold steady for all criteria. Alternatively, as in Frank and Goyal, we also used *net* assets (i.e., item #6 – item #5) as a scaling factor and obtain qualitatively similar results (unreported).

Finally, we revisit the constraint characterizations that are based on the existence of ratings (bond and commercial paper). Following Faulkender and Petersen (2006) and Lemmon and Zender (2004), we focus on data that start from 1986 — when COMPUSTAT provides extensive coverage on ratings — and define as financially unconstrained firm-years those firms for which COMPUSTAT reports the existence of a rating during the very year under examination (i.e., we do not input ratings information from the later part of the sample into the early sample years). Differently from our previous strategy, this approach allows firms to migrate across constraint categories over the years. Studying only the second half of our sample period also serves the purpose of verifying whether our results are stable through time. The seventh row of Table 5 reports the results we obtain when we fit Eq. (1) over the 43,350 data points contained in the 1986–2001 period, under the newly proposed constrained/unconstrained partitions. The estimates from this experiment show that the patterns we have uncovered are nearly insensitive to qualitative changes to our constraint characterizations and that our previous results seem to emerge consistently across different windows of our sample period.

– insert Table 5 here –

4.2.2 Additional Testing Strategies and Robustness Checks

Besides the base robustness checks reported in Table 5, we have experimented with two other tests which we describe here. The associated tables are available upon request.

Firstly, it is plausible that financially constrained firms find it difficult to issue long-term debt, and optimally choose to rely on short-term debt. Because constrained firms need to refinance their debt more frequently, they might behave similarly to firms that face lower adjustment costs. In this way, an adjustment cost story could confound the results in Tables 3, 4, and 5.

To verify this possibility, for each one of our eight financial constraints categories, we compute the ratio of short-to-total debt, where total debt is the sum of short- plus long-term debt. We find that the median and mean short-to-total ratios are somewhat larger for constrained firms, in particular for the constraint criteria that are based on size and the existence of bond ratings. However, those ratios are essentially the same for the criterion based on the payout ratio, and slightly lower for constrained firms according to the commercial paper ratings criterion. Despite the lack of a strong link between constraint categorizations and debt maturity, we still examine whether reliance on short-term debt can explain our results. Specifically, conditional on the existence of positive debt in the firms' balance sheets, we split each of our constraint categories into two subgroups: those firms with no short-term debt, and those whose ratio of short-to-total debt is ranked above the median cut-off of their particular constraint category. This essentially introduces a "double-sorting" approach to our categorizations. We find very little variation in the relation between internal cash flows and external financing activities across the new subcategories we consider.

Secondly, it is well known that in many firm-years do not observe economically meaningful changes in capital structure, a pattern that can be partly due to adjustment costs. Since our tests are based on issuance activity, it is interesting to examine whether our results hold if we restrict the sample to times when firms experience large refinancing activities.

To do this, we have considered a variety of cut-offs to define years in which firms initiate "large" issuance/repurchase activities (proxied by $ExternalFinancing$): (1) 0.5%; (2) 1%; (3) 2%; (4) 5%; (5) 10%; and (6) 20%. We then discard firm-years in which $ExternalFinancing$ is below these cutoffs and perform our tests in the trimmed sample. The samples associated with these different cut-offs vary in size in considerable ways; for example, as we restrict the data to those observations pertaining to very large net issuance cut-offs (such as 20%), the number of observations become a concern for constraint-subsample regressions. Despite the arbitrary nature of any of these choices, we find that our results hold still when we subject our data to this additional set of tests irrespective of the cutoff used.

4.3 Is it Debt or Equity?

The analysis thus far focuses on the total amount of funds that firms raise in the capital markets, both debt and equity. Yet, one may wonder whether the data patterns that we have uncovered hold for both debt and equity issues separately, or if they are driven primarily by one of those two securities. One might conjecture, for example, that the firms that we deem as financially constrained are primarily constrained in their ability to contract *debt* when cash flows fall short of investment needs.[15] This argument would suggest that the cross-sectional patterns that we have uncovered could be largely driven by debt financing alone. Conversely, most optimal contracting models suggest that debt — not equity — should be the preferred form of external financing when firms face the types of frictions (e.g., agency- and imperfect information-type problems) that make them financially constrained (see Tirole (2006)). This would suggest that the differences in financing patterns between constrained and unconstrained firms that we have uncovered could be largely driven by cross-sectional differences in the dynamics of outside equity financing alone.

In order to evaluate these different possibilities, we re-estimate our baseline empirical model separately for debt and equity issues (as opposed to *total* issues) across samples of constrained and unconstrained firms. The first row of Table 6 displays the results we obtain for constrained firms when we replace *ExternalFinancing* in Eq. (1) with either *DebtFinancing* (the ratio of net debt issuances

[15] Lemmon and Zender (2004) suggest that this consideration might help reconcile the findings that small firms "too often" issue equity with the pecking order theory.

(COMPUSTAT's item #111 – item #114) to total book value of assets (item #6)) or *EquityFinancing* (the ratio of total net equity issuances (item #108 – item #115) to total book value of assets). Row 2 presents the results from similar models estimated over samples of financially unconstrained firms. Row 3 reports p-values for a Wald test of cross-group differences in cash flow sensitivities.

The cash flow sensitivity estimates in Table 6 suggest that our previous results cannot be attributed to either debt or equity financing alone. The cash flow sensitivity of *both* debt and equity financing is negative and significant in all of the eight different unconstrained regressions; with debt– and equity–cash flow sensitivities attracting remarkably similar estimates within sample partitions. In sharp contrast, the cash flow sensitivities of constrained firms are uniformly less negative than in the unconstrained sample, again for both debt and equity financing. The case for differences in the substitutability between internal and external (debt *and* equity) funds is further highlighted by the results from the tests of cross-group differences in cash flow sensitivities (see row 3): for every possible constrained–unconstrained comparison pair, the cash flow sensitivity of external finance (again, debt and equity) is significantly more negative for unconstrained firms at the 5% test level or better. The results suggest that, comparatively to the unconstrained firms, constrained firms *use less of both debt and equity* financing to absorb variations in internal cash flows.

– insert Table 6 here –

5 Extensions

The results above show strong evidence of a greater degree of complementarity between internal and external financing among financially constrained firms, relative to unconstrained ones. The discussion in Section 2 suggests that this greater complementarity could arise from the optimal management of liquid asset holdings by constrained firms, and from a credit multiplier argument that directly links profitability to the firm's ability to raise external finance. In this section, we attempt to provide additional evidence that suggests that such investment–financing interactions are indeed behind our baseline findings.

5.1 Credit Multiplier Tests

One channel through which the endogenous association between investment and financing works relates to the level of collateral a firm may be able to offer to external creditors. To wit, the positive relation between cash flow and external financing could be particularly strong for financially constrained firms with tangible assets, in that new investment in more collateralizable assets — e.g., hard assets such as plants and machines — may enhance their credit capacity more than what is observed for constrained firms with less tangible assets. This proposed mechanism relates to the "credit multiplier" effect found in the macroeconomics literature (e.g., Bernanke et al. (1996) and Kiyotaki and Moore (1997)), where more collateral helps relax external financing constraints, which allows for more external credit, which in turn allows for more investment (in collateralizable assets), which allow for more external credit, and so on.

To test the endogenous internal–external financing story via the collateral channel, we design an empirical test in the spirit of the multiplier effect just described. Recall, our benchmark empirical specification models external financing as a function of internal funds (i.e., cash flows) plus controls. To better characterize the differential effect of cash flows on external financing activity along the lines of the credit multiplier idea, we introduce a measure of asset collateral (which we dub "asset tangibility") and an interaction term between cash flow and asset tangibility. We expect our endogenous internal–external financing mechanism to be stronger at higher levels of asset tangibility, conditional on a sample of financially constrained firms. More precisely, in our external financing regressions, we expect the cash flow coefficients to be more positive for constrained firms whose assets are easier to liquidate (are more tangible). At the same time, within a sample of financially unconstrained firms, we do not expect to see a differential impact of cash flow on external financing activities for firms with more tangible assets. This is akin to a "differences-in-differences" test — high/low constraints × high/low tangibility — that plays off of a wrinkle that is consistent with our endogenous financing constraint story, but that is unlikely to confound other stories.

Our new test revolves around the estimation of the following credit multiplier-type regression:

$$\begin{aligned} ExternalFinancing_{i,t} &= \alpha_1 CashFlow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \alpha_4 Tangibility_{i,t} \\ &\quad + \alpha_5 \left(CashFlow \times Tangibility\right)_{i,t} + \sum_i Firm_i + \sum_t Year_t + \varepsilon_{i,t}. \end{aligned} \tag{4}$$

The model is a direct extension of our baseline model (Eq. (1)) and the estimation methods used are similar (e.g., fixed-effects and error clustering). A unique feature of this model is the introduction of a proxy for asset tangibility (*Tangibility*). Following Kessides (1990), Worthington (1995), and Almeida and Campello (2007), we use a time-variant proxy that gauges the ease with which lenders can liquidate a firm's productive capital.[16] This measure of asset redeployability is computed as the ratio of used to total (i.e., used plus new) fixed depreciable capital expenditures in an industry times the firm's ratio of (beginning of the year) fixed depreciable assets to total assets. To construct this proxy, starting from 1981, we first hand-collect data for used and new capital acquisitions at the four-digit SIC level from the Bureau of Census' *Annual Survey of the Manufacturers*. Data on plant and equipment acquisitions are compiled by the Bureau every year, with the last survey identifying both used and new capital acquisitions being published in 1996. Besides the shorter time

[16] The idea that the degree of activity in asset resale markets (i.e., demand for second-hand capital) positively affects financial contractibility is formalized by Shleifer and Vishny (1992).

coverage, we note that estimations based on this measure of asset tangibility use smaller sample sizes because not all of COMPUSTAT's SIC codes are present in the Census data. Since different firms in the same industry may differ in the degree of hard, salable assets in their balance sheets, we then multiply the aforementioned industry-level Census data by the firm-level ratio of plant, property and equipment to total book assets (or COMPUSTAT's item #8 divided by item #6).[17]

According to our story, the extent to which internal funds affect external financing activities under a constrained investment optimization problem should be an increasing function of asset tangibility. While Eq. (4) above is a direct linear measure of the influence of tangibility on external–internal funding sensitivities, note that its interactive form can make the interpretation of the estimated coefficients somewhat indirect. In particular, if one wants to assess the partial effect of cash flow on external financing, one has to read off the result from $\alpha_1 + \alpha_5 \times Tangibility$.

– insert Table 7 here –

Table 7 reports the coefficients associated with our proposed credit multiplier regression. Each of the regression pairs in the table reveals the same key result: constrained firms' external–internal financing sensitivities are increasing in asset tangibility, while unconstrained firms' sensitivities show no or little response to tangibility. In particular, the interaction between cash flow and tangibility attracts positive, statistically significant coefficients in all of the constrained firm estimations. Further, these coefficients are uniformly higher than those of the unconstrained samples, and statistically different at the 1% test level in virtually all of the comparison pairs. These contrasts are consistent with the presence of a multiplier effect for constrained firm's financing patterns, one that is explained by the endogeneity of investment and the substitutability of external and internal financing under credit constraints.

Before concluding our discussion of the multiplier model results, it is worth noting that compared to our benchmark, non-interactive model (Table 3), the coefficients returned for *CashFlow* are now less weakly negative for constrained firms. This is due to the impact of the (tangibility-) "interaction" effect on the "main" regression effect of cash flows: the coefficient returned for α_1 (alone) reflects the elasticity of *ExternalFinancing* to *CashFlow* when *Tangibility* would equal zero. Notice, however, that this is a point that lies outside the empirical distribution of *Tangibility*.[18]

[17] A firm's ratio of fixed, depreciable assets to total assets is likely to be largely determined by industry characteristics, such as production technology, consumer preferences, and input costs. These features are exogenous to any particular firm in an industry. However, one could still wonder about the endogeneity of the firm's fixed-to-total asset ratio in our variable construction approach. To check whether our results are sensitive to this concern, we also run tests where our *Tangibility* proxy does not include the firm specific PPE/total asset scaling (i.e., is based only on the Census data). Our results are unaffected by this choice.

[18] The linear estimator for interactive models will produce vector coefficients for the "main" effects of the interacted variables even when those effects accrue to data points that lie outside of the underlying sample distribution.

5.2 External and Internal Financing

The arguments in Section 2 suggest that, if investment and external financing are jointly determined, then the same set of constrained firms that display a less negative sensitivity of external financing to cash flow innovations should also display a more positive sensitivity of liquid asset holdings (cash, inventory, etc.) to cash flows, relative to unconstrained firms. To test this prediction, we examine how different sources of funds — internal or external to the firm — absorb contemporaneous shocks to a firm's cash flow process. This simultaneous (within-firm) policy analysis can be done for each firm in the sample by estimating the following SUR system separately across sets of constrained and unconstrained firms:

$$ExternalFinancing_{i,t} = \alpha_1 CashFlow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \sum_i firm_i + \sum_t year_t + \varepsilon_{i,t,}^{EF} \quad (5)$$

$$InternalFinancing_{i,t} = \beta_1 CashFlow_{i,t} + \beta_2 Q_{i,t} + \beta_3 Size_{i,t} + \sum_i firm_i + \sum_t year_t + \varepsilon_{i,t}^{IF}. \quad (6)$$

ExternalFinancing is defined as above, i.e., net security issuance over total assets. In contrast, *InternalFinancing* captures changes in a set of proxies for internal funding sources ("savings") that, according to previous research, can be used to smooth the investment process: changes in cash stocks (COMPUSTAT's item #236), changes in inventories (item #203), and changes in accounts receivables (item #202) (see, e.g., Fazzari and Petersen (1993), Calomiris et al. (1995), and Almeida et al. (2004)).[19]

We expect the estimates from Eq. (5) to be close to those of Eq. (1) in that we are estimating a similar model, but now conditioning on the sample of firms for which we have full information on the components of internal savings policy (from Table 1 one can see that only 63% of the sample firms provide complete information on *InternalFinancing*). Regarding Eq. (6), we expect to find that the greater complementarity between external and internal financing among constrained firms translates into a greater propensity to use cash flow surpluses to build internal stocks of liquid wealth. That is, the coefficient β_1 should be larger (more positive) among constrained firms.

Table 8 reports the results from the above SUR system separately for constrained and unconstrained firm samples. For ease of exposition, we only present the results for the estimates associated with the cash flow innovations in the system (i.e., α_1 and $\beta_1$in Eqs. (5) and (6)). As in previous estimations, unconstrained firms display a strong, negative cash flow sensitivity of external financing,

[19] In defining *InternalFinancing*, we also experimented with changes in dividend policies as a way firms might deal with cash flow shortages. Our results are virtually unchanged. That strategy, however, raises additional issues. First, it is not clear that firms fine tune their dividend policy according to their cash flow process (dividends are relatively sticky, whereas cash flows are not). Second, recall that our first financial constraint sampling criterion is based on firms' dividend policies. Sample selection biases will likely arise if we use dividend policy both as a criterion for subsample assignment as well as in the construction of the dependent variable.

while constrained firms show estimates that are neither economically nor statistically significant (see results in row 1). In accordance with our prior that *external* financing constraints must also influence the *internal* financing choices of constrained firms, we find that these firms display a strong, positive cash flow sensitivity of internal financing. Unconstrained firms, on the other hand, do not accumulate internal resources out of their cash flows (see row 2). Altogether, the results from Table 8 are consistent with the notion that constrained firms manage their liquid asset holdings in a way that makes internal and external financing more complementary, relative to unconstrained firms.

– insert Table 8 here –

5.3 Macroeconomic Dynamics

Research on the impact of financing constrains on corporate behavior commonly draws inferences from macroeconomic dynamics. This follows naturally from the idea that financing constraints are linked with the real economy in that it is generally believed that those constraints bind more during recessions and monetary contractions — when corporate net worth falls, collateral values collapse, and higher interests increase the cost of servicing debt. Empirical analyses using such testing expedients are found in papers dealing with corporate financing (e.g., Gertler and Gilchrist (1994), Calomiris et al. (1995), and Korajczyk and Levy (2003)), liquidity (Kashyap et al. (1994)), and inventory investment (Fazzari et al. (1994)), to name a few.

Showing that cross-sectional differences in firm behavior, on *average*, conform with expectations regarding the impact of financing constraints on corporate behavior is an important step in testing any argument, but empirical limitations may still permeate those findings. For example, it is impossible to completely rule out the importance of concerns with simultaneity biases in our cross-sectional estimates.[20] Exploring the dynamics of macroeconomic movements, on the other hand, can provide for evidence that the impact of constraints on firm behavior *covaries* with exogenous tightenings and relaxations of those constraints. In this testing set up, when comparing differential external financing behavior across groups of firms categorized as either constrained or unconstrained, one does not need to focus on differences in the *levels* of external financing–cash flow sensitivities across those two groups of firms (as we have done thus far), but instead on the *responses* of those sensitivities to macroeconomic innovations. In this way, the "macroeconomic-dynamics" testing approach can help shed light on the impact of financing constraints on external financing behavior even in the presence of biases in our estimate of the first-order substitution effect between internal cash flows and the external contracting of funds.

[20] In particular, one could raise an involved argument suggesting that estimation biases might affect one set of subsample regressions more severely than another, possibly yielding misleading inferences.

Our basic proposition is that differences in the external financing behavior of constrained and unconstrained firms — specifically, cross-sectional differences in the sensitivity of external financing to cash flow — will become *more pronounced* following negative innovations to macroeconomic conditions; that is, in periods when financial constraints are more likely to bind. In particular, prior research suggests that the credit multiplier matters more during recessions and monetary contractions. As discussed in Section 2, the credit multiplier is a potential reason why internal funds and external finance are more complementary among constrained firms.

To implement a test of this proposition, we use a two-step approach similar to that used by Kashyap and Stein (2000). The idea is to relate external financing–cash flow sensitivities and aggregate demand conditions by combining cross-sectional and times series regressions.

The first step of this procedure consists of estimating our baseline regression model (Eq. (1)) every year separately for groups of financially constrained and unconstrained firms. From each yearly sequence of cross-sectional regressions, we collect the coefficients returned for cash flow (i.e., α_1) and "stack" them into the vector Ψ_t, which is then used as the dependent variable in the following (second-stage) time series regression:

$$\Psi_t = \eta + \phi \Delta Activity_t + \rho Trend_t + u_t, \tag{7}$$

where the term $\Delta Activity$ represents shocks to aggregate activity. These shocks are computed from the residual of an autoregression of log real GDP on four lags of itself, with the error structure following a moving average process.[21] The impact of unforecasted shocks to aggregate activity on the sensitivity of external financing to cash flow can be gauged from ϕ. A time trend ($Trend$) is included to capture secular changes in external financing activities. Finally, because movements in aggregate demand and other macroeconomic variables often coincide, in "multivariate" versions of Eq. (7) we also include changes in inflation (log CPI) and changes in basic interest rates (Fed funds rate) to ensure that our findings are indeed driven by shocks to demand. These macroeconomic series are gathered from the Bureau of Labor Statistics and the Federal Reserve websites.

The results from the two-stage estimator are summarized in Table 8. The table reports the coefficients returned for ϕ from Eq. (7), along with the associated p-values (calculated via Newey and West's (1987) covariance estimator). Row 1 collects the results for financially constrained firms while row 2 reports results for unconstrained firms. Additional tests for cross-group coefficient differences are reported at the bottom of the table (row 3). Standard errors for the "difference" coefficients are estimated via a SUR system that combines the two constraint categories (p-values reported).

– insert Table 8 here –

[21] Even though the macro innovation proxy is a generated regressor the coefficient estimates of Eq. (7) are consistent (see Pagan (1984)).

The GDP-response coefficients for the constrained firms in row 1 are all negative and highly statistically significant, indicating that the cash flow sensitivity of external financing of these firms increases (i.e., becomes even less negative) during recessions. This finding suggests that the degree of complementarity between internal funds and external finance increases during recessions for constrained firms. In contrast, the response coefficients for the unconstrained firms (row 2) are typically indistinguishable from zero. The differences between those sets of coefficients (row 3) suggest that the external financing–cash flow sensitivities of financially constrained and unconstrained firms follow markedly different paths in the aftermath of negative shocks to the macroeconomy.

5.4 From External Financing to Investment Spending

Our tests of the investment endogeneity argument have focused on firms' external financing activities. The underlying assumption is that external financing is more strongly associated with investment spending when firms face pronounced deadweight costs external financing (beyond standard adjustment costs). If our story is correct, we could reverse the set up of our tests and check whether constrained firms' investment is more strongly linked to external financing activities than what is observed for unconstrained firms.

Following this strategy, we further examine our endogenous investment–financing argument across our eight subsamples of constrained and unconstrained firms by gauging the proportion of a firm's current investment that is explained by recent issuance activity. Denote *Investment* as COMPUSTAT's item #128 divided by lagged item #8. For each one of our eight constraint subsamples we estimate the following model:

$$Investment_t = Trend + \sum_{l=1}^{2} \phi_l ExternalFinancing_{t-l} + \sum_i Firm_i + \varepsilon_t, \tag{8}$$

where *Trend* is a linear time trend capturing secular movements in firm investment. To the extent that the estimation of Eq. (8) captures information about the correlation between firm investment and external funding, one can use it to measure the importance of recent external funding initiatives for a firm's spending plan. We must stress that the estimation of (8) is not meant to fully characterize the determinants of investment demand; rather it is meant to produce a measure of empirical association.

While we do not report the results in a table, the point estimates and associated t-statistics for the summation coefficient $\sum_{l=1}^{2} \phi_l$ in Eq. (8) suggest a stronger association between investment spending and external financing across the samples of financially constrained firms.[22] Roughly speaking, a constrained firm uses somewhere between 8 and 21 cents of recently raised external funds for every

[22] The complete set of results are readily available from the authors.

investment dollar spent (the summation coefficients are statistically significant at the 1% test level in all constrained samples). In contrast, an unconstrained firm's investment is less dependent of external funding; it uses only between 2 and 5 of those funds for a dollar spent on investment (the summation coefficients have weaker statistical significance in unconstrained samples). The economic interpretation of these estimates deserves much caution, but the differential degree in the magnitude of the investment–external financing correlations across samples of constrained and unconstrained firms is notable and consistent with our proposed story.

6 Final Remarks

In this paper we study the implications of investment–financing interactions for the understanding of one of the key stylized facts of the empirical capital structure literature, namely the finding that more profitable firms demand less external finance. The literature has argued that this finding is consistent with a preference for internal funds to finance investments, in world in which external financing is costly. However, we show new, robust evidence that this negative relation is concentrated among firms that are least likely to face high costs of external finance. We argue that this negative relation is more consistent with the existence of small but pervasive capital structure adjustment costs (see Strebulaev (2007)). We also argue that the endogeneity of investment that is engendered by financing constraints can explain the apparently puzzling finding that firms that face the highest costs of external financing do not seem to show a preference for internal funds. While it is still the case that such firms place a high value on internal funds, reducing external finance is not necessarily the best use of funds for them. These firms can also use additional internal funds to increase investment, holdings of liquid assets, or to create collateral that allows further borrowing. As a result, internal funds and external finance can become complements rather than substitutes when external financing costs are high.

It is important to stress that our results do not imply that asymmetric information is unimportant for external financing decisions. Instead, they suggest that the negative relation between profitability and external financing should not be interpreted as evidence for the role of asymmetric information in firm financing. Our results also suggest that endogenous investment is a key factor behind observed external financing decisions. We believe that the sorts of financing constraints that firms face in the real world should be more carefully considered in future attempts at characterizing corporate financial policies in the empirical literature.

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Table 1. Sample Descriptive Statistics

This table displays summary statistics for the main variables used in the paper's empirical estimations. Panel A shows detailed statistics for the entire sample. Panel B shows only variable means and standard deviations for each of the constraint partitions used in estimations. All firm data are collected from COMPUSTAT's annual industrial tapes over the 1971–2001 period. The sampled firms exclude financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental agencies (SICs greater than 8000). *ExternalFinancing* is the ratio of the total net equity issuances (COMPUSTAT's item #108 – item #115) plus net debt issuances (item #111 – item #114) to the total book value of assets (item #6). *CashFlow* is the ratio of earnings before extraordinary items and depreciation (item #123 + item #125) to total assets. Q is computed as the market value of assets divided by the book value of assets, or (item #6 + (item #199 × item #25) – item #60 – item #74) / (item #6). *Size* is the natural log of sales (item #12). *Cash* is item #1 divided by item #6. *Inventory* is equal to item #2 plus item #3, divided by item #6. *PPE* is item #8 divided by item # 6. *Debt/Equity* is item #9 plus item #34, divided by item #216. *InternalFinancing* is item #236, plus item #203, plus item #202, all divided by item #6. *Tangibility* is a measure of asset redeployment. This measure is computed as the product of the ratio of new-to-total depreciable asset acquisition (industry-level data available from 1981 through 1996 from the Bureau of Census' *Annual Survey of Manufacturers*) and the firm-level ratio of fixed-to-total assets (COMPUSTAT's item #8 over item #6).

Panel A: Entire Sample

Variables	Sample Statistics					
	Mean	Median	Std. Dev.	25^{th} Pct.	75^{th} Pct.	Obs.
ExternalFinancing (Total)	0.0325	0.0022	0.1153	–0.0129	0.0589	72,851
DebtFinancing	0.0132	0.0000	0.1032	–0.0138	0.0272	72,851
EquityFinancing	0.0194	0.0003	0.0632	–0.0000	0.0057	72,851
CashFlow	0.0628	0.0948	0.2145	0.0519	0.1359	72,851
Q	1.9098	1.3013	2.6311	0.9814	2.0154	72,851
Size	2.1837	1.9277	1.5084	1.0188	3.0601	72,851
CashHoldings	0.1764	0.0979	0.1973	0.0401	0.2374	72,851
Inventory	0.1682	0.1431	0.1503	0.0341	0.2604	72,483
PPE	0.3238	0.2795	0.2167	0.1547	0.4567	72,738
Debt/Equity	0.7482	0.3620	12.7943	0.0636	0.8206	72,830
Tangibility	0.0162	0.0106	0.0192	0.0049	0.0303	16,473
InternalFinancing	–0.0033	–0.0085	0.1761	–0.0658	0.0489	46,264

Table 1. Sample Descriptive Statistics — Continued

Panel B: Constraint Partitions

Variables	Statistics by Constraint Partition							
	Div. Payout		Firm Size		Bond Ratings		CP Ratings	
	Constrained Mean/Std.Dev.	Unconstrained Mean/Std.Dev.	Constrained Mean / Std.Dev.	Unconstrained Mean/Std.Dev.	Constrained Mean/Std.Dev.	Unconstrained Mean/Std.Dev.	Constrained Mean/Std.Dev.	Unconstrained Mean/Std.Dev.
ExternalFinancing (Total)	0.0335/0.1442	0.0125/0.0812	0.0487/0.1413	0.0225/0.0892	0.0344/0.1167	0.0295/0.1129	0.0361/0.1219	0.0149/0.0722
DebtFinancing	0.0144/0.1263	0.0131/0.0791	0.0023/0.1133	0.0200/0.0870	0.0071/0.0981	0.0232/0.1104	0.0130/0.1087	0.0141/0.0701
EquityFinancing	0.0401/0.0835	0.0006/0.0354	0.0464/0.0967	0.0026/0.0220	0.0273/0.0748	0.0063/0.0330	0.0231/0.0680	0.0008/0.0224
CashFlow	0.0111/0.3859	0.1120/0.1589	0.0081/0.3379	0.0934/0.0883	0.0475/0.2586	0.0882/0.1027	0.0533/0.2326	0.1099/0.0583
Q	2.3529/3.6575	1.5476/1.1932	2.5314/3.2045	1.5224/1.1389	2.1268/3.1757	1.5509/1.2200	1.9744/2.8421	1.5896/1.0391
Size	1.8382/1.2788	2.6435/1.6749	1.1535/0.7432	3.5575/1.5541	1.7508/1.2265	2.8995/1.6515	1.8843/1.2817	3.6667/1.6626
CashHoldings	0.2464/0.2402	0.1125/0.1312	0.3127/0.2382	0.0814/0.0947	0.2261/0.2195	0.0942/0.1131	0.1970/0.2073	0.0740/0.0794
Inventory	0.1427/0.1523	0.1739/0.1376	0.1520/0.1502	0.1577/0.1333	0.1666/0.1511	0.1708/0.1490	0.1670/0.1542	0.1739/0.1293
PPE	0.2826/0.2221	0.3693/0.2125	0.2384/0.1900	0.4118/0.2168	0.2842/0.2077	0.3894/0.2154	0.3073/0.2165	0.4057/0.1981
Debt/Equity	0.8774/11.4923	0.6601/4.5208	0.3391/4.6073	0.9812/11.9519	0.5232/5.8846	1.1202/14.5835	0.7006/14.9839	0.9839/9.3108
Tangibility	0.0127/0.0264	0.0192/0.0217	0.0123/0.0153	0.0192/0.0230	0.0148/0.0180	0.0184/0.0208	0.0156/0.0191	0.0185/0.0197
InternalFinancing	–0.0028/0.2190	–0.0095/0.0977	–0.0108/0.2643	–0.0103/0.0741	0.0008/0.2065	–0.0106/0.1004	–0.0019/0.1880	–0.0118/0.0613

Table 2. Cross-Classification of Financial Constraint Types

This table displays firm-year cross-classifications for the various criteria used to categorize firm-years as either financially constrained or unconstrained (see text for definitions). To ease visualization, we assign the letter (C) for constrained firms and (U) for unconstrained firms in each row/column. All firm data are collected from COMPUSTAT's annual industrial tapes. The sampled firms exclude financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental agencies (SICs greater than 8000).

Financial Constraints Criteria		Div. Payout		Firm Size		Bond Ratings		CP Ratings	
		(C)	(U)	(C)	(U)	(C)	(U)	(C)	(U)
1. Payout Policy									
Constrained Firms	(C)	30,947							
Unconstrained Firms	(U)		22,530						
2. Firm Size									
Constrained Firms	(C)	13,637	3,380	21,873					
Unconstrained Firms	(U)	5,027	11,453		22,569				
3. Bond Ratings									
Constrained Firms	(C)	22,290	11,362	20,245	5,547	45,392			
Unconstrained Firms	(U)	8,657	11,168	1,628	17,022		27,459		
4. Comm. Paper Ratings									
Constrained Firms	(C)	29,319	15,378	21,746	11,925	44,891	15,720	60,611	
Unconstrained Firms	(U)	1,628	7,152	127	10,644	501	11,739		12,240

Table 3. The Cash Flow Sensitivity of External Financing: The Baseline Model

This table displays results for OLS (with year- and firm-fixed effects) estimations of the baseline regression model (Eq. (1) in the text). All firm data are collected from COMPUSTAT's annual industrial tapes. See Table 1 for detailed variable definitions. The sampled firms exclude financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental agencies (SICs greater than 8000). The estimations correct the error structure for heteroskedasticity and within-period error correlation using the White-Huber estimator. t-statistics (in parentheses).

Dependent Variable		Independent Variables			R^2	Obs.
ExternalFinancing		*CashFlow*	*Q*	*Size*		
Financial Constraints Criteria						
1. Payout Policy						
Constrained Firms	(C)	–0.0134	0.0039**	0.0204**	0.42	30,947
		(–1.09)	(4.22)	(9.05)		
Unconstrained Firms	(U)	–0.2725**	0.0051**	0.0112	0.39	22,530
		(–11.23)	(5.91)	(0.99)		
P-Value of Difference	(C) – (U)	[0.00]	[0.34]	[0.43]		
2. Firm Size						
Constrained Firms	(C)	–0.0208	0.0045**	0.0234**	0.50	21,873
		(–1.21)	(4.52)	(6.88)		
Unconstrained Firms	(U)	–0.0727**	0.0046**	0.0116	0.29	22,569
		(–4.24)	(5.45)	(1.56)		
P-Value of Difference	(C) – (U)	[0.03]	[0.94]	[0.15]		
3. Bond Ratings						
Constrained Firms	(C)	–0.0202	0.0035**	0.0106**	0.39	45,392
		(–1.57)	(4.14)	(8.34)		
Unconstrained Firms	(U)	–0.0701**	0.0052**	0.0093**	0.21	27,459
		(–3.63)	(4.52)	(4.91)		
P-Value of Difference	(C) – (U)	[0.03]	[0.23]	[0.57]		
4. Comm. Paper Ratings						
Constrained Firms	(C)	–0.0262	0.0037**	0.0116**	0.33	60,611
		(–1.74)	(4.30)	(8.26)		
Unconstrained Firms	(U)	–0.1866**	0.0032*	–0.0014	0.22	12,240
		(–4.64)	(2.05)	(–1.41)		
P-Value of Difference	(C) – (U)	[0.00]	[0.78]	[0.00]		

Note: ** and * indicate statistical significance at the 1-percent and 5-percent (two-tail) test levels, respectively.

Table 4. The Cash Flow Sensitivity of External Finance: Augmented Regression Model

This table displays results for GMM estimations (with year- and firm-fixed effects) of the augmented baseline regression model (Eq. (2) in the text). All firm data are collected from COMPUSTAT's annual industrial tapes. See Table 1 for detailed variable definitions. The sampled firms exclude financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental agencies (SICs greater than 8000). The estimations correct the error structure for heteroskedasticity and within-period error correlation using the White-Huber estimator. t-statistics (in parentheses). The table also reports diagnostic statistics for instrument overidentification restrictions (p-values for Hansen's J-statistics reported) and instruments' first-stage partial F-statistics (only lowest F-statistics reported).

Dependent Variable *ExternalFinancing*	Independent Variables *CashFlow*	*Q*	*Size*	*CashHoldings*	*Inventory*	*PPE*	*Debt/Equity*	Hansen's J-statistic (p-value)	First-stage F-test (lowest p-value)
Financial Constraints Criteria									
1. Payout Policy									
Constrained Firms (C)	–0.0109	0.0045**	0.0092**	0.0828*	0.0832*	0.0193	–0.0033	0.55	0.01
	(–1.17)	(5.19)	(5.38)	(2.54)	(2.46)	(0.66)	(–1.19)		
Unconstrained Firms (U)	–0.2710**	0.0066**	–0.0003	0.0134	0.0390*	0.0287*	0.0004*	0.20	0.00
	(–10.21)	(6.72)	(–0.29)	(0.76)	(2.33)	(2.27)	(2.32)		
P-Value of Diff. (C) – (U)	[0.00]	[0.10]	[0.00]	[0.06]	[0.24]	[0.77]	[0.18]		
2. Firm Size									
Constrained Firms (C)	–0.0186	0.0042**	0.0118**	–0.0141	–0.0007	–0.0268	–0.0024	0.22	0.00
	(–1.08)	(4.24)	(3.96)	(–0.35)	(–0.02)	(–0.50)	(–0.86)		
Unconstrained Firms (U)	–0.0958**	0.0047**	–0.0005	0.0666*	0.0582**	0.0200	0.0005	0.51	0.01
	(–5.02)	(3.75)	(–0.44)	(2.55)	(3.37)	(1.56)	(1.17)		
P-Value of Diff. (C) – (U)	[0.00]	[0.75]	[0.00]	[0.09]	[0.13]	[0.40]	[0.30]		
3. Bond Ratings									
Constrained Firms (C)	–0.0234	0.0038**	0.0052**	–0.0054	0.0369	–0.0226	–0.0213*	0.28	0.00
	(–1.84)	(5.74)	(4.09)	(–0.23)	(1.59)	(–1.06)	(–2.00)		
Unconstrained Firms (U)	–0.1100**	0.0046**	0.0022*	0.0833**	0.0646**	0.0307*	0.0008	0.79	0.00
	(–3.71)	(3.03)	(2.02)	(3.17)	(3.71)	(2.10)	(1.36)		
P-Value of Diff. (C) – (U)	[0.01]	[0.63]	[0.07]	[0.01]	[0.34]	[0.04]	[0.04]		
4. Comm. Paper Ratings									
Constrained Firms (C)	–0.0246	0.0041**	0.0064**	0.0520**	0.0644**	0.0034	0.0001	0.26	0.01
	(–1.51)	(6.02)	(6.13)	(2.90)	(3.48)	(0.21)	(0.24)		
Unconstrained Firms (U)	–0.1640**	0.0048**	–0.0023	0.0607*	0.0563**	0.0251	0.0011	0.23	0.00
	(–5.34)	(3.14)	(–1.89)	(2.05)	(3.06)	(1.70)	(1.21)		
P-Value of Diff. (C) – (U)	[0.00]	[0.68]	[0.00]	[0.80]	[0.76]	[0.32]	[0.32]		

Note: ** and * indicate statistical significance at the 1-percent and 5-percent (two-tail) test levels, respectively.

Table 5. Robustness Checks: Alternative Specifications and Sample Restrictions

This table displays results for OLS and IV (with year- and firm-fixed effects) estimations using alternative versions of the baseline regression model (Eq. (1) in the text) as well as different variable construction and sampling criteria. The reported estimates are the coefficients returned for *CashFlow*. All firm data are collected from COMPUSTAT's annual industrial tapes. See Table 1 for detailed variable definitions. The sampled firms exclude financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental agencies (SICs greater than 8000). The estimations correct the error structure for heteroskedasticity and within-period error correlation using the White-Huber estimator. t-statistics (in parentheses).

Dependent Variable		Financial Constraints Criteria			
ExternalFinancing		Div. Payout	Firm Size	Bond Ratings	CP Ratings
Proposed Changes to Baseline Model Estimation:					
1. Cummins et al. Estimaor					
Constrained Firms	(C)	–0.0141 (–1.18)	–0.0165 (–1.27)	–0.0221 (–1.84)	–0.0264 (–1.61)
Unconstrained Firms	(U)	–0.6640** (–17.06)	–0.1660** (–10.77)	–0.3433** (–13.31)	–0.4474** (–13.44)
P-Value of Difference	(C) – (U)	[0.00]	[0.00]	[0.00]	[0.00]
2. Investment Included via IV Methods					
Constrained Firms	(C)	–0.0129 (–1.05)	–0.0204 (–1.19)	–0.0228 (–1.55)	–0.0258 (–1.72)
Unconstrained Firms	(U)	–0.3746** (–11.00)	–0.0729** (–4.20)	–0.0778** (–3.69)	–0.1858** (–4.69)
P-Value of Difference	(C) – (U)	[0.00]	[0.02]	[0.04]	[0.00]
3. Q replaced by R&D expenditures					
Constrained Firms	(C)	–0.0235 (–1.77)	–0.0255* (–2.12)	–0.0289* (–2.17)	–0.0222 (–1.49)
Unconstrained Firms	(U)	–0.3230** (–10.47)	–0.0805** (–3.60)	–0.0830** (–3.84)	–0.1701** (–4.59)
P-Value of Difference	(C) – (U)	[0.00]	[0.03]	[0.03]	[0.00]
4. IPO-years eliminated from sample					
Constrained Firms	(C)	–0.0286 (–1.28)	–0.0268 (–1.68)	–0.0278* (–2.06)	–0.0287* (–2.01)
Unconstrained Firms	(U)	–0.3858** (–12.22)	–0.0969** (–4.09)	–0.0863** (–3.24)	–0.1900** (–4.46)
P-Value of Difference	(C) – (U)	[0.00]	[0.01]	[0.05]	[0.00]

Note: ** and * indicate statistical significance at the 1-percent and 5-percent (two-tail) test levels, respectively.

Table 5. Robustness Checks — Continued

Dependent Variable *ExternalFinancing*		Financial Constraints Criteria: Div. Payout	Firm Size	Bond Ratings	CP Ratings
Proposed Changes to Baseline Model Estimation:					
5. Zero-leverage firms eliminated from sample					
Constrained Firms	(C)	–0.0149 (–1.04)	–0.0228 (–1.17)	–0.0246 (–1.49)	–0.0277 (–1.41)
Unconstrained Firm	(U)	–0.4486** (–12.57)	–0.0879** (–4.62)	–0.0701** (–3.63)	–0.1866** (–4.64)
P-Value of Difference	(C) – (U)	[0.00]	[0.02]	[0.07]	[0.00]
6. Market values of asset used as scaling factor					
Constrained Firms	(C)	–0.0049 (–0.29)	–0.0202 (–1.18)	–0.0424 (–1.40)	–0.0378 (–1.34)
Unconstrained Firms	(U)	–0.4099** (–9.60)	–0.0728** (–3.86)	–0.1227** (–3.69)	–0.1643** (–4.30)
P-Value of Difference	(C) – (U)	[0.00]	[0.04]	[0.07]	[0.01]
7. Sample restricted to the 1986–2001 period					
Constrained Firms	(C)	–0.0094 (–0.78)	–0.0082 (–0.57)	–0.0143 (–1.17)	–0.0156 (–1.22)
Unconstrained Firms	(U)	–0.3928** (–7.84)	–0.0704** (–3.29)	–0.0763** (–2.72)	–0.2097** (–4.08)
P-Value of Difference	(C) – (U)	[0.00]	[0.02]	[0.04]	[0.00]

Note: ** and * indicate statistical significance at the 1-percent and 5-percent (two-tail) test levels, respectively.

Table 6. Debt or Equity?

This table displays results for OLS (with year- and firm-fixed effects) estimations of the baseline regression model (Eq. (1) in the text), but estimated separately for net issues of debt (*DebtFinancing*) and equity (*EquityFinancing*) on the left-hand side of the specification. The reported estimates are the coefficients returned for *CashFlow*. All firm data are collected from COMPUSTAT's annual industrial tapes. The sampled firms exclude financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental agencies (SICs greater than 8000). The estimations correct the error structure for heteroskedasticity and within-period error correlation using the White-Huber estimator. t-statistics (in parentheses).

		Financial Constraints Criteria			
		Div. Payout	Firm Size	Bond Ratings	CP Ratings
1. Constrained Firms	(C)				
DebtFinancing		–0.0081 (–0.79)	–0.0166 (–1.52)	–0.0115 (–1.24)	–0.0193 (–1.55)
EquityFinancing		–0.0053 (–1.63)	–0.0142* (–2.11)	–0.0127* (–2.15)	–0.0069 (–1.65)
2. Unconstrained Firms	(U)				
DebtFinancing		–0.2504** (–7.61)	–0.0592** (–4.31)	–0.0485** (–2.90)	–0.0975* (–2.55)
EquityFinancing		–0.1821** (–10.08)	–0.0435** (–3.52)	–0.0416** (–3.58)	–0.0891** (–5.58)
3. P-Value of Difference	(C) – (U)				
DebtFinancing		[0.00]	[0.02]	[0.05]	[0.05]
EquityFinancing		[0.00]	[0.04]	[0.03]	[0.00]

Note: ** and * indicate statistical significance at the 1-percent and 5-percent (two-tail) test levels, respectively.

Table 7. The Cash Flow Sensitivity of External Finance: Credit Multiplier Model

This table displays results for OLS (with year- and firm-fixed effects) estimations of the credit multiplier regression model (Eq. (4) in the text). All firm data are collected from COMPUSTAT's annual industrial tapes. See Table 1 for detailed variable definitions. The sampled firms exclude financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental agencies (SICs greater than 8000). The estimations correct the error structure for heteroskedasticity and within-period error correlation using the White-Huber estimator. t-statistics (in parentheses). The table also reports diagnostic statistics for instrument overidentification restrictions (p-values for Hansen's J-statistics reported) and instruments' first-stage partial F-statistics (only lowest F-statistics reported).

Dependent Variable *ExternalFinancing*		Independent Variables *CashFlow*	*Q*	*Size*	*Tangibility*	*CashFlow* ×*Tangibility*	R^2	Obs.
Financial Constraints Criteria								
1. Payout Policy								
Constrained Firms	(C)	–0.0335 (–1.37)	0.0039** (4.23)	0.0154** (5.11)	–0.0068 (–1.72)	0.0643** (2.58)	0.419	30,947
Unconstrained Firms	(U)	–0.3224** (–8.54)	0.0061** (5.86)	0.0072 (1.01)	–0.0095 (–1.64)	–0.0165 (–1.09)	0.389	22,530
P-Value of Diff.	(C) – (U)	[0.00]	[0.12]	[0.32]	[0.71]	[0.00]		
2. Firm Size								
Constrained Firms	(C)	–0.0259 (–1.00)	0.0046** (4.61)	0.0236** (7.11)	–0.0057 (–1.40)	0.0616** (3.20)	0.501	21,873
Unconstrained Firms	(U)	–0.1090** (–2.95)	0.0045** (5.23)	0.0016 (1.57)	–0.0020 (–0.47)	–0.0117 (–1.12)	0.290	22,569
P-Value of Diff.	(C) – (U)	[0.07]	[0.94]	[0.00]	[0.53]	[0.00]		
3. Bond Ratings								
Constrained Firms	(C)	–0.0480* (–2.05)	0.0036** (4.14)	0.0107** (4.66)	–0.0077 (–1.93)	0.0615** (3.66)	0.392	45,392
Unconstrained Firms	(U)	–0.1482** (–2.99)	0.0057** (4.38)	0.0063** (2.60)	–0.0095 (1.24)	0.0093 (1.02)	0.210	27,459
P-Value of Diff.	(C) – (U)	[0.06]	[0.18]	[0.21]	[0.83]	[0.00]		
4. Comm. Paper Ratings								
Constrained Firms	(C)	–0.0400* (–2.02)	0.0037** (4.31)	0.0117** (8.32)	–0.0078 (–1.13)	0.0647** (3.02)	0.335	60,611
Unconstrained Firms	(U)	–0.2346** (–2.72)	0.0030* (1.97)	–0.0014 (–1.42)	–0.0066 (–1.42)	–0.0098 (–0.45)	0.119	12,240
P-Value of Diff.	(C) – (U)	[0.03]	[0.69]	[0.01]	[0.89]	[0.01]		

Note: ** and * indicate statistical significance at the 1-percent and 5-percent (two-tail) test levels, respectively.

Table 8. Internal Financing and External Financing

This table displays results for the SUR system in Eqs. (6) and (7) in the text, estimated separately for constrained and unconstrained firms. The reported estimates are the coefficients returned for *CashFlow*. All firm data are collected from COMPUSTAT's annual industrial tapes. The sampled firms exclude financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental agencies (SICs greater than 8000). The estimations correct the error structure for heteroskedasticity and within-period error correlation using the White-Huber estimator. *t*-statistics (in parentheses).

		Financial Constraints Criteria			
		Div. Payout	Firm Size	Bond Ratings	CP Ratings
1. Dep. Variable: *ExternalFinancing*					
Constrained Firms	(C)	–0.0090	–0.0189	–0.0106	–0.0125
		(–1.01)	(–1.27)	(–1.16)	(–1.52)
Unconstrained Firms	(U)	–0.3392**	–0.0550**	–0.0628**	–0.1611**
		(–11.47)	(–4.28)	(–4.56)	(–6.87)
P-Value of Difference	(C) – (U)	[0.00]	[0.07]	[0.00]	[0.00]
2. Dep. Variable: *InternalFinancing*					
Constrained Firms	(C)	0.0479**	0.0654**	0.0556**	0.0499**
		(8.08)	(8.18)	(9.87)	(10.08)
Unconstrained Firms	(U)	0.0148	–0.0037	–0.0479**	–0.0133
		(1.50)	(–0.55)	(–2.92)	(–1.44)
P-Value of Difference	(C) – (U)	[0.00]	[0.00]	[0.00]	[0.00]

Note: ** and * indicate statistical significance at the 1-percent and 5-percent (two-tail) test levels, respectively.

Table 9. Macroeconomic Dynamics: The Impact of Shocks to Aggregate Activity on the Cash Flow Sensitivity of External Financing (Two-Step Estimator)

The dependent variable is the annual series of estimated sensitivities of external financing to cash flow (from Eq. (1). In each estimation, the dependent variable is regressed on the residual of an autoregression of the log real GDP on three of its own lags ($\Delta Activity$) as specified in Eq. (8) in the text. All regressions include a constant and a time trend. Only the coefficients returned for $\Delta Activity$ are reported in the table. In the multivariate regressions, changes in inflation (log CPI) and changes in basic interest rates (Fed funds rate) are also added. The sampled firms exclude financial institutions (SICs 6000–6999), utilities (SICs 4900–4999), and not-for-profit organizations and governmental agencies (SICs greater than 8000). The sample period is 1971 through 2001. Heteroskedasticity- and autocorrelation-consistent errors are computed with a Newey-West lag window of size four. The standard errors for cross-equation differences in the GDP-innovation coefficients are computed via a SUR system that estimates the group regressions jointly. Consistent p-values [in square brackets].

		Financial Constraints Criteria			
		Div. Payout	Firm Size	Bond Ratings	CP Ratings
1. Constrained Firms	(C)				
Univariate Regressions		–1.2119 [0.00]	–1.9765 [0.01]	–1.2219 [0.00]	–0.8511 [0.00]
Multivariate Regressions		–1.2779 [0.04]	–2.3659 [0.03]	–1.2724 [0.02]	–0.9388 [0.04]
2. Unconstrained Firms	(U)				
Univariate Regressions		0.1274 [0.21]	0.1195 [0.75]	0.0504 [0.92]	0.1993 [0.80]
Multivariate Regressions		0.1163 [0.25]	0.2084 [0.49]	0.0445 [0.73]	0.2736 [0.49]
3. Diffs. Estimates and P-Values	(C) – (U)				
Univariate Regressions		–1.3393 [0.00]	–2.0960 [0.01]	–1.2723 [0.00]	–1.0504 [0.01]
Multivariate Regressions		–1.3942 [0.02]	–2.5743 [0.02]	–1.3169 [0.02]	–1.2124 [0.05]