The Impact of Capital Market Imperfections

on Investment-Cash Flow Sensitivity*

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Abstract

We examine the investment-cash flow sensitivity of U.S. manufacturing firms in relation to five factors associated with capital market imperfections – fund flows, institutional ownership, analyst following, bond ratings, and an index of antitakeover amendments. We find a steady decline in the estimated sensitivity over time. Furthermore, we find that investment-cash flow sensitivity decreases with increasing fund flows, institutional ownership, analyst following, antitakeover amendments and with the existence of a bond rating. The overall evidence suggests that investment-cash flow sensitivity decreases with factors that reduce capital market imperfections.

Keywords: Investment-cash flow sensitivity, capital market imperfections, fund flows, institutional ownership, analyst following, bond ratings, corporate governance

JEL Classification: G14, G31, G32

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I. Introduction

As argued by Modigliani and Miller (1958), the investment decisions of firms are not affected by their financing decisions in perfect capital markets. Capital markets, however, are not perfect, and existing imperfections introduce a wedge between the costs of external and internal funds. Firms facing higher informational imperfections experience a wider wedge, and therefore are more financially constrained.

A measure that has been used in the literature to assess the degree of financial constraints experienced by firms is the sensitivity of investments to the availability of internal funds, controlling for investment opportunities as measured by Tobin's Q. A number of studies, starting with Fazzari, Hubbard, and Petersen (1988), show that investment is more sensitive to cash flow for firms that have a high degree of financial constraints.[1] On the other hand, Kaplan and Zingales (1997) and Cleary (1999) show that investment-cash flow sensitivity can be higher for unconstrained firms.[2] Additionally, Gilchrist and Himmelberg (1995), Erickson and Whited (2000), and Alti (2003) argue that measurement problems associated with Tobin's Q affect the estimated sensitivity of investments to the availability of internal funds.

There has been little investigation of the evolution of investment-cash flow sensitivities over time. The evidence that exists suggests that it has decreased over time in the US: while earlier papers in the area (Fazzari, Hubbard, and Petersen (1988), and Kaplan and Zingales (1997)), using data from the seventies and early eighties, have reported sensitivities in the (0.4,

[1] See Hubbard (1998) for a detailed review of this literature.

[2] Allayannis and Mozumdar (2004) show that including firms with negative cash flows can lead to these findings, since these firms are financially distressed and therefore their investments are not sensitive to cash flow. Rauh (2005) presents evidence that capital expenditures decrease as internal funds reduce due to mandatory pension contributions. Moyen (2004) shows that different criteria used to differentiate between financially constrained and unconstrained firms can lead to results consistent either with Fazzari, Hubbard, and Petersen (1988) or with Kaplan and Zingales (1997). According to Gomes (2001) and Alti (2003), investment-cash flow sensitivity can be positive even without any financial frictions.

0.7) range, studies employing data from the late eighties and nineties (Cleary (1999), and Erickson and Whited (2000)) have found sensitivities in the (0.1, 0.2) range. Therefore, in this paper, we first examine whether there is a decline in investment-cash flow sensitivity through time.

Applying the Erickson-Whited estimators to U.S. manufacturing firm data, we find that, consistent with Erickson and Whited (2000), cash flow is not significant in explaining investment for the period from 1992 to 1995. Extending the analysis to a much longer sample period (1970-2001), however, we find that while the role of Q increases and that of cash flow declines (relative to OLS estimates) in explaining investment, cash flow continues to be a significant factor in most of the sub-samples examined.[3] Of particular interest is the finding that the declining pattern of estimated cash flow effects is robust to the application of the Erickson-Whited estimators.

If investment-cash flow sensitivity is linked with capital market imperfections, then it should decrease with factors that reduce these imperfections. There is some international cross-sectional evidence to support this hypothesis. Wurgler (2000) examines cross-sectional data from 65 countries, and shows that capital allocation is more efficient in financially developed markets. Using cross-sectional data for several countries, Love (2003) and Islam and Mozumdar (2006) show that the sensitivity of investment to cash decreases with financial market development. We pursue this analysis further by focusing on U.S. firms and examining the relation between their investment-cash flow sensitivities and five factors related to capital market imperfections—aggregate fund flows, institutional ownership, analyst following, bond ratings, and corporate

[3] Polk and Sapienza (2004) too find that cash flow effects remain significant when Erickson and Whited's (2000) estimators are used. Also, using Erickson and Whited's (2000) sample and estimators, Hennessy (2004) finds cash flow to be significant for firms with junk-rated debt, and insignificant for those with investment-grade debt.

governance.[4] Again, to control for the measurement problems related to Tobin's Q, we apply the GMM estimators of Erickson and Whited (2000) in addition to OLS.

Our evidence suggests that the sensitivity of investment to internal funds decreases with factors that reduce capital market imperfections.[5] Specifically, we find that investment-cash flow sensitivity reduces with increasing fund flows, institutional ownership, analyst following, antitakeover amendments and with the existence of a bond rating. Therefore, the sensitivity of investments to the availability of internal funds cannot be explained solely as an artifact of measurement error.

The rest of the paper is organized as follows. Section 2 provides a brief summary of the basic q model of investments, the measurement error problem in estimating it, as well as the major hypotheses. Section 3 describes the data. Section 4 analyzes the time series characteristics of investment-cash flow sensitivity. Section 5 examines the relation between investment-cash flow sensitivity and the factors associated with capital markets. Section 6 concludes the paper.

II. The q Model of Investments and Hypotheses on Investment-Cash Flow Sensitivity in Relation to Capital Market Factors

A. The q Model of Investments and Measurement Error

As a remedy for the measurement error problem highlighted in their critique, Erickson and Whited (2000) propose a class of GMM estimators that exploit the information in the higher

[4] Mitigation of capital market imperfections may have two effects: first, it may cause a reduction in the cost of internal funds, and second, it may cause a reduction in the wedge between the costs of external and internal funds. It is the second effect that is of interest from an investment-cash flow sensitivity viewpoint. The mechanism by which this effect may occur is also two-fold. First, reduced capital market imperfections could induce a liquidity effect of greater supply of funds to primary capital markets that increases the total pool of external funds available to firms. Second, there could be a narrowing of the information gap between firm insiders and outsiders due to superior information production. The capital market factors that we consider seek to capture one or both of these mechanisms.

[5] Our findings, however, do not allow the inference that investment-cash flow sensitivities in the U.S. have declined because capital market imperfections have decreased over time. While such an inference may appear plausible, it may only be reliably made on the basis of an explicit analysis of the temporal evolution of the relation between the two.

order moments of the regression variables. Using these estimators and a sample of U.S. manufacturing firms over the period 1992-1995, they find that the explanatory power of Q improves dramatically relative to traditional OLS estimates, while cash flow loses significance as a determinant of investment. Naturally then, the first question that needs to be settled is whether the investment-cash flow sensitivity estimates represent anything meaningful, or whether they are purely artifactual.

Consider the simplified version of the standard q investment model presented by Erickson and Whited (2000). The firm chooses an investment policy to maximize the expected discounted value of cash flow subject to the law of motion for capital. Let I_t denote gross investment; K_{t-1} beginning-of-period capital stock, and q_t the marginal cost of capital In perfect markets, investments are determined solely by the shadow price of capital, or marginal q. In particular, considerations of the availability of internal funds should play no role in the process. On the other hand, significant deviations from the perfect market paradigm would result in such considerations playing an important role. In empirical work, marginal q (q_t) is typically approximated by Tobin's average Q (Q_t), while the most commonly used measure of internal funds is cash flow. Erickson and Whited (2000) list the several layers of approximation that lie between the marginal q of theory and the various versions of Tobin's q used in practice. Let Q_t be the mismeasured empirical proxy of the true marginal q_t, i.e., $Q_t = a_0 + q_t + v_t$, with $v_t \sim i.i.d.(0, \sigma_v^2)$. Then, the investment equation in a regression framework is as follows:

$$\begin{aligned} \frac{I_t}{K_{t-1}} &= (a - \beta_1 a_0) + \beta_1 Q_t + \mathbf{z}_t \mathbf{B} + (u_t - \beta_1 v_t) \\ &= \alpha + \beta_1 Q_t + \mathbf{z}_t \mathbf{B} + \varepsilon_t \end{aligned} \tag{1}$$

where **z** represents some measure(s) of internal funds.

Erickson and Whited (2000) show that the biases induced by measurement error in q in the above equation may be substantial and may be responsible for the estimated coefficients on Q being low and those on cash flow being high, as reported in earlier papers. They propose a class of measurement error-consistent GMM estimators that utilize the information in the higher order moments of the data. We use their GMM estimators in addition to OLS estimators to address problems related to measurement error. In addition to the usual assumption of independence between the errors (u,v) and the (true) regressors ($\mathbf{z}$, q), Erickson and Whited's (2000) approach also requires two technical conditions to be satisfied for the model to be identified.[6]

B. Hypotheses on the Relation of Investment-Cash Flow Sensitivity to Certain Capital Market Factors

If investment-cash flow sensitivity is not simply an artifact of measurement error but rather linked to capital market imperfections, then it should decrease with factors that reduce these imperfections. We explore this hypothesis by examining the relation between investment-cash flow sensitivity and five factors related to capital market imperfections—aggregate fund flows, institutional ownership, analyst following, bond ratings, and corporate governance.

Over the last fifty years, there has been a steady increase in investments through institutions such as mutual funds and pension funds. This increase in fund flows can be seen as a proxy for the increase in overall market liquidity. As documented by Chordia, Roll and Subrahmanyam (2000), Hasbrouck and Seppi (2001), and Huberman and Halka (2001), there is

[6] The two identification conditions require that $E(\beta_1)$ and $E(\eta^3)$ be significantly different from 0, where η is the residual from a linear projection of q on $\mathbf{z}$. These two identification conditions are notoriously difficult to satisfy in the data (Erickson and Whited (2000), Hennessy (2004), Polk and Sapienza (2004), Almeida and Campello (2006)). We encounter the problem in some of our tests as well; we report GMM results only for those sub-samples for which the conditions are met. However, the GMM overidentifying restrictions (Hansen (1982)) do not hold for a number of identified samples. We report these results also with the corresponding J-statistics.

commonality in liquidity across assets, and the liquidity of an asset is positively related to market liquidity. In this respect, increasing fund flows (a proxy for increasing market liquidity) should increase liquidity across all assets. Additionally, institutions have better information processing skills, and therefore, reduce informational asymmetries. Thus, increased fund flows should reduce the external financing costs for all firms. Butler, Grullon and Weston (2005) present evidence supporting this hypothesis by examining seasoned equity offerings. They show that securities issuance costs are lower for firms with stocks that are more liquid, which reduces their cost wedge between external and internal funds. If this reduction is reflected in the sensitivity of investments to the availability of internal funds, then increasing fund flows should reduce this sensitivity. Therefore our first hypothesis is

H1: Investment cash flow sensitivity decreases with increasing fund flows.

An overall increase in fund flows reduces the liquidity-related imperfections for all firms by increasing overall market liquidity. However, the impact should be greater for firms with larger institutional shareholdings. Moreover, as documented by Bennet, Sias and Starks (2003), institutions act on information. Therefore, firms with institutional ownership should have more information reflected into prices, which reduces the information asymmetry between outsiders and insiders and therefore the cost wedge between external and internal funds. If this reduction in the cost wedge is reflected in the sensitivity of investments to the availability of internal funds, one should observe a decrease in these sensitivities. Thus, our second hypothesis is

H2: Investment-cash flow sensitivity decreases with institutional holdings.

Analyst coverage is another important factor related to capital market imperfections. There is an extensive body of literature linking analyst coverage with the flow of information to prices (see Chang, Dasgupta and Hillary (2006) for a review). The incomplete information

theory of Merton (1987) suggests that firms that are covered by a large number of analysts should have lower costs of external capital. Consistent with this hypothesis, Leary and Roberts (2006) find that firms with more analyst coverage rely more on external funds due to reduced information asymmetries. If this lower premium for external funds translates into investment-cash flow sensitivities, then we should observe a decrease in these sensitivities with increased analyst following. Hence our third hypothesis states that

H3: Investment-cash flow sensitivity decreases as analyst following increases.

Bond ratings also have an impact on the cost wedge between external and internal funds. When a firm obtains a debt rating, it undergoes an independent evaluation that produces additional public information and thus mitigates its asymmetric information problem. Moreover, access to public bond markets extends the set of external financing choices available to the firm. Additionally, the junk bond market, which started in the early 1980s, has created an opportunity for firms without investment grade bond ratings to raise capital through bond markets. The existence of a bond rating reduces the cost of external financing and thus eases the firm's reliance on internal cash for making investments. Consequently, our fourth hypothesis is

H4: Investment cash flow sensitivity decreases with the existence of bond ratings.

The final factor we examine is corporate governance. An important external control mechanism is the takeover market.[7] The corporate governance index developed by Gompers, Ishii and Metrick (2003) (GIM, henceforth), provides us a composite measure of corporate governance. The GIM index is formed by adding one point for each takeover defense provision[8] that increases managerial power. Therefore, a high value for this index corresponds to strong managerial rights (low takeover vulnerability). While GIM find that operating performance is

[7] See Shleifer and Vishny (1997) and Denis and McConnell (2003) for surveys on corporate governance..

[8] The provisions used in the index of Gompers, Ishii and Metrick (2003) are from *Corporate Takeover Defenses* (Rosenbaum(1990, 1993, 1995,1998)).

better for firms with strong shareholder rights, they fail to find a significant relation between the governance index and returns on equity. Klock, Mansi and Maxwell (2005) analyze the impact of corporate governance on the cost of debt financing using the same index. They find that high managerial rights reduce the cost of debt financing.[9] The firms with available GIM index data are generally large firms. Debt is the major source of external funds for these firms. Therefore, we would expect to find changes in investment-cash flow sensitivity to be in the same direction as the cost of debt financing. Thus, our final hypothesis is

H5: Investment-cash flow sensitivity decreases as takeover vulnerability decreases for firms that depend more on debt financing.

III. Data and Sample Description

Our data come from six sources: COMPUSTAT, CRSP, the Federal Reserve's Flow of Funds Account of the United States, I/B/E/S, CDA/Spectrum, and the Investors Research Responsibility Center.

We use annual COMPUSTAT industrial files covering the years 1970 through 2001 as our primary source for U.S. manufacturing firm data. We measure investment, cash flow, Tobin's Q, and capital in the same manner as Kaplan and Zingales (1997). As in Kaplan and Zingales (1997), we deflate cash flow and investment by capital stock at the beginning of each year.

Aggregate fund flow data are taken from the Flow of Funds Accounts of the United States, which is published by the Federal Reserve Board. The publication contains quarterly data on sector holdings for each major asset class, starting with 1951. For the years 1970 through

[9] Several potential explanations for this finding are available in the literature: takeover related wealth changes of bond holders and wealth transfer from bondholders to shareholders (Warga and Welch (1993), and Billet, King and Mauer (2004)), managers having the opportunity to engage in longer term projects when shielded from takeover risks (DeAngelo and Rice (1983) and Stein (1988)), reduction in firm risk due to reduced job protection activities of managers when there are takeover defenses (Jensen and Ruback (1983))).

2001, annual net fund flows are obtained by adding up the corresponding quarterly data on the net equity purchased by insurance companies, pension funds, mutual funds and closed-end funds. Net fund flow values for each year are converted to 2001 values using the CPI index of the Bureau of Labor Statistics.

The data on analyst following are obtained from I/B/E/S for the period 1976-2001. To get annual figures for the number of analysts following a firm, the last available quarterly data at or before that firm's fiscal year end are used. If no data exist for a firm, the number of analysts following that firm is taken to be zero.

Institutional ownership data for 1980 through 2001 are from the CDA/Spectrum database. This database provides quarterly reports on institutional holdings derived from the SEC's 13(f) filings. Spectrum classifies each institution as one of five types: bank, insurance company, investment company, independent investment advisor or 'other'. The institutional holdings of these institutions are added up in order to determine the institutional ownership of each stock. If a stock has no reported institutional ownership, we assume the institutional holdings of the stock to be zero.

Bond ratings data from 1985 to 2001 are taken from the annual COMPUSTAT industrial files. On the basis of bond ratings data, firms are divided into two categories—firms with rating and with no rating. Dummies are assigned accordingly.[10]

Annual data on takeover defenses for the period 1990-2001 are taken from the Investors Research Responsibility Center. GIM created an annual corporate governance index for U.S. firms based on five governance rules that consist of a total of twenty-four takeover defense provisions We consider these twenty-four provisions to form the index as in GIM. The value of

[10] We carry out the analyses using all junk bonds as well as by removing those that have a below-CCC rating. The latter is carried out to remove the impact of financial distress. The results are comparable to those reported.

the index varies between 2 and 18. A high governance index value corresponds to strong managerial rights (or low takeover vulnerability) and weak shareholder rights. The annual index values are used as a measure of corporate governance. If the governance index of a firm is missing for a year, the index value of the previous year is used.

Since all the data are not available for the overall sample period 1970-2001, we report the results for the 1985-2001 and 1990-2001 periods.[11] We also examine the time series pattern of investment-cash flow sensitivity by running ten year rolling regressions of investment on cash flow and Tobin's Q from 1970 to 2001. Additionally, we look at the period from 1992 to 1995, since this is the sample analyzed in Erickson and Whited (2000). We omit firm-years with negative cash flows on account of their potential distortionary impact on investment-cash flow sensitivity estimates.[12] Additionally, in order to reduce the effects of extreme observations, for each sub-period, the top and bottom one percentile of the data with respect to investment, cash flow, and Tobin's Q are removed. We require a firm to have at least three years of data to be in the sample.[13] Since investment and cash flow are deflated by capital stock, and Tobin's Q is a ratio, we convert all variables to ratios. With respect to fund flows, the net fund flow value for 1970 serves as a base and is assigned a value of one. The fund flow values for subsequent years are calculated relative to this base. We divide the number of analysts following a firm each year by the mean number of analysts following stocks for that year. This ratio gives us a relative figure for analyst following of a firm compared to other firms in that year. This allows us to distinguish reduced information asymmetries due to analyst following across firms in a given

[11] We also examine the periods 1976-2001 and 1980-2001 with available variables for these periods. The results are comparable to those reported for the available variables.
[12] See Allayannis and Mozumdar (2004) and Bhagat, Moyen, and Suh (2005).
[13] We require three years of data to calculate beginning-of-year Q and capital stock as well as to examine first difference regressions. First difference regressions are not reported since the results are comparable to those reported.

year. For similar reasons, for each year, the institutional ownership of a firm is divided by the total institutional holdings for that year, depending on the fiscal year end of the firm. The first quarterly report on institutional holdings at or after the firm's fiscal year end is used to calculate the ratio. Again, to get a relative figure for corporate governance index for each firm in a year, each firm's annual governance index value is divided by the mean governance index for that year.

Table 1 reports descriptive statistics for these variables. As can be observed in Table 1, investment, cash flow, analyst following, institutional ownership and percentage of firms with bond ratings are fairly stable throughout the 1985-2001 and 1990-2001 periods. Firm size and fund flows, on the other hand, are higher for the 1990-2001 period compared to 1985-2001 period. The governance index values are similar to those reported in GIM. Also, as expected, when we require firms to have governance index values, the sample size is reduced. The proportion of large firms with bond ratings, large institutional ownership and number of analysts following increases for this sample.

Table 1

IV. The Time Series Pattern of Investment-Cash Flow Sensitivity

Using data from the late eighties and early nineties, Cleary (1999) and Erickson and Whited (2000) report investment-cash flow sensitivities that are much lower than those estimated by Fazzari, Hubbard, and Petersen (1988) and Kaplan and Zingales (1997), who used data from the 1970-1984 period. To examine if a decline is observed in our sample, we run rolling regressions from 1970 to 2001 for overlapping periods of ten years. This allows us to analyze the time series pattern of investment-cash flow sensitivity. Our first regression is for the period

1970-1979, the second for the period 1971-1980, and so forth. We estimate the following regression:

$$I_t / K_{t-1} = \alpha + \beta_1 Q_{t-1} + \beta_2 CF_t / K_{t-1} + \varepsilon_t , \qquad (2)$$

where $I_{t,}$ and CF_t represent investment and cash flow during period t, respectively; K_{t-1} is the amount of fixed capital at the beginning of period t; and Q_t is Tobin's Q, calculated at the beginning of period t. β_2 measures investment-cash flow sensitivity for the period t. The data are transformed into their mean deviation form by taking the differences between the raw data and the firm-level means. This allows us to eliminate fixed firm effects. We include year dummies to control for year effects. Heteroscedasticity correction is used for estimating standard errors.

We report the results based on OLS estimation as well as the measurement error-consistent GMM estimation of Erickson and Whited (2000). GMM estimates based on product moments up to third and fourth orders (GMM3 and GMM4, respectively) are reported for the identified models.

Table 2 and Figure 1 present the results of the above regressions for the overall sample. In Table 2, Panel A reports the results of ten year rolling regressions from 1970 to 2001, and Panel B reports the results of the regression for the sample period from 1992 to 1995 for comparison with Erickson and Whited (2000). In line with the results of Erickson and Whited (2000), the application of GMM estimators results in the coefficient on Tobin's Q being more than three times higher and the coefficient on cash flow being lower than those obtained with OLS estimation. For the period from 1992 to 1995, as in Erickson and Whited (2000), cash flow is not significant when GMM estimators are used. Over most of the other years, however, the estimated investment-cash flow sensitivity, β_2, is positive and significant, indicating that the Erickson and Whited (2000) sample period was somewhat special in this respect. Only those

results for which both the identification and the over-identification criteria are satisfied, as well as the coefficient is significantly different from 0, are reported in bold.[14] Further, there is a clear and steady decrease in the estimated sensitivity, β_2, over time for most of the sub-samples examined.

Interestingly, the decrease in investment-cash flow sensitivity β_2 is not associated with any corresponding pattern in β_1, the sensitivity to Tobin's Q. A possible alternative explanation for the decline in β_2 is that Tobin's q became a less noisy proxy for marginal q over time, such that the incorrectly inflated role of cash flow also reduced. However, since the measurement-error consistent estimators also yield a declining pattern for β_2, and the pattern for β_1 remains stable, the decline in β_2 cannot be explained by a reduction in measurement error alone. Furthermore, since the sample period spans several business cycles, and almost every ten year sub-sample covers at least one recession and one expansion, these results cannot be explained by business cycle fluctuations.[15] Thus, the evidence lends support to the hypothesis that the estimated sensitivity β_2 is decreasing through time and is significant most of the time even after controlling for measurement errors.

Table 2 and Figure 1

V. Investment-Cash Flow Sensitivity in Relation to Capital Market Factors

Since the sensitivity of investment to the availability of internal funds is significant (although decreasing) through different time periods, it is not merely an artifact of measurement errors, but is linked to capital market imperfections. Therefore it should decrease with factors

[14] Note that this means that the identification test rejects, the over-identification test fails to reject, and the coefficient t-test rejects.

[15] Business cycle expansions and recessions are as reported by the NBER at its web site, http://www.nber.org/cycles.html.The only ten year period considered in our rolling regressions that does not cover both an expansion and a recession is March 1991 to March 2001, which is a 120 month expansionary period.

that reduce these imperfections. We consider factors that prior research has identified as being related to capital market imperfections, and examine the impact of these factors on investment-cash flow sensitivity. Our regression model is as follows:

$$I_t / K_{t-1} = \alpha + \beta_1 Q_{t-1} + \beta_2 CF_t / K_{t-1} + \gamma_i (CF_t / K_{t-1} \times Factor_i) + \varepsilon_t . \qquad (3)$$

The factors considered in the regression are fund flows, analyst following, institutional ownership, bond ratings, and the corporate governance index. The data are transformed into their mean deviation form by taking the differences between the raw data and the firm-level means to eliminate fixed firm effects. We include year dummies to control for year effects. Heteroscedasticity correction is used for estimating standard errors.

We analyze the interaction of cash flow with these factors, and report the results for the 1985-2001 and 1990-2001 periods.[16] When the interaction of cash flow with the corporate governance index is considered in 1990-2001 period, the sample size is reduced due to unavailability of the index value for many small firms. We include the interaction of cash flow with the natural logarithm of size (book value of total assets) as an additional control variable.[17] The results are given in Table 3. OLS estimates as well as the GMM estimates based on Erickson and Whited (2000) are reported.

Table 3

In Table 3, we observe a negative and significant coefficient on the interaction of cash flow with fund flows for all periods. Consistent with hypothesis stated in Section 2, these results suggest that the sensitivity of investments to the availability of internal funds decreases with factors that reduce capital market imperfections. The coefficient on the interaction of cash flow

[16] We also examine 1970-2001, 1976-2001 and 1980-2001 periods. The results are comparable to those reported for the 1985-2001 and 1990-2001 periods.

[17] We control for firm size since Gilchrist and Himmelberg (1995), Kadapakkam, Kumar and Riddick (1998), Erickson and Whited (2000), and Allayannis and Mozumdar (2004) find a significant relation between firm size and financing constraints.

with firm size is positive whenever it is significant, although it is largely insignificant with GMM estimates. The finding that the coefficient is largely insignificant with the GMM estimates but not with the OLS estimates may be indicative of size capturing some unobserved factors related to Tobin's Q that are not captured by OLS estimates due to measurement error.

Although fund flows have an impact on the overall market, we would expect the largest effect to be on firms with higher levels of institutional ownership. These firms should be able to raise external funds more easily, since increased liquidity as well as reduced informational asymmetries through information flow to prices should reduce the cost wedge between external and internal funding. In Table 3, we find that the coefficient on the interaction of cash flow with institutional ownership is negative and significant.

Stock analysts produce research that adds to the publicly available information about the firm and thus reduces the information asymmetry between insiders and outsiders. Thus analyst following should reduce the wedge between internal and external financing costs. Consistent with this hypothesis, in Table 3, GMM estimates of the coefficient on the interaction of cash flow with the number of analysts following are negative and significant.

Debt markets play a major role in the external financing of corporations. The credit rating process generates additional public information about the firm as well as making public bond markets accessible to it. In Table 3, we observe that the interaction of cash flow and the bond rating dummy is always negative and significant. These results are supportive of an association between a decreasing investment-cash flow sensitivity and a decreasing cost wedge between internal and external funds due to access to bond markets.

Klock, Mansi and Maxwell (2005) find that the cost of debt financing decreases with an increase in the GIM index. Using institutional ownership as a proxy for shareholder control,

Cremers, Nair and Wei (2006) show that antitakeover amendments lead to a decrease in the cost of debt financing when there is strong shareholder control. We examine the relation between investment-cash flow sensitivity and the GIM index for the sample period 1990-2001. Most of the firms in this sample are large firms (Table 1). Debt financing is the major source of external financing for large firms. Thus the cost of debt financing should have a larger impact on the cost wedge between internal and external funds for the firms in our sample. We report OLS estimates in Table 3. GMM estimates are not reported since the corresponding GMM models are not identified. The coefficient on the corporate governance index is negative and significant. The evidence thus indicates a negative relation between investment-cash flow sensitivity and the number of antitakeover amendments. However, since OLS estimates may not be reliable due to measurement error problems related to Tobin's Q, this evidence can at best be seen as weak support for the hypothesized negative relation between investment-cash flow sensitivity and the GIM index.

VI. Conclusion

This paper examines the sensitivity of investments to the availability of internal funds using U.S. manufacturing firm data. The paper first shows that there has been a steady decrease in investment-cash flow sensitivity over time, and that this decline cannot be explained on the basis of measurement error alone. Next, investment-cash flow sensitivity is examined in relation to five capital market-related factors: fund flows, institutional ownership, analyst following, bond ratings, and antitakeover amendments. By analyzing the relation of investment-cash flow sensitivity to these five capital-market related factors, we explore whether this sensitivity reduces with factors that decrease capital market imperfections.

Our findings indicate that investment-cash flow sensitivity decreases when there is a reduction in capital market imperfections through increased fund flows, institutional ownership, analyst following, antitakeover amendments and with the existence of a bond rating. Thus capital market factors that decrease market imperfections and as a result reduce the cost wedge between external and internal funds, lead to lower investment-cash flow sensitivities. It is possible that the decline in investment-cash flow sensitivity has been due to reduction in capital market imperfections over time. However, such an inference cannot be made categorically without a direct time-series analysis of the relation between the two. We leave that exercise for future research.

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Table 1
Descriptive Statistics

This table reports the mean and median values of the variables for the 1985-2001 and 1990-2001 sample periods. The Obs column shows the sample size for each period. For the period 1990-2001, there are two samples. When we require a firm to have a corporate governance index, the sample size reduces to the one reported at the bottom of the table. I, CF, and Q represent investment, cash flow, and Tobin's Q, respectively, calculated as in Kaplan and Zingales (1997). Fund flows are calculated using the 1970 values as the base. Fund flows are converted to 2001 values using the CPI index of the Bureau of Labor Statistics. The analysts column shows the analyst following for the sample firms. The number of analysts following a firm is divided by the mean number of analysts following for each year. The IO column reports the proportion of the institutional ownership of the sample firms relative to the institutional ownership of all firms with fiscal year ends corresponding to the same quarter. The Bond column reports the proportion of firms that have bond ratings. The Govn column reports the corporate governance index, and is taken from GIM. The corporate governance index value of each firm is divided by the mean corporate governance index for that year. For each variable except bond ratings, the first row reports the mean values and the second row the median values.

	Obs	Total Assets	I	CF	Q	Fund flows	Analysts	IO	Bond	Governance Index
1985-2001	21944	2245.77	0.27	0.62	1.61	5.44	5.62	0.031	0.24	
		169.29	0.21	0.40	1.32	5.29	2.00	0.002		
1990-2001	14935	2651.88	0.27	0.66	1.68	7.12	5.57	0.030	0.26	
		203.21	0.20	0.41	1.36	8.50	2.00	0.002		
1990-2001**	5848	3606.33	0.23	0.49	1.79	7.34	10.48	0.06	0.50	9.47
		993.51	0.20	0.38	1.49	8.88	8.00	0.014		10.00

** Sample size is reduced due to the exclusion of firms that do not have corporate governance index data available.

Table 2
Time Series Pattern of Investment-Cash Flow and -Tobin's Q Sensitivities

This table presents the sensitivity of investment to internal funds and Tobin's Q. We run rolling regressions from 1970 to 2001 for overlapping periods of ten years according to the following regression model:

$$I_t / K_{t-1} = \alpha + \beta_1 Q_t + \beta_2 CF_t / K_{t-1} + \varepsilon_t ,$$

where I_t, and CF_t represent investment and cash flow during period t, respectively; K_{t-1} is the amount of capital at the beginning of period t; and Q_t is Tobin's Q, calculated at the beginning period t as in Kaplan and Zingales (1997). Panel A reports the rolling ten year regressions from 1970 to 2001. The first regression is from 1970 to 1979, and is reported below as 1979. The second is from 1971 to 1980, and is reported as 1980, and so forth. Panel B reports the regression for the period from 1992 to 1995. In the regressions, the data are transformed into their mean deviation form by taking the differences between the raw data and the firm-level means so as to eliminate the fixed-firm effects. We keep the year dummies to control for the year effects. OLS and GMM results are reported. In the columns below, Obs represents the number of observations. Heteroscedasticity adjusted standard errors are in parentheses.

Panel A: 1979 to 2001 Rolling Regressions

		OLS			GMM3			GMM4			
	Obs	R^2	CF	Q	R^2	CF	Q	R^2	CF	Q	J-stat
1979	12347	0.187	**0.28**	**0.053**	0.251	**0.157**	**0.352**	0.233	**0.177**	**0.271**	1.356
			(0.013)	**(0.005)**		**(0.03)**	**(0.113)**		**(0.015)**	**(0.032)**	(0.508)
1980	13376	0.168	**0.259**	**0.057**	0.231	**0.149**	**0.314**	0.223	**0.159**	**0.278**	0.469
			(0.011)	**(0.004)**		**(0.024)**	**(0.083)**		**(0.015)**	**(0.036)**	(0.791)
1981	13803	0.158	**0.243**	**0.06**	0.22	**0.152**	**0.294**	0.22	**0.153**	**0.291**	0.054
			(0.011)	**(0.004)**		**(0.02)**	**(0.072)**		**(0.015)**	**(0.04)**	(0.973)
1982	14072	0.151	**0.234**	**0.057**	0.214	**0.150**	**0.316**	0.221	**0.147**	**0.331**	0.84
			(0.01)	**(0.005)**		**(0.024)**	**(0.107)**		**(0.015)**	**(0.05)**	(0.657)
1983	14237	0.16	**0.238**	**0.055**	0.193	**0.155**	**0.204**	0.23	**0.147**	**0.354**	3.23
			(0.01)	**(0.006)**		**(0.021)**	**(0.098)**		**(0.014)**	**(0.049)**	(0.198)
1984	14398	0.168	**0.241**	**0.055**	0.208	**0.156**	**0.297**	0.26	0.119	0.484	8.61
			(0.01)	**(0.006)**		**(0.047)**	**(0.13)**		(0.018)	(0.068)	(0.014)
1985	14474	0.17	**0.236**	**0.067**	0.228	**0.135**	**0.364**	0.259	0.117	0.447	7.00
			(0.01)	**(0.006)**		**(0.056)**	**(0.145)**		(0.017)	(0.054)	(0.03)
1986	14476	0.163	**0.228**	**0.073**	0.211	**0.145**	**0.284**	0.27	0.106	0.448	13.49
			(0.01)	**(0.007)**		**(0.054)**	**(0.128)**		(0.017)	(0.052)	(0.001)
1987	14495	0.165	**0.216**	**0.072**	0.207	**0.138**	**0.245**	0.271	0.093	0.414	14.67
			(0.011)	**(0.007)**		**(0.058)**	**(0.102)**		(0.019)	(0.054)	(0.001)
1988	14497	0.168	**0.2**	**0.074**	0.202	**0.133**	**0.207**	0.281	0.079	0.398	18.14
			(0.01)	**(0.006)**		**(0.049)**	**(0.098)**		(0.017)	(0.044)	(0.00)
1989	14399	0.168	**0.185**	**0.081**	0.217	**0.112**	**0.230**	0.29	0.067	0.378	15.59
			(0.01)	**(0.006)**		**(0.038)**	**(0.101)**		(0.015)	(0.036)	(0.00)
1990	14248	0.159	**0.167**	**0.077**	0.232	**0.083**	**0.266**	0.285	0.055	0.352	11.38
			(0.009)	**(0.006)**		**(0.034)**	**(0.102)**		(0.014)	(0.033)	(0.003)

Table 2 - *Continued*

			OLS			GMM3			GMM4		
	R^2	Obs	CF	Q	R^2	CF	Q	R^2	CF	Q	J-stat
1991	0.162	14099	**0.155**	**0.080**	0.250	**0.067**	**0.294**	0.291	0.050	0.350	9.193
			(0.009)	**(0.005)**		**(0.032)**	**(0.097)**		(0.014)	(0.034)	(0.01)
1992	0.165	14017	**0.144**	**0.071**	0.263	**0.074**	**0.283**	0.308	0.056	0.342	9.770
			(0.008)	**(0.005)**		**(0.028)**	**(0.087)**		(0.014)	(0.035)	(0.008)
1993	0.17	13939	**0.138**	**0.068**	0.287	**0.055**	**0.341**	0.320	0.043	0.381	6.350
			(0.008)	**(0.005)**		**(0.031)**	**(0.101)**		(0.016)	(0.042)	(0.042)
1994	0.166	13876	**0.128**	**0.067**	0.313	**0.037**	**0.429**	0.306	0.040	0.376	8.220
			(0.007)	**(0.005)**		**(0.022)**	**(0.122)**		(0.015)	(0.041)	(0.016)
1995	0.159	13834	**0.121**	**0.065**	0.315	0.038	**0.450**	0.287	0.043	0.357	6.670
			(0.006)	**(0.005)**		(0.028)	**(0.129)**		(0.013)	(0.037)	(0.036)
1996	0.152	13825	**0.110**	**0.065**	0.294	0.037	**0.383**	0.283	0.041	0.333	6.260
			(0.006)	**(0.004)**		(0.026)	**(0.124)**		(0.013)	(0.037)	(0.044)
1997	0.149	13702	**0.102**	**0.064**	0.262	**0.045**	**0.308**	0.272	**0.043**	**0.315**	0.263
			(0.006)	**(0.004)**		**(0.024)**	**(0.083)**		**(0.012)**	**(0.038)**	(0.278)
1998	0.14	13460	**0.098**	**0.060**	0.256	0.031	**0.324**	0.277	0.026	0.341	5.973
			(0.005)	**(0.004)**		(0.033)	**(0.12)**		(0.013)	(0.039)	(0.05)
1999	0.146	13178	**0.097**	**0.057**	0.250	**0.038**	**0.295**	0.278	0.029	0.325	6.490
			(0.005)	**(0.004)**		**(0.022)**	**(0.11)**		(0.013)	(0.038)	(0.04)
2000	0.148	12846	**0.091**	**0.054**	0.223	**0.053**	**0.223**	0.267	0.032	0.293	3.610
			(0.005)	**(0.004)**		**(0.026)**	**(0.084)**		(0.014)	(0.038)	(0.165)
2001	0.146	12310	**0.085**	**0.052**	0.215	**0.062**	**0.195**	0.284	0.028	0.309	3.810
			(0.005)	**(0.003)**		**(0.022)**	**(0.07)**		(0.014)	(0.041)	(0.149)

Panel B: 1992 to 1995 Regression

		OLS			GMM3			GMM4		
Obs	R^2	CF	Q	R^2	CF	Q	R^2	CF	Q	J-stat
5135	0.139	**0.117**	**0.061**	0.162	0.100	**0.119**	0.286	0.023	0.374	5.75
		(0.01)	**(0.007)**		(0.066)	**(0.022)**		(0.022)	(0.055)	(0.056)

Table 3
Capital Market Imperfections and Investment Cash Flow Sensitivity

This table shows the impact of capital market imperfections on investment-cash flow sensitivity, controlling for firm size, over two sample periods. The periods are 1985-2001, and 1990-2001. Data are available for fund flows for all subperiods, analyst following only after 1976, institutional ownership only after 1980, bond ratings only after 1985, and the corporate governance index only after 1990. We run the following regression:

$$I_t / K_{t-1} = \alpha + \beta_1 Q_t + \beta_2 CF_t / K_{t-1} + \gamma_i (CF_t \times Factor_i) + \varepsilon_t ,$$

where I_t, and CF_t represent investment and cash flow during period t, respectively; K_{t-1} is the amount of capital at the beginning of period t; and Q_t is Tobin's Q, calculated at the beginning period t in the same manner as in Kaplan and Zingales (1997). We control for size by interacting cash flow with the natural logarithm of size (CF*Size). CF_t*$Factor_t$ are the interactions of cash flow with the factors related to capital market imperfections. The factors considered are: fund flows (CF*Fund), analyst following (CF*Analyst), institutional ownership (CF*IO), the proportion of firms with bond ratings (CF*Bond), and the corporate governance index (CF*Govn). In the regressions, the data are transformed into their mean deviation form by taking the differences between the raw data and the firm-level means so as to eliminate the fixed-firm effects. We keep the year dummies to control for the year effects. OLS and GMM results are reported. Heteroscedasticity adjusted standard errors are in parentheses.

	Obs	J-stat	R^2	CF	Q	CF* Size	CF* Fund	CF* Analyst	CF*IO	CF* Bond	CF* Govn
1985-2001	21944										
OLS			0.154	**0.107**	**0.057**						
				(0.005)	**(0.003)**						
			0.167	**0.099**	**0.056**	**0.008**	**-0.003**	0.007	**-0.115**	**-0.023**	
				(0.012)	**(0.003)**	**(0.003)**	**(0.001)**	(0.005)	**(0.037)**	**(0.016)**	
GMM3			0.282	**0.034**	**0.295**						
				(0.015)	**(0.048)**						
			0.299	**0.061**	**0.310**	**0.007**	**-0.004**	**-0.041**	**-0.569**	**-0.028**	
				(0.016)	**(0.049)**	**(0.003)**	**(0.001)**	**(0.012)**	**(0.119)**	**(0.016)**	
GMM4		4.974	0.287	0.036	0.289						
		(0.083)		(0.008)	(0.023)						
		2.63	0.288	**0.064**	**0.284**	**0.007**	**-0.004**	**-0.036**	**-0.552**	**-0.029**	
		(0.26)		**(0.015)**	**(0.024)**	**(0.004)**	**(0.001)**	**(0.008)**	**(0.086)**	**(0.017)**	

Table 3 –Continued

	Obs	J-stat	R^2	CF	Q	CF* Size	CF* Fund	CF* Analyst	CF*IO	CF* Bond	CF* Govn
1990-2001	14935										
OLS			0.142	**0.088**	**0.051**						
				(0.005)	**(0.003)**						
			0.153	**0.084**	**0.052**	**0.008**	**-0.003**	0.009	**-0.11**	**-0.037**	
				(0.016)	**(0.004)**	**(0.004)**	**(0.001)**	(0.005)	**(0.038)**	**(0.016)**	
GMM3			0.247	**0.030**	**0.270**						
				(0.018)	**(0.08)**						
			0.295	**0.074**	**0.322**	0.006	**-0.006**	**-0.041**	**-0.602**	**-0.022**	
				(0.016)	**(0.05)**	(0.004)	**(0.001)**	**(0.012)**	**(0.121)**	**(0.011)**	
GMM4		3.811	0.274	**0.026**	**0.300**						
		(0.149)		**(0.011)**	**(0.032)**						
		2.043	0.283	**0.078**	**0.291**	0.006	**-0.006**	**-0.035**	**-0.546**	**-0.022**	
		(0.36)		**(0.015)**	**(0.029)**	(0.004)	**(0.001)**	**(0.008)**	**(0.087)**	**(0.011)**	
1990-2001*	5848										
OLS			0.177	**0.041**	**0.038**	**0.018**	**-0.004**	0.006	**-0.063**	**-0.021**	**-0.053**
				(0.01)	**(0.004)**	**(0.009)**	**(0.002)**	(0.007)	**(0.032)**	**(0.011)**	**(0.024)**

* Sample size is reduced from 14,935 to 5,848 due to firms that do not have GIM index data available

Figure 1A
Regression Coefficients on Cash Flow (CF)

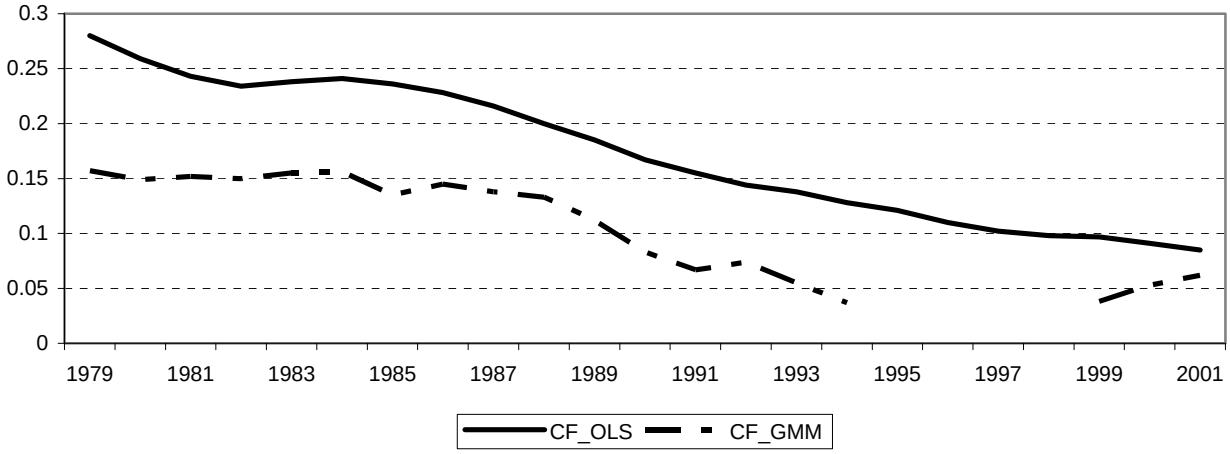

Figure 1B
Regression Coefficients on Tobin's Q (Q)

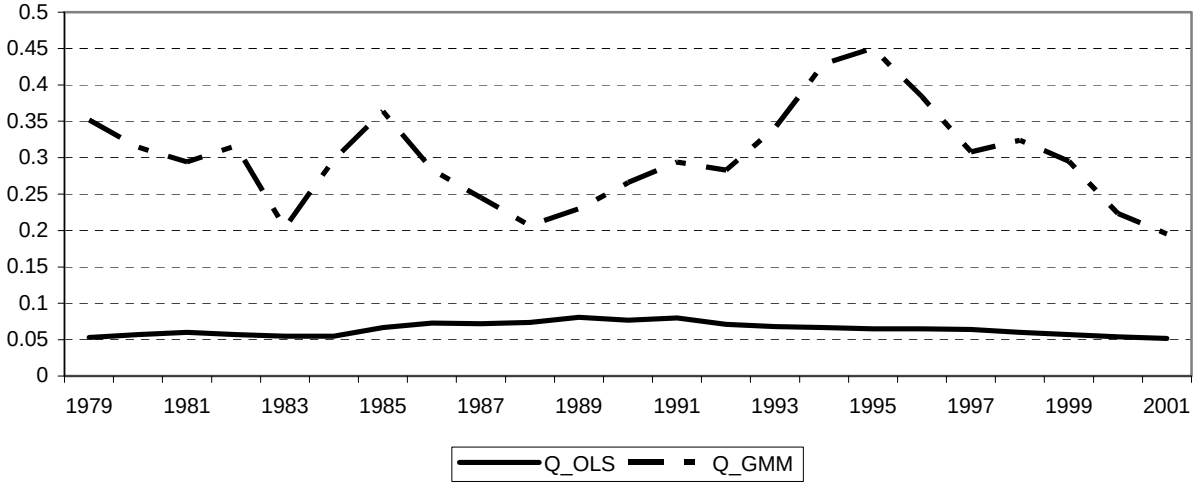

Figure 1. Regression Coefficients on Cash Flow (CF) and Tobin's Q. Investment is regressed on CF and Q over ten year periods from 1970 to 1992, i.e. 1970-1979, 1971-1980, and so forth. In the above figure, years correspond to the last years in the rolling regression. For example, the period 1970-1979 is shown as 1979. Both OLS (CF_OLS and Q_OLS) and GMM3 (CF_GMM and Q_GMM) estimates are shown.