Changing U.S. Economy and Investment–Cash Flow Sensitivity

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Abstract

The changes to the U.S. economy due to globalization, outsourcing, and the introduction of Nasdaq exchange have resulted in a decline in (i) the importance of manufacturing firms, (ii) capital expenditure as the main investment type, and (iii) operating cash flow as the primary source of internal capital to fund investment. To account for these changes, we broaden the definitions of (i) investment to include R&D, SG&A, cash used to fund subsidiaries, joint ventures, and purchase assets through M&A and (ii) internal capital to include cash holding available at the beginning of the year. We apply these innovations to the investment-cash flow-sensitivity literature. We find that this sensitivity is 570% higher than estimates from prior literature; it has declined modestly but has not disappeared, and is still large in recent years.

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Changing U.S. Economy and Investment–Cash Flow Sensitivity

The U.S. economy has changed substantially due to outsourcing of manufacturing capacity (to China primarily, enabled partly by Chinese economic reform initiated in 1978) followed by outsourcing of Information Technology, and the introduction of Nasdaq exchange. This has resulted in several trends that affect empirical research. The importance of manufacturing firms in the U.S. economy has steadily declined. Since the early 80's, capital expenditure has declined by half partly due to outsourcing and partly due to the growing importance of firms in the economy that rely less on physical capital (CAPEX) and more on human capital (R&D) and organizational capital (SG&A). Globalization has increased foreign investment by U.S. multinationals through subsidiaries and joint ventures. This is typically done to access the foreign markets in response to regulations in the foreign countries. In terms of capital available for investment, operating cash flow, similar to capital expenditures, has declined by half. On the other hands, firms' cash holding, that is also available for investment, has been increasing over time (Bates, Kahle, and Stulz, 2009)

Empirical researchers need to modify their research design to accommodate these trends. (i) We need to broaden the sample of firms beyond manufacturing. (ii) We need to broaden the definition of investment beyond capital expenditures to include any form of long-term investment that firms undertake to capitalize on growth opportunities. A long-term investment is one where there is cash outflow today in the hopes of higher cash flows in future years. Thus, in investments, we also include operating leases, R&D, SG&A, cash used to fund subsidiaries and joint ventures, and cash used to purchase assets through M&A. We call this "*Total Investment*." (iii) We also need to broaden the definition of internal capital available for investment beyond operating cash flow to include beginning-of-the-year cash holding. We call this "*Total Funds*." These three innovations are relevant for several strands of the literature. We choose to apply these to the investment-cash flow-sensitivity literature because these innovations directly affect the sample (primarily manufacturing firms), the dependent variable (investment), and the key independent variable (internal capital) used in this literature. This large body of literature, starting with Fazzari, Hubbard, and Petersen (1988), documents that firms' investment is sensitive to the availability of their internal capital that is free of information asymmetry (termed "investment-cash flow sensitivity").

The goal of this paper is to examine the impact of the three innovations on the average investment-cash flow sensitivity as well as the time trend in investment-cash flow sensitivity. This is important because recent literature has cast doubt on whether investments are sensitive to internal capital and whether this sensitivity has declined and disappeared in recent years.[1]

We present two pieces of evidence that validates the importance of our innovations. First, we find that these innovations provide significantly more explanatory power for investment. Specifically, we find that when we estimate the investment-cash flow sensitivity using our definitions, the R^2 for the regression is 63% compared to the R^2 of 39% using definitions based on prior literature. Second, broadening the definition of investment results in an almost 200% increase in the sensitivity of investment to growth opportunities (proxied by Tobin's *q*).

With respect to our key results on investment-cash flow sensitivity, we find a different picture of the overall average sensitivity and its time trend than presented by the current literature. In terms of the overall average, we find that sensitivity of investment to cash flow is 570% higher than that obtained based on definitions in prior literature. Non-manufacturing firms have 60%

[1] See Chen and Chen (2012), Brown and Peterson (2009), and Allayannis and Mazumdar (2004).

higher investment-cash flow sensitivity relative to their manufacturing counterparts. This implies that not including non-manufacturing firms understates the true investment-cash flow sensitivity. Broadening the definition of investment results in an increase (of almost 700%) in sensitivity, while broadening the definition of internal capital results in a decrease (of almost 40%) in sensitivity.

In terms of the time trend in investment-cash flow sensitivity, we find a decline in sensitivity using our measures of investment and internal capital, though the decline is more modest relative to that documented using the definitions in prior literature. Importantly, there is no disappearance in sensitivity in recent years as documented by prior literature; the sensitivity remains economically (> 0.3) and statistically significant in recent periods. Our results are robust to several alternative definitions of investment, internal capital, and *q* (such as the Erickson and Whited *q* corrected for measurement error). See Section VI for the full set of results.

While some have argued that positive investment-cash flow sensitivity implies the presence of financing constraints (Fazarri, Hubbard, and Petersen, 1988), others have argued that this could arise even in the absence of financing frictions (Gomes, 2001; Alti, 2003) or could arise due to mismeasurement of *q* (Erikson and Whited, Gomes, 2001). Our findings do not help settle this debate. Rather, our point is (i) to show that broader definitions of investment and cash flow affect the inferences from existing studies, and (ii) to refute the notion that investment-cash flow sensitivity has disappeared in recent years

How are we different from other papers? We are not aware of any papers that have argued for inclusion of investment in subsidiaries and joint venture, and *M&A* as part of *Total Investment*. Moreover, none of the papers explores the importance of broadening the investment and internal capital on the time trend in sensitivity. While we see still see a decline in sensitivity as documented in prior literature, this decline is modest; importantly, there is no disappearance in sensitivity. Below, we attempt to place our paper in the context of prior literature.

We categorize related papers into two bins: those that have considered some aspects of investments that we argue are important and those that have considered some aspects of internal capital that we argue are important. Baker, Wurgler, and Stein (2003) and Peters and Taylor (2017) are closest to ours in terms of investments. They argue that *R&D* and *SG&A* are investments in intangible capital and hence they include them as part of total investment. We are different along three dimensions. (i) Their focus is on the sensitivity of investment to *q*, while ours is on the sensitivity of investment to cash flow. We also document that with our revised measures, the sensitivity does not disappear. (ii) Our measure of investment is more comprehensive and includes investment in subsidiaries and joint venture, and cash investment to purchase assets. (iii) Our measure of internal capital is also more comprehensive and includes available cash holdings.

Other papers—not as closely related to our paper as is Peters and Taylor—have looked at sensitivity of just one component of *Total Investment* to cash flow. For example, prior literature has looked at the sensitivity of *R&D* to *OCF* (Himmelberg and Petersen, 1994), the sensitivity of Advertising expenditure (which is a part of SG&A) to cash flow (Fee, Hadlock, and Pierce, 2009), and the sensitivity of leasing to OCF (Eisfeldt and Rampini, 2009). Examining individual components is informative if the components of *Total Investment* are uncorrelated with each other. Empirically, we find that the correlations between *Capex* and the four components of investments that we include in *Total Investment* are negative. Given the substitutability among various types of investments, one will not get the correct picture of overall investment-cash flow sensitivity by looking at individual components.

The second set of papers are those that have considered the impact of cash holdings on the investment-cash flow sensitivity. Typically, these papers have looked at the sensitivity of investment to *OCF* after controlling for cash holdings. Our point is that, as far the firm is concerned, there is no distinction between dollars from *OCF* and dollars from cash holdings. Thus, it is hard to interpret the sensitivity of investment to *OCF* and the sensitivity of investment to cash holdings when both *OCF* and cash holdings are included in the regression. In such a setting, the sensitivity of investment to *OCF* after controlling for cash holdings still misestimates the true sensitivity of investment to internal capital.

While our direct contribution lies in revising prior views on investment-cash flow sensitivity, our more general contribution is to document that, given changes to U.S. economy, it is important to (i) consider a more comprehensive measure of investment than capital expenditure and (ii) consider a more comprehensive proxy for internal capital available for investment than operating cash flow. Thus, our research has implications for other streams of literature beyond the primary application to investment-cash flow sensitivity literature. For example, researchers who test overinvestment and quiet life hypotheses typically use capital expenditure as a measure of investment (for example, Coles, Daniel, and Naveen, 2014; Pan, Wang, and Weisbach, 2016). Similarly, researchers typically use free cash flow, defined as *OCF* minus *Capex*, as a proxy for the magnitude of agency problem. Our analysis suggests *OCF* underestimates the true internal capital available for investment and *Capex* underestimates the true investment. Our proxy for agency problem, which equals *Total Funds* minus *Total Investment*, has a correlation of only 37% with prior proxies for agency problem (free cash flow). Moreover, our estimate classifies 49% of the firms has having agency problem whereas prior literature classifies 66% of the firm-years as having agency problem.

In the next section, we explain the logic underlying our three proposed innovations to the investment-cash flow literature. We also provide several examples that illustrate our point.

I. Theoretical and Anecdotal Evidence Supporting Our Innovations

We propose three changes to the current investment-cash flow sensitivity literature: (i) expand the sample to include non-manufacturing firms, (ii) broaden the definition of investment, and (iii) broaden the definition of internal capital. We develop our reasoning below.

A. Expand to Include Non-Manufacturing Firms

With a few exceptions, most papers in this literature examine only manufacturing firms.[2] In keeping with the literature, we define manufacturing firms as those with a two-digit SIC code between 20 and 39 (both inclusive). We drop financials (two-digit SIC codes between 60 and 69) and utilities (two-digit SIC code 49). All other firms are non-manufacturing.

There are at least two reasons to consider non-manufacturing firms. First, there is growing importance of non-manufacturing firms in the economy, and these firms now comprise a significant part of the economy. At the start of our sample period (1967), non-manufacturing firms account for 28% of the total sample. By 2013, the corresponding number is 49%.[3] On average,

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[2] Examples of papers that consider only manufacturing firms include Fazzari et al. (1988), Almeida, Campello, and Weisbach (2004), Allayannis and Mozumdar (2004), Almeida and Campello (2007), and Brown, Fazzari, and Petersen (2009). Peters and Taylor (2017) consider the five Fama-French industries, which includes some non-manufacturing firms. They examine the sensitivity for these five industries and correlate it to the level of intangible capital of these five industries.

[3] In terms of assets and market cap, the numbers are similar: non-manufacturing firms account for 30% and 34% of the sample in 1967, but are much higher at 51% and 49% by 2013.

during our sample period, 42% of the firms are in the non-manufacturing sector. Second, it is a misconception that non-manufacturing firms are not in capital-intensive industries. We provide examples of several such industries along with the SIC code and one prominent firm in the industry that readers could relate to.

Industry	Example	2-digit SIC	Capex/Lagged Assets
Metal Mining	Freeport-McMoRan	10	13%
Coal Mining	Cliffs Natural Resources	12	12%
Oil and Gas Extraction	Halliburton	13	21%
Residential Construction	Toll Brothers	15	2%
Non-residential Construction	Fluor	16	8%
Rail Transportation	CSX	40	8%
Couriers	UPS	42	17%
Shipping	Dryships	44	10%
Air Transportation	Delta Airlines	45	17%
Pipelines	Valero Energy Partners	46	8%
Communications	AT&T	48	10%
Hardware	Home Depot	52	11%
General Merchandise	Walmart	54	11%
Auto Dealers	Carmax	55	8%
Apparel Stores	Nordstrom	56	10%
Home Furnishings	Williams Sonoma	57	8%
Restaurants	Chipotle Mexican Group	58	17%
Hotels	Marriot	70	10%
Equipment Rentals	United Rental	73	6%
Car Rentals	Hertz	75	18%
Cinema Theaters	AMC Entertainment	78	12%
Amusement Parks	Six Flags	79	11%

In fact, during our sample period, 17 out of the top 18 industries in terms of the ratio of *Capex* to lagged assets are in the non-manufacturing sector. The sole exception is petroleum refining (SIC 29). The average value of *Capex* to lagged assets for non-manufacturing firms is higher than that for non-manufacturing firms (9.5% versus 6.6%). Thus, any study on aggregate investment patterns would be incomplete if we ignore the subsample of non-manufacturing firms.

B. Broaden the Definition of Investment

We broaden the definition of investment to include any form of long-term investment that firms undertake to capitalize on growth opportunities.

The focus of prior literature has been on capital expenditure, which is just one form of investment in tangible capital. R&D expenditures, for example, have benefits in the long-term; indeed the finance and accounting literature assumes that managers that are more myopic invest less in R&D. Similarly, SG&A includes expenses incurred on marketing and advertising (that focus on brand building), information technology, exploration for extractive industries, as well as employee training, all of which are investments that build organizational capital.[4] Peters and Taylor (2017) term the investment in *R&D* and *SG&A* as investment in intangible capital. In addition, firms invest in subsidiaries, joint ventures, and purchase both tangible and intangible assets through acquisitions.

We view investment as any expenditure made by the firm that is long term in nature; that is, it reaps benefits over multiple years. Corrado and Hulten (2010) conclude that capital investments should include a company's expenditures on product design, marketing and customer support, and human capital and organizational development. Such expenses show up in both R&D and SG&A. We, therefore, propose that the definition of total investment (*Total Investment*) should include, in addition to *Capex*, R&D expenditure ('*R&D*') and selling and general administrative expenditure ('*SG&A*'). Below, we provide support for our arguments using prior

[4] Corrado, Hulten, and Sichel (2005) argue that we should treat such expenditures as firms' capital investments as they increase future rather than current consumption. They state (pg. 13) that "there is no basis…for treating investments in intangible capital differently from investments in plant and equipment, or tangible capital." Also see Lev and Radhakrishnan (2005) and Eisfeldt and Papanikolaou (2013) for a discussion of why *SG&A* is a good proxy for investment in organizational capital.

literature as well as excerpts from corporate statements.

There are three different ways we motivate the inclusion of R&D and SG&A as part of the firm's investment. The first way is to view human capital as a factor of production. Lev and Radhakrishnan (2005) and Eisfeldt and Papanikolaou (2013) argue that investment in human capital has become an increasingly important factor of production. For some firms, investment in human capital is the only factor of production. For example, ARM Holdings during its analyst day in 2015 states: "Now, obviously, in ARM here, we don't run factories. Our investment is in people." *Capex* captures investment in physical capital, but investments in human capital are likely to show up in the form of *R&D* and *SG&A* rather than *Capex*.[5]

A second way to motivate the inclusion of R&D and SG&A in investments is to consider a firm's investments across the entire product life cycle. Firms invest in *R&D* to develop the product, then in *Capex* to produce it, and finally in *SG&A* to market it. As such, all three have to be considered as part of the firm's long-term investment.

A third way to think about inclusion of *R&D* and *SG&A* is to view them as investments made through the income statement and not just through the balance sheet. For example, Aerovironment in its earnings call, states: "investments to develop and pursue new growth opportunities are primarily on the income statement in the form of R&D and SG&A rather than on the balance sheet." While the current literature considers *Capex*—a balance sheet investment

[5] Microsoft Corp., which spends up to 13% of its revenue on *R&D* and 20% of its revenue on SG&A notes in its 2014 annual report that "research and development expenses include payroll, employee benefits, stock-based compensation expense, and other headcount-related expenses associated with product development,..." and "sales and marketing expenses include payroll, employee benefits, stock-based compensation expense, and other headcount-related expenses associated with sales and marketing personnel..." LinkedIn, in its 2014 annual report, notes that "consistent with our investment philosophy for 2015, we expect general and administrative expenses to increase..."

—it ignores income statement investments such as *R&D* and *SG&A*.[6]

Consistent with our reasoning above, starting in 2013, the U.S. Bureau of Economic Analysis, recognizes R&D as an investment, rather than as an operating expense. Firms too, clearly consider *R&D* as an investment. For example, the CEO of LinkedIn, in the April 2015 earnings call, states, "To take full advantage of these market opportunities…we are accelerating R&D head count hired to work on our monetized products." Similarly, Yandex (the Russian equivalent of Google), in its Apr 2015 earnings call, notes "(p)ersonnel costs still remain our largest cost item. Talented personnel is essential for the company to maintain its leadership position in the market…." Such costs of highly-skilled personnel are likely to show up under *R&D*.

Consistent with the argument that investment in *R&D* is vital for these firms, the *R&D*/Sales ratio for LinkedIn is 24% while that for Yandex is 17% (as of 2014). In comparison, this ratio is 0% for over almost two-thirds of publicly listed firms. Equity analysts also consider a broader definition of investment. For example, an analyst for Westport Innovations comments: "Investment, as defined by R&D expense and CapEx, has grown at a 43% CAGR since 2009."[7]

SG&A includes many expenses that, similar to R&D, generate income not just in the current period, but also in future periods. Lev and Radhakrishnan (2005) state that SG&A

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[6] Peters and Taylor (2017) also include *R&D* and *SG&A* as part of investment. They refer to these as investment in intangible capital.

[7] Some prior studies have considered the sensitivity of R&D to cash flow (Brown and Petersen, 2009; Brown, Fazzari, and Petersen, 2009; Chen and Chen, 2012). These studies, however, do not consider other investments that firms make (such as SG&A and investment in subsidiaries and joint ventures) and other sources of internal capital (such as cash holding at the beginning of the year). Further, the first study includes only high-tech firms, while the second considers only manufacturing firms.

"includes most of the expenditures that generate organization capital, such as IT outlays, employee training costs, brand enhancement activities, payment to systems and strategy consultants, and the cost of setting up and maintaining Internet-based supply and distribution channels." Clearly, these expenses are long-term investments made by the firm with payoffs occurring over multiple future years.[8] Supporting the idea that firms view *SG&A* as an important investment, the CFO of Twitter, mentioned at the firm's 2014 annual meeting that the firm had "invested a significant amount of capital…$1.2 billion…across our SG&A expenses to ensure that we are investing in the business to capture long-term opportunity." To put this investment in perspective, the firm's revenue for 2014 was $1.4 billion; in other words, *SG&A* constituted 86% of the sales. These firms have great products but cannot grow without substantial investment in *SG&A* in order to enter new verticals and new geographies.[9]

In addition to *R&D*, *Capex*, and *SG&A*, we consider two investments that flow through the balance sheet just like *Capex*: (i) *SubJV*, which is the cash investment in subsidiaries and joint ventures and (ii) *M&A*, which is the cash used to finance mergers and acquisitions. These are indirect investments that do not show up as *Capex*/*R&D*/*SG&A* but nevertheless help firms capitalize on their growth opportunities.

The choice between direct investment (*R&D*, *Capex*, and *SG&A*) and indirect investment (*SubJV* and *M&A*) may depend on the regulatory environment. For firms that want to expand and

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[8] SG&A also includes period expenses that are not "investments" as defined here. Unfortunately, we cannot separate out period expenses from those that are more long-term in nature.

[9] Similarly, Fleetmatics Group, on its analyst day in May 2015 comments: "…we're not afraid to invest in sales and marketing…we are building a sales force for our WORK business, we continue to expand our North American SMB and our enterprise businesses, and we have some new geographies that we continue to grow." Gogo, on its analyst day in Jun 2015, comments on how its SG&A investment is supporting its growth: "we went from North America to global. This required additional infrastructure…"

grow in countries that restrict foreign ownership, the only way to grow may be through subsidiaries and joint ventures (*SubJV*). For example, in a 2015 conference WhiteWave Foods comments: "In line with our vision of expanding globally, we formed a 51%-49% joint venture ….with Mengniu Dairy, the largest dairy company in China."

Firms use M&A to buy hard assets, technology, or even add personnel quickly (termed "Acquihires" in Wall Street). For example, ARM Holdings during its analyst day in Aug 2014 commented: "our Physical IP business came from, in fact, the largest acquisition that we've done."

We focus on the cash used to finance acquisitions because the equity used to finance acquisitions is subject to information asymmetry problems.[10] We consider the total deal value of M&A as part of the investment in our robustness checks.

Overall, indirect investment can significantly affect growth. Harmon International Industries during its investor day presentation in Aug 2015 noted: "About $450 million of our revenue growth came from organic growth and acquisitions contribute about $350 million."[11]

B.1. Why is it Important to Add Up the Individual Components of Investment?

As mentioned earlier, the proportion of the three types of internal investment (*R&D*, *Capex*, and *SG&A*) varies depending on the product life cycle. For example, an executive for 8x8 Inc. speaking at an industry conference states: "as a company, we've not spent a lot on advertising…we're now finally starting to put some focused effort on marketing,…But we didn't

[10] Cvent in its earnings call in the 1st calendar quarter of 2016 states that they had: "cash equivalents and short-term investment of $145.5 million, a decrease from $158.6 million at the end of the third quarter of 2015, reflecting the impact of approximately $11.5 million in cash paid to acquire Alliance Tech."

[11] WhiteWave Foods notes: "In 2014 total net sales increased over 35%, which included a robust 12% organic top-line growth."

want to do it until we make sure that the technology is rock-solid…Now is the time to turn on the gas." Thus, while a firm is in innovation mode, its *R&D* is likely to dominate its investment in *Capex* and *SG&A*. Therefore, while *Capex* understates true investment for such a firm, adding up all the components gives a more accurate picture of total investments at any given point.

The proportion of each of these investments could also vary by industry, and even within the same industry, could vary by firm. For example, within the semiconductor chip industry, there are three types of firms: (i) Firms like ARM Holdings that are fabless chip stocks, and focus on only the design of the chips and not the fabrication. Thus, their *R&D* is high while their *Capex* is virtually negligible. (ii) Firms like Taiwan Semi that are foundries, and focus on only the fabrication but not the design. Thus, their *R&D* is low while their *Capex* is high. (iii) Firms like Intel that are integrated chip manufacturers, and engage in both design and fabrication. The table below summarizes the various types of investments made by these firms.

	R&D/Assets	Capex/Assets	SG&A/Assets	Total
ARM Holdings	12%	1%	12%	25%
Taiwan Semi	4%	19%	2%	25%
Intel	12%	11%	9%	32%

It is clear that even though the firms belong to the same industry, their *Capex, R&D*, and *SG&A* are different, but their total investments are comparable in magnitude.

The choice between growth through investments in R&D/Capex/SG&A versus growth through acquisitions may also depend on the type of firm, industry, and macroeconomic conditions. Some firms explicitly include M&A in their internal models while other firms do not. For example, Tesco Corp in its 2014 annual report states: "we proposed a total of $650 million in strategic capital investments during the five-year period through 2019. This included a budget of

$250 million in capital expenditures to fuel organic growth, $250 million in acquisitions and the remainder in enhancing total shareholder return." On the other hand, United Natural Foods, in its June 2012 conference call, states: "we don't have M&A in our internal models that help us build the scale, but certainly if those opportunities were there they would help us get there sooner." Market participants understand this substitution. For example, hedge fund manager Chanos notes: "(Hewlett Packard has) done $36 billion in acquisitions…those are maintenance capital expenditures or maintenance R&D hidden as acquisitions."[12]

To the extent that the individual components of investments are substitutes, it is important to add up the investment instead of examining each separately. Empirically, we find that the correlations between *Capex* and the four components of investments that we introduce are negative.

C. Broaden the Definition of Internal Capital

We broaden the definition of internal capital to include any form of funds that is not subject to information asymmetry and that is readily available to the firm to undertake investment. Specifically, we include cash holding at the beginning of the year. We call this measure "*Total Funds.*" The inclusion of cash relies on theory as well as anecdotal evidence. For instance, in a June 2016 survey of CFOs conducted by Duke, 17% state that they "save cash as dry powder for future investment opportunities." Conditional on deploying cash reserves in the next 12 months, 54% of CEOs say that they will use it for "capital spending or investment," 30% say they will use it for "acquisitions," 18% for "marketing and advertising," and 14% for "research and

[12] http://blogs.barrons.com/techtraderdaily/2012/07/18/hp-purchased-rd-makes-it-a-short-says-chanos/

development."

We propose that the definition of internal capital ('*Internal Capital*') should include, in addition to operating cash flow ('*OCF'*), the opening balance of cash holding ('*Available Cash*'). The premise behind the use of *OCF* is that external capital is costly because of information asymmetry (Fazzari, Hubbard, and Petersen (1988)). This, however, ignores beginning-of-year cash holdings, an important source of internally available funds that has no information asymmetry problems. Firms that face temporary cash flow shortfalls could still capitalize on their growth opportunities if they have built up a sufficient cash buffer by either saving from cash flows (Almeido, Campello, and Weisbach, 2004) or from having raised debt or equity financing in prior years. Indeed, firms raise money at the IPO, which will increase cash reserves, for the very purpose of taking advantage of growth opportunities. Celikyurt, Sevilir, and Shivdasani (2010) find that newly public firms use their IPO proceeds to make acquisitions, and that acquisitions are as important for their growth as *R&D* and *Capex*.

Supporting the idea that firms view cash balance as an important source of capital for investment, FireEye, Inc. mentions in its 2014 annual report "our cash and cash equivalents of $146.4 million were held for working capital, capital expenditures, investment in technology and business acquisition purposes." National Oilwell Varco in its earnings call in Aug 2015 states that they will conserve their cash for acquisitions: "we were going to dial back the rate of share repurchases in view of M&A opportunities." Similarly, ARM Holdings, in its 2016 first quarter earnings call notes: "we're committed to having a net cash balance over the medium term and this reflects our commitment to maintaining the investment that's necessary for our roadmap…Given the expected rates of cash generation and the pipeline of opportunities that we can see today, I wouldn't expect us to resort to external financing market for any acquisitions in the near future."

Chen and Chen (2012), as a robustness check, control for cash in the investment regressions and then interpret the coefficient on operating cash flow as the investment-cash flow sensitivity. The discussion above suggests that this lead to mis-estimation of investment-cash flow sensitivity because firms view their total available cash for investments as the sum of cash and cash from operations. Thus to obtain the total available cash as perceived by firms, we need to add up these two sources rather than control for them separately in regressions.

II. Data

We start with all firms on *Compustat*. Our sample period is from 1967–2013. As with prior literature, we (i) include only firms incorporated in the United States that trade on either the NYSE, AMEX, or NASDAQ, (ii) exclude finance firms and utilities, (iii) exclude firms with book assets or sales less than one million dollars, and (iv) include only firms with data on all the variables needed to estimate *Total Investment*, *Total Funds*, and *q* (the proxy for growth opportunities). *q* is the ratio of market value of assets to the book value of assets. We winsorize all variables at the 1st and 99th percentiles at the yearly level to minimize the influence of outliers. We define our main variables below. We provide the corresponding *Compustat* pneumonics in the Appendix.

A. Investment

Our investment measure, *Total Investment,* is the sum of *Capex*, *R&D*, *SG&A*, *SubJV*, and *M&A*. We scale our investment by total assets (and not by the book value of property, plant, and equipment; Compustat item: *ppegt*). This is because our investments is more comprehensive than tangible capital and includes investment in *SubJV* and *M&A*, which add to total assets. Baker, Wurgler, and Stein also scale by total assets because their measure of investment includes intangible capital such as *R&D* and *SG&A*. We obtain *SubJV* and *M&A* from the cash flow statement. As in Coles, Daniel, and Naveen (2006), we treat missing *Capex* and missing *R&D* as zero. As in Eisfeldt and Papanikolaou (2013), we treat missing *SG&A* as zero. Finally, if firms do not have any cash investment in subsidiaries or do not use cash in M&A, these measures may have missing values, and as such, we treat missing values of *SubJV* and *M&A* as zero.

B. Internal Capital

In keeping with the literature, we define *OCF* as income before extraordinary items plus depreciation and amortization. *Available Cash* is the beginning-of-the-year value of cash and short-term investments taken from the balance sheet.

When we consider *Total Investment* as our measure of investment, we modify the cash flow measure by adding *R&D*×(1–T) + *SG&A*×(1–T) to *OCF*, where T is the effective tax rate in the prior fiscal year and is constrained to be between 0 and 1. This is because *OCF* is obtained after expensing *R&D* and *SG&A* in the income statement. We term this *Adj. OCF*, which is the cash flow available for making *Total Investment*. Studies that consider R&D-cash flow sensitivity do a similar adjustment to cash flow (see Himmelberg and Petersen, 1994; Brown et al., 2009). Finally, we add *Available Cash* to *Adj. OCF* to arrive at *Total Funds*, which is the total internal capital available to make *Total Investment*.

Does adding back *R&D* and *SG&A* to *OCF* induce a mechanical relation between investment and internal capital? The short answer is "No." Consider a simple firm with no depreciation (because it has no *Capex*) and Net Income = $60. Thus *OCF* = $60. Assume tax rate of 40%, which implies its Earnings before Tax = \$100. Assume its combined *R&D* and *SG&A* is \$50. Thus, the firm's Earnings before *R&D, SG&A*, and Tax = \$100 + \$50 = \$150. This is the pre-tax funds available for the firm but it has to pay 40% tax on this income, therefore, the after-tax availability of funds = 150 × (1–40%) = \$90. Several firms can all have the same \$90 in *Adj. OCF*, but if the growth opportunities are different for these firms, then the firm with greater investment opportunities may need to invest, say, \$150 in *R&D* and *SG&A* while the firm with lower investment opportunities may need to invest only \$50 (as in above example). Thus, there is no mechanical relation between investment and internal capital. Only when the internal capital is a binding constraint will the investment be a function of the availability of funds.[13]

III. Empirical Evidence Supporting our Innovations

In Section I, we provided the economic rationale for broadening the sample and the measures of investment and internal capital. We now provide data to assess whether the changes we propose are significant in empirical terms. We first examine, for the overall sample, the relative importance of manufacturing firms in the economy, the relative importance of *Capex* versus other types of investment, and the relative importance of *OCF* versus *Available Cash*. We then examine how this importance has changed over time.

A. Overall Averages

Table I provides the summary statistics. Our sample consists of 108,286 firm-year observations. We find that 42% of the firms are from the non-manufacturing sector. Thus, by

[13] For robustness, we ignore this adjustment and compute *Total Funds* = *OCF* + *Available Cash*. Our main results are robust to this measure (see Section VI).

excluding non-manufacturing firms, we are excluding a big part of the economy.

Consistent with prior literature, we scale all measures by lagged book value of assets. As can be seen from Table I, the average values of *Capex*, *R&D*, and *SG&A* are 7.9%, 4.2%, and 28.2% of assets respectively. The average cash investment in joint ventures and subsidiaries (*SubJV*) is 2.7% and cash used in M&A (*M&A*) is 2.6% of assets. *Capex* is still the largest in terms of magnitude after *SG&A*, but the average values of *R&D*, *SubJV*, and *M&A* are economically significant. Further, even if we exclude *SG&A*, the other three investment measures account for 9.5% of assets, which is still greater than *Capex* (= 7.9%). Thus, ignoring these additional components severely underestimates the true investment.

This problem of underestimation is more serious because the correlation between *Capex* and the various investment types is not positive (see Panel B of Table I). In fact, *Capex* has a significant negative correlation with all the other investment types (correlations range from –0.01 to –0.13). Overall, *Capex* has only a 21% correlation with *Total Investment.* If anything, it appears that *SG&A* and *R&D* are better proxies for total investment (relative to *Capex*) as they have higher correlations with *Total Investment* (76% and 27%).

In terms of internal capital, the typical measure of cash flow used in the literature, *OCF*, amounts to 8.2% of assets. *Available Cash* accounts for 15.6% of assets, almost twice the level of *OCF*. In terms of correlation (Panel C), we find that the correlation between *OCF* and *Available Cash* is very low (= –0.01), though it is statistically significant. *OCF* is correlated positively with *Total Funds* (correlation = 31%), but *Available Cash* appears to be a better proxy for internal capital (relative to *OCF*) as it has a higher correlation with *Total Funds* (correlation = 65%).

Overall, the numbers presented here suggest that using the broader definitions of investment and internal capital is important, not just theoretically and anecdotally, but empirically too.

B. Time Series

We present the data on the time-series graphically for the convenience of the reader. The data represent means from rolling 5-year averages. Thus, for the year 1971, the number represents the average over the 5-year period 1967–1971. We use rolling averages rather than annual values to smooth out any fluctuations in the data; also, in the regressions that follow, we use rolling 5-year periods.

B. 1. Declining Importance of Manufacturing Firms

Panel A of Figure 1 shows the time-series pattern in the proportion of manufacturing firms in our sample. We find that the proportion of manufacturing firms falls over time from 70% to 52%. By the early 2000s, manufacturing firms constitute only half the economy. In untabulated results, we find that this trend remains when we examine the proportion of manufacturing firms in terms of their market capitalization.

B.2. Declining Importance of Capital Expenditure

We next examine how the importance of the various types of investment has changed over time. From Panel B of Figure 1, we observe that *Capex* has decreased over time, from a peak of 10.8% in 1982 to 5.1% in 2013. Figure 2 graphs the time series patterns for various types of investment. We find that *R&D*, *SubJV*, and *M&A* have all increased (Panel A).[14] Taken together,

[14] Brown, Fazzari, and Petersen (2009) document an increase in *R&D* while Brown and Petersen (2009) have also documented a decrease in *Capex*.

these three components increased from 1.2% in 1971 to 12.7% in 2013 (Panel B). For the first 23 years (from 1971–1993), *Capex* is higher than *R&D*, *SubJV*, and *M&A* combined, but for the next 20 years (from 1994–2013), it is lower. Clearly, firms are substituting away from *Capex* into other forms of investment. Thus, the importance of *Capex* is declining, while the importance of other types of investment is increasing.

Panel C shows that the pattern in *SG&A* is similar to *Capex*; it increases from 1971 to 1981 (from 27% to 31%) and declines over the rest of the period (to 24%). While capex investment was cut in half from its peak level, the decline in SG&A is not as severe.

Overall, we find that *Total Investment* increased from 38% to 55% at the peak of the internet bubble (year 2000) and then gradually declined to 43% (Panel D). Taken together with the decline in *Capex*, it is evident that the relative importance of *Capex* has declined over time. The ratio of *Capex* to *Total Investment* declines from 28% to 18% (Panel E).

B.3. Declining Importance of Operating Cash Flow

We next examine how the measures of internal capital have changed over time. Panel C of Figure 1 shows the time-series pattern in *OCF*. It is clear that *OCF* has declined significantly over time, from 10.8% at the start of the sample to half the value (5.4%) at the end of the sample period.[15] Panel A of Figure 3 shows that, in contrast, *Available Cash* has increased over time from 8.4% to 21.2%. This trend is consistent with Bates, Kahle, and Stulz (2009). From 1985 onwards, *Available Cash* is higher than *OCF*.

Overall, *Total Funds* has increased steadily from about 35% to 50% (Panel B of Figure 3).

[15] Fama and French (2005) also document a sharp increase in negative-profitability firms, primarily due to the influx of Nasdaq firms.

Given the decline in *OCF* and the increase in *Total Funds*, it is not surprising that the relative importance of *OCF* as a proportion of internal capital has declined over time. The ratio of *OCF* to *Total Funds* falls from 58% to 39% (Panel C of Figure 3).

To sum up, the results in this section indicate that considering only manufacturing firms in the sample, using *Capex* as the only measure of investment, and using *OCF* as the only measure of internal capital could lead to misleading inferences. This is because manufacturing firms, *Capex*, and *OCF*, have declined in importance over time, while non-manufacturing firms, other types of investment such as *R&D*, *SG&A*, *SubJV*, and *M&A*, and other types of internal capital such as *Available Cash* have gained importance over time.

C. Difference between Manufacturing and Non-Manufacturing Firms

We next investigate whether the types of investment or the sources of internal capital differ across manufacturing and non-manufacturing firms. Table II presents the average values of the components of *Total Investment* (top panel) and *Total Funds* (bottom panel).

We find that the ratio of *Capex* to lagged assets for manufacturing firms is lower than the corresponding number for non-manufacturing firms (6.6% vs. 9.5%), and the difference is statistically significant at the 1% level. While these results appear surprising at first glance, they highlight what we mention earlier that non-manufacturing firms include firms that are capital intensive, such as firms in oil and gas exploration, in metal mining, coal mining etc.

The data indicate that even if we consider only *Capex* as the measure of investment, non-manufacturing firms should be included as they have significantly higher levels of *Capex*. In terms of *R&D*, we find that the pattern is reversed: manufacturing firms have higher *R&D* relative to non-manufacturing firms (5.7% vs. 2.2%). *SG&A* is similar for both types of firms (27.1% vs

29.6%). *SubJV* is roughly the same for both types of firms (2.9% vs. 2.6%), although the difference is statistically significant. Finally, manufacturing firms have lower *M&A* relative to non-manufacturing firms (2.3% vs. 3.1%, difference significant at 1%). Overall, we find that both manufacturing and non-manufacturing firms are similar in terms of *Total Investment*; for both types of firms, investment is between 45% and 48% of their lagged assets. This underscores more strongly the need to include non-manufacturing firms to get the true picture of investment-cash flow sensitivity.

In terms of the components of *Total Funds*, *we* find that *OCF* (scaled by lagged assets) is slightly lower for manufacturing firms relative to their non-manufacturing counterparts (7.6% vs. 8.9%, difference significant at 1%). For both manufacturing and non-manufacturing firms, however, *Available Cash* is much larger than *OCF* (16.0% vs. 7.6% for manufacturing; 14.9% vs. 8.9% for non-manufacturing). Interestingly, just as *Total Investment* scaled by assets is similar across manufacturing and non-manufacturing firms, *Total Funds* scaled by assets is also similar (46.7% vs. 45.9%).

Thus, manufacturing firms and non-manufacturing firms are not different in terms of the either their investment intensity or the availability of internal capital. However, the underlying components are different.

IV. Overall Investment-Cash Flow Sensitivity

Following Fazzari, Hubbard, and Petersen (1988), we estimate the investment-cash flow sensitivity as follows:

$$Investment_{i,t} = \beta_0 + \beta_1 Internal\ Capital_{i,t} + \beta_2 q_{i,t-1} + \alpha_i + \alpha_t + \varepsilon_{it} \quad (1)$$

where $Investment_{i,t}$ is the firm's investment, measured as either *Capex* (based on prior literature) or *Total Investment* (our measure), both scaled by lagged assets. $Internal\ Capital_{i,t}$ is the firm's availability of internal capital, measured as either *OCF* (based on prior literature) or *Total Funds* (our measure), both scaled by lagged assets. Firm and year fixed effects are denoted by α_i and α_t. $q_{i,t-1}$ is the beginning-period market-to-book ratio, a proxy for investment opportunities. β_1 measures the sensitivity of investment to cash-flow, and is the focus of our analysis. β_2 measures the sensitivity of investment to q.

Panel A of Table III presents correlations between the key dependent variables (*Capex*, *Total Investment*) and independent variables. In all cases, the correlation with *Total Investment* is greater than the corresponding one with *Capex*. The correlation of *Total Investment* with q is 0.36, which is more than 3 times the correlation of *Capex* with q (at 0.11), which provides some initial validation for our investment measure being more representative of the true investment that firms undertake. This univariate result is validated in the regression results below. The sensitivity of *Total Investment* to q (β_2) is about three times the sensitivity of *Capex* to q.

The correlation of *Total Investment* with *Adj. OCF* and *Available Cash*, the two sources of *Internal Capital*, are 0.67 and 0.25. In contrast, the correlation of *Capex* with *OCF* and *Available Cash*, the two sources of *Internal Capital*, are only 0.25 and -0.10. Overall, the correlation of *Total Investment* with *Internal Capital* is 0.64, while the correlation between *Capex* and *Internal Capital* is virtually zero at 0.02. These univariate results also manifest in multivariate regression results below: we find that the investment-cash flow sensitivity is much higher with *Total Investment* relative to *Capex*.

Panel B of Table III reports the regression results. The t-statistics are based on standard errors that are heteroskedasticity-consistent and clustered at the firm level. Panel A compares the results from prior literature with the results using all three innovations that we introduce. Panels B and C present the results for each in isolation.

Consistent with prior literature, for manufacturing firms, we find (in row 1) that *Capex* is sensitive to *OCF*. When we include non-manufacturing firms and broaden the definition of investment and internal capital, we find (in row 2) that *Total Investment* is highly sensitive to *Total Funds.* The investment-cash flow sensitivity is higher by 570% (0.523 vs 0.078), and (in untabulated results) this difference is statistically significant at the 1% level.

Panel B presents results where we introduce one innovation at a time. Our first change is to consider non-manufacturing firms. Row 3 presents results. We find that the sensitivity of *Capex* to *OCF* for non-manufacturing is 0.125, which is 60% higher than that for manufacturing firms (= 0.078, Row 1). The results point to the importance of including non-manufacturing firms in the sample. The sensitivity of *Capex* to *q* is comparable across the two samples (0.012 vs. 0.010).

In row 4, we use our more comprehensive definition of investment. Note that we replace *OCF* with *Adj. OCF* because *Total Investment* includes *R&D* and *SG&A* and the *OCF* has to be adjusted for these investments that are made through the income statement. Comparing rows 4 and 1, we find that the sensitivity increases by 740% from 0.078 to 0.658. The increase in sensitivity is because (i) *Capex* understates the true investment and (ii) at least one of the other components of investment (such as *R&D*, *SG&A*, *SubJV*, *M&A*) is sensitive to internal capital. Indeed, Brown et al. (2009) document that R&D is sensitive to *OCF*. Thus, broadening the definition of investment has a significant impact on estimated investment-cash flow sensitivity.

In row 5, we use our more comprehensive definition of internal capital. Since we hold the investment constant (at *Capex*), we simply add *Available Cash* to *OCF*. Comparing rows 5 and 1 reveals that the sensitivity decreases by 40% from 0.078 to 0.047. The decrease in sensitivity is because (i) *OCF* understates the true internal capital available, and (ii) investment is sensitive to cash holding. Thus, broadening the definition of internal capital affects the estimated investment-cash flow sensitivity, but not to the same extent as broadening the definition of investment.

Panel C reports results that help us understand the impact of broadening the definition of investment and internal capital using all firms. Row 6 sets the base case, which includes manufacturing and non-manufacturing firms, and applies the definition of investment and internal capital based on existing literature. As expected, the sensitivity is higher than that for manufacturing firms (Row 1) because non-manufacturing firms have a 60% higher sensitivity (as seen in Row 2). Row 7 reports the results where we change the definition of investment from *Capex* to *Total Investment.* As before, we have to change the definition of internal capital from *OCF* to *Adj. OCF* to account for the investments in *R&D* and *SG&A*. Comparing rows 7 and 6, we find that the sensitivity increases. The increase is 640%, which is similar to the 740% increase observed in Panel B.

Row 8 reports the results where we hold investment constant (= *Capex*) and therefore, change the definition of *Internal Capital* from *OCF* to *OCF* + *Available Cash.* Comparing rows 8 and 6, we find that the sensitivity decreases. The decrease is 35%, similar to the 40% decline observed in Panel B.

While the focus of our paper is not on the sensitivity of investment to *q*, we find it interesting that this sensitivity is nearly 200% higher (0.029 vs. 0.010; comparing rows 1 and 2) when we use *Total Investment* rather than *Capex*. This is consistent with the non-*Capex* components of investment also being sensitive to *q*. This result indicates that the non-*Capex* components of investment, on aggregate, are more important than *Capex*.

Finally, comparing rows 1 and 2, we find that R^2 increases substantially from 39% to 63%, which provides some indirect validation for our innovations. It appears that R^2 increases substantially because of non-manufacturing firms even when we use *Capex* and *OCF*: R^2 is 39% for manufacturing firms but is 54% for non-manufacturing firms (rows 1 and 3). This provides strong support for including non-manufacturing firms in any study of investment-cash flow sensitivity. Thus, including non-manufacturing firms increases R^2 from 39% to 50% (compare rows 6 and 1). When we broaden the definition of investment, R^2 increases further from 50% to 66% (compare rows 6 and 7), whereas when we broaden the definition of internal capital, there is no increase in R^2 (compare rows 6 and 8).

A. Decomposition of Investment Sensitivities into Individual Components

To understand the importance of any given component of total investment, we replace *Total Investment* as the dependent variable by each of the five components and estimate five separate regressions. Table IV reports the results. The coefficient on *Internal Capital* (i.e., the investment cash flow sensitivity) when *Capex*, *R&D*, *SG&A*, *SubJV*, and *M&A* is the dependent variable are 0.068, 0.033, 0.316, 0.008, and 0.064. All coefficients are statistically significant. The sum of the coefficients (= 0.489) is more or less equal to the coefficient obtained using *Total Investment* as the dependent variable (= 0.523). It is clear that the contribution of *Capex* to the overall sensitivity is quite small (=0.068/0.523 = 13%). *SG&A* has the highest sensitivity at 0.316 while *SubJV* has the lowest sensitivity. The high sensitivity of *SG&A* could reflect the fact that firms prefer to cut operating expenses first to bring it in alignment with reduced cash flows.

We find that the sensitivity of *Capex*, *R&D*, *SG&A*, *SubJV*, and *M&A* to *q* are 0.009, 0.006, 0.004, 0.006, and 0.001. All coefficients are statistically significant, which validates the importance of all the additional investment components that we propose. The sum of the coefficients (= 0.026) is more or less equal to the coefficient obtained using *Total Investment* as the dependent variable (= 0.029). While the *Capex*-q sensitivity is the highest at 0.009, R&D *and SubJV* also have relatively high sensitivities to *q* at 0.006. *M&A* has the lowest sensitivity at 0.001. This could be due to some firms undertaking M&A not necessarily to capitalize on growth opportunities but to capitalize on overvalued equity.

B. Decomposition of Internal Capital into Individual Components

Earlier, we argued that it is important to add up all sources of internal capital into one piece. In this section, we provide empirical evidence on the magnitude of the mismeasurement in investment cash flow sensitivity when we do not aggregate all sources of internal capital.

Table V presents the key regression results. Rows 1–3 report regression results with *Capex* as the dependent variable while rows 4–6 report regression results with *Total Investment* as the dependent variable. As can be seen, 4 of the 6 results are carried over from Table III. Comparing rows 1 and 2, we find that including *Available Cash* does not impact the coefficient on *OCF*. This has led prior papers to conclude that the investment-cash flow sensitivity is unaffected even after controlling for cash holdings. But that is a wrong interpretation because internal capital includes both cash flows and cash holdings. Row 3 results suggest that the coefficient on *Internal Capital* is much lower than the coefficient on cash flows; the investment-cash flow sensitivity drops by 35% from 0.097 to 0.063.

We find similar patterns with *Total Investment* as the dependent variable. Adding in *Available Cash* as an additional regressor hardly alters the coefficient on *Adj. OCF* (increases from 0.715 to 0.719). However, the coefficient on *Internal Capital*, which is the true investment-cash flow sensitivity is lower by 27% (at 0.523).

The reason that the investment cash flow sensitivity is lower than prior literature is because the sensitivity of investment to cash holding is much lower than the sensitivity of investment to cash flow. The corresponding numbers are 0.020 and 0.097 for *Capex* and 0.105 and 0.719 for *Total Investment*. Thus, the sensitivity of investment to internal capital will lie in between the two sensitivities (to cash flow and cash holdings), and it turns out to be 0.063 and 0.523. Thus, the reason we find lower sensitivity of investment compared to prior literature is because the sensitivity of investment to cash holdings is much lower than the sensitivity of investment to cash flows.

V. Time Series Trend in Investment-Cash Flow Sensitivity

Recent studies document a decline in the sensitivity of *Capex* to *OCF* (Allayanis and Mozumdar, 2004; Brown et al., 2009; Chen and Chen, 2012). We start, therefore, by reproducing this declining trend. We then examine the effect of broadening the sample as well as the measures of investment and internal capital.

Panel A of Figure 4 shows the trend in investment-cash flow sensitivity using *Capex* and *OCF*. In other words, Panel A illustrates the time trend in the results shown in row 1 of Table III. Panel B of Figure 4 shows the trend in investment-cash flow sensitivity using *Total Investment* and *Total Funds* respectively. In other words, Panel B illustrates the time trend in the results shown in row 2 of Table III. We use rolling five-year regressions to estimate the investment cash-flow sensitivity for a given year. Given that our data starts in 1967, the first sensitivity we can estimate is for 1971, which we estimate using data from 1967–1971. Our figure thus shows estimates from 1971 to 2013.

Consistent with the literature, Panel A of Figure 4 indicates that, for manufacturing firms (solid line), there is a decline in investment-cash flow sensitivity using *Capex* and *OCF*. For the last 20 years or so, the sensitivity is low and is below 0.1. This trend is evident for non-manufacturing firms also (dotted line). The sensitivity for non-manufacturing firms is usually higher than that for manufacturing firms. This is consistent with the results from Table III, which showed that non-manufacturing firms, on average, have 60% higher sensitivity. We find that in the last 22 years (since 1991), the difference in investment-cash flow sensitivity between manufacturing and non-manufacturing firms has narrowed.

Panel B reports the results when we use *Total Investment* and *Total Funds* as our measure of investment and internal capital. Similar to what we observed in Panel A, we find that the sensitivity of *Total Investment* to *Total Funds* also shows a decline over time for both manufacturing firms (solid line) and non-manufacturing firms (dotted line). As before, the sensitivities for non-manufacturing firms are usually higher. There is an important difference, however, from Panel A. The rate of decline is smaller (note the Y-axis scale is different across Panels A and B). Importantly, the sensitivity remains statistically and economically significant. Even in the recent years, sensitivity is between 0.3 and 0.5.

Given that manufacturing and non-manufacturing firms follow the same trend, we hereafter combine both into one sample. Panel C plots the sensitivity of *Capex* to *OCF* (prior literature) and the sensitivity of *Total Investment* to *Total Funds* (our estimate). It is clear that the sensitivity of *Total Investment* to *Total Funds* is much higher than the sensitivity of *Capex* to *OCF*. Both show a decline but the sensitivity of *Total Investment* to *Total Funds* even in the most recent period is above 0.3.

Overall, the results indicate that, when appropriate measures of investment and internal capital are considered, investment-cash flow sensitivity declines over time, but remains economically and statistically significant. In untabulated results, we find that, for most years in the sample, the sensitivities calculated using *Total Investment* and *Total Funds* are about 3 times higher than that calculated using *Capex* and *OCF*.

VI. Robustness: Alternative Definitions of Investment, Internal Capital, and *q*

Our main results relate to the overall investment cash flow sensitivity and the time-trends in investment-cash flow sensitivity. In this section, we show that our results are qualitatively similar when we use various alternative definitions of investment, internal capital, and *q*.

A. Overall Investment Cash-Flow Sensitivity: Robustness

In this subsection, we examine the robustness of our results as they relate to overall investment-cash flow sensitivity. Row 1 of Table VI presents our baseline results (reproduced from row 2 of Table III)

A.1 Inclusion of Deal Value of M&A

Our baseline measure of investment includes only the cash portion of the M&A. The idea is that the cash used to finance M&A is free of information asymmetry problems. One could argue, however, that the entire value of the acquisition is the correct measure of investment from the firm's point of view. This is because the value of assets purchased equal deal value. We, therefore, include the deal value of the M&A as part of the investment. Specifically, *Total Investment = Capex + R&D + SubJV + Deal Value of M&A.* Row 2 of Table VI presents the results. Given that investment is higher than the base case, as expected, the sensitivity of investment to *q* is larger (0.066 versus 0.029 for our baseline). The investment-cash flow sensitivity is 0.531, which is also higher than our baseline result of 0.523, though very similar in economic terms. The number of observations is smaller in this case because we obtain the deal value of the M&A from SDC, which is available only from 1982.

A. 2. Inclusion of Equity Compensation to Employees in Total Funds

The investment cash flow literature uses cash from operations as the source of cash flow based on the idea that this source is least affected by information asymmetry issues. Fama and French (2005) however, argue that there are two sources of equity characterized by much lower information asymmetry problems and transactions costs (relative to other sources such as SEOs, convertible bonds etc.). The first of these two is equity compensation to employees. Murphy (2012) notes that "options were particularly attractive in cash-poor start-ups (such as in the emerging new economy firms in the early 1990s), which could compensate employees through options without spending any cash." By using equity compensation to attract and retain highly skilled employees, firms reduce their reliance on cash compensation and thus overcome financial constraints imposed by their cash flows.[16] Indeed, Fama and French (2005) find that the value of

[16] For example, Amazon, in its 1st quarter 10Q in 2015 states "operating expenses without stock-based compensation have limitations due to the fact that they do not include all expenses primarily related to our workforce. More

stock issued to employees is significantly larger than the value of stock issued through SEOs and private placements. Stock options can also be a significant source of cash when employees exercise these options.[17] Babenko, Lemmon, and Tserlukevich (2011) find that these cash inflows can substitute for costly external finance. Specifically, they document that firms increase investment by $0.34 for every additional dollar received from employee stock option exercise, and this sensitivity is even higher in firms that face more costly external financing.

Following this literature, we broaden our measure of internal capital to include the value of equity compensation issued to employees. Specifically, *Total Investment* is the same as our baseline measure and *Total Funds* = *OCF* + *R&D* (1–T) + *SG&A* (1–T) + *Available Cash* + *Equity To Empl*, where *Equity_Empl* is the value of equity compensation—both options and stock—granted to all employees, not just the top 5 employees.

We estimate the approximate value of *Equity To Empl* using data available on *Execucomp*. *Execucomp* covers the firms in the S&P 1500, which account for about 90% of the market capitalization of all listed firms. *Execucomp* provides compensation data from 1992 for the named executive officers (NEOs) of the firm, who are typically the top five highest paid executives. SEC changed compensation disclosure guidelines starting in fiscal 2006, and FASB introduced a rule change in 2005 (FAS 123R) that required firms to expense stock option grants. This changed how firms reported their compensation from 2006 onwards. We therefore restrict our analysis of *Equity To Empl* to the period 1992–2005.

specifically, if we did not pay out a portion of our compensation in the form of stock-based compensation, our cash salary expense ...would be higher." Similarly, VMware, a software firm, notes in its 10Q in 2015: "if VMware did not pay out a portion of its compensation in the form of stock-based compensation... the cash salary expense included in operating expenses would be higher, which would affect VMware's cash position."

[17] For example, Salesforce.com, a leading cloud software firm, received $309 million (for the fiscal year ended Jan 2015) from employees exercising options, which was greater than its *OCF* of $185 million.

We first estimate the value of option grants to all employees. Following Call, Kedia, and Rajgopal (2016), for each firm-year-NEO-tranche, we estimate the total number of options issued by the firm for that year as *NUMSECUR* (number of options awarded to an NEO in a tranche) divided by *PCTTOTOPT* (the fraction of the firm's total stock option grants awarded to that executive in that tranche). For example, for a given executive, *if NUMSECUR* is 10,000 and *PCTTOTOPT* is 0.05, that means that the total awards at the firm level was 200,000 (=10,000/0.05). This estimate should be the same for each tranche, but is not. We drop firm-years where the total number of options estimated using each tranche is not within 3% of each other.

To estimate the value of options granted to all employees, we use the (i) the total number of options granted to all employees (estimated from previous step), (ii) total number of options granted to the NEOs, which is the sum across all tranches across all NEOs (given by Execucomp), and (iii) the total value of all options granted to the NEOs, which is the sum across all tranches across all NEOs (given by Execucomp). For example, if the total number of options granted to all employees is 200,000, the total number of options granted to all NEOs in a given year is 100,000, and the total value of options granted to the NEOs is $25 million, then the value of options granted to all employees = 25*200,000/100,000 = $50 million. Clearly, this is not a precise estimate for several reasons, but we believe that there this is no systematic bias.

We next aggregate the value of all restricted stock grants across all NEOs each year to get the total stock grant value. We do not have data on how much stock was issued to all employees as a whole and there is no way to estimate it even if it is imprecise. Our measure therefore understates the restricted stock grant issued at the firm level. *Equity To Empl* is the sum of the option value and restricted stock value as computed above.

Row 3 presents the results. The sample is much smaller because we are limited to a smaller sample of firms (S&P 1500) for fewer years (1992–2005), as explained earlier. The results, however, are qualitatively very similar to our baseline results. Given that internal capital is higher than the base case, the investment-cash flow sensitivity is lower at 0.501 (relative to 0.523 in the baseline).

A.3. Inclusion of Equity Portion of M&A in Total Funds

Fama and French (2005) also suggest that equity issued by the acquirer, as part of stock-financed mergers, is a potential source of funds for firms that are less vulnerable to information asymmetry problems. This is because most mergers are friendly and are typically negotiated between informed parties. Moreover, target shareholders often have investment advisors to advise them. Information asymmetry will be even lower if the bidder and target are in the same industry or supply chain.

Based on this notion, we include equity issued to target shareholders as part of stock-financed acquisitions as a source of internal capital. Specifically, *Internal Capital = OCF + R&D (1–T) + SG&A (1–T) + Available Cash + Equity Issued in M&A*, where *Equity Issued in M&A* is the value of equity issued to the target shareholders as part of the M&A transaction. Broadening the definition of internal capital also necessitates broadening the definition of investment to replace cash used in M&A with the total deal value of M&A, and is given by: *Total Investment = Capex + R&D + SG&A + SubJV + Deal Value of M&A.*

Row 4 of Table VI presents the results. The investment-cash flow sensitivity is now much higher than the baseline (= 0.817 versus 0.523), while the investment-*q* sensitivity and R^2 are about the same as the baseline (= 0.031 and 0.64 versus 0.029 and 0.63 for the baseline). As with row 2, the number of observations is slightly smaller because we need data from SDC.

A.4. Adjusting for Tax Deductibility of R&D and SG&A

In our baseline results, the definition of *Total Investment = Capex + R&D + SG&A + SubJV + M&A.* It is possible, however, that because *R&D* and *SG&A* are tax-deductible expenditures, firms only consider the post-tax values of these as their investment. We do not think this is correct logic because *Capex* is also eligible for 100% tax deductibility, but over the life of the project through annual depreciation. Nevertheless, to account for this, we define *Total Investment = Capex + R&D* (1–T) + *SG&A* (1–T) + *SubJV + M&A.* The measure of *Internal Capital* is the same as that used in the baseline. Row 5 of Table IV presents the results. The investment-cash flow sensitivity, as expected, is lower than the baseline (= 0.512 versus 0.523).

A.5. Excluding SG&A From Total Investment

As mentioned earlier, SG&A while including many investments in organizational capital also includes expenses such as wages to employees, administration expenses etc., which are period costs. Ideally, we would like to include only the long-term investment part of SG&A, but the data do not allow us to do so. We, therefore, examine whether our inferences change when we completely exclude SG&A from the definition of investment. Specifically, *Total Investment = Capex + R&D + SubJV + M&A* and *Internal Capital = OCF+ R&D* (1–T) + *Available Cash.* Row 6 of Table VI presents the results. As expected, the investment-cash flow sensitivity is now lower at 0.208. While this is smaller in magnitude compared to our baseline result, it is still 167% bigger than the sensitivity obtained using the definition from prior literature (= 0.078, see Row 1 of Table III). The coefficient on *q* is similar to the baseline result, and the overall R^2 is much smaller when we exclude SG&A from the investment measure (=0.43 compared to 0.63 in the baseline).

VII. Conclusions

Fazzari, Hubbard, and Petersen (1988) theorize that in the presence of costly external financing, a firm's investments will be sensitive to the availability of its internal capital. This is because internal capital are not vulnerable to information asymmetry problems and, therefore, less costly compared to external funds. Following their study, a large and rich literature has emerged in this area. Typically, studies in this area examine a sample of manufacturing firms, use capital expenditure as a measure of a firm's investment, and use operating cash flow as a measure of a firm's internal capital. Several trends in the population of U.S. firms, however, suggests that the literature needs to reconsider, and broaden, both the sample as well as the measures used.

First, the proportion of non-manufacturing firms has increased significantly, from 32% to 49%. Additionally, non-manufacturing firms, on average, have capital expenditures that are significantly higher than the capital expenditures of manufacturing firms. Second, the importance of capital expenditure as an investment type has declined, while R&D and SG&A has gained prominence over time because firms have become more human-capital intensive (and investments in human capital take the form of R&D and SG&A). Moreover, cash investment in subsidiaries and joint ventures and cash investment in mergers and acquisitions have also increased over time. Thus, we broaden the definition of investments to include these four additional investments.

Finally, the importance of operating cash flow as a source of internal capital has declined while that of cash holdings has increased significantly over time. Cash held at the beginning of the year, similar to operating cash flow, is free from asymmetric information problems. It can, therefore, substitute as a source of internal capital for firms in keeping with the premise of Fazzari et al. (1988).

Our contribution in this study is to document that when we use the broader sample and economically more relevant measures of investment and cash flow, we find that investment is highly sensitive to cash flow. Indeed, the investment-cash flow sensitivity is 570% higher than that obtained using definitions based on prior literature—and this higher sensitivity is primarily due to the broadening of the definition of investment. Further, while the investment-cash flow sensitivity has declined over time, the decline is modest and, importantly, the sensitivity is still economically and statistically meaningful.

In addition to contributing to the investment-cash flow sensitivity literature, our study has implications for papers that use capital expenditure as a measure of investment to analyze overinvestment or those that use free cash flow (= operating cash flow less capital expenditures) as a proxy for agency problems. The inferences of these studies may be quite different if broader measures of investment or internal capital are used.

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Appendix

Variable definitions are from Compustat unless otherwise stated.

Variable	Definition	Mnemonic
Assets	Total Assets	at
q	(Assets – Book equity + Market equity) / Assets	(at – ceq + prcc_f×csho) / at
Investment		
Capex	Capital Expenditure	capx
Lease	Operating Lease	xrent×10
R&D	Research and Development Expense	xrd
SG&A[18]	Selling, General and Administrative Expense	xsga – xrd if xrd ≥ 0 xsga if xrd not reported
SubJV[19]	Cash investments in unconsolidated subsidiaries and joint ventures, from Statement of Cash Flow	ivch
M&A	Cash used to finance mergers and acquisitions, from Statement of Cash Flow	aqc
Total Investment	CAPEX + R&D + SG&A + SubJV + M&A	
Internal Capital		
OCF	Income before Extraordinary Items + Depreciation & Amortization	(ib + dp)
Available Cash	Beginning of period cash holdings	lagged che
Adj. OCF	OCF + R&D×(1–T) + SG&A×(1–T)	
Total Funds	Adj. OCF + Available Cash	

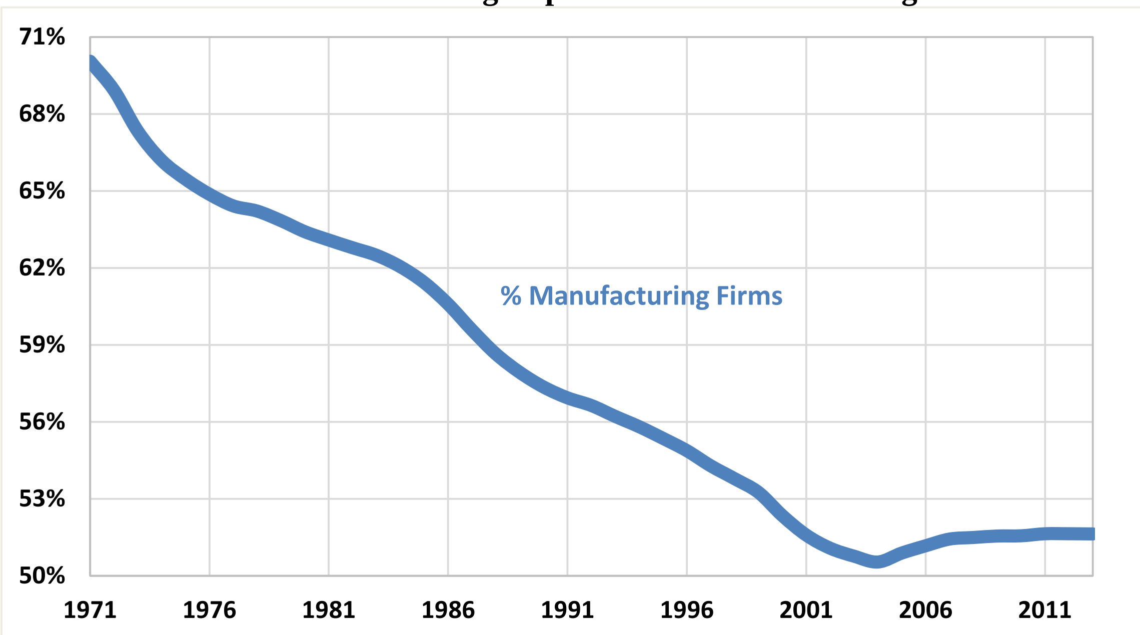
[18] R&D is included in SG&A by *Compustat* as long as the firm reports R&D separately. If the firm reports R&D as part of COGS, then *Compustat* does not add R&D to SG&A. See *Compustat* explanation for xsga for more details.

[19] To the extent that the *Compustat* item that we use to measure *SubJV* ("IVCH"), includes "Sale of property held for sale when included as an investment on the Balance Sheet" we estimate *SubJV* with error.

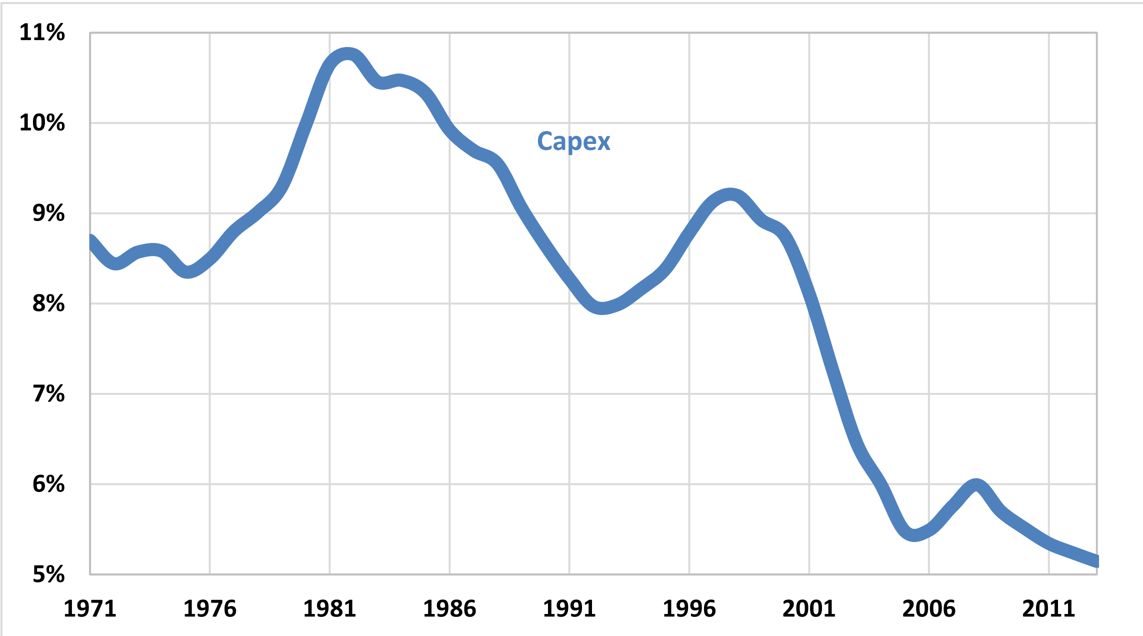
Figure 1
Declining Trend in Key Variables in Investment-Cash Flow Sensitivity

The figure plots the rolling 5-year average of the proportion of manufacturing firms in the sample (Panel A), *Capex* scaled by lagged assets (Panel B), and *OCF* scaled by lagged assets (Panel C). For example, for 1971, the number represents the pooled average for firm-years in the 1967-1971 period. Manufacturing firms are firms with a 2-digit SIC code ranging from 20 to 39.

Panel A: Declining Importance of Manufacturing Firms



Panel B: Declining Capex



Panel C: Declining OCF

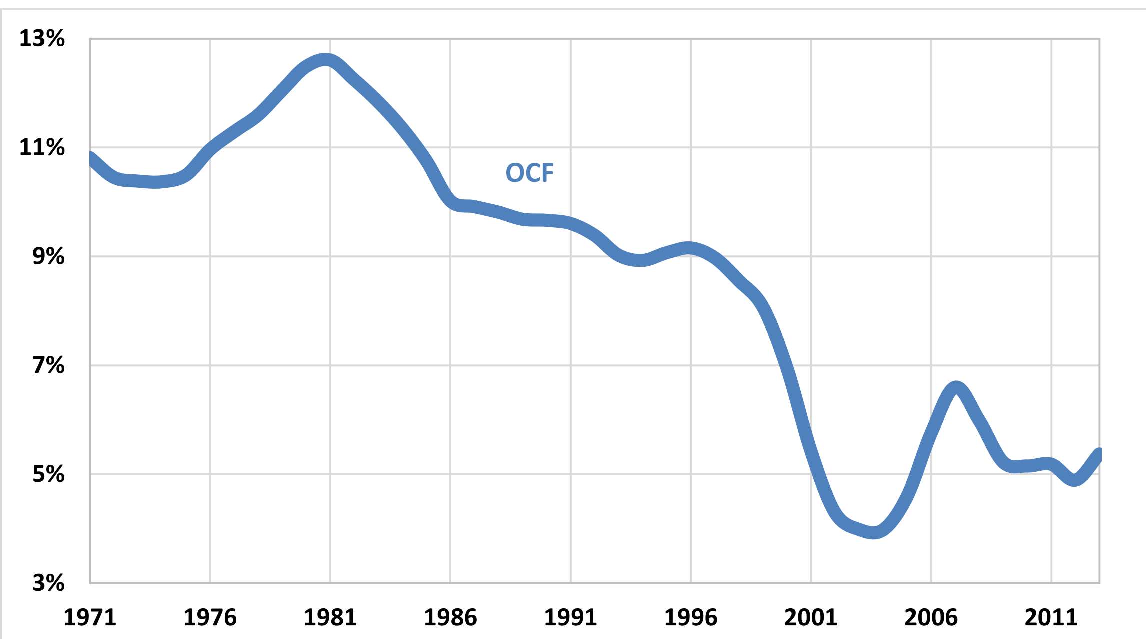
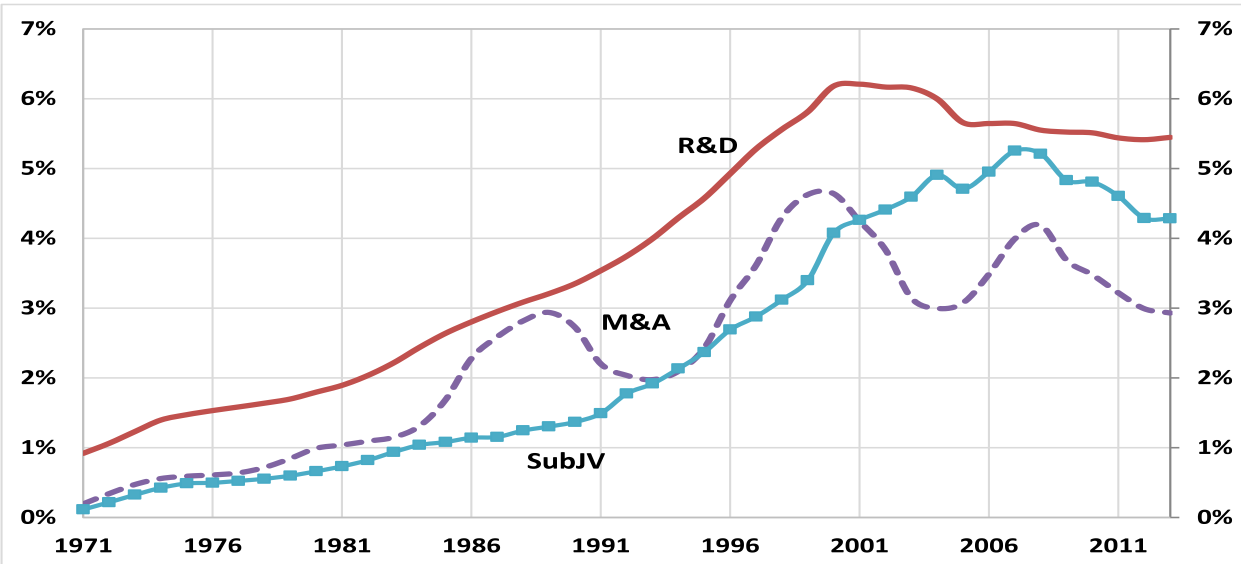


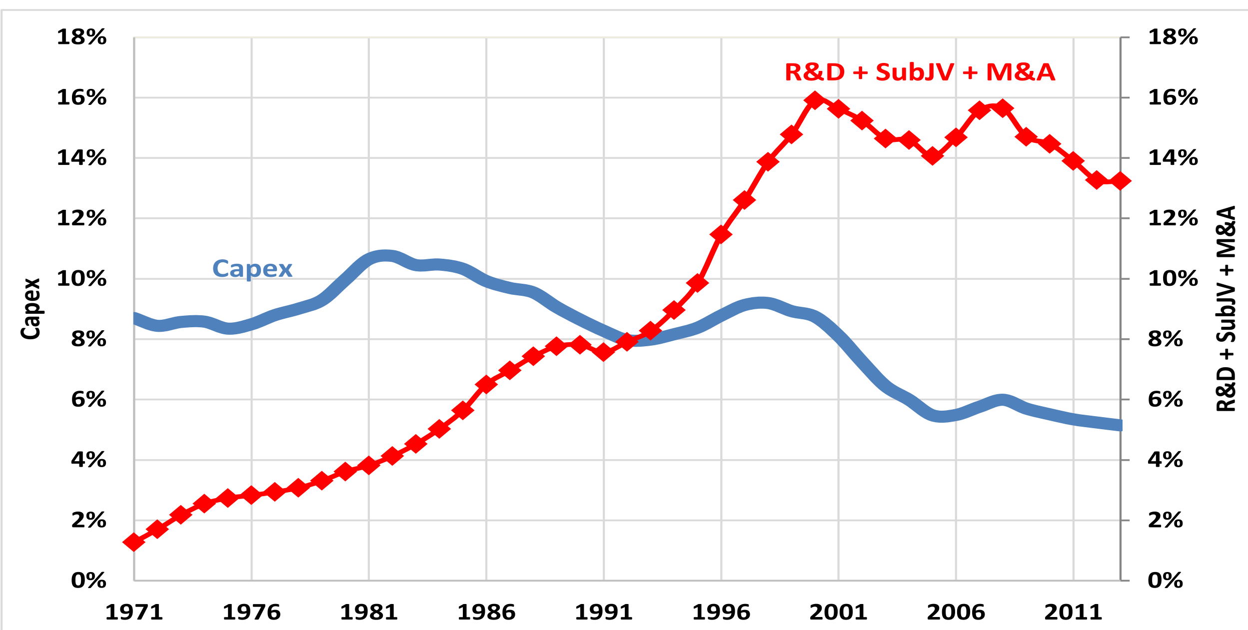
Figure 2
Importance of Various Types of Investment

Panels A to D plots the rolling 5-year average of various types of investment, all scaled by lagged assets. For example, for 1971, the number represents the pooled average of the investment measure of all the firms that exist in the 1967-1971 period. Panel E plots the rolling 5-year average of the ratio of *Capex* to *Total Investment*.

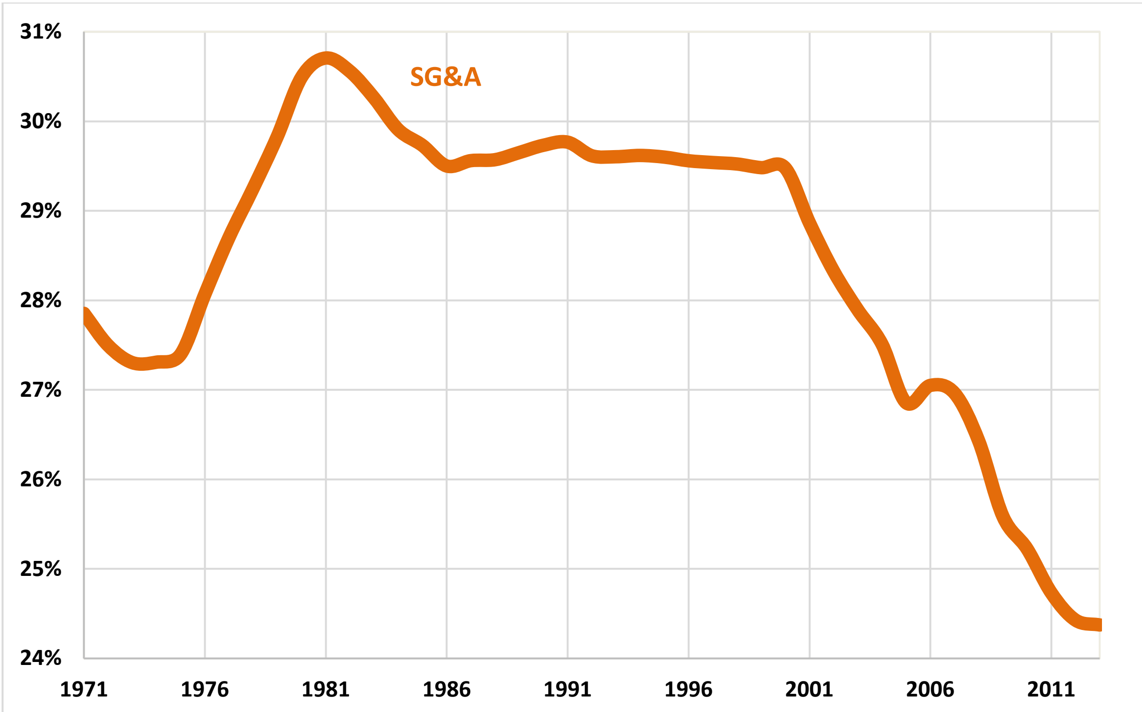
Panel A: Increasing Non-Capex Investments



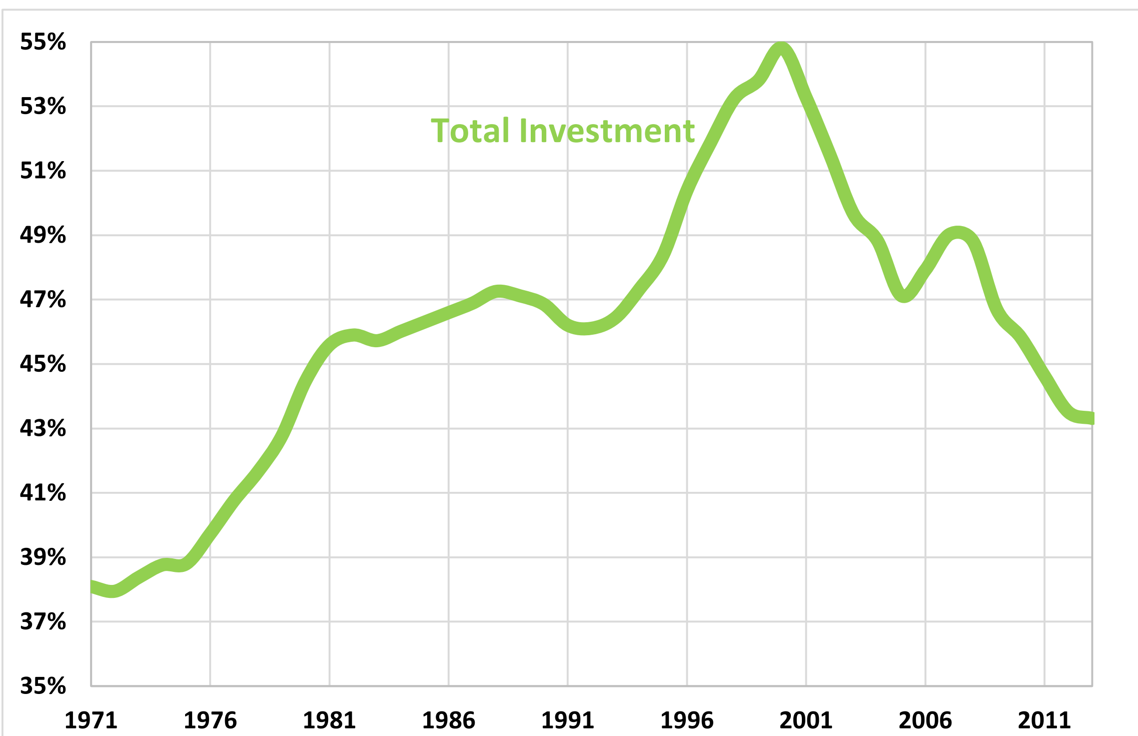
Panel B: Declining Capex vs. Increasing Non-Capex Investments



Panel C: Large and Declining SG&A



Panel D: Total Investment



Panel E: Declining Importance of Capex

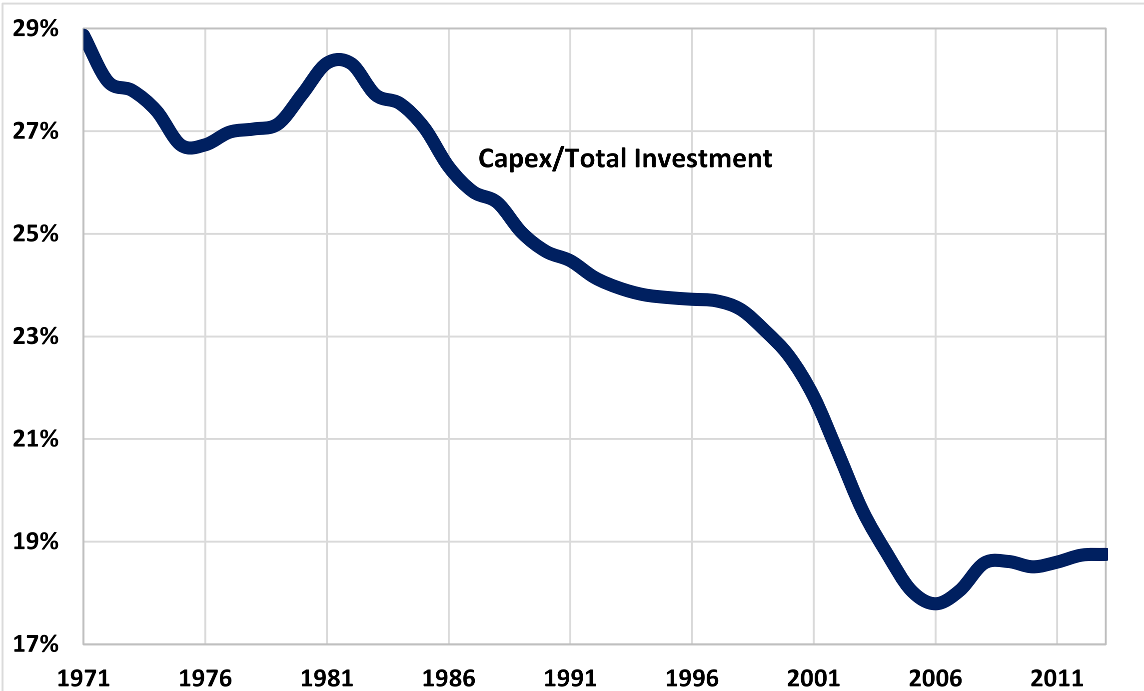
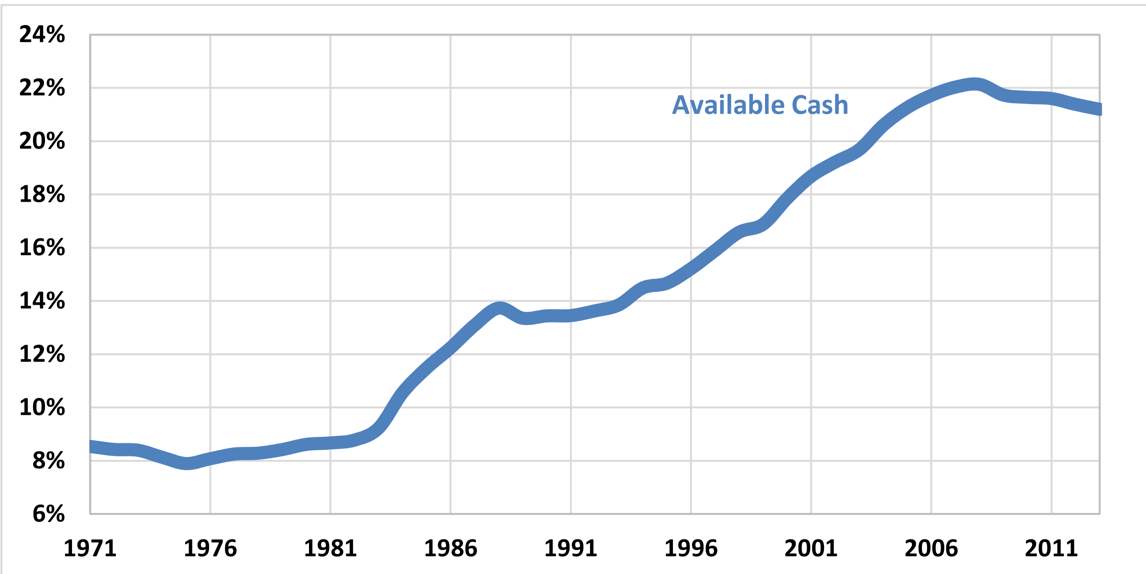


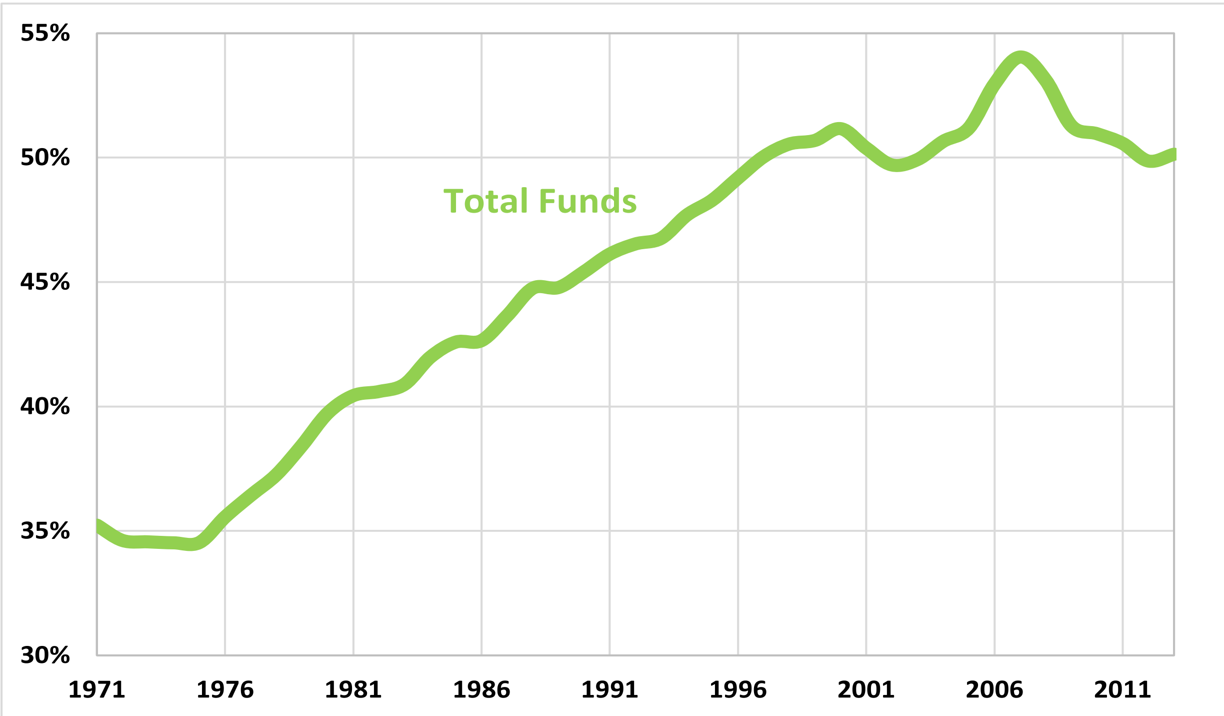
Figure 3
Importance of Various Sources of Internal Capital

Panels A and B plots the rolling 5-year average of *Available Cash* and *Total Funds*, both scaled by lagged assets. *Available Cash* = *Lagged Cash Holdings*. *Total Funds* = *OCF* + *R&D* (1–T) + *SG&A* (1–T) + *Available Cash*. For example, for 1971, the number represents the pooled average of the measure of internal capital of all the firms that exist in the 1967-1971 period. Panel C plots the rolling 5-year average of the ratio of *OCF* to *Total Funds*.

Panel A: Increasing Available Cash



Panel B: Increasing Total Funds



Panel C: Declining Importance of OCF

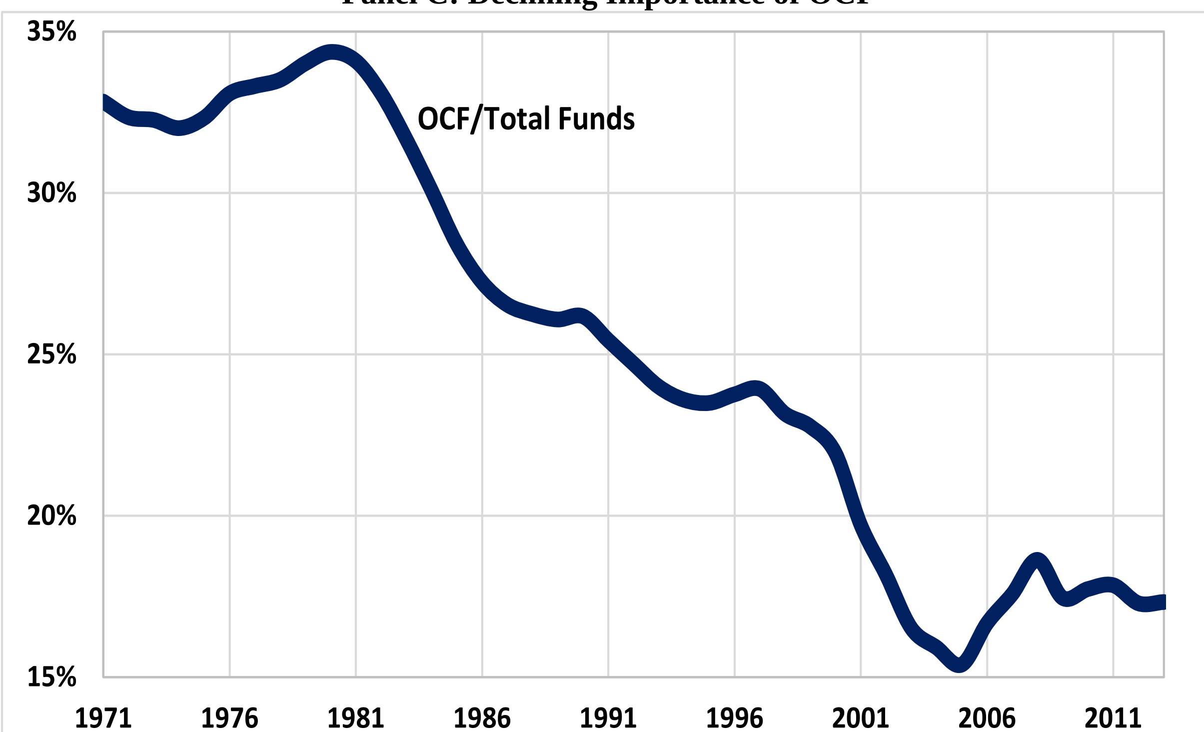


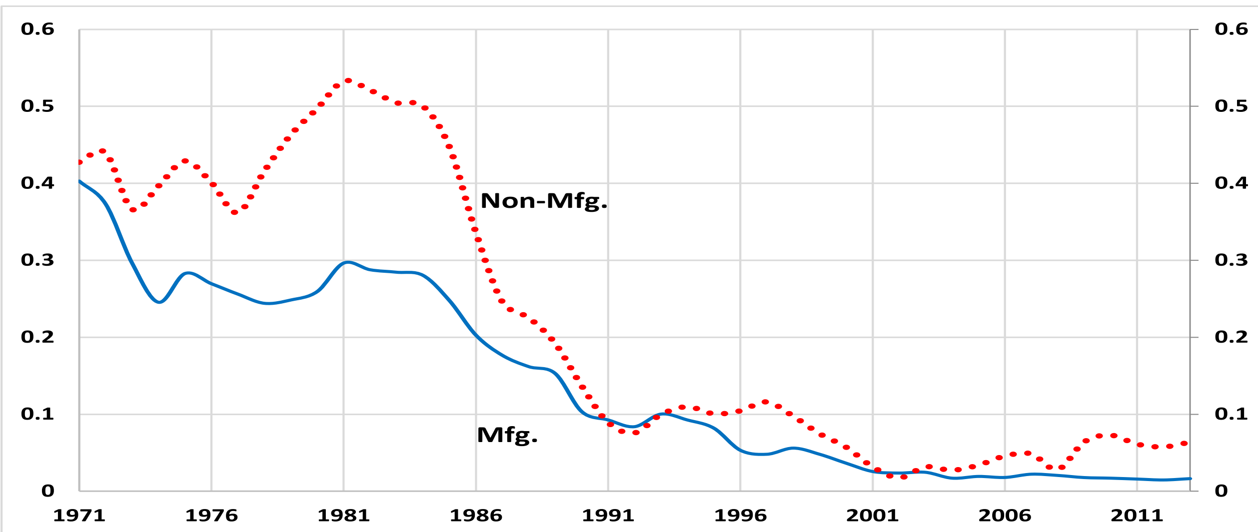
Figure 4
Trend in Investment-Cash Flow Sensitivity

The figures plot the investment-cash flow sensitivity (β_1) from rolling 5-year regressions of

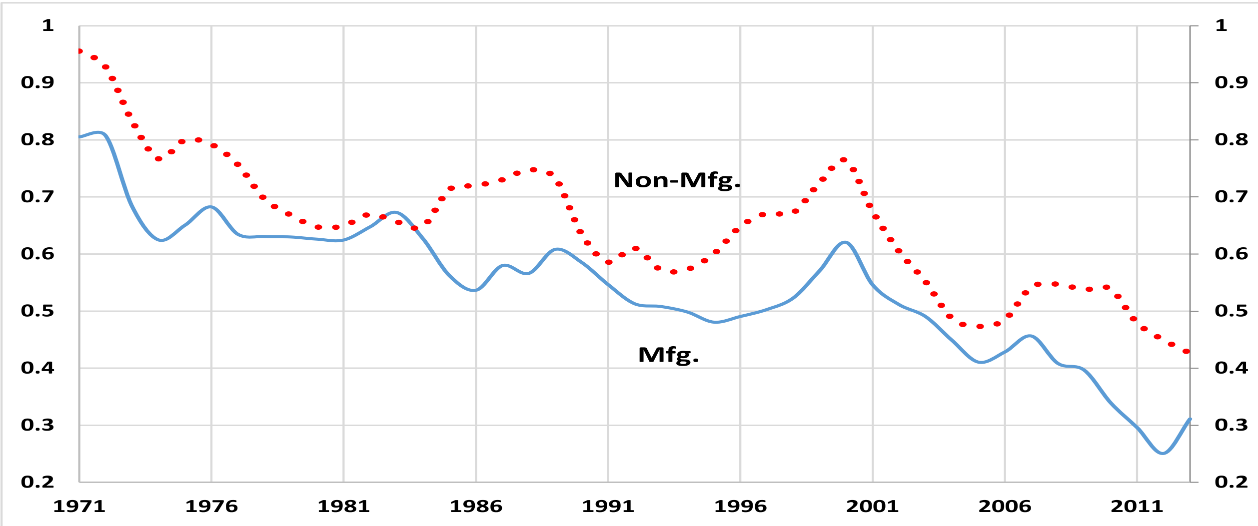
$$Investment_{i,t} = \beta_0 + \beta_1 Internal\ Capital_{i,t} + \beta_2\, q_{i,t-1} + \alpha_i + \alpha_t + \varepsilon_{it}.$$

For example, for 1971, the number represents the sensitivity from pooled regression using firms that existed in the 1967-1971 period. α_i and α_t denote firm and year fixed effects. $q_{i,t-1}$ is the beginning period market to book ratio. In Panel A, as per prior literature, *Investment* = *Capex* and *Internal Capital* = *OCF*. In Panel B, *Investment* = *Total Investment* and *Internal Capital* = *Total Funds*. Panels A and B plots the graphs separately for manufacturing and non-manufacturing firms. Given that the trend is similar for both manufacturing and non-manufacturing firms, Panel C plots both the sensitivities for all firms. *Total Investment* = *Capex* + *R&D* + *SG&A* + *SubJV* + *M&A*. *Total Funds* = *OCF* + *R&D* (1–T) + *SG&A* (1–T) + *Available Cash*, where *Available Cash* = Lagged Cash Holdings.

Panel A: Capex–OCF Sensitivity



Panel B: Total Investment–Total Funds Sensitivity



Panel C: Comparison of Capex–OCF Sensitivity and Total Investment–Total Funds Sensitivity

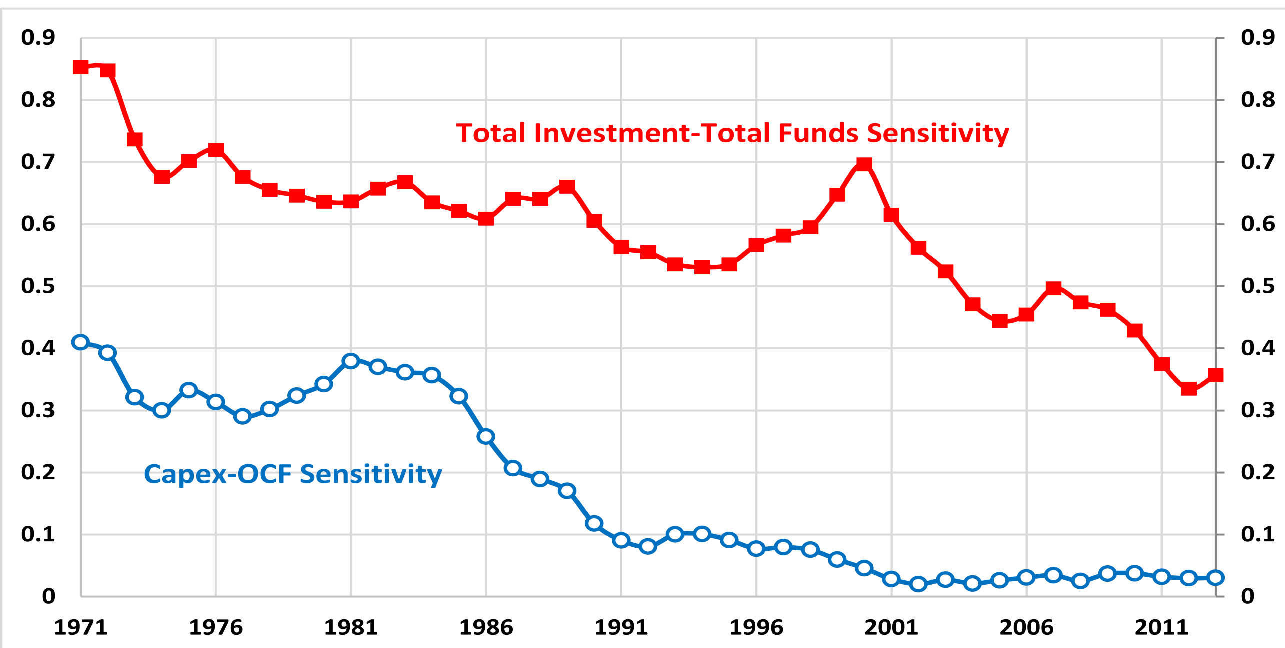


Table I
Summary Statistics

This table reports the summary statistics for the period 1967 to 2013. Total number of observations is 108,286. Assets are in \$ Millions. *Total Investment* = *Capex* + *R&D* + *SG&A* + *SubJV* + *M&A*. *OCF* = Earnings before Extraordinary Items + Depreciation & Amortization. *Adj. OCF* = *OCF* + *R&D* (1–T) + *SG&A* (1–T). *Available Cash* = *Lagged Cash Holdings*. *Total Funds* = *Adj. OCF* + *Available Cash*. We scale all measures by lagged assets. Table A1 provides all variable definitions. Panels B and C provide Spearman correlations. ***, **, and * represent significance at 1%, 5%, and 10% levels of significance.

Panel A: Descriptive Statistics

Variable	Mean	Median	Std. Dev.
Assets	1514.0	172.5	5302.8
q	1.8	1.3	1.3
% of Non-Manufacturing Firms	42%		
Investment			
Capex	7.9%	5.2%	8.8%
R&D	4.2%	0.0%	8.5%
SG&A	28.2%	22.5%	24.5%
SubJV	2.7%	0.0%	11.9%
M&A	2.6%	0.0%	8.8%
Total Investment	46.7%	38.6%	34.4%
Internal Capital			
OCF	8.2%	9.9%	14.9%
Adj. OCF	30.8%	26.8%	22.4%
Available Cash	15.6%	7.7%	18.9%
Total Funds	46.4%	38.8%	30.7%

Panel B: Correlations between Investment Measures

	Capex	R&D	SG&A	SubJV	M&A	Total Investment
Capex	1.00					
R&D	-0.13^{***}	1.00				
SG&A	-0.01^{***}	0.11^{***}	1.00			
SubJV	-0.02^{***}	0.06^{***}	-0.14^{***}	1.00		
M&A	-0.03^{***}	-0.02^{***}	0.003	0.07^{***}	1.00	
Total Investment	0.21^{***}	0.27^{***}	0.76^{***}	0.06^{***}	0.13^{***}	1.00

Panel C: Correlations between Internal Capital Measures

	OCF	Opening Cash	Adj. OCF	Total Funds
OCF	1.00			
Available Cash	-0.01^{***}	1.00		
Adj. OCF	0.52^{***}	0.15^{***}	1.00	
Total Funds	0.31^{***}	0.65^{***}	0.73^{***}	1.00

Table II

Investment and Internal Capital: Manufacturing vs. Non-Manufacturing

This table reports the means of the components of investment and internal capital for manufacturing and non-manufacturing firms. The data are from 1967–2013. *Total Investment* = *Capex* + *R&D* + *SG&A* + *SubJV* + *M&A*. *OCF* = Earnings before Extraordinary Items + Depreciation & Amortization. *Available Cash* = *Lagged Cash Holdings*. *Adj. OCF* = *OCF* + *R&D* (1–T) + *SG&A* (1–T). *Total Funds* = *Adj. OCF* + *Available Cash*. We scale all measures by lagged assets. Table A1 provides all variable definitions. *, **, and *** indicate that the mean for the non-manufacturing firms is significantly different from that for manufacturing firms at the 10%, 5%, and 1% significance levels.

	Manufacturing	**Non-Manufacturing**
Investment		
Capex	6.6%	9.5%***
R&D	5.7%	2.2%***
SG&A	27.1%	29.6%***
SubJV	2.9%	2.6%***
M&A	2.3%	3.1%***
Total Investment	45.5%	48.3%***
Internal Capital		
OCF	7.6%	8.9%***
Available Cash	16.0%	14.9%***
Adj. OCF	30.7%	30.9%*
Total Funds	46.7%	45.9%***

Table III
Investment-Cash Flow Sensitivities: Main Results

Panel A provides the correlations between the independent variables and the dependent variables. Panel B provides the coefficient estimates from the following regression specification:

$$Investment_{i,t} = \beta_0 + \beta_1 Internal\ Capital_{i,t} + \beta_2\, q_{i,t-1} + \alpha_i + \alpha_t + \varepsilon_{it}$$

α_i and α_t denote firm and year fixed effects. $q_{i,t-1}$ is the beginning period market to book ratio. *Investment* is either *Capex* (prior literature) or *Total Investment*. *Internal Capital* is *OCF* (prior literature), *Adj. OCF*, *OCF + Available Cash*, or *Total Funds*. *Total Investment = Capex + R&D + SG&A + SubJV + M&A*. *Available Cash = Lagged Cash Holdings*. *Adj. OCF = OCF + R&D* (1–T) + *SG&A* (1–T). *Total Funds = Adj. OCF + Available Cash*. Table A1 provides all variable definitions. *, **, and *** indicate the 10%, 5%, and 1% significance levels.

Panel A: Correlations between Investment, Internal Capital, and q

	Capex	Total Investment
q	0.11***	0.36***
OCF (Adj. OCF)	0.25***	0.67***
Available Cash	-0.10***	0.25***
Internal Capital	0.02***	0.64***

Panel B: Regression Results

Row		Compare Rows	Sample of Firms	Investment Measure	Internal Capital Measure	β_1	β_2	N	R^2
				Panel A: Our Results vs. Prior Results					
1	Prior Results		Manufacturing	Capex	OCF	0.078*** (17.5)	0.010*** (19.9)	61,206	0.39
2	Our Results		All	Total Investment	Total Funds	0.523*** (50.0)	0.029*** (16.3)	108,286	0.63
				Panel B: Introducing one Innovation at a Time (Relative to Prior Literature)					
3	Considering Non-Mfg.	3 vs 1	Non Manufacturing	Capex	OCF	0.125*** (16.2)	0.012*** (18.7)	47,080	0.54
4	Broadening Investment	4 vs 1	Manufacturing	Total Investment	Adj. OCF	0.658*** (41.2)	0.029*** (12.2)	61,206	0.62
5	Broadening Internal Capital	5 vs 1	Manufacturing	Capex	OCF + Available Cash	0.047*** (10.6)	0.009*** (19.4)	61,206	0.39
				Panel C: Introducing one Innovation at a Time (for All Firms)					
6	Including Non-Mfg.	6 vs 2	All	Capex	OCF	0.097*** (23.4)	0.011*** (27.5)	108,286	0.50
7	Broadening Investment	7 vs 6	All	Total Investment	Adj. OCF	0.715*** (62.7)	0.030*** (17.3)	108,286	0.66
8	Broadening Internal Capital	8 vs 6	All	Capex	OCF + Available Cash	0.063*** (23.9)	0.010*** (26.3)	108,286	0.50

Table IV

Sensitivity of Each Component of Total Investment to Internal Capital

The table provides the coefficient estimates from the following regression specification:

$$Investment_{i,t} = \beta_0 + \beta_1 Internal\ Capital_{i,t} + \beta_2\, q_{i,t-1} + \alpha_i + \alpha_t + \varepsilon_{it}$$

α_i and α_t denote firm and year fixed effects. $q_{i,t-1}$ is the beginning period market to book ratio. *Investment* is either *Capex*, *R&D*, *SG&A*, *SubJV*, *M&A*, or *Total Investment*. *Total Investment* = *Capex* + *R&D* + *SG&A* + *SubJV* + *M&A*. *Internal Capital* is *Total Funds*. *Total Funds* = *OCF* + *R&D* (1–T) + *SG&A* (1–T) + *Available Cash*. Table A1 provides all variable definitions. *, **, and *** indicate the 10%, 5%, and 1% significance levels.

Row	Investment Measure	β_1 (Inv-CF)	β_2 (Inv-q)	N	adj. R^2
1	Total Investment	0.523***	0.029***	108,286	0.63
2	Capex	0.068***	0.009***	108,286	0.51
3	R&D	0.033***	0.006***	108,286	0.81
4	SG&A	0.316***	0.004***	108,286	0.84
5	SubJV	0.008***	0.006***	108,286	0.40
6	M&A	0.064***	0.001***	108,286	0.15

Table V
Sensitivity of Investment to Each Component to Internal Capital

The table provides the coefficient estimates from the following three regression specifications:

$$Investment_{i,t} = \theta_0 + \theta_1 Cash\ Flow_{i,t} + \theta_2\ q_{i,t-1} + \alpha_i + \alpha_t + \varepsilon_{it}$$

$$Investment_{i,t} = \delta_0 + \delta_1 Internal\ Capital_{i,t} + \delta_2\ q_{i,t-1} + \alpha_i + \alpha_t + \varphi_{it}$$

$$Investment_{i,t} = \gamma_0 + \gamma_1 Cash\ Flow_{i,t} + \gamma_2 Available\ Cash_{i,t} + \gamma_3\ q_{i,t-1} + \alpha_i + \alpha_t + \epsilon_{it}$$

α_i and α_t denote firm and year fixed effects. $q_{i,t-1}$ is the beginning period market to book ratio. *Investment* is either *Capex* or *Total Investment*. *Total Investment* = *Capex* + *R&D* + *SG&A* + *SubJV* + *M&A*. For *Capex*, *Cash Flow* = *OCF* and *Internal Capital* = *OCF* + *Available Cash*. For *Total Investment*, *Cash Flow* = *Adj. OCF* and *Internal Capital* = *Adj. OCF* + *Available Cash*. *Adj. OCF* = *OCF* + *R&D* (1–T) + *SG&A* (1–T). Table A1 provides all variable definitions. *, **, and *** indicate the 10%, 5%, and 1% significance levels. Rows 6 and 8 of Table III

			Independent Variables					
Row	Investment Measure		Cash Flow	Available Cash	Internal Capital	q	N	adj. R^2
1	Capex	Row 6, Table III	0.097***			0.011***	108,286	0.50
2	Capex	Prior Lit	0.097***	0.020***		0.011***	108,286	0.50
3	Capex	Row 8, Table III			0.063***	0.010***	108,286	0.50
4	Total Investment	Row 7, Table III	0.715***			0.030***	108,286	0.66
5	Total Investment		0.719***	0.105***		0.029***	108,286	0.66
6	Total Investment	Row 2, Table III			0.523***	0.029***	108,286	0.63

Table VI
Investment-Cash Flow Sensitivities: Robustness

The table provides the coefficient estimates from the following regression specification:

$$Investment_{i,t} = \beta_0 + \beta_1 Internal\ Capital_{i,t} + \beta_2\, q_{i,t-1} + \alpha_i + \alpha_t + \varepsilon_{it}$$

α_i and α_t denote firm and year fixed effects. $q_{i,t-1}$ is the beginning period market to book ratio. Row 1 presents our baseline results as given in Row 2 of Table III. Thus, *Investment* = *Total Investment* and *Internal Capital* = *Total Funds*. *Total Investment* = *Capex* + *R&D* + *SG&A* + *SubJV* + *M&A*. *Total Funds* = *OCF* + *R&D (1–T)* + *SG&A (1–T)* + *Available Cash*. Row 2 presents the results after including the full deal value of the M&A, rather than just the cash portion, as investment. Thus, *Total Investment* = *Capex* + *R&D* + *SubJV* + *Deal M&A*; Row 3 includes the value of equity-based compensation issued by the firm to employees as part of funds available for investment. Thus, for Row 3, the sample includes only *Execucomp* firms for the period 1992-2013. *Total Investment* = *Capex* + *R&D (1–T)* + *SG&A (1–T)* + *SubJV* + *M&A*; *Total Funds* = *OCF* + *R&D (1–T)* + *SG&A (1–T)* + *Available Cash* + *Value of Equity-Based Compensation to Employees*. Row 4 considers the full deal value of the M&A, rather than the cash portion, as an investment and, thus, includes the equity portion of the M&A in internal capital. Thus, for Row 4, *Total Investment* = *Capex* + *R&D* + *SubJV* + *Deal M&A*; *Total Funds* = *OCF* + *R&D (1–T)* + *SG&A (1–T)* + *Available Cash* + *Equity Issued in M&A*. Row 5 allows for the fact that management may view only the post-tax portion of *R&D* and *SG&A* as the actual, effective investment. Thus, for Row 5, *Total Investment* = *Capex* + *R&D (1–T)* + *SG&A (1–T)* + *SubJV* + *M&A*; *Total Funds* = *OCF* + *R&D (1–T)* + *SG&A (1–T)* + *Available Cash*. Row 6 presents the results excluding *SG&A* as an investment. Thus, for Row 6, *Total Investment* = *Capex* + *R&D* + *SubJV* + *M&A*; *Total Funds* = *OCF* + *R&D (1–T)* + *Available Cash*. Table A1 provides all variable definitions. *, **, and *** indicate the 10%, 5%, and 1% significance levels.

Row	Specification	β_1 (Inv-CF)	β_2 (Inv-q)	N	adj. R^2
1	Baseline Results	0.523***	0.029***	108,286	0.63
2	Inclusion of Deal Value of M&A	0.531***	0.066***	83,655	0.51
3	Inclusion of Equity-Based Compensation	0.501***	0.017***	10,627	0.67
4	Inclusion of M&A Equity	0.817***	0.031***	83,655	0.64
5	Adj. Inv. for Tax Deductibility of R&D and SG&A	0.512***	0.023***	108,286	0.58
6	Exclusion of SG&A	0.208***	0.027***	108,286	0.43