Investment Cash Flow Sensitivities Really Reflect Related Investment Decisions[*]

Robert M. Bushman
Kenan-Flagler Business School, University of North Carolina at Chapel Hill

Abbie J. Smith
Booth School of Business, University of Chicago

X. Frank Zhang
School of Management, Yale University

May 2012

---

[*] We appreciate the comments of Steve Fazzari, Bob Holthausen, Steve Kaplan, Anil Kashyap, Bruce Petersen, Jerry Zimmerman, and seminar participants at Carnegie Mellon University, Chinese University of Hong Kong, Emory University, INSEAD, Penn State University, Yale University, and the University of Toronto. This paper previously circulated under the title Investment Cash Flow Sensitivities are Really Investment-Investment Sensitivities. Bushman thanks the Kenan-Flagler Business School, University of North Carolina at Chapel Hill for financial support, and Smith appreciates support from the William Ladany Research Fund at the University of Chicago Booth School of Business.

Investment Cash Flow Sensitivities Really Reflect Related Investment Decisions

Abstract

There exists a longstanding, unresolved debate over whether the sensitivity of capital investment to *internally generated cash flows* reflects the impact of binding financing constraints on firms' investment decisions. We exploit the underlying accrual accounting structure of the cash flow variable used in the literature, earnings before depreciation (*EBD*), to reveal the empirical underpinning of investment-cash flow sensitivity (*ICFS)*. By decomposing *EBD* into cash flow from operations (*CFO*) and working capital accruals (*WCACC*), we provide systematic evidence that *ICFS* primarily reflects the fundamental connection between capital investment and working capital investment as interrelated manifestations of firm growth. In contrast, investment-*CFO* sensitivity is often negative and tends to decrease as financing constraints increase, inconsistent with *CFO* serving as a source of investment financing for constrained firms. Further, we use the framework of Dechow and Dichev (2002) and show that *CFO* actually represents noise in *EBD* that obscures the primitive growth relation between capital and working capital investment. Our paper, by empirically revealing the inner workings of *ICFS*, provides a framework for re-interpreting the large body of existing *ICFS* evidence and for guiding a more informed and nuanced use of *ICFS* in the future.

Introduction

Beginning with Fazzari, Hubbard, and Petersen (1988), a large literature utilizes coefficients from regressing firms' capital investment on internally generated cash flow (i.e., investment cash flow sensitivity, hereafter *ICFS*) to explore the impact of financing constraints on firms' investment behavior.[1] The idea is that if financing frictions due to information asymmetry or agency problems increase the cost of external sources of finance relative to internal funds, then investment decisions of financially constrained firms will be sensitive to availability of internally generated cash flows. This literature interprets higher *ICFS* as evidence of greater financing constraints, and documents that firms classified as a priori more likely to confront binding financing constraints display greater *ICFS*.[2] However, a number of papers criticize the *ICFS* approach and raise serious concerns over whether higher *ICFS* actually represents greater financing constraints.[3] Kaplan and Zingales (2000, p. 711) contend that a key, open issue for future research is to determine what actually causes *ICFS*.

In this paper, we directly address the open issue raised by Kaplan and Zingales (2000) by providing systematic evidence that *ICFS* primarily reflects the fundamental connection between capital investment and working capital investment as interrelated manifestations of firm growth. A key contribution of our analysis is its focus on the underlying accounting structure of the cash

---

[1] The investment-cash flow sensitivity approach continues to be widely used as a tool to study a variety of issues in accounting and finance. For example, recent studies examine earnings quality and capital investment (Biddle and Hilary 2006, Li and Tang 2008, Polk and Sapienza 2008), information asymmetry and investment-cash flow sensitivity (Ascioglu, Hegde, and McDermott, 2008), SOX and information asymmetry (Chowdhury et al. 2012), management bias (Li 2010), the financial crisis and investment (Khramov 2012), investor protection (McLean et al. 2012), asset tangibility and financing constraints (Almeida and Campello 2007), and U-shaped investment (Cleary, Povel and Raith 2007), among many others.

[2] A typical design partitions firms based on measures of the a priori likelihood that they face binding financing constraints and then examines whether ICFS increases as financial constraints intensify. For literature reviews see Schiantarelli (1996), Hubbard (1998), and Bond and Van Reenen (2007).

[3] We discuss the main arguments below. Key papers include Poterba (1988), Kaplan and Zingales (1997, 2000), Gilchrist and Himmelberg (1995), Cleary (1999), Fazzari, Hubbard, and Petersen (2000), Erickson and Whited (2000), Alti (2003), Moyen (2004), and Hadlock and Pierce (2010), among others. Hubbard (1998) provides an excellent synthesis of the criticisms leveled against the investment-cash flow sensitivity approach.

flow variable. This allows us to directly address a longstanding criticism of *ICFS* positing that if internal cash flow embeds information about investment opportunities, then *ICFS* may simply reflect the relation between capital investment and investment opportunities rather than reflecting financing constraints.[4] While this criticism is well known, the extent to which growth information in cash flows is a central driver of *ICFS* has not been definitively resolved. By exploiting the underlying structure of the cash flow variable as defined by accrual accounting, our analysis reveals new insights into how growth interacts with the cash flow variable to generate *ICFS.*

Our point of departure is the fact that prior research generally defines internal cash flow as accounting earnings before depreciation and amortization (*EBD*). *EBD* can be decomposed into a non-cash working capital accrual component (*WCACC*) which reflects net investment in non-cash working capital items such as inventory and accounts receivable, and a cash component, cash flow from operations (*CFO*). This decomposition clearly shows that the cash flow variable (*EBD*) does indeed reflect investment opportunities in that it directly includes an aspect of investment itself in the form working capital investment. To the extent that an investment in fixed assets (i.e. "capital investment") represents an increase in firms' scale capacity, it is natural to expect corresponding investment in complementary factors of production such as inventory and accounts receivable captured by *WCACC*. This suggests that *ICFS* may be driven by the direct connection between fixed capital and working capital investment as interrelated manifestations of firm growth. Alternatively, since *CFO* represents internally available cash, *ICFS* may capture the role of *CFO* in funding investments by firms constrained in their ability to access outside capital, consistent with the traditional interpretation. We explore

---

[4] Key papers here include Poterba (1988), Gilchrist and Himmelberg (1995), Erickson and Whited (2000), and Alti (2003), among others.

these alternatives in our empirical analysis, and further consider the possibility that *WCACC* and *CFO* jointly impact investment.

Another important criticism of the *ICFS* literature concerns the methods used to classify firms based on their a priori degree of financing constraints (Kaplan and Zingales 1997, Cleary 1999 and Moyen 2004). The *ICFS* literature following Fazzari et al. (1988) uses a range of firm specific characteristics to measure a priori financing constraints and documents that firms classified as more constrained by these measures display greater *ICFS*. Two widely used measures are dividend payout ratio and firm age, with higher values indicating lower financing constraints. However, in an influential paper, Kaplan and Zingales (1997) instead measure financing constraints based on quantitative and qualitative information from annual reports and show that *more* financially constrained firms exhibit *lower ICFS* than less financially constrained firms. Cleary (1999) replicates the Kaplan and Zingales (1997) finding that *ICFS* is higher for less financially constrained firms using a large sample version of the Kaplan and Zingales (1997) measure called Z_{FC}, where higher values correspond to lower financing constraints.[5] In this paper, we address these competing literatures by employing dividend payout ratio, firm age, and Cleary's Z_{FC} index as measures of a priori financing constraints.

However, rather than focusing on differences, we instead focus on commonality across these measures. The source of commonality we isolate is firm growth. We find that all three measures are highly correlated with firm growth, where dividend yield and firm age are *negatively* correlated with growth while Z_{FC} exhibits a strong *positive* correlation. Based on this finding, we conjecture that partitions based on these three measures fundamentally reflect

---

[5] Kaplan and Zingales (2000) and Fazzari et al. (2000) vigorously debate the implications of conflicting evidence between *ICFS* and measures of financing constraints, arriving at no resolution. Kaplan and Zingales (1997) develop a simple model to show that even if firms face differing degrees of financing constraints, it is not necessarily the case that *ICFS* increases monotonically with the degree of financing constraints. This point is also established in a richer model setting by Moyen (2004).

differences in firm growth, rather differences in financing constraints. We ultimately verify this conjecture. Under this interpretation, *ICFS* is shown to monotonically increase with firm growth, reconciling conflicting results in the literature where *ICFS* decreases with dividend yield and firm age, but increases in Z_{FC}.

To empirically establish that *ICFS* is driven by the growth connection between capital investment and working capital investment, we proceed by replacing *EBD* in the investment equation first with *WCACC* and then with *CFO*, and examining how investment-*WCACC* sensitivity and investment-*CFO* sensitivity vary across a priori financing constraint, where we now interpret these partitions in terms of firm growth.[6] We find that investment-*WCACC* sensitivity is positive and increasing in firm growth, reflecting co-movement in capital and working capital investment as related manifestations of capacity expansion. In contrast, investment-*CFO* sensitivity is often *negative* and tends to decrease as financing constraints increase, rejecting the hypothesis that investment decisions of constrained firms are relatively more sensitive to internally generated cash flows than for less constrained firms.

We next investigate underlying drivers of investment-*WCACC* sensitivity. We recognize that *WCACC* not only reflects investment in working capital, but also captures random fluctuations in working capital due to timing issues that are independent of growth.[7] Building directly on Dechow and Dichev (2002), we disaggregate *WCACC* into a working capital investment component and a random timing component. We establish that the monotonically increasing relation between investment-*WCACC* sensitivity and firm growth is driven solely by

---

[6] While we refer to the estimated coefficient on *WCACC* as "investment-*WCACC* sensitivity", we interpret the coefficient as a reflection of the co-movement of fixed and working capital investment rather than the causal effect of working capital investment on capital investment.

[7] A significant literature considers the random timing of accruals (e.g., Financial Accounting Standards Board 1978; Dechow 1994; Dechow and Dichev 2002). There also is a line of research on the fundamental investment of accruals (e.g., Stickney, Brown, and Wahlen (2003, Chapter 3); Fairfield et al. 2003; Zhang 2007; Wu et al. 2010).

the fundamental investment component of *WCACC,* not the random timing component. We also include *WCACC* and *CFO* simultaneously in the investment equation. It is generally accepted that the robust negative correlation between *WCACC* and *CFO* is a manifestation of accrual accounting's role in smoothing random timing fluctuations (e.g., Dechow 1994). When both *WCACC* and *CFO* are included in the investment equation, we find that the sensitivity of investment to *CFO* is significant because, operating through its negative correlation with *WCACC*, it controls for the random timing fluctuations in *WCACC*. It is really *WCACC* net of timing fluctuations that is the primitive driver of *ICFS*, while *CFO* basically serves to control for random timing fluctuations in *WCACC,* rather than serving as a source of investment financing.

The analysis up to now has partitioned firms based on dividend payout ratio, firm age, and Z_{FC}, interpreting these partitions in terms of firm growth rather than financing constraints. We directly verify that *ICFS* is higher for high-growth firms than for low-growth firms by substituting growth proxies in place of the three financing constraint variables, finding that *ICFS* increases monotonically in firm growth. We further examine the relative power of growth proxies versus financing constraint variables, and find that *ICFS* significantly increases with growth proxies while the financing constraint measures have no incremental explanatory power in the presence of the growth measures.

Our evidence supports the case that *ICFS* primarily reflects the fundamental growth connection between capital investment and working capital investment. The evidence also suggests that the cash flow variable *EBD* does not generally capture the extent of internal financing as posited by Fazzari et al. (1988), but rather reflects growth via the *WCACC* component. What does this growth interpretation imply about the connection between *ICFS* and financing constraints? We argue that the nature of *ICFS* is conditional on the underlying catalyst of firm growth. For example, a firm's rational response to a decrease in the cost of capital may be to increase investment in fixed capital and complementary working capital items. However, a central tenet of the *ICFS* literature is that cost of capital is comprised of two parts, the opportunity cost of internal capital and the premium required to access external capital. If the decrease in the cost of capital is wholly due to a decrease in the external financing premium, the wedge between internal and external costs of capital gets smaller. Therefore, *ICFS* will reflect the rational investment response to this reduction in financing constraints. In this case, contrary to Fazzari et al. (1988), higher *ICFS* is associated with a greater reduction in the external financing premium, not with higher financing constraints! If however, capacity expansion is driven by macro shifts in the opportunity cost of firms' internal funds, exogenous shocks in investment opportunities, executive's empire building behavior, or managerial irrationality, *ICFS* does not reflect financing frictions but rather reflects the natural consequence of capacity expansion on the co-movement of fixed and working capital investment.

Our paper makes three contributions to the longstanding debate over *ICFS*. First, we provide a novel answer to the research challenge posed by Kaplan and Zingales (2000, p. 711) to determine what actually causes *ICFS*. We present systematic evidence that *ICFS* is caused by firm growth and reflects the direct growth connection between fixed capital and working capital as complementary production factors. This growth interpretation in turn implies that the nature of *ICFS* is conditional on the underlying catalyst of firm growth. Second, our accrual decomposition of cash flow contributes directly to the literature positing that *ICFS* reflects the relation between capital investment and information about investment opportunities in cash flows (e.g., Poterba 1988, Alti 2003). Consistent with this idea, we show that *IFCS* is indeed driven by the fact that cash flow reflects investment opportunities in the sense that a component of *EBD* is working capital investment which is a response to real or perceived investment opportunities. Third, our reinterpretation of a priori measures of financing constraints in terms of growth resolves conflicting results in the literature where *ICFS* decreases with dividend yield and firm age, but increases in Z_{FC}.

Our paper also makes significant contribution to the accounting literature. A variety of accounting papers use *ICFS* to examine earnings quality, information asymmetry, management bias, and other issues (e.g., Biddle and Hilary 2006, Li and Tang 2008, Li 2010). The evidence in our paper calls into questions the inferences of these studies. In addition, we contribute directly to the accounting literature on the nature of accruals. We provide a novel dissection of the relation between accruals and capital investment by exploiting the framework of Dechow and Dichev (2002) to decompose *WCACC* into a random timing component and a fundamental investment component. We show that including two growth variables increases the adjusted R^2 from the accrual model from 34% in Dechow and Dichev (2002) to 55%, highlighting the importance of controlling for fundamental investment when examining earnings quality in accruals. .

The rest of the paper is organized as follows. Section 2 lays discusses the conceptual foundation of *ICFS* and the accrual decomposition of cash flow. Section 3 describes the sample and provides preliminary evidence on the growth-*ICFS* connection. In section 4, we present our main empirical analysis of the drivers of *ICFS*. In section 5 we analyze the implications of growth for the connection between *ICFS* and financing constraints. Section 6 presents additional results and robustness analysis, and section 7 concludes.

2. Conceptual foundation of *ICFS* and the accrual decomposition of cash flow

In section 2.1 we intuitively develop the conceptual foundation of the Fazzari et al. (1988) empirical specification for estimating *ICFS*. Building on this conceptual foundation, in section 2.2 we discuss the cash flow variable which is central to the estimation of *ICFS*. In particular, we detail the main issues concerning the nature of the cash flow variable and *ICFS*, describe our decomposition of cash flow into *WCACC* and *CFO* components, and develop the implications of this decomposition for understanding *ICFS*.

2.1 Conceptual foundation of *ICFS*

To develop the conceptual foundation of *ICFS*, we combine the model from Kaplan and Zingales (1997) with the graphical analysis from Hubbard (1998) and Fazzari et al. (2000). The Kaplan and Zingales (1997) model consists of a return on investment $F(I)$, where I is capital investment, internal financing W with constant opportunity cost r, external financing EF, and the cost of raising external funds $C(EF,k)$ in the presence of financing frictions, where k measures the severity of information asymmetries or agency problems driving the cost wedge between internal and external funds.[8] Assume first an economy with perfect markets and thus no financing frictions. That is internal and external funds have the same cost r. The firm chooses I to solve:

$$Max\ F(I) - I*r - I\,. \tag{1}$$

The first-order condition yields the following characterization of optimal investment:

$$F'(I) = 1 + r\,. \tag{2}$$

Figure 1 graphically characterizes the solution to equation (2) designated as I^*. F' represents investment opportunities, and because markets are perfect, the marginal cost of capital is constant and the firm raises $EF=I^* - W$ of external capital to supplement internal funds. The

---

[8] The model assumes that $F' > 0$, $F'' < 0$, $C_1 > 0$, and $C_{11} > 0$. In the graphical analysis of figure 1, we assume for simplicity that both F''' and $C_{111} = 0$.

perfect market setting has been extensively examined empirically using a specification derived formally from the *q*-theory of investment (Tobin 1969, Hayashi 1982). The *q*-theory analogue of equation (2) posits that in perfect markets without financing frictions, investment is completely determined by investment opportunities and adjustment costs as

$$I_t / K_{t-1} = \beta_1 q_{t-1} + e_t \ , \tag{3}$$

where I_t is capital investment in period *t*, K_{t-1} is capital stock at the beginning of period *t*, q_{t-1} captures investment opportunities (i.e., marginal *q*), and adjustment costs are captured by β_1 (see Hayashi 1982 or Hubbard 1998 for a formal derivation of (3)).

We return to the Kaplan and Zingales (1997) model, and drop the perfect markets assumption. Thus, if the firm invests beyond internal funds *W*, it must raise external financing *EF* at cost *C(EF,k)*. The firm now chooses *I* to solve

$$Max\ F(I) - C(EF,k) - I, \text{ such that } I = W + EF, \tag{4}$$

yielding first order condition

$$F'(I) = 1 + C_I(I - W, k). \tag{5}$$

When there is risk of opportunistic behavior by firms, suppliers of external funds require compensation as captured by C_I in (5). In figure 1, the upward sloping portion of C_I implies that the marginal cost of funds is increasing after the point that internal funds *W* are exhausted. The slope of C_I captures the extent of financing frictions, with higher slopes indicative of greater financing frictions. Figure 1 illustrates that financing frictions lead to a significant reduction in investment from the first best of I^* to I^0.

With the basics in place, we turn to the conceptual foundation of the Fazzari et al. (1988) empirical specification for estimating *ICFS*. We present the argument graphically in figure 1.[9] Consider the implications of an exogenous increase in internal funding from W to W^1, holding investment opportunities F' constant. The key idea, as seen in figure 1, is that the increase in internal funds of $\Delta W = W^1 - W$ generates an increase in investment from I^0 to I^1. That is, investment is sensitive to internal cash flows! With perfects markets, the level of investment is insensitive to internal cash flows and the firm invests I^* regardless of W.

To empirically examine the implications of this model, Fazzari et al. (1988) extend the perfect markets version of the q-theory model in equation (3) to include internal cash flows. The extended specification is

$$I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 CashFlow_t / K_{t-1} + e_t\,, \tag{6}$$

where the cash flow variable is generally operationalized as earnings before extraordinary items plus depreciation and amortization expense. The coefficient β_2 in (6) captures sensitivity of capital investment to internally generated cash flows, or *ICFS*.

We turn next to a discussion of equation (6) that focuses on the underlying structure of the cash flow variable and what this structure implies about the nature of *ICFS*.

2.2 The accrual decomposition of cash flow and *ICFS*

The characterization of the sensitivity of investment to cash flows in section 2.1 and figure 1 requires holding investment opportunities constant. It is thus important to control for investment opportunities in the empirical estimation of *ICFS*. Beginning with Poterba (1988), a number of papers question the interpretation of *ICFS* estimated from (6). These papers argue that if q imperfectly controls for investment opportunities, and if cash flows contain information

---

[9] The interested reader is directed to Kaplan and Zingales (1997, 2000) and Fazzari (2000) for more formal development of the model.

about investment opportunities not reflected in q, then *ICFS* may simply reflect the relation between investment and investment opportunities, not financing constraints.

In an important paper, Alti (2003) posits a setting where measurement error in q is higher for young, high growth firms with low dividend payout policies, and where cash flow contains information about investment opportunities that may not be reflected in q.[10] Under these assumptions, Alti (2003) shows that *ICFS* is higher for low dividend payout firms (relative to high payout firms) because q has more measurement error for these firms which is compensated for by the information in cash flows. While this criticism of Alti (2003) and others is well known, the extent to which growth information in cash flows is a central driver of *ICFS* has not been definitively resolved.

In this paper we exploit the underlying accounting structure of the cash flow variable to provide evidence that *IFCS* is driven by the fact that cash flow is comprised of a working capital investment component which represents a direct response to real or perceived investment opportunities. However, unlike Alti (2003), our explanation does not require that measurement error in q vary systematically across growth partitions. We argue instead that the extent to which working capital investment is reflected in cash flows varies with growth. We develop this further in section 3.2.

As discussed earlier, the primary cash flow measure used in the literature is earnings before extraordinary items plus depreciation and amortization expense (*EBD*). As output from a firm's accrual accounting system, *EBD* can be disaggregated as

$$\begin{aligned} EBD &= E + DEPEXP \\ &= (CFO + ACCRUALS) + DEPEXP \\ &= (CFO + WCACC - DEPEXP) + DEPEXP \\ &= CFO + WCACC\ , \end{aligned} \tag{7}$$

---

[10] Other key papers include Erickson and Whited (2000) and Gilchrist and Himmelberg (1995).

where *E* is earnings before extraordinary items, *ACCRUALS* is total accruals (the difference between accounting net income and cash flow from operations), *WCACC* is working capital accruals, *CFO* is cash flow from operations, and *DEPEXP* is depreciation and amortization expense. The *WCACC* component of *EBD* primarily reflects net investment in non-cash working capital items such as inventory and accounts receivable.[11]

Accrual accounting systems recognize economic events in firms' financial statements independently of the timing of cash flows associated with these events. In (7), the relation *EBD= CFO + WCACC* reflects the fact that accrual accounting transforms *CFO* into *EBD* via a series of adjustments captured by *WCACC*. The *WCACC* component of *EBD* can be conceptualized as consisting of two aspects: (1) random fluctuations in working capital due to timing issues that are largely independent of growth, and (2) investments in non-cash working capital which are a direct manifestation of firm growth.

The first aspect of *WCACC* derives from accrual accounting's short term role in smoothing out random timing fluctuations in cash flows (e.g., Dechow (1994)). For example, consider a firm in steady state with constant scale of operations over time. An increase in accounts receivable due to a customer delaying payments unexpectedly would simultaneously reduce *CFO* and increase *WCACC* by the same amount. Similarly, if a firm automatically replenishes inventory to upper threshold S when inventory level hits lower threshold s, an unexpected change in the timing of sales to customers would generate random fluctuations in *WCACC* unrelated to firm growth as inventory levels bounce between s and S. The random

---

[11] With few exceptions existing studies define cash flow as earnings before depreciation (Compustat data item 18 plus data item 14). Examples using this definition include Fazzari et al. (1988), Whited (1992), Fazzari and Petersen (1993), Kaplan and Zingales (1997), Erickson and Whited (2000), Biddle and Hilary (2006), Almeida and Campello (2007), Cleary et al. (2007), Polk and Sapienza (2008), Li and Kang (2008), Hadlock and Pierce (2010), Li (2010), and McLean et al. (2012). While Cleary (1999) in addition adds back changes in deferred taxes, his cash flow measure follows the rest of literature by embedding changes in non-cash working capital items. In table 4 below we replicate the main results in Cleary (1999) with the standard *EBD* measure.

timing component of *WCACC* bears no conceptual relation to capital investment and we do not expect this component to impact estimated investment-*EBD* sensitivity. We later verify this by directly estimating the random timing component of *WCACC* and showing that it is unrelated to fixed investment regardless of firms' financing constraints or growth characteristics.

The second aspect of *WCACC* derives from accrual accounting's role in long-term smoothing over firms' business and life cycles. Accrual accounting acts to smooth earnings by recognizing higher (lower) earnings than cash flows during periods of growth (decline), implying that the difference between earnings and cash flows is sensitive to firms' business trajectory. During expansions, firms increase levels of fixed assets, employees, production output, and sales to customers. Investment in fixed assets for growing firms is naturally accompanied by investment in working capital items like inventory and accounts receivable to support the increasing scale of operations, where this growth in working capital impacts *WCACC* and *CFO*. For example, if a growing firm invests in higher inventory levels by spending cash, *CFO* decreases but *WCACC* increases to reflect the fact that this inventory growth represents an investment asset rather than an expense of the period.

The fact that *WCACC* directly embeds an element of investment in the form of working capital investment is the foundation of our analysis. To the extent that capital investment represents growth in firms' scale capacity, it is natural to expect corresponding investment in complementary factors of production such as inventory and accounts receivable captured by *WCACC*.[12] This suggests that *ICFS* may be driven by the direct connection between fixed capital

---

[12] Consistent with this story, Wu et al. (2010) use a *q*-theory model to show analytically that fixed capital and working capital accruals co-move in response to changes in the discount rate. Their theory implies that when the discount rate falls, more investment projects become profitable, increasing both fixed investment and working capital accruals, and future returns decrease on average because the lower discount rate means lower expected returns going forward. They provide empirical evidence consistent with this optimal investment hypothesis (see also Zhang 2007 and Dechow, Richardson, and Sloan 2008, p. 564).

and working capital investment as interrelated manifestations of firm growth. We explore this possibility next in our empirical analysis of *ICFS*.

3. Sample and preliminary evidence on the growth-ICFS connection

In section 3.1 we describe our sample and present descriptive statistics. Then, we present a preliminary analysis that provides two important pieces of the *ICFS* puzzle. Our main objective in this paper is to provide evidence that *ICFS* reflects co-movement between capital investment and working capital investment as related elements of growth. To establish this, we need to show how our growth explanation squares with the extant literature showing that *ICFS* varies systematically with a priori measures of financing constraints. In section 3.2, we first clarify why co-movement between capital investment and working capital investment is higher for higher growth firms and provide evidence consistent with our explanation. In section 3.3, we demonstrate that three of the most widely used a priori measures of financing constraints used in the literature can be re-interpreted as measures of firm growth.

3.1 Sample and descriptive statistics

Our sample selection procedure follows that of Gilchrist and Himmelberg (1995), Almeida et al. (2004), and Almeida and Campello (2007). We consider the universe of manufacturing firms (2000<=SIC<=3999) spanning the period 1971 to 2006. We delete:

1. Firm-years with beginning PP&E less than $5 million (in 1982 dollars) in order to avoid the small denominator problem.
2. Firm-years with asset growth exceeding 100% in order to avoid large M&A transactions and seasoned equity offers.
3. Firms-years with negative q or with q in excess of 10 to reduce measurement error.

Additionally, following Bond and Meghir (1994) and Almeida and Campello (2007), we do not require that firms have no-missing observations throughout the sample period. Instead, we only require that firms have at least five consecutive years of data in the sample period in order to address survivorship bias.

Following the literature, investment (*I*) is measured as capital expenditures. Tobin's *q* is measured as the market value of assets divided by the book value of assets.[13] *EBD* is earnings before extraordinary items plus depreciation. Working capital accruals (*WCACC*) are defined as changes in current assets excluding the cash balance, minus changes in current liabilities excluding debt and taxes payable. Cash flow from operations (*CFO*) equals earnings plus depreciation expense minus working capital accruals.[14] Beginning capital (K_{t-1}) is beginning net property, plant, and equipment.

Table 1 provides descriptive statistics and describes precisely how all variables are measured. Panel A shows that sample firms on average invest 23.6% of beginning capital. All variables exhibit significant variation, where the variables *EBD*, *CFO,* and *WCACC*, all scaled by K_{t-1}, range from large positive to large negative values.

Table 1, panel B reports a correlation matrix. Focusing on Pearson correlations (results from Spearman correlations are qualitatively similar), the investment variable, I_t/K_{t-1}, exhibits correlations of .26 or higher with all variables except for *CFO* ($\rho = .06$). All variables are correlated with *q* at greater than .17 except for *CFO* ($\rho = .06$). Also note that *CFO* and *WCACC* are negatively correlated at -.37. This large negative correlation is well documented in the literature (see e.g., Dechow (1994) and Dechow, Kothari and Watts (1998)). Despite the large

---

[13] In section 5, we try alternative measures of investment opportunities and implement a variety of other robustness checks.

[14] We measure *WCACC* using the balance sheet method. A more direct method uses the cash flow statement, but this data is available only from 1989 forward. In section 5, we verify that our results are not an artifact of using the balance sheet method.

negative correlation between *WCACC* and *CFO*, *WCACC* is highly correlated with capital investment (($\rho = .26$) while *CFO* is only correlated with investment at a level of .06. This fact will prove important to our analysis.

3.2 Firm growth and co-movement between fixed capital and working capital investment

Why is co-movement between capital investment and working capital investment higher for higher growth firms relative to low growth firms? Consider first that the nature of capital investment differs for high growth firms relative to low growth firms. Specifically, capital investment of high growth firms will generally be higher in magnitude and reflect a higher proportion of capacity expanding investment relative to that of low growth firms where investment will be dominated by replacement of depreciated capital. Further, growth in working capital investment will be related to capacity expanding investment, not replacement investment. Because the connection between capital and working capital investment is driven by capacity expanding investment, the higher proportion of capacity expanding versus replacement investment for high growth relative to low growth firms implies that the correlation between capital investment and working capital investment will be higher for high growth relative to low growth firms.

Consider next that higher capacity expanding versus replacement investment suggests that the volatility of investment will be higher for high relative to low growth firms. When investment approximates replacement capital (i.e., depreciation) it will tend to be small in magnitude and fairly steady over time. In contrast, capacity expanding investment will tend to be large in magnitude and reflect significant volatility given the general lumpiness of manufacturing investment (e.g., Doms and Dunne 1998). Higher investment volatility in turn increases the volatility of the working capital investment component of *WCACC* relative to random timing fluctuations, driving a higher correlation between *WCACC* and capital investments for high growth firms. For slow growth or steady state firms, random fluctuations dominant the working capital investment aspect of *WCACC*, resulting in a lower correlation between capital investment and *WCACC* for these firms.

To clarify these arguments consider the following simple model. Assume that

1. Capital Investment is given by *I*. The proportion of *I* representing capacity expanding investment (as opposed to replacement of depreciated capital) is given by the fraction *G*. *G* is strictly increasing in firm growth.[15] Let $VAR(I) = \sigma_I^2$;
2. Working capital investment is $WCI = a \cdot (G \cdot I)$. That is, working capital investment is proportional to the growth component of capital investment, $G \cdot I$; and
3. Working capital accruals, $WCACC = WCI + \varepsilon = a(GI) + \varepsilon$, where ε is independently distributed random fluctuation in *WCACC* due to timing issues and $VAR(\varepsilon) = \sigma_\varepsilon^2$.

It is straightforward to show that the correlation between *I* and *WCACC* is given by

$$\rho(I, WCACC) = \frac{a}{\left(a + \dfrac{\sigma_\varepsilon^2}{G\sigma_I}\right)^{1/2}}. \qquad (8)$$

Using (8), we establish sufficient conditions under which $\frac{\partial \rho(I, WCACC)}{\partial growth} > 0$. From (8) we see that $\rho(I, WCACC)$ is increasing in $G\sigma_I / \sigma_\varepsilon^2$. It is then clear that $\frac{\partial \rho(I, WCACC)}{\partial growth} > 0$ if, holding σ_ε constant, $\frac{dG}{dgrowth} > 0$ and $\frac{d\sigma_I}{dgrowth} > 0$. Note that we treat the underlying catalyst of growth as being outside the model. That is, the model is indifferent as to whether growth is spurred by a decrease in the cost of capital, an increase in investment opportunities, empire building, or

---

[15] *G* can be conceptualized as the expected value of the ratio $\frac{growth\ investment}{(growth\ investment + replacement\ investment)}$. This implies that the growth component of capital investment is equal to $G \cdot I$.

managerial irrationality. However, as we argue later, while *ICFS* is driven by growth from any source, the interpretation of *ICFS* depends directly on the specific underlying catalyst of growth.

To establish the plausibility of this growth explanation, in table 2 we provide empirical evidence that $\frac{dG}{dgrowth} > 0$ and $\frac{d\sigma_I}{dgrowth} > 0$. We measure *G* as the fraction of total investment representing capacity expanding investment (i.e., growth investment/ (growth investment + replacement investment)), where replacement investment is set equal to depreciation expense and growth investment is the remaining portion (i.e., investment – depreciation expense). Table 2, panels A and B show that *G* and the standard deviation of capital investment increase with growth (i.e. $\frac{dG}{dgrowth} > 0$ and $\frac{d\sigma_I}{dgrowth} > 0$).[16]

Finally, we acknowledge that the random accrual timing noise σ_ε may increase with growth, requiring further that as firm growth increases, $G\sigma_I$ must increase faster than the σ_ε. While we do not think it is likely that random timing noise would in general increase faster than changes in fundamentals, this is an empirical question. In sections 4.2.1 and 4.2.2 we deal with composition of *WCACC* head on by empirically decomposing *WCACC* into working capital investment and random fluctuation components and showing that the random timing component is basically unrelated to capital investment.

3.3 Re-interpreting a priori financing constraint partitions in terms of firm growth

The *ICFS* literature following Fazzari et al. (1988) uses a range of firm specific characteristics to measure a priori financing constraints and documents that firms classified as

---

[16] In panel A we compute standard deviation of investment ($Std(I_t/K_{t-1})$) and average proportion of growth investment (*G*) across quartiles of growth measures using pooled firm years, while in panel B we compute firm specific $Std(I_t/K_{t-1})$ and firm average *G*, and then partition all firms into four growth quartiles based on a firm's average growth characteristics.

more constrained by these measures display greater *ICFS*. Two of the most widely used measures in this literature are dividend payout ratio and firm age, with higher values indicating lower financing constraints. In contrast, Kaplan and Zingales (1997) use a measure based on quantitative and qualitative information from annual reports and show that *more* financially constrained firms exhibit *lower ICFS* than less financially constrained firms. Cleary (1999) replicates the Kaplan and Zingales (1997) finding that *ICFS* is higher for less financially constrained firms using a large sample version of the Kaplan and Zingales (1997) measure called Z_{FC} (higher values correspond to lower financing constraints).[17] The premise of Z_{FC} is that firms who cut dividends are more likely to be financially constrained. Following Cleary (1999), we use discriminant analysis, classifying firms into dividend cut, no change, and dividend increase groups based on the following beginning-of-period variables: current ratio (*Current*), debt ratio (*Debt*), fixed charge coverage (*FCCov*), net income margin (*NI%*), sales growth (*SalesGrowth*), and slack/net fixed assets (*SLACK/K*). Z_{FC} is estimated using the following model (see Cleary (1999) for more detail) [18]:

$$\begin{aligned} Z_{FC} &= \beta_1 Current + \beta_2 FCCov + \beta_3 SLACK / K + \beta_4 NI\% \\ &\quad + \beta_5 SalesGrowth + \beta_6 Debt \end{aligned} \tag{9}$$

In this paper, we span the competing literatures by employing dividend payout ratio, firm age, and Cleary's Z_{FC} index as measures of a priori financing constraints. However, rather than focusing on differences, we instead focus on commonality across these measures. The source of commonality we isolate is firm growth. In table 3, Panel A we document that all three

---

[17] Kaplan and Zingales (2000) and Fazzari et al. (2000) vigorously debate the implications this documented non-monotonicity between *ICFS* and measures of financing constraints, arriving at no resolution. Kaplan and Zingales (1997) develop a simple model to show that even if firms face differing degrees of financing constraints, it is not necessarily the case that *ICFS* increases monotonically with the degree of financing constraints. This point is also established in a richer model setting by Moyen (2004).

[18] Note that Slack is defined as balance sheet cash + short term investments + (0.50 x inventory) + (0.70 x accounts receivable) - short term loans.

partitioning variables are significantly correlated with firm growth. We see that the dividend payout ratio and firm age are negatively related to employee growth, sales growth and earnings growth, while Cleary's Z_{FC} is significantly positively related to all three growth measures. In table 3, Panel B we detail how all three measures of growth, employee growth, sales growth and earnings growth, vary across quartiles of dividend payout ratio, firm age and Z_{FC}. Table 3, panel B clearly shows that dividend payout ratio and firm age are negatively related to growth, while Z_{FC} is positively related growth.

Based on this finding, we conjecture that these three financing constraint measures can be re-interpreted in terms of firm growth. Under this interpretation, *ICFS* will be shown next to monotonically increase with firm growth, reconciling conflicting results in the literature where *ICFS* decreases with dividend yield and firm age, but increases in Z_{FC}.

4. Main empirical analysis of *ICFS*

In this section, we present direct evidence that *ICFS* reflects the fundamental connection between capital investment and working capital investment as interrelated manifestations of firm growth. In section 4.1 we separately analyze investment-*WCACC* and investment-*CFO* sensitivity and show that *ICFS* are driven by *WCACC*, not by *CFO*. In section 4.2, we examine direct implications of growth for *ICFS* and provide evidence consistent with a growth interpretation of *ICFS*.

4.1 Separate analysis of investment-*WCACC* and investment-*CFO* sensitivity

We begin our analysis of *ICFS* in table 4, where we examine the relation between investment and *EBD*, *CFO*, and *WCACC*, after controlling for *q* but before considering any a priori partitioning of firms. Table 4, column 1 documents the well-known positive and significant *ICFS*, with a coefficient on *EBD* of .122 and a t-statistic of 16.56. In contrast, column

2 substitutes *CFO* for *EBD* and documents a negative relation between fixed investment and *CFO* (t = -3.09), while column 3 reveals a strong, positive relation between investment and *WCACC* (t = 20.23).

Table 5 consists of three panels, one for each of the financing constraint variables dividend payout ratio, firm age, and Z_{FC}. Throughout our discussion of table 5, we will emphasize our interpretation of these financing constraint partitions in terms of growth. After partitioning firms into quartiles, we run panel regressions of investment on a cash flow construct and *q* for firms in each quartile, iteratively using one of three different cash flow measures, *EBD, WCACC*, and *CFO*. For parsimony, we only report the coefficients and t-statistics for the cash flow measures and the differences between the coefficients for the bottom and top quartiles of each partitioning variable. All regression models include firm and year fixed effects with standard errors clustered at the firm level (see table 5 for details).

In table 5, the column labeled *EBD/K* replicates the classic *ICFS* formulation from Fazzari, et al. (1988). For all three financing constraint measures, we see that *ICFS* varies systematically across financing constraint partitions. For dividend payout partitions, the sensitivity coefficient decreases.132 in the bottom quartile (high financing constraints, high growth) to .116 in the top quartile (low financing constraints, low growth). The sensitivity coefficient difference between the bottom and top quartiles is positive and significant at the 5% level. For firm age, the bottom quartile has a sensitivity of .93, while the second through top quartiles have roughly the same sensitivity (.085, .083 and .084 respectively). However, in this case the difference is not significant at conventional levels (t = 1.54). The positive difference in the sensitivity for the bottom and top dividend payout and firm age quartiles is consistent with *ICFS* increasing in financing constraints (or growth).[19]

In contrast, for the Z_{FC} measure, we see that the ordering of *ICFS* across financing constraints reverses, replicating Cleary (1999). Table 5 shows that *ICFS* is *lower* for firms classified as *more* constrained by the Z_{FC} measure. *ICFS* increases monotonically from .039 in the bottom quartile (high constraints, low growth) to .181 in the top quartile (low constraints, high growth). This difference is negative and highly significant (t=-15.18).

The remaining two columns of Table 5 replace *EBD* in the investment equation with *CFO* and *WCACC*. We see that for partitions based on both dividend payout ratio and firm age, *CFO*-investment sensitivity is significantly *higher* for less financially constrained (Q4) than for more constrained firms (Q1). Further, *CFO* sensitivities are often negative or statistically insignificant. For example, the most financially constrained firms under the dividend payout ratio and firm age partitions show a negative relation between investment and *CFO*. With respect to Z_{FC}, investment-*CFO* sensitivities are higher for less financially constrained firms, and are negative for the more financially constrained firms. These results are inconsistent with a story that investment decisions of constrained firms are more sensitive to internally generated cash flows than for less constrained firms.

Finally, table 5 shows that investment-*WCACC* sensitivity varies monotonically across partitions based on all three financial constraint variables.[20] For dividend payout ratio and firm age partitions (inversely related to growth), investment-*WCACC* sensitivity decreases monotonically from the bottom quartile to the top quartile, while for Z_{FC} partitions (positively

---

[19] While the result of firm age is a little anemic in this partitioning analysis, in table 8, panel B, we replicate Fazzari et al. (1988) using a regression approach with interactions, documenting that *IFCS* is significantly decreasing in both dividend payout and firm age.

[20] Adding both WCACC and CFO in the same regression does not change the coefficient pattern presented in Table 5.

related to growth) the ordering is reversed. The differences in *WCACC* sensitivity for Q1-Q4 are significantly positive in all three panels. That is, investment-*WCACC* sensitivity increases monotonically with growth, reconciling the contradictory findings between Fazzari, Hubbard, and Petersen (1988) and Cleary (1999) (also Kaplan and Zingales 1997) where *ICFS* increases in financing constraints as defined by dividend yield and firm age, but decreases in financing constraints defined by Cleary's Z_{FC}.

4.2 Direct implications of a growth story for investment-cash flow sensitivity

In section 4.2.1 we separate the random timing component of *WCACC* from working capital investment component, and show that the pattern in investment-*WCACC* sensitivity is driven by the fundamental investment component of *WCACC*. In section 4.2.2, we include *WCACC* and *CFO* simultaneously in the investment equation, providing evidence that *WCACC* net of timing fluctuations is the primitive driver of *ICFS*, while *CFO* basically serves to control for random timing fluctuations in *WCACC,* rather than serving as a source of investment financing. And in section 4.2.3, we show that *ICFS* increases significantly with measures of firm growth, Further, *ICFS* is not sensitive to financial constraints (as measured by dividend payout, firm age, and Z_{FC}) once we control for growth.

4.2.1 Decomposing *WCACC* into fundamental investment and random timing components

To distinguish fundamental investment and random timing components of *WCACC*, we adapt the Dechow and Dichev (2002) framework by including two growth proxies as follows

$$\begin{aligned} WCACC_t / K_{t-1} = {} & \alpha_0 + \alpha_1 CFO_{t-1} / K_{t-1} + \alpha_2 CFO_t / K_{t-1} + \alpha_3 CFO_{t+1} / K_{t-1} \\ & + \alpha_4 SGR_t + \alpha_5 EMPGR_t + e_t . \end{aligned} \tag{10}$$

In (10), *SGR* is sales growth from year t-1 to t (in percentage), and *EMPGR* is the growth in the number of employees (in percentage). The fitted value of the three cash flow variables from (10) is used to capture the random timing component of accruals (*WCACC_RT*). That is

$$WCACC\_RT_t = \alpha_1 CFO_{t-1} / K_{t-1} + \alpha_2 CFO_t / K_{t-1} + \alpha_3 CFO_{t+1} / K_{t-1}. \tag{11}$$

From Dechow and Dichev (2002), we expect $\alpha_1 > 0$, $\alpha_2 < 0$, and $\alpha_3 > 0$.

We use sales growth and employee growth to proxy for change in a firm's scale. These proxies for growth (*SGR* and *EMPGR*) are not exhaustive. The fitted value of the two growth variables is posited to capture the fundamental investment component of accruals (*WCACC_FI*). That is

$$WCACC\_FI_t = \alpha_4 SGR_t + \alpha_5 EMPGR_t \ . \tag{12}$$

As fundamental investment in working capital should be positively correlated with growth, we expect $\alpha_4 > 0$ and $\alpha_5 > 0$.

We note that the original Dechow-Dichev model is designed to capture accruals' short-term role in smoothing out random timing fluctuations in cash flows. As Dechow and Dichev (2002) acknowledge, their model ignores accruals' long-term role in smoothing earnings over firms' business and life cycles. Panel A of Table 6 shows that the adjusted R^2 increases on average across models estimated for each 2-digit SIC code by .19 to .55 from adding the two growth variables to capture accruals' long-term smoothing role. The residual likely captures random timing and investment information as well as accrual quality due to incomplete controls of accrual short-term and long-term roles in the model. Hence, we do not include the residual in either the estimated random component or the fundamental investment component of accruals. Rather, we conduct our tests based on the relatively clean proxies from the fitted variables on cash flows or growth.[21]

---

[21] On accrual quality, Richardson et al. (2005) rate changes in inventory and accounts receivable as low reliability and changes in accounts payable (ΔAP) as high reliability accruals. In untabulated analyses, we find that the behavior of investment- ΔAP sensitivity is consistent with the behavior of investment- ΔINV and investment- ΔAR sensitivities.

Panel A of table 6 shows that the coefficient estimates are consistent with our prediction in every industry ($\alpha_1 > 0$, $\alpha_2 < 0$, $\alpha_3 > 0$, $\alpha_4 > 0$, and $\alpha_5 > 0$). Additionally, the coefficients are similar to those in Dechow and Dichev (2002), despite different samples and our inclusion of two growth proxies.

Using the *WCACC* decomposition from (11) and (12), we examine relations between capital investment and the two components of *WCACC*. We expect capital investment to be positively associated with the investment component (*WCACC_FI*) and unrelated with the random timing component (*WCACC_RT*). We estimate

$$I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 WCACC\_RT_t / K_{t-1} + \beta_3 WCACC\_FI_t / K_{t-1} \\ FIRMDUMMIES + YEARDUMMIES + e_t . \tag{13}$$

Panel B of table 6 shows that the coefficient on *WCACC_RT* is 0.007 and insignificantly different from zero (t=1.32), while the coefficient on *WCACC_FI* is 0.309, with a t-statistic of 40.8. In panel C, we estimate equation (13) for each financing constraint partition, finding that *WCACC_FI* is the main driver of the investment-*WCACC* sensitivity patterns across dividend payout, firm age and Z_{FC} partitions.

4.2.2 Including *WCACC* and *CFO* simultaneously in the investment regression

The previous analyses consider investment-*WCACC* and investment-*CFO* sensitivity separately. However, given that *EBD* = *WCACC*+*CFO*, it is important that we consider *WCACC* and *CFO* simultaneously, leading to the model

$$I_t / K_{t-1} = \beta_0 + \beta_1 q_{t-1} + \beta_2 WCACC_t / K_{t-1} + \beta_3 CFO_t / K_{t-1} + e_t , \tag{14}$$

where β_0 represents firm and year dummies.

What are the implications of the growth interpretation of *ICFS* for equation (14)? If *ICFS* reflects the growth connection between capital investment and working capital investment, we argue that when $WCACC_t$ and CFO_t are both included, CFO_t will proxy for the random timing component of $WCACC_t$ and essentially serve to control for random timing noise in *WCACC* that obscures the fundamental investment component. That is, CFO_t will imperfectly play the same role as the joint effect of the three cash flow variables in equation (10) above. To examine this proposition consider the regression

$$WCACC_t = \alpha_0 + \alpha_1 CFO_t + v_t \,. \tag{15}$$

It well established that *WCACC* and *CFO* are negatively correlated (e.g., Dechow 1994), and so we predict that α_1<0.[22]

Analogous to the Dechow and Dichev decomposition of *WCACC* in section 4.3.1, we interpret the fitted value from (15) as an estimate of the random timing component, and the residual (v_t) as the fundamental investment component of *WCACC*. This suggests the following model:

$$\begin{aligned} I_t / K_{t-1} &= \beta_0 + \beta_1 q_{t-1} + \beta_2 v_t + e_t \\ &= \beta_0 + \beta_1 q_{t-1} + \beta_2 (WCACC_t / K_{t-1} - (\alpha_0 + \alpha_1 CFO_t / K_{t-1})) + e_t \\ &= (\beta_0 - \beta_2 * \alpha_0) + \beta_1 q_{t-1} + \beta_2 WCACC_t / K_{t-1} + (-\beta_2 * \alpha_1) CFO_t / K_{t-1} + e_t \,. \end{aligned} \tag{16}$$

The final equation in (16) shows that the role of CFO_t, via its negative correlation with *WCACC*, is to control out random noise in *WCACC*. This is reflected in the coefficient on CFO_t, $-\beta_2 * \alpha_1 > 0$, where the inequality follows from our predictions that $\beta_2 > 0$ and α_1<0.[23]

---

[22] We do not believe that multi-collinearity from including both WCACC and CFO in the same regression is a problem for our purposes. Multicollinearity tends to inflate the standard errors and to render one or both coefficients statistically insignificant, whereas we still find highly significant coefficients on both WCACC and CFO.

[23] The absolute value of α_1 should be less than one. If $WCACC_t$ and CFO_t are perfectly matched on the timing issue, the coefficient on CFO_t would equal to -1. Thus, any noise or mismatch, such as the mismatch due to past or future cash flows, drives the coefficient on CFO_t towards zero, suggesting a value of α_1 between -1 and 0. Thus, we expect the coefficient on CFO_t to be less than the coefficient on $WCACC_t$ ($-\beta_2 * \alpha_1 < \beta_2$).

The results in table 7 are consistent with our predictions. Panel A shows that α_1 = -0.417, while in panel B we see that the coefficient on CFO_t is 0.057, which is not statistically different from our predicted value in equation (16) of $-\beta_2 * \alpha_1$ = -0.130*(-0.417) = 0.054. That is, when both *WCACC* and *CFO* are included in the investment equation, the sensitivity of investment to *CFO* is significant because, operating through its negative correlation with *WCACC*, it controls for the timing fluctuations in *WCACC*. This evidence supports the hypothesis that the investment component of *WCACC* is the primitive driver of *ICFS*, while *CFO*, rather than serving as a source of investment financing, controls out noise that obscures the primitive growth relation.

4.2.3 Influence of financing constraints measures on *ICFS*, controlling for growth

If *ICFS* reflects the connection between capital and working capital investment as interrelated manifestations of growth implies, then *ICFS* should be higher for high-growth firms than for low-growth firms. We empirically test this implication in this section, using sales growth (*SGR*), growth in earnings (*EGR*), and growth in the number of employees (*EMPGR*) to proxy for growth. Specifically, we consider the following model:

$$\begin{aligned} I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 EBD_t / K_{t-1} + \beta_3 Growth + \beta_4 (EBD_t / K_{t-1}) * Growth \\ + FIRMDUMMIES + YEARDUMMIES + e_t , \end{aligned} \qquad (17)$$

In (17), the variable *Growth* will be one of *SGRrank*, *EGRrank*, or *EMPGRrank*, which are the percentile rankings of *SGR*, *EGR*, and *EMPGR*, respectively, and are converted to a [0,1] scale. We expect a positive β_4 in all three growth variables.

Panel A of table 8, columns 1-3 show that the coefficients on the interaction terms are positive and statistically significant (all t-statistics ≥7), verifying that *ICFS* is larger for high-growth firms. We jointly consider all three growth proxies in column 4, finding that all three interaction terms have significant positive coefficients.

In table 8, panel B, we re-examine the association of *ICFS* with financing constraint proxies (dividend payout, firm age, and Z_{FC}), before and after controlling for growth variables. We run the following two regression models:

$$\begin{aligned} I_t / K_{t-1} = {} & \beta_1 q_{t-1} + \beta_2 EBD_t / K_{t-1} \\ & + \beta_3 FINCONSTrank + \beta_4 (EBD_t / K_{t-1}) * FINCONSTrank \\ & + FIRMDUMMIES + YEARDUMMIES + e_t \end{aligned} \tag{18}$$

and

$$\begin{aligned} I_t / K_{t-1} = {} & \beta_1 q_{t-1} + \beta_2 EBD_t / K_{t-1} \\ & + \beta_3 FINCONSTrank + \beta_4 (EBD_t / K_{t-1}) * FINCONSTrank \\ & + \beta_5 SGRrank + \beta_6 (EBD_t / K_{t-1}) * SGRrank \\ & + \beta_7 EGRrank + \beta_8 (EBD_t / K_{t-1}) * EGRrank \\ & + \beta_9 EMPGRrank + \beta_{10} (EBD_t / K_{t-1}) * EMPGRrank \\ & + FIRMDUMMIES + YEARDUMMIES + e_t \end{aligned} \tag{19}$$

FINCONSTrank is the percentile rankings of one of the three proxies for financial constraints (i.e. dividend payout ratio, firm age, or Z_{FC}), converted to a [0,1] scale. Model (18) replicates Fazzari et al. (1988) in a regression framework with interactions. We expect a negative β_4 in model (18) for dividend payout ratio and firm age, and a positive β_4 for Z_{FC}. Model (19) is designed to see whether the financial constraint proxies have incremental power after controlling for growth. If *SGR*, *EGR*, and *EMPGR* absorb the growth information in the financial constraint proxy, we expect β_4 in Model (19) to be close to zero.

The interaction of *EBD* with financial constraints as measured by dividend payout ratio and firm age has a significant negative coefficient as reported in table 8, panel B in columns (1) and (2) (replicating Fazzari et al. 1988), and a significant positive coefficient with financial constraints as measured by Z_{FC} as reported in column (3) (replicating Cleary 1999). Columns (4)–(6) show that after controlling for growth, *ICFS* no longer varies significantly with *PAYOUT*, *AGE*, or Z_{FC}, while the interactions between *EBD* and growth proxies are still highly significant in most cases. These results bolster the case that it is growth, not financial constraints, that drive the variation in *ICFS*.[24]

5 The implication of growth for the connection between *ICFS* and financing constraints

Our evidence supports the case that *ICFS* reflects the fundamental growth connection between fixed capital and working capital investment. The evidence also suggests that the cash flow variable *EBD* does not generally capture the extent of internal financing, but rather reflects growth via the *WCACC* component. But if *EBD* does not capture internal financing, this calls into question the classic Fazzari et al. (1988) financing constraint explanation of *ICFS* as described in section 2. That is, in terms of figure 1, we contend that *EBD* does not proxy for $\Delta W = W^1 - W$. What then does our growth interpretation imply about the connection between *ICFS* and financing constraints?

If *ICFS* actually reflects the growth connection between fixed and working capital investment, then the nature of estimated *ICFS* will be conditional on the underlying catalyst of firm growth. Consider first a net present value rule view of optimal investment. A firm’s rational response to a decrease in the cost of capital is to increase investment. However, a central tenet of the *ICFS* literature is that cost of capital is comprised of two parts, the opportunity cost of internal capital and the premium required to access external capital. In figure 2, the cost of internal capital is given by *r* and the premium required to access external capital is captured by the slope of the curve C_1. Now, assume a decrease in the cost of capital is due to a reduction in

---

[24] When we replace EBD with WCACC in Panel B of Table 8, we also find that the interactions between WCACC and growth proxies are highly positive, whereas the interactions between WCACC and financial constraint proxies become largely insignificant.

financing constraints as represented in figure 2 by a shift in the marginal cost of financing curve from C_1 to the lower sloped curve C_1^L. Thus, the wedge between internal and external costs of capital gets smaller and *ICFS* will reflect the rational investment response to this reduction in financing constraints. However, contrary to Fazzari et al. (1988), in this case higher *ICFS* is associated with a greater reduction in financing constraints, not with higher financing constraints!

If instead, capacity expansion is driven by a drop in the opportunity cost of firms' internal funds, represented by the shift from r to r^L in figure 2, *ICFS* does not reflect financing frictions or changes in such frictions, but rather reflects the natural consequences of capacity expansion. We note that this particular source of *ICFS* is related in some respects to a recent paper by Abel and Eberly (2011). In their model, Abel and Eberly (2011) show that investment and cash flow positively co-move because both react in the same direction to shocks to the user cost of capital.

Of course, capacity expansion can also be driven by exogenous shocks in investment opportunities (shifting F' to the Northeast in figure 2), executive's empire building behavior, or managerial irrationality. As in the case of the opportunity cost of firms' internal funds, when growth is driven by any of these forces, *ICFS* does not reflect financing frictions but rather reflects the natural consequence of capacity expansion on the co-movement of fixed and working capital investment.

6 Additional results and robustness analysis

6.1 Sensitivity of investment to changes in accounts receivables or changes in inventory

In table 9 we examine the sensitivity of capital investment to changes in inventory and changes in accounts receivable. Beginning with Sloan (1996), a large literature documents that high (low) accruals predict lower (higher) future returns. Bernard and Stober (1989), Abarbanell and Bushee (1998), and Thomas and Zhang (2002) show that while the component of *WCACC* due to change in inventory impacts future returns, this is not generally the case for the accounts receivable component. Table 9 documents that both *ΔINV*-investment and Δ*AR*-investment sensitivities are positive and significant, and increase monotonically across financial constraint partitions consistent with our growth theory.

6.2 Revisiting Fazzari and Petersen (1993)

We briefly contrast our analysis with a widely cited paper by Fazarri and Petersen (1993). Fazzari and Petersen (1993) argue that financially constrained firms can offset the impact of cash-flow shocks on fixed investment by adjusting working capital. They extend the Fazzari et al. (1988) *ICFS* approach by including change in working capital (ΔWC) as an independent variable:

$$I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 EBD_t / K_{t-1} + \beta_3 \Delta WC + e_t \ . \tag{20}$$

This is very different from what we are doing in this paper. Note that ΔWC is defined as

$$\begin{aligned} \Delta WC &= \Delta\text{Current Assets} - \Delta\text{Current Liabilities} \\ &= WCACC + (\Delta CASH_{BS} - \Delta STD - \Delta TP), \end{aligned} \tag{21}$$

where $\Delta CASH_{BS}$ is change in cash and cash equivalents on the balance sheet, *ΔSTD* is change in short-term debt, and *ΔTP* is change in taxes payable. Our analysis focuses on the fact that *EBD* can be decomposed into *WCACC* and *CFO*. In essence, Fazzari and Petersen (1993) put *WCACC* into the equation again as an element of ΔWC. It is very difficult to interpret the coefficients in equation (20) due to the significant relationships between the independent variables.

6.3 Working capital investment may lag capital investment

In all the analysis above, we have followed the bulk of the previous literature by regressing capital investment for year on EBD_t, $WCACC_t$ and CFO_t. We also consider the possibility under a growth interpretation that working capital investment may lag capital investment, as a firm needs to have capacity ready before increasing inventory production and accounts receivable. In untabulated results, we find that capital investment and future *WCACC* are positively correlated even after controlling for contemporaneous *WCACC*.

6.4 Additional proxies for investment opportunities

In untabulated analyses, we extend the main regression (equation 1) to include additional proxies for investment opportunities, including q_t, q_{t-2}, and q_{t-3}. In addition, we estimate specifications adding the median analyst forecast of long-term growth and the median analysts forecast of year $t+1$'s earnings scaled by assets per share in year t. The basic relations documented in table 4 continue to hold in these specifications.

6.5 Measurement error in *WCACC*

We have thus far estimated working capital accruals from the balance sheet because the statement of cash flows is only available after 1989. Hribar and Collins (2002) show that balance sheet-based accrual measures may suffer from measurement error due primarily to mergers and acquisitions. While large M&A transactions with asset growth exceeding 100% are excluded from our sample, we further show that our results are robust to the following three specifications. First, because *WCACC* is based on the balance sheet approach, we measure capital expenditure using the balance sheet approach as changes in net property, plant, and equipment plus depreciation expense. Next, we exclude observations where sales from mergers and acquisitions exceed 5% of total sales. Finally, we measure both *CFO* and *WCACC* from the statement of cash flows using the post-1989 sample period due to the availability of the statement of cash flow.

6.6 Sub-period analysis

We also examine whether our key results are sensitive to specific time periods. We break our sample period into two sub-periods: 1971-1988 and 1989-2006. In untabulated results, we find that the correlation between *CAPEX* and *WCACC* is strong and the correlation increases with growth proxies in each sub-period. Similar results hold using even finer sub-period partitions.

7. Summary

An important, unresolved issue in finance is whether the sensitivity of capital investment to *internally generated cash flows* reflects the impact of binding financing constraints on firms' investment decisions. We contribute substantive new insight to this debate by providing systematic evidence that investment-cash flow sensitivity (*ICFS*) primarily reflects the fundamental connection between capital investment and working capital investment as interrelated manifestations of firm growth. We decompose the cash flow measure used in the literature, earnings before depreciation (*EBD*), into cash flow from operations (*CFO*), and working capital accruals (*WCACC*) which reflects net investment in working capital items like inventory and accounts receivable. We demonstrate that *ICFS* is driven by the natural co-movement between fixed investment and the working capital investment aspect of *WCACC* as complementary factors of production. In contrast, investment-*CFO* sensitivity is often *negative* and tends to decrease as financing constraints increase, inconsistent with *CFO* serving as a source of investment financing for constrained firms.

Our evidence strongly supports the case that *ICFS* reflects the fundamental growth connection between fixed capital and working capital investment. The evidence also suggests that the cash flow variable *EBD* does not generally capture the extent of internal financing, but rather reflects growth via the *WCACC* component. But if *EBD* does not capture internal financing, this calls into question the classic Fazzari et al. (1988) financing constraint explanation of *ICFS*. What does this growth interpretation imply about the connection between *ICFS* and financing constraints? If *ICFS* actually reflects the growth connection between fixed and working capital investment, then that the nature of estimated *ICFS* will be conditional on the underlying catalyst of firm growth. If investment is driven solely by a reduction in the cost wedge between external and internal financing, *ICFS* reflects the investment consequences of this reduction in financing constraints. However, if capacity expansion is instead driven by shifts in the opportunity cost of firms' internal funds, shocks in investment opportunities, empire building behavior, or managerial irrationality, *ICFS* will not reflect financing frictions but rather the natural consequence of capacity expansion on the co-movement of fixed and working capital investment.

References

Abarbanell, Jeffery and Brian Bushee. 1998. Abnormal Stock Returns to a Fundamental Analysis Strategy. Accounting Review 73 (1998): 19-45.

Abel, Andrew and Janice Eberly. 2011. How Q and Cash Flow Affect Investment without Frictions: An Analytic Explanation. Review of Economic Studies :1-22.

Almeida, Heitor and Murillo Campello. 2007. Financial constraints, asset tangibility, and corporate investment. *The Review of Financial Studies* v 20 n 5, 1429.

Almeida, Heitor, Murillo Campello, and Michael Weisbach. 2004. The cash flow sensitivity of cash. *Journal of Finance* 59, 1777-1804.

Alti, Aydogan. 2003. How sensitive is investment to cash flow when financing is frictionless? *Journal of Finance* 58, 707-722.

Ascioglu, A., Hegde, S.P., McDermott, J.B., 2008. Information asymmetry and investment-cash flow sensitivity. Journal of Banking and Finance 32, 1036–1048.

Bernard, Victor and Thomas Stober. 1989. The Nature and Amount of Information Reflected in Cash Flows and Accruals. *The Accounting Review*: 624-652.

Biddle, Gary and Gilles Hilary. 2006. Accounting Quality and Firm-level Capital Investment. *The Accounting Review*, Vol. 81, No. 5, 2006, 963-982.

Bond, Stephen and Costas Meghir. 1994. Dynamic investment models and the firm’s financial policy. *Review of Economic Studies* 61, 197-222.

Bond, S., Van Reenen, J., 2007. Microeconometric Models of Investment and Employment. Handbook of Econometrics. In: Heckman, J.J., Leamer, E.E. (Eds.), Handbook of Econometrics, vol. 6A. North Holland, Amsterdam, pp. 4417–4498.

Brown, James and Bruce Petersen. 2009. Why has the investment-cash flow sensitivity declined so sharply? Rising R&D and equity market developments. *Journal of Banking & Finance* 33, 971-984.

Chowdbury, J., R. Kumar, D. Shome. 2012. Investment-cash flow sensitivity under changing information Asymmetry. working paper.

Cleary, Sean. 1999. The relationship between firm investment and financial status. *Journal of Finance*, 673-692.

Cleary, Sean, Paul Povel and Michael Raith. 2007. The U-shaped investment curve: theory and evidence, *Journal of Financial and Quantitative Analysis* 42, 1-39.

Dechow, P. 1994. Accounting earnings and cash flows as measures of firm performance: The role of accounting accruals. *Journal of Accounting & Economics* 26, 1-34.

Dechow, P., and I. Dichev. 2002. The quality of accruals and earnings: The role of accrual estimation errors. *The Accounting Review* 77, 35-59.

Dechow, P., S. Kothari, and R. Watts. 1998. The relation between earnings and cash flows. *Journal of Accounting and Economics* 25, 133-168.

Dechow, P. M., S. A. Richardson and R. G. Sloan. 20088. The Persistence and Pricing of the Cash Component of Earnings. *Journal of Accounting Research* 46, 537–66.

Doms, M., and T. Dunne, 1998. Capital Adjustment Patterns in Manufacturing Plants. *Review of Economic Dynamics* 1**,** 409-429.

Erickson, Timothy and Toni Whited. 2000. Measurement error and the relationship between investment and q. *Journal of Political Economy* 108, 1027-1057.

Fazzari, Steven, R. Glenn Hubbard, and Bruce Petersen. 1988. Financing constraints and corporate investment. *Brookings Papers on Economic Activities*, 141-195.

Fazzari, Steven, R. Glenn Hubbard, and Bruce Petersen. 2000. Investment-cash flow sensitivities are useful: A comment on Kaplan and Zingales. *Quarterly Journal of Economics*, 695-705.

Fazzari, Steven and Bruce Petersen. 1993. Working capital and fixed investment: new evidence on financing constraints. *Rand Journal of Economics* 24, 328-342.

Fairfield, P.M., J. S.Whisenant, and T. Yohn. 2003. Accrued Earnings and Growth: Implications for Future Profitability and Market Mispricing. The Accounting Review 78, 353–71.

Financial Accounting Standards Board (FASB). 1978. Objectives of financial reporting by business enterprises. Statement of Accounting Concepts No. 1. Norwalk, CT

Gilchrist, Simon and Charles Himmelberg. 1995. Evidence on the role of cash flow for investment. *Journal of Monetary Economics* 36, 541-572.

Hadlock, C. and J. Pierce. 2010. New evidence on measuring financial constraints: Moving beyond the KZ index. *Review of Financial Studies* 23-5, 1909-1940.

Hayashi, F. 1982. Tobin’s marginal and average q: A neoclassical interpretation. Econometrica 50: 213-24.

Hribar, Paul and Dan Collins. 2002. Errors in estimating accruals: Implications for empirical research. *Journal of Accounting Research* 40, 105-134.

Hubbard, R. Glenn. 1998. Capital market imperfections and investment. *Journal of Economic Literature* 36, 193-227.

Kaplan, Steven and Luigi Zingales. 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics*, 169-215.

Kaplan, Steven and Luigi Zingales. 2000. Investment-cash flow sensitivities are not valid measures of financing constraints. *Quarterly Journal of Economics*, 707-712.

Khramov, Vadim. 2012. Asymmetric effects of the financial crisis: Collateral-based investment-cash flow sensitivity analysis. IMF and UCLA, working paper.

Li, Feng. 2010. Managers' self-serving attribution bias and corporate financial policies. University of Michigan working paper.

Li K. and V. Tang. 2008. Earnings quality and future capital investment: Evidence from discretionary accruals. Georgetown University working paper.

Lyandres, Evgeny. 2007. Costly external financing, investment timing, and investment-cash flow sensitivity. *Journal of Corporate Finance* 13, 959-980.

McLean, D., T. Zhang, and M. Zhao. 2012. Why does the law matter? Investor protection and its effects on investment, finance, and growth. Journal of Finance, forthcoming.

Moyen, N. 2004. Investment-cash flow sensitivities: Constrained versus unconstrained firms. Journal of Finance 69, 2061-2092.

Polk, C., and P. Sapienza. 2008. The Stock Market and Corporate Investment: A Test of Catering Theory. *Review of Financial Studies*, 22(1): 187-217..

Poterba, James M. 1988. Comment on 'Financing constraints and corporate investment', Brookings Paper on Economic Activity 1, 200–204.

Richardson S., R. Sloan, M. Soliman, and I. Tuna. 2005. Accrual reliability, earnings persistence and stock prices. Journal of Accounting and Economics 39, 437-485.

Sloan, Richard, 1996, "Do stock prices fully reflect information in accruals and cash flows about future earnings?" The Accounting Review 71, 289-315.

Schiantarelli, F., 1996. Financial constraints and investment: Methodological issues and international evidence. Oxford Review of Economic Policy, 70–89.

Stickney, C.P., P. Brown, and J.M. Wahlen. Financial reporting and statement analysis: A strategic approach, 5th ed., Mason, OH: South-Western College Publishing, 2003.

Thomas, Jacob and Hui Zhang, 2002, "Inventory Changes and Future Returns," Review of Accounting Studies 7, 163-187.

Tobin, J. 1969. A general equilibrium approach to monetary theory. Journal of Money, Credit, and Banking, 1: 15-29.

Whited, Toni. 1992. Debt, Liquidity Constraints, and Corporate Investment: Evidence from Panel Data. Journal of Finance 47:425–60.

Wu, J., L. Zhang, X.F., Zhang, 2010. The q-theory approach to understanding the accrual anomaly. Journal of Accounting Research 48, 177-233.

Zhang, X. Frank. 2007. Accruals, investment, and the accrual anomaly. *The Accounting Review* 82, 1333-1363.

Figure 1 Graphical Analysis of *ICFS*

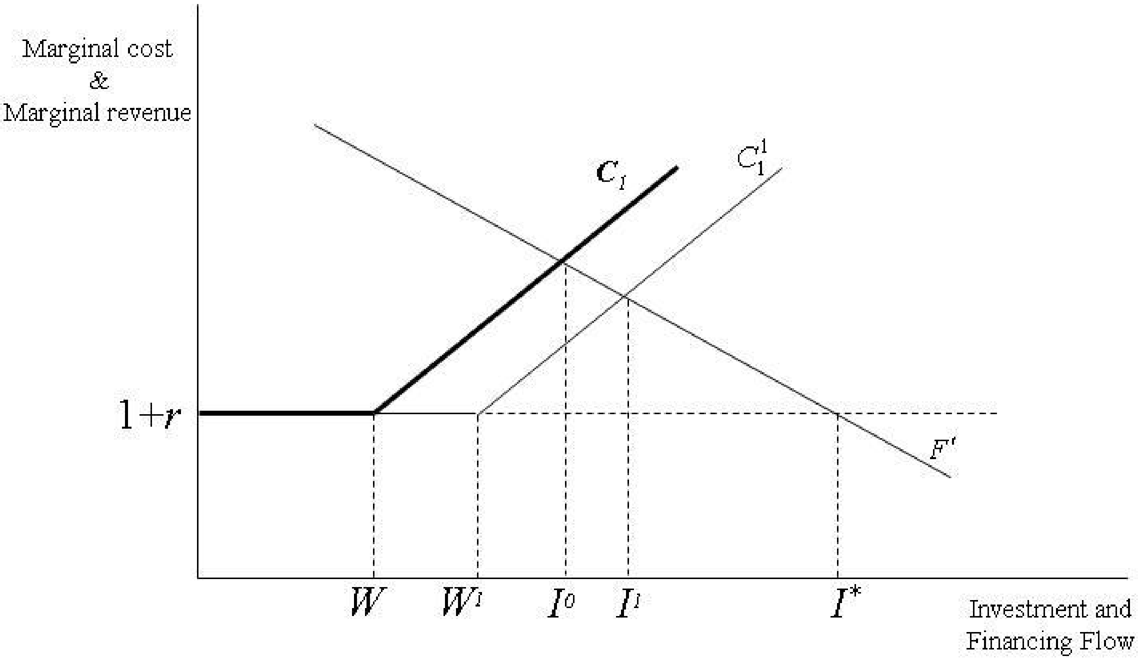
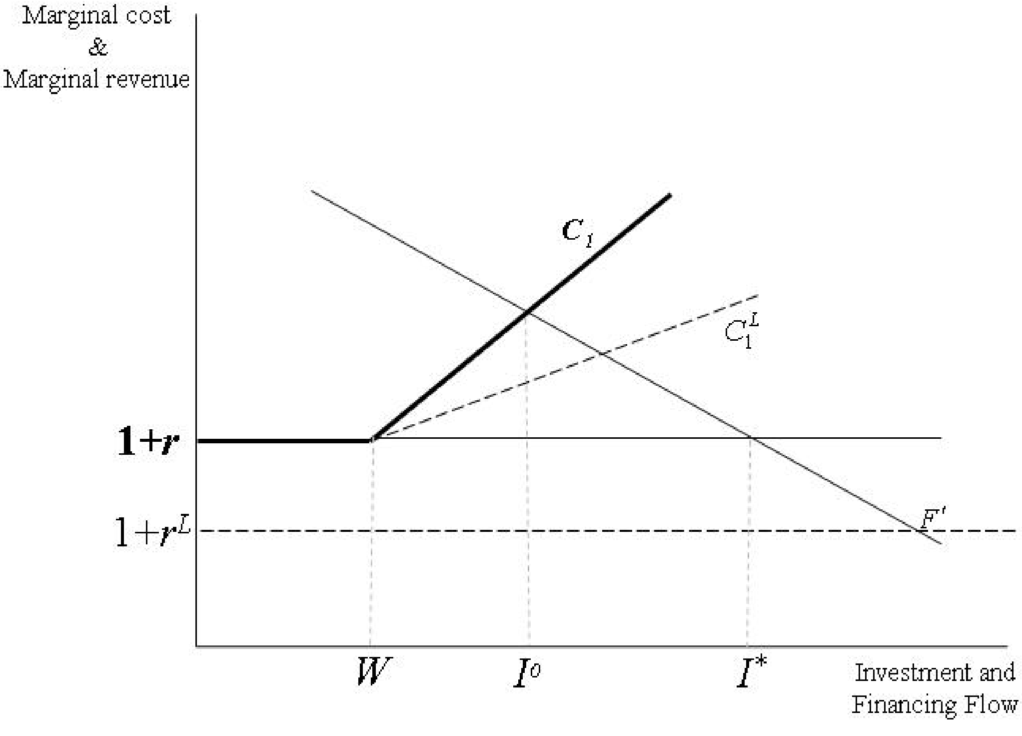


Figure 2 Catalysts of firm growth and interpretation of *ICFS*



I is capital investment, *W* is internal financing, *r* is internal opportunity cost of funds, C_1 is marginal cost of external financing, and F' is return on investment.

Table 1 Descriptive statistics

Panel A: Descriptive statistics

Variable	Mean	Std	Min	Q1	Median	Q3	Max
I_t/K_{t-1}	0.236	0.190	0.014	0.115	0.186	0.289	1.102
q_{t-1}	1.487	0.942	0.552	0.920	1.181	1.684	5.936
EBD_t/K_{t-1}	0.305	0.551	-2.304	0.155	0.297	0.491	2.201
CFO_t/K_{t-1}	0.277	0.571	-2.270	0.105	0.270	0.482	2.275
$WCACC_t/K_{t-1}$	0.027	0.391	-1.409	-0.100	0.011	0.144	1.594

Panel B. Correlation Matrix (Pearson correlations are shown above the diagonal with Spearman below)

	I_t/K_{t-1}	q_{t-1}	EBD_t/K_{t-1}	CFO_t/K_{t-1}	$WCACC_t/K_{t-1}$
I_t/K_{t-1}	1	0.331	0.264	0.062	0.264
q_{t-1}	0.323	1	0.182	0.060	0.170
EBD_t/K_{t-1}	0.437	0.350	1	0.710	0.339
CFO_t/K_{t-1}	0.175	0.142	0.612	1	-0.374
$WCACC_t/K_{t-1}$	0.256	0.225	0.321	-0.393	1

I_t is capital expenditure (data128). K_{t-1} is beginning capital stock measured as net property, plant, and equipment (data8). q_{t-1} is average q at the beginning of the period measured as the market value of assets divided by the book value of assets ((data6+data25*data199-data60-data74)/data6). EBD_t is cash flow as measured as earnings before extraordinary items (data18) plus depreciation (data14). $WCACC_t$ is working capital accruals measured as (ΔCA - $\Delta CASH_{BS}$) – (ΔCL - ΔSTD - ΔTP), where ΔCA = change in current assets (data4), $\Delta CASH_{BS}$ = change in cash and cash equivalents (data1), ΔCL = change in current liabilities (data5), ΔSTD = change in short-term debt (data34), and ΔTP = change in tax payable (data71). CFO_t is cash flows from operations measured as earnings before extraordinary items minus accruals, where accruals are equal to working capital accruals minus depreciation. The sample includes all manufacturing firms (SIC code between 2000 and 3999) with non-missing capital expenditure and cash flow variables from 1971 to 2006. We require that firms have at least five consecutive years of data in the sample period. All variables are winsorized at 1% and 99%.

Table 2 Relations between firm growth, investment volatility, and capacity expanding investment

Panel A: Cross-sectional statistics: Standard deviation of investment (*Std*(I_t/K_{t-1})) and average *G* across growth quartiles

Partitioned by	Variable	Q1 (low growth)	Q2	Q3	Q4 (high growth)	Q4-Q1
Employee Growth	$Std(I_t/K_{t-1})$	0.142	0.135	0.159	0.251	0.109 (0.00)
	G	-0.035	0.107	0.211	0.278	0.313 (0.00)
Sales Growth	$Std(I_t/K_{t-1})$	0.149	0.141	0.159	0.250	0.101 (0.00)
	G	-0.013	0.136	0.199	0.244	0.257 (0.00)
Earnings Growth	$Std(I_t/K_{t-1})$	0.165	0.151	0.171	0.229	0.064 (0.00)
	G	0.077	0.189	0.225	0.172	0.095 (0.00)

Panel B: Time-series statistics: Firm specific standard deviation of investment (*Std*(I_t/K_{t-1})) and firm average *G* across quartiles of growth measures

Partitioned by	Variable	Q1 (low growth)	Q2	Q3	Q4 (high growth)	Q4-Q1
Employee Growth	$Std(I_t/K_{t-1})$	0.139	0.130	0.146	0.198	0.059 (0.00)
	G	-0.039	0.091	0.124	0.182	0.221 (0.00)
Sales Growth	$Std(I_t/K_{t-1})$	0.136	0.126	0.148	0.200	0.064 (0.00)
	G	-0.017	0.099	0.129	0.143	0.160 (0.00)
Earnings Growth	$Std(I_t/K_{t-1})$	0.158	0.115	0.141	0.178	0.020 (0.06)
	G	-0.007	0.134	0.167	0.121	0.128 (0.00)

Employee growth is the growth in the number of employees (data29) from year t-1 to t, measured as ($data29_t$ – $data29_{t-1}$)/$data29_{t-1}$. Sales growth is the growth in sales (data12) from year t-1 to t. Earnings growth is the growth in operating income before depreciation (data13) from year t-1 to t, where earnings in year t-1 has to be positive. I_t is capital expenditure. K_{t-1} is beginning capital stock (net property, plant, and equipment). *G* is the fraction of total investment representing capacity expansion, growth investment/(growth investment + replacement investment), where replacement investment is depreciation (data14) and growth investment is the remaining portion (*investment – replacement investment*). In Panel A, each year we partition firms into four equal-size groups based on employee growth, sales growth and earnings growth, and then calculate average *G* and the standard deviation of investment for each resulting group using cross-sectional data. In Panel B, we calculate firm-level average *G* and the standard deviation of investment for each firm and then partition all firms into four growth quartiles and reports average firm-specific statistics for each quartile. The sample includes all manufacturing firms (SIC code between 2000 and 3999) with non-missing capital expenditure and cash flow variables from 1971 to 2006. We require that firms have at least five consecutive years of data in the sample period. P-values are in parentheses.

Table 3 Firm growth and a priori financing constraint proxies

Panel A: Correlations between "proxies" for financial constraints and growth

	Dividend Payout Ratio	Firm Age	The financial constraint index Z_{FC} in Cleary (1999)
	Spearman correlations		
Employee growth	-0.154**	-0.135**	0.182**
Sales growth	-0.211**	-0.094**	0.171**
Earnings growth	-0.262**	-0.021**	0.176**
	Pearson correlations		
Employee growth	-0.021**	-0.118**	0.149**
Sales growth	-0.030**	-0.096**	0.127**
Earnings growth	-0.032**	-0.012*	0.112**

** Significant at 0.01 level.

Panel B: Growth across the financial constraint quartiles

	Sales growth	Earnings growth	Employee growth
Quartiles based on Dividend Payout Ratio (negatively related to growth)			
Bottom quartile (Q1)	11.69%	39.84%	6.73%
Second quartile (Q2)	10.68%	23.15%	6.74%
Third quartile (Q3)	6.09%	10.88%	3.52%
Top quartile (Q4)	1.03%	-0.05%	0.24%
Q1 – Q4	10.66%	39.89%	6.48%
(t-stat)	(19.80)	(28.26)	(14.67)
Quartiles based on Firm Age (negatively related to growth)			
Bottom quartile (Q1)	9.99%	9.89%	6.65%
Second quartile (Q2)	6.35%	9.81%	3.62%
Third quartile (Q3)	4.45%	9.29%	1.94%
Top quartile (Q4)	2.64%	6.75%	0.10%
Q1 – Q4	7.35%	3.14%	6.55%
(t-stat)	(12.23)	(2.51)	(12.29)
Quartiles based on Firm financial constraint index Z_{FC} (Cleary 1999, positively related to growth)			
Bottom quartile (Q1)	-1.12%	-14.88%	-2.67%
Second quartile (Q2)	5.04%	9.39%	2.78%
Third quartile (Q3)	7.47%	15.49%	4.29%
Top quartile (Q4)	11.61%	21.66%	7.06%
Q1 – Q4	-12.73%	-36.54%	-9.73%
(t-stat)	(-7.35)	(-9.55)	(-11.44)

Employee growth is the growth in the number of employees (data29) from year t-1 to t. Sales growth is the growth in sales (data12) from year t-1 to t. Earnings growth is the growth in operating income before depreciation (data13) from year t-1 to t, where earnings in year t-1 has to be positive. Dividend payout ratio is dividend and stock repurchase divided by earnings before interest and tax. Firm age is the number of years since first time covered by CRSP. Z_{FC} is the financial constraint index in Cleary (1999). Each year we partition firms into four equal-size groups based on the financial constraint proxy and calculate average sales growth, earnings growth, and employee growth for each resulting quartile. The reported numbers are the average of annual growth over 36 years; t-statistics in parentheses are Fama-MacBeth t-statistics. The sample includes all manufacturing firms (SIC code between 2000 and 3999) with required variables from 1971 to 2006.

Table 4 Regressions of investment on Tobin's *q* and cash flows

	1	2	3
q_{t-1}	0.077 (19.22)	0.102 (25.33)	0.087 (21.94)
EBD_t/K_{t-1}	0.122 (16.56)		
CFO_t/K_{t-1}		-0.014 (-3.09)	
$WCACC_t/K_{t-1}$			0.101 (20.23)
Firm & Year Dummies	YES	YES	YES
R^2	0.209	0.154	0.203

We run three regressions as follows.

Model 1: $I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 EBD_t / K_{t-1} + FIRMDUMMIES + YEARDUMMIES + e_t$

Model 2: $I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 CFO_t / K_{t-1} + FIRMDUMMIES + YEARDUMMIES + e_t$

Model 3: $I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 WCACC_t / K_{t-1} + FIRMDUMMIES + YEARDUMMIES + e_t$

I_t is capital expenditure. K_{t-1} is beginning capital stock (net property, plant, and equipment). q_{t-1} is average q at the beginning of the period measured as the market value of assets divided by the book value of assets. EBD_t is cash flow as measured as earnings before extraordinary items plus depreciation. CFO_t is cash flows from operations. $WCACC_t$ is working capital accruals measured as changes in non-cash current assets minus changes in non-debt current liabilities. The regressions are standard panel regressions with firm and year fixed effects and with standard errors clustered at the firm level. The sample includes all manufacturing firms (SIC code between 2000 and 3999) with non-missing capital expenditure and cash flow variables from 1971 to 2006. We require that firms have at least five consecutive years of data in the sample period. T-statistics are in parentheses.

Table 5 *ICFS, CFO*- and *WCACC*-investment sensitivity across constraint quartiles

Panel A: Four quartiles based on Dividend Payout Ratio (negatively related to growth)

	The coefficient estimates of		
	EBD_t/K_{t-1}	CFO_t/K_{t-1}	$WCACC_t/K_{t-1}$
Bottom quartile (Q1) (most financially constrained) (high growth)	0.132 (16.56)	-0.014 (-3.09)	0.101 (20.23)
Second quartile (Q2)	0.153 (13.32)	0.016 (2.50)	0.083 (11.84)
Third quartile (Q3)	0.149 (13.49)	0.004 (0.55)	0.083 (12.08)
Top quartile (Q4) (least financially constrained) (low growth)	0.116 (11.80)	0.012 (2.15)	0.071 (11.61)
Most constrained – least constrained (high growth – low growth)	0.016 (1.98)	-0.026 (-3.64)	0.030 (3.87)

Panel B: Four quartiles based on Firm Age (negatively related to growth)

	The coefficient estimates of		
	EBD_t/K_{t-1}	CFO_t/K_{t-1}	$WCACC_t/K_{t-1}$
Bottom quartile (Q1) (most financially constrained) (high growth)	0.093 (13.30)	-0.006 (-1.21)	0.089 (15.49)
Second quartile (Q2)	0.085 (12.68)	-0.001 (-0.23)	0.085 (17.07)
Third quartile (Q3)	0.083 (12.47)	0.010 (2.41)	0.079 (15.43)
Top quartile (Q4) (least financially constrained) (low growth)	0.084 (11.14)	0.014 (2.67)	0.058 (10.54)
Most constrained – least constrained (high growth – low growth)	0.009 (1.54)	-0.020 (-2.79)	0.031 (3.89)

Panel C: Four quartiles based on Firm financial constraint index Z_{FC} (Cleary 1999, positively related to growth)

	The coefficient estimates of		
	EBD_t/K_{t-1}	CFO_t/K_{t-1}	$WCACC_t/K_{t-1}$
Bottom quartile (Q1) (most financially constrained) (low growth)	0.039 (8.20)	-0.014 (-3.63)	0.058 (14.18)
Second quartile (Q2)	0.096 (12.52)	-0.016 (-3.02)	0.084 (14.56)
Third quartile (Q3)	0.144 (15.39)	-0.004 (-0.67)	0.095 (14.65)
Top quartile (Q4) (least financially constrained) (high growth)	0.181 (20.69)	0.032 (4.95)	0.113 (14.94)
Most constrained – least constrained (low growth – high growth)	-0.142 (-15.18)	-0.046 (-6.32)	-0.055 (-6.50)

Each year we partition firms into four quartiles based on dividend payout ratio, firm age, or Z_{FC}. Then we run the following three regressions for each resulting quartile.

Model A: $I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 EBD_t / K_{t-1} + FIRMDUMMIES + YEARDUMMIES + e_t$

Model B: $I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 CFO_t / K_{t-1} + FIRMDUMMIES + YEARDUMMIES + e_t$

Model C: $I_t / K_{t-1} = \beta_1 q_{t-1} + \beta_2 WCACC_t / K_{t-1} + FIRMDUMMIES + YEARDUMMIES + e_t$

The table reports β_2 estimates from these three regressions. Dividend payout ratio is dividend and stock repurchase divided by earnings before interest and tax. Firm age is the number of years since first time covered by CRSP. Z_{FC} is the financial constraint index in Cleary (1999). I_t is capital expenditure. K_{t-1} is beginning capital stock. q_{t-1} is average q at the beginning of the period measured as the market value of assets divided by the book value of assets. EBD_t is cash flow as measured as earnings before extraordinary items plus depreciation. CFO_t is cash flows from operations. $WCACC_t$ is working capital accruals measured as changes in non-cash current assets minus changes in non-debt current liabilities. The regressions are standard panel regressions with firm and year fixed effects and with standard errors clustered at the firm level. The sample includes all manufacturing firms (SIC code between 2000 and 3999) with non-missing capital expenditure and cash flow variables from 1971 to 2006. We require that firms have at least five consecutive years of data in the sample period. T-statistics are in parentheses.

Table 6 Decomposing *WCACC* into random timing and investment components

Panel A:

$$WCACC_t / K_{t-1} = \alpha_0 + \alpha_1 CFO_{t-1} / K_{t-1} + \alpha_2 CFO_t / K_{t-1} + \alpha_3 CFO_{t+1} / K_{t-1} + \alpha_4 SGR_t + \alpha_5 EMPGR_t + e_t$$

2-digit SIC industry	CFO_{t-1}/K_{t-1}	CFO_t/K_{t-1}	CFO_{t+1}/K_{t-1}	SGR_t	$EMPGR_t$	Adj. R^2
20	0.22	-0.58	0.17	0.23	0.12	0.63
21	0.11	-0.54	0.12	0.46	0.43	0.59
22	0.21	-0.57	0.13	0.60	0.31	0.66
23	0.22	-0.68	0.11	1.44	0.42	0.67
24	0.18	-0.57	0.17	0.37	0.20	0.59
25	0.22	-0.63	0.13	0.60	0.18	0.66
26	0.19	-0.47	0.19	0.19	0.16	0.56
27	0.17	-0.38	0.09	0.52	0.27	0.40
28	0.11	-0.19	0.12	0.11	0.32	0.24
29	0.25	-0.49	0.20	0.06	0.05	0.52
30	0.21	-0.53	0.19	0.45	0.27	0.55
31	0.22	-0.59	0.15	1.89	0.43	0.67
32	0.21	-0.50	0.16	0.22	0.20	0.51
33	0.18	-0.53	0.18	0.27	0.24	0.57
34	0.20	-0.55	0.15	0.39	0.30	0.60
35	0.16	-0.39	0.11	0.73	0.54	0.48
36	0.17	-0.35	0.11	0.61	0.45	0.43
37	0.18	-0.62	0.16	0.42	0.26	0.59
38	0.21	-0.38	0.16	0.60	0.54	0.49
39	0.20	-0.58	0.14	0.95	0.52	0.61
Average	0.19	-0.51	0.15	0.56	0.31	0.55
Average incremental R^2 from adding growth						0.19
Dechow & Dichev (2002), Table 3, panel B	0.19	-0.51	0.15			0.34

Panel B: $I_t / K_{t-1} = \beta_0 + \beta_1 q_{t-1} + \beta_2 WCACC\_RT_t / K_{t-1} + \beta_3 WCACC\_FI_t / K_{t-1} + e_t$

	q_{t-1}	$WCACC\_RT_t / K_{t-1}$	$WCACC\_FI_t / K_{t-1}$	Year & Firm Dummies	R^2
coefficient	0.062**	0.007	0.309**	YES	0.194
(t-stat)	(27.79)	(1.32)	(40.80)		

Panel C: $I_t / K_{t-1} = \beta_0 + \beta_1 q_{t-1} + \beta_2 WCACC\_RT_t / K_{t-1} + \beta_3 WCACC\_FI_t / K_{t-1} + e_t$ across financial constraint quartiles

	q_{t-1}	$WCACC\_RT_t / K_{t-1}$	$WCACC\_FI_t / K_{t-1}$	Year & Firm Dummies	R^2
Dividend payout (Q1) (most financially constrained)	0.083** (20.93)	0.021* (2.21)	0.330** (24.09)	YES	0.242
Dividend payout (Q2)	0.064** (15.66)	-0.022 (-1.95)	0.317** (19.70)	YES	0.174
Dividend payout (Q3)	0.052** (14.98)	0.003 (0.29)	0.248** (15.23)	YES	0.154
Dividend payout (Q4) (least financially constrained)	0.036** (10.68)	0.002 (0.19)	0.244** (15.10)	YES	0.127
Most – least constrained (high – low growth)	0.047** (9.33)	0.019 (1.30)	0.086** (3.62)		
Firm age (Q1) (most financially constrained)	0.073** (20.15)	0.008 (0.82)	0.340** (25.75)	YES	0.227
Firm age (Q2)	0.069** (18.88)	0.018 (1.89)	0.297** (22.84)	YES	0.196
Firm age (Q3)	0.060** (16.75)	0.001 (0.08)	0.288** (21.22)	YES	0.188
Firm age (Q4) (least financially constrained)	0.036** (10.18)	-0.004 (-0.53)	0.220** (15.14)	YES	0.176
Most – least constrained (high – low growth)	0.038** (7.44)	0.012 (1.02)	0.120** (6.06)		
Z_{FC} (Q1) (most financially constrained)	0.076** (14.56)	0.022* (2.38)	0.260** (18.50)	YES	0.179
Z_{FC} (Q2)	0.077** (16.94)	0.017 (1.55)	0.271** (22.94)	YES	0.173
Z_{FC} (Q3)	0.068** (16.51)	-0.001 (-0.06)	0.288** (19.41)	YES	0.193
Z_{FC} (Q4) (least financially constrained)	0.051** (17.05)	-0.043** (-3.26)	0.378** (20.87)	YES	0.207
Most – least constrained (low – high growth)	0.025** (4.20)	0.065** (4.73)	-0.118** (-5.09)		

Panel A reports the coefficient estimated of the accrual model by industry. We expand the Dechow-Dichev (2002) model by including two growth variables and decompose *WCACC* into two components: the random timing component (*WCACC_RT*) and the fundamental investment component (*WCACC_FI*). In Panel B, we examine whether these two components are related to capital expenditure. Panel C report regression results by financial constraint partitions. I_t is capital expenditure. K_{t-1} is beginning capital stock. $WCACC_t$ is working capital accruals measured as changes in non-cash current assets minus changes in non-debt current liabilities. CFO_t is cash flows from operations. SGR_t is sales growth measured as sales in year t minus sales in year t-1 and then scaled by sales in year t-1. Similarly, $EMPGR_t$ is growth in the number of employees. The sample includes all manufacturing firms (SIC code between 2000 and 3999) with non-missing capital expenditure and cash flow variables from 1971 to 2006. We require that firms have at least five consecutive years of data in the sample period. The regressions are standard panel regressions with firm and year fixed effects and with standard errors clustered at the firm level. T-statistics are in parentheses. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

Table 7 Including *WCACC* and *CFO* simultaneously in the model

Panel A: $WCACC_t / K_{t-1} = \alpha_0 + \alpha_1 CFO_t / K_{t-1} + v_t$

	CFO_t / K_{t-1}	Year & Firm Dummies	R^2
coefficient	-0.417**	YES	0.293
(t-stat)	(-43.02)		

Panel B: $I_t / K_{t-1} = \beta_0 + \beta_1 q_{t-1} + \beta_2 WCACC_t / K_{t-1} + \beta_3 CFO_t / K_{t-1} + e_t$

	q_{t-1}	$WCACC_t / K_{t-1}$	CFO_t / K_{t-1}	Year & Firm Dummies	R^2
coefficient	0.059**	0.130**	0.057**	YES	0.172
(t-stat)	(26.16)	(31.45)	(15.61)		
The predicted coefficient on CFO_t / K_{t-1} ($-\beta_2 * \alpha_1$)			0.0542		
The difference between β_3 and its predicted value ($-\beta_2 * \alpha_1$)			0.003 (0.79)		

** and * indicate statistical significance at the 1% and 5% levels, respectively.

In Panel A, we regress *WCACC* on *CFO*. The fitted value of the regression model captures the random timing component and the residual captures the fundamental investment component.

$$WCACC_t / K_{t-1} = \alpha_0 + \alpha_1 CFO_t / K_{t-1} + v_t$$

In Panel B, we examine the association between capital expenditure and the fundamental investment component of *WCACC*. According to our theory, CAPEX should be positively correlated with the fundamental investment component (v_t) but not the random timing component of *WCACC*.

$$\begin{aligned} I_t / K_{t-1} &= \beta_0 + \beta_1 q_{t-1} + \beta_2 v_t + e_t \\ &= \beta_0 + \beta_1 q_{t-1} + \beta_2 (WCACC_t / K_{t-1} - (\alpha_0 + \alpha_1 CFO_t / K_{t-1})) + e_t \\ &= \beta_0 - \beta_2 * \alpha_0 + \beta_1 q_{t-1} + \beta_2 WCACC_t / K_{t-1} + (-\beta_2 * \alpha_1) CFO_t / K_{t-1} + e_t \end{aligned}$$

where I_t is capital expenditure, K_{t-1} is beginning capital stock, $WCACC_t$ is working capital accruals measured as changes in non-cash current assets minus changes in non-debt current liabilities, and CFO_t is cash flows from operations. The sample includes all manufacturing firms (SIC code between 2000 and 3999) with required non-missing capital expenditure and cash flow variables from 1971 to 2006. We require that firms have at least five consecutive years of data in the sample period. The regressions are standard panel regressions with firm and year fixed effects and with standard errors clustered at the firm level. T-statistics are in parentheses.

Table 8 Investment-cash flow sensitivity conditional on growth variables

Panel A: The variation between the *I-EBD* sensitivity and growth proxies

$$I_t / K_{t-1} = \beta_0 + \beta_1 q_{t-1} + \beta_2 EBD_t / K_{t-1} + \beta_3 SGRrank + \beta_4 (EBD_t / K_{t-1}) * SGRrank + e_t$$

$$I_t / K_{t-1} = \beta_0 + \beta_1 q_{t-1} + \beta_2 EBD_t / K_{t-1} + \beta_3 EGRrank + \beta_4 (EBD_t / K_{t-1}) * EGRrank + e_t$$

$$I_t / K_{t-1} = \beta_0 + \beta_1 q_{t-1} + \beta_2 EBD_t / K_{t-1} + \beta_3 EMPGRrank + \beta_4 (EBD_t / K_{t-1}) * EMPGRrank + e_t$$

	1	2	3	4
q_{t-1}	0.057**	0.052**	0.053**	0.043**
	(25.47)	(22.21)	(24.07)	(19.71)
EBD_t / K_{t-1}	0.035**	0.062**	0.037**	0.027**
	(8.09)	(11.33)	(8.97)	(4.94)
SGRrank	0.093**			0.080**
	(30.62)			(22.99)
*EBD * SGRrank*	__0.066**__			__0.047**__
	__(8.59)__			__(3.26)__
EGRrank		-0.005		-0.066**
		(-1.77)		(-21.54)
*EBD * EGRrank*		__0.108**__		__0.058**__
		__(12.78)__		__(4.64)__
EMPGRrank			0.120**	0.087**
			(39.33)	(28.13)
*EBD * EMPGRrank*			__0.061**__	__0.032**__
			__(7.91)__	__(2.67)__
Year & Firm Dummies	YES	YES	YES	YES
R^2	0.188	0.175	0.208	0.232

Panel B: Relation between *ICFS* and financial constraints conditional on growth

	1	2	3	4	5	6
q_{t-1}	0.049** (20.40)	0.063** (27.49)	0.061** (25.05)	0.038** (17.32)	0.046** (21.09)	0.045** (19.39)
EBD_t / K_{t-1}	0.149** (16.46)	0.082** (12.99)	0.048** (9.50)	0.049** (3.74)	0.034** (4.15)	0.009 (1.38)
PAYOUTrank	-0.017** (-7.05)			-0.013** (-5.40)		
*EBD * PAYOUTrank*	**-0.034**** **(-2.35)**			**-0.013** **(-0.89)**		
AGErank		-0.071** (-27.62)			-0.057** (-23.17)	
*EBD * AGErank*		**-0.028*** **(-2.25)**			**-0.009** **(-0.76)**	
$Z_{FC} rank$			0.081** (25.81)			0.061** (20.61)
$EBD * Z_{FC} rank$			**0.041**** **(4.46)**			**0.026** **(1.94)**
SGRrank				0.079** (22.27)	0.079** (22.80)	0.075** (21.42)
*EBD * SGRrank*				0.037* (1.97)	0.041** (2.88)	0.038** (2.49)
EGRrank				-0.073** (-22.17)	-0.066** (-21.25)	-0.070** (-23.04)
*EBD * EGRrank*				0.013 (0.73)	0.053** (4.31)	0.054** (4.11)
EMPGRrank				0.077** (24.15)	0.082** (26.53)	0.079** (25.98)
*EBD * EMPGRrank*				0.087** (5.20)	0.028* (2.40)	0.026* (2.09)
Year & Firm Dummies	YES	YES	YES	YES	YES	YES
R^2	0.177	0.178	0.181	0.238	0.245	0.244

** and * indicate statistical significance at the 1% and 5% levels, respectively.

In Panel A, we directly examine whether the I-*EBD* sensitivities vary with growth proxies, where growth is proxied by sales growth (SGR), growth in earnings (EGR), and growth in the number of employees (EMPGR). In Panel B, we examine whether the I-EBD sensitivities vary with financial constraints conditional on growth proxies. I_t is capital expenditure. K_{t-1} is beginning capital stock. EBD_t is cash flow as measured as earnings before extraordinary items plus depreciation. q_{t-1} is average q at the beginning of the period measured as the market value of assets divided by the book value of assets. SGR_t is sales in year t minus sales in year t-1 and then scaled by sales in year t-1. Similar definitions apply to EGR_t and $EMPGR_t$. *PAYOUT* is dividend payout ratio. *AGE* is firm age. Z_{FC} is the financial constraint index in Cleary (1999). The rank variables are in percentile rankings and converted to a [0,1] scale, where rankings are obtained by ranking observations and assigning them to 100 portfolios. The sample includes all manufacturing firms (SIC code between 2000 and 3999) with non-missing capital expenditure and cash flow variables from 1971 to 2006. We require that firms have at least five consecutive years of data in the sample period. The regressions are standard panel regressions with firm and year fixed effects and with standard errors clustered at the firm level. T-statistics are in parentheses.

Table 9 Sensitivity of investment to changes in accounts receivables or changes in inventory

	1	2	3	4	5	6
q_{t-1}	0.064** (27.20)	0.069** (30.62)	0.067** (28.11)	0.061** (26.70)	0.065** (29.80)	0.063** (27.31)
ΔAR	0.160** (19.96)	0.152** (18.25)	0.084** (13.10)			
ΔINV				0.184** (23.62)	0.197** (23.52)	0.121** (18.85)
$PAYOUTrank$	-0.023** (-9.64)			-0.022** (-9.25)		
$\Delta AR*PAYOUTrank$	**-0.073**** **(-5.25)**					
$\Delta INV*PAYOUTrank$				**-0.056**** **(-4.12)**		
$AGErank$		-0.043** (-22.51)			-0.041** (-21.91)	
$\Delta AR*AGErank$		**-0.070**** **(-4.73)**				
$\Delta INV*AGErank$					**-0.084**** **(-5.68)**	
$Z_{FC}rank$			0.049** (20.79)			0.044** (19.19)
$\Delta AR* Z_{FC}rank$			**0.085**** **(5.96)**			
$\Delta INV* Z_{FC}rank$						**0.095**** **(6.96)**
Year & Firm Dummies	YES	YES	YES	YES	YES	YES
R^2	0.154	0.164	0.163	0.176	0.190	0.191

** and * indicate statistical significance at the 1% and 5% levels, respectively.

We examine the investment sensitivity to two specific components of WCACC: Changes in accounts receivables (ΔAR_t) and changes in inventory (ΔINV_t). In both panels, the dependent variable is capital expenditure scaled by beginning capital stock (I_t/K_{t-1}). *PAYOUT* is dividend payout ratio. *AGE* is firm age. Z_{FC} is the financial constraint index in Cleary (1999). The rank variables are in percentile rankings and converted to a [0,1] scale, where rankings are obtained by ranking observations and assigning them to 100 portfolios. The results are based on the firm- and year-fixed effect regressions with standard errors clustered at the firm level. The sample includes all manufacturing firms (SIC code between 2000 and 3999) with non-missing capital expenditure and cash flow variables from 1971 to 2006. We require that firms have at least five consecutive years of data in the sample period. T-statistics are in parentheses.