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Over-investment of free cash flow

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Abstract This paper examines the extent of firm level over-investment of free cash flow. Using an accounting-based framework to measure over-investment and free cash flow, I find evidence that, consistent with agency cost explanations, over-investment is concentrated in firms with the highest levels of free cash flow. Further tests examine whether firms' governance structures are associated with over-investment of free cash flow. The evidence suggests that certain governance structures, such as the presence of activist shareholders, appear to mitigate over-investment.

Keywords Free cash flow · Over-investment · Agency costs

JEL Classification G3 · M4

This paper examines firm investing decisions in the presence of free cash flow. In theory, firm level investment should not be related to internally generated cash flows (Modigliani & Miller, 1958). However, prior research has documented a positive relation between investment expenditure and cash flow (e.g., Hubbard, 1998). There are two interpretations for this positive relation. First, the positive relation is a manifestation of an agency problem, where managers in firms with free cash flow engage in wasteful expenditure (e.g., Jensen 1986; Stulz 1990). When managers' objectives differ from those of shareholders, the presence of internally generated cash flow in excess of that required to maintain existing assets in place and finance new positive NPV projects creates the potential for those funds to be squandered. Second, the positive relation reflects capital market imperfections, where costly external

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financing creates the potential for internally generated cash flows to expand the feasible investment opportunity set (e.g., Fazzari, Hubbard, & Petersen, 1988; Hubbard, 1998).

This paper focuses on utilizing accounting information to better measure the constructs of free cash flow and over-investment, thereby allowing a more powerful test of the agency-based explanation for why firm level investment is related to internally generated cash flows. In doing so, this paper is the first to offer large sample evidence of over-investment of free cash flow. Prior research, such as Blanchard, Lopez-di-Silanes, and Vishny (1994), document excessive investment and acquisition activity for eleven firms that experience a large cash windfall due to a legal settlement, Harford (1999) finds using a sample of 487 takeover bids, that cash-rich firms are more likely to make acquisitions that subsequently experience abnormal declines in operating performance, and Bates (2005) finds for a sample of 400 subsidiary sales from 1990 to 1998 that firms who retain cash tend to invest more, relative to industry peers. This paper extends these small sample findings by showing that over-investment of free cash flow is a systematic phenomenon across all types of investment expenditure.

The empirical analysis proceeds in two stages. First, the paper uses an accounting-based framework to measure both *free cash flow* and *over-investment*. *Free cash flow* is defined as cash flow beyond what is necessary to maintain assets in place and to finance expected new investments. *Over-investment* is defined as investment expenditure beyond that required to maintain assets in place and to finance expected new investments in positive NPV projects. To measure over-investment, I decompose total investment expenditure into two components: (i) required investment expenditure to maintain assets in place, and (ii) new investment expenditure. I then decompose new investment expenditure into over-investment in negative NPV projects and expected investment expenditure, where the latter varies with the firm's growth opportunities, financing constraints, industry affiliation and other factors.

Under the agency cost explanation, management has the potential to squander free cash flow only when free cash flow is positive. At the other end of the spectrum, firms with negative free cash flow can only squander cash if they are able to raise "cheap" capital. This is less likely to occur because these firms need to be able to raise financing and thereby place themselves under the scrutiny of external markets (DeAngelo, DeAngelo, & Stulz, 2004; Jensen, 1986). Consistent with the agency cost explanation, I find a positive association between over-investment and free cash flow for firms with positive free cash flow.[1] For a sample of 58,053 firm-years during the period 1988–2002, I find that for firms with

[1] Prior work in finance and economics examining the relation between cash flow and investment expenditure has tended to use either balance sheet measures of the stock of cash and cash equivalents (e.g., Harford, 1999) or earnings based measures as a proxy for cash flow (e.g., Lang, Stulz, & Walkling, 1991; Opler & Titman, 1993). It is well known that earnings and cash flows are not equivalent measures (e.g., Sloan, 1996). This paper seeks to measure free cash flow directly using information from the statement of cash flows as opposed to noisy combinations from the income statement and balance sheet.

positive free cash flow the average firm over-invests 20% of its free cash flow. Furthermore, I document that the majority of free cash flow is retained in the form of financial assets. The average firm in my sample retains 41% of its free cash flow as either cash or marketable securities. There is little evidence that free cash flow is distributed to external debt holders or shareholders.

Finding an association between over-investment and free cash flow is consistent with recent research documenting poor future performance following firm level investment activity. For example, Titman, Wei, and Xie (2004) and Fairfield, Whisenant, and Yohn (2003) show that firms with extensive capital investment activity and growth in net operating assets respectively, experience inferior future stock returns. Furthermore, Dechow, Richardson, and Sloan (2005) find that cash flows retained within the firm (either capitalized through accruals or ‘‘invested’’ in financial assets) are associated with lower future operating performance and future stock returns. This performance relation is consistent with the over-investment of free cash flows documented in this paper.

The second set of empirical analyses examine whether governance structures are effective in mitigating over-investment. Prior research has examined the impact of a variety of governance structures on firm valuation and the quality of managerial decision making (see Brown & Caylor, 2004; Gompers, Ishii, & Metrick, 2003; Larcker, Richardson, & Tuna, 2005 for detailed summaries). Collectively, the ability of cross-sectional variation in governance structures to explain firm value and/or firm decision making is relatively weak. Consistent with this, I find evidence that out of a large set of governance measures only a few are related to over-investment. For example, firms with activist shareholders and certain anti-takeover provisions are less likely to over-invest their free cash flow.

The next section develops testable hypotheses concerning the relation between free cash flow and over-investment. Section 2 describes the sample selection and variable measurement. Section 3 discusses empirical results for the over-investment of free cash flow. Section 4 contains empirical analysis examining the link between corporate governance and the over-investment of free cash flow, while section 5 concludes.

1. Free cash flow and over-investment

This section describes in detail the various theories supporting a positive relation between investment expenditure and cash flow and then develops measures of free cash flow and over-investment that can be used to test the agency based explanation.

1.1. Explanations for a positive relation between investment expenditure and cash flow

In a world of perfect capital markets there would be no association between firm level investing activities and internally generated cash flows. If a firm needed additional cash to finance an investment activity it would simply raise that cash from external capital markets. If the firm had excess cash beyond that needed to fund available positive NPV projects (including options on future investment) it would distribute free cash flow to external markets. Firms do not, however, operate in such a world. There are a variety of capital market frictions that impede the ability of management to raise cash from external capital markets. In addition, there are significant transaction costs associated with monitoring management to ensure that free cash flow is indeed distributed to external capital markets. In equilibrium, these capital market frictions can serve as a support for a positive association between firm investing activities and internally generated cash flow.

The agency cost explanation introduced by Jensen (1986) and Stulz (1990) suggests that monitoring difficulty creates the potential for management to spend internally generated cash flow on projects that are beneficial from a management perspective but costly from a shareholder perspective (the free cash flow hypothesis). Several papers have investigated the implications of the free cash flow hypothesis on firm investment activity. For example, Lamont (1997) and Berger and Hann (2003) find evidence consistent with cash rich segments cross-subsidizing more poorly performing segments in diversified firms. However, the evidence in these papers could also be consistent with market frictions inhibiting the ability of the firm to raise capital externally and not necessarily an indication of over-investment. Related evidence can also be found in Harford (1999) and Opler, Pinkowitz, Stulz, and Williamson (1999, 2001). Harford uses a sample of 487 takeover bids to document that cash rich firms are more likely to make acquisitions and these ''cash rich'' acquisitions are followed by abnormal declines in operating performance. Opler et al. (1999) find some evidence that companies with excess cash (measured using balance sheet cash information) have higher capital expenditures, and spend more on acquisitions, even when they appear to have poor investment opportunities (as measured by Tobin's Q). Perhaps the most direct evidence on the over-investment of free cash flow is the analysis in Blanchard et al. (1994). They find that eleven firms with windfall legal settlements appear to engage in wasteful expenditure.

Collectively, prior research is suggestive of an agency-based explanation supporting the positive relation between investment and internally generated cash flow. However, these papers are based on relatively *small* samples and do not measure *over*-investment or *free* cash flow directly. Thus, the findings of earlier work may not be generalizable to larger samples nor is it directly attributable to the agency cost explanation. More generally, a criticism of the literature examining the relation between investment and cash flow is that finding a positive association may merely indicate that cash flows serve as an effective proxy for investment opportunities (e.g., Alti, 2003). My aim is to better measure the constructs of *free* cash flow and *over*-investment by incorporating an accounting-based measure of growth opportunities, and test whether the relation is evident in a large sample of firms.

In addition to prior empirical work on agency based explanations for the link between firm level investment and internally generated free cash flow, there exists a stream of research dedicated to examining the role of financing constraints (e.g., Fazzari et al. (1988), Hoshi, Kashyap, and Scharfstein (1991), Fazzari and Petersen (1993), Whited (1992) and Hubbard (1998)). Myers and Majluf (1984) suggest that information asymmetries increase the cost of capital for firms forced to raise external finance, thereby reducing the feasible investment. Thus, in the presence of internally generated cash flow, such firms will invest more in response to the lower cost of capital.

Some early work in this area examined the sensitivity of investment to cash flow for high versus low dividend paying firms (Fazzari et al., 1988), comparing differing organizational structures where the ability to raise external financing was easier/harder (Hoshi, Kashyap and Scharfstein, 1991, with Japanese keiretsu firms) and debt constraints (Whited, 1992). These papers find evidence of greater sensitivity of investment to cash flow for sets of firms which appeared to be financially constrained (e.g., low dividend paying firms, high debt firms and firms with limited access to banks). However, more recent research casts doubt on the earlier results. Specifically, Kaplan and Zingales (1997, 2000), find that the sensitivity of investment to cash flow persists even for firms who do not face financing constraints. They construct a measure of ex ante financing constraints for a small sample of firms and find that the sensitivity of investment to cash flow for firms is negatively associated with this measure, thereby casting doubt on the financing constraint hypothesis. Nonetheless the investment expectation model described in Section 1.4 includes a variety of measures designed to capture financing constraints.

1.2. Primary hypothesis

As described in the earlier section, in a world of perfect capital markets (no frictions for raising external finance, no information asymmetries and associated moral hazard problems, no taxes etc.), there should be no association between firm level investment and internally generated cash flows. However, when it is costly for external capital providers to monitor management, and it is costly for the firm to raise external finance, an association is expected. Specifically, there should be a positive relation between firm level investment expenditure and internally generated cash flows.

This relation, however, could be due to several factors. It could reflect management engaging in additional investment on self-serving projects rather than distribute the cash to shareholders. Such decisions can include: (i) empire building (see e.g., Shleifer & Vishny, 1997), (ii) perquisite consumption (Jensen & Meckling, 1976), (iii) diversifying acquisitions (e.g., Morck, Shleifer, & Vishny, 1990), and (iv) subsidizing poorly performing divisions using the cash generated from successful ones instead of returning the cash to shareholders (e.g., Berger and Hann, 2003; Jensen & Meckling, 1976; Lamont, 1997). Alternatively, it could reflect the increased investment opportunity set from (relatively less costly) internal financing sources.

To focus on the agency-based explanation, the next section builds an investment expectation model that captures firm specific growth opportunities and measures of financing constraints. Firms with positive residuals from this expectation model are likely to be over investing. The empirical tests focus on this group of firms and examine whether over-investment is related to available free cash flow at the time those investments were made. Thus, the primary hypothesis (stated in alternate form) is:

H1: Firms with positive free cash flow over-invest.

The relation is expected to be asymmetric (i.e., concentrated in firms with positive free cash flow). This is because when firms have negative free cash flow they are forced to find alternative sources of financing for investment projects. The external capital markets are expected to serve an additional monitoring role in disciplining managerial use of funds (e.g., Jensen 1986).

1.3. A framework to measure the constructs of free cash flow and over-investment

The empirical analyses examine the relation between *over*-investment and *free* cash flow. This section describes how these two constructs will be measured. I define total investment, I_{TOTAL}, as the sum of all outlays on capital expenditure, acquisitions and research and development less receipts from the sale of property, plant and equipment:

$$I_{TOTAL,t} = CAPEX_t + Acquisitions_t + RD_t - SalePPE_t$$

Total investment expenditure can then be split into two main components: (i) required investment expenditure to maintain assets in place, $I_{MAINTENANCE}$, and (ii) investment expenditure on new projects, I_{NEW} (see Strong & Meyer, 1990 for a similar decomposition). My proxy for $I_{MAINTENANCE}$ is amortization and depreciation. Amortization and depreciation is an estimate of the portion of total investment expenditure that is necessary to maintain plant, equipment and other operating assets.[2] The next step is to then decompose I_{NEW} into expected investment expenditure in new positive NPV projects, I^{*}_{NEW}, and abnormal (or unexpected) investment, I^{ε}_{NEW}. This breakdown is shown below (and in complete detail in Fig. 1):

[2] Depreciation and amortization is likely to be a reasonable estimate for maintenance investment (of the capital expenditure variety) for firms whose depreciation schedule closely maps with the use of the asset. However, this is not likely to be the case for all firms. Likewise, depreciation and amortization is not likely to be a good approximation of maintenance investment for R&D. Recognizing these limitations, the investment expectation model developed in Section 1.4 includes prior firm level investment. To the extent that there is a temporally constant component to maintenance investment including this variable will help capture such investment.

$$I_{TOTAL,t} = I_{MAINTENANCE,t} + \underbrace{I_{NEW,t}}_{I^{*}_{NEW,t} \quad I^{\varepsilon}_{NEW,t}}$$

The abnormal component of investment can be negative or positive. Negative (positive) values correspond to under-(over-)investment. The focus of the empirical analysis in this paper is on the over-investment of free cash flow. Hence, the analysis will focus on firms with positive values for I^{ε}_{NEW}. The

Panel A: Definition of Investment Expenditures

		Acronym	Data Item
	<u>Total Investment Expenditure</u>	I_{TOTAL}	
+	Capital Expenditures	*CAPEX*	128
+	Research and Development Expenditure	*RD*	46
+	Acquisitions	*ACQ*	129
-	Sale of Property, Plant and Equipment	*SalePPE*	107
	<u>Investment to Maintain Existing Assets in Place</u>		
+	Amortization and Depreciation	$I_{MAINTENANCE}$	125

Panel B: Decomposition of Investment Expenditures

New Investments (I_{NEW})

Total Investment Expenditure = Investment to Maintain Existing Assets in Place + Expected Investment on New Projects + Over-investment in New Projects

$$I_{TOTAL,t} = I_{MAINTENANCE,t} + \underbrace{I_{NEW,t}}_{I^{*}_{NEW,t} \quad I^{\varepsilon}_{NEW,t}}$$

$$I_{NEW,t} = \underbrace{\hat{\alpha} + \hat{\beta} VP_{t-1} + \hat{\varphi} Z_{t-1}}_{I^{*}_{NEW,t}} + I^{\varepsilon}_{NEW,t}$$

Panel C: Definition of Growth Opportunities

V/P is a measure of growth opportunities. It is calculated as the ratio of the value of the firm (V_{AIP}) to the market value of equity (item 25 * item 199). V_{AIP} is estimated as $V_{AIP} = (1-\alpha r)BV + \alpha(1+r)X - \alpha rd$ where, $\alpha=(\omega/(1+r-\omega))$ and r =12% and ω=0.62. ω is the abnormal earnings persistence parameter from the Ohlson (1995) framework, *BV* is the book value of common equity (item 60), *d* is annual dividends (item 21) and *X* is operating income after depreciation (item 178).

Z is a vector of additional determinants of investment expenditure. This vector includes leverage, firm size, firm age, stock of cash, past stock returns, prior firm level investment, annual fixed effects and industry fixed effects.

Fig. 1 Framework for examining investment expenditure and free cash flow

Panel D: Reconciliation of the Sources and Uses of Free cash flow

		Acronym	Data Item	Totals
SOURCES:				
Free cash flow from Existing Assets in Place		CF_{AIP}		
+	Net Cash flow from Operating Activities	CFO	308	
-	Maintenance Investment Expenditure	$I_{MAINTENANCE}$	125	
+	Research and Development Expenditure	RD	46	1
Free cash flow from Growth Opportunities		I^{*}_{NEW}		
-	Expected Investment on New Projects			2
Net Sources of Free cash flow		$FCF = CF_{AIP} - I^{*}_{NEW}$ (2)		1-2
USES:				
Over-Investment		I^{ε}_{NEW}		3
Net Cash Flow to Equity Holders		$\Delta Equity$		
+	Purchase of Common and Preferred Stock		115	
+	Cash Dividends		127	
-	Sales of Common and Preferred Stock		108	4
Net Cash Flow to Debt Holders		$\Delta Debt$		
+	Long-term Debt Reduction		114	
-	Long-term Debt Issuance		111	
-	Changes in Current Debt		301	5
Change in Financial Assets		$\Delta Fin.\ Asset$		
+	Increase in Cash and Cash Equivalents		274	
-	Change in Short Term Investments		309	6
Other Investments		$Other\ Inv.$		
+	Increase in Investments		113	
-	Sale of Investments		109	7
Miscellaneous Cash Flows		$Other$		
-	Other Investing Activities		310	
-	Other Financing Activities		312	
-	Exchange Rate Effect		314	8
Net Uses of Free cash flow				3+4+5+6+7+8

The following equality will always hold:

$$FCF_t = I^{\varepsilon}_{NEW,t} + \Delta Equity_t + \Delta Debt_t + \Delta Financial\ Asset_t + Other\ Inv._t + Other_t$$

$$FCF_t$$

$I_{NEW,t}$ $\Delta Equity_t$ $\Delta Debt_t$ $\Delta FinancialAsset_t$ $Other\ Inv._t$ $Other_t$

Fig. 1 continued

investment expectation model is described in more detail in Section 1.4. The predicted value from this expectation model is I^{*}_{NEW} and the residual value from the expectation model is I^{ε}_{NEW}. The residual value is my estimate of over-investment.

Free cash flow is cash flow beyond what is necessary to maintain assets in place (including servicing existing debt) and to finance expected (optimal) new investments. To measure free cash flow, I need estimates of three components:

1. A measure of cash flow generated from assets in place (CF_{AIP}).
2. A measure of investment expenditure necessary to maintain assets in place ($I_{MAINTENANCE}$).
3. A measure of the expected level of new investment expenditure (I_{NEW}).

CF_{AIP} is estimated directly from the statement of cash flows by adding research and development expenditure back to operating cash flows. This is required because accounting standards force companies to expense research and development (RD) expenditure. As such this amount is included as a deduction to operating cash flows. Financial economists, however, usually consider RD as discretionary investment expenditure. Maintenance expenditure ($I_{MAINTENANCE}$) is also deducted to reflect the fact that this investment expenditure is not a discretionary use of funds. Thus, my estimate of the cash flow generated from assets in place, CF_{AIP}, is computed as follows:

$$CF_{AIP} = CFO - I_{MAINTENANCE} + RD$$

Again this is depicted in complete detail in Fig. 1. Finally, to compute free cash flow (FCF), expected new investment (I^{*}_{NEW}) is subtracted from cash flow generated from assets in place (CF_{AIP}):

$$FCF = CF_{AIP} - I^{*}_{NEW}$$

Utilizing the investment decomposition described above (and in full detail in the next section) this framework allows the simultaneous estimation of free cash flow and over-investment.

1.4. Expectation model for firm level investment decisions

There is an extensive literature in economics and finance that has examined firm level investment decisions (e.g., Hubbard 1998). I use this literature to estimate expected investment according to the following regression specification:

$$\begin{aligned} I_{NEW,t} = {} & \alpha + \beta_1 V/P_{t-1} + \beta_2 Leverage_{t-1} + \beta_3 Cash_{t-1} + \beta_4 Age_{t-1} \\ & + \beta_5 Size_{t-1} + \beta_6 Stock\ Returns_{t-1} + \beta_7 I_{NEW,t-1} \\ & + \Sigma Year\ Indicator + \Sigma Industry\ Indicator \end{aligned}$$

The fitted value from the above regression is the estimate of the expected level of new investment, I^{*}_{NEW}. The unexplained portion (or residual) is the estimate of over-investment, I^{ε}_{NEW}.[3] Expected investment expenditure on new projects will be an increasing function of growth opportunities. The underlying construct of growth opportunities refers to the present value of the firm's options to make future investments (Myers, 1977). As researchers we are at a disadvantage when we try to measure this construct, because managers have access to the information pertaining to prospective investment activity and people outside the firm do not. The standard approach in the literature has been to use market price relative to some measure of fundamental value to determine growth opportunities. Tobin's Q (the ratio of the market value of assets to the current replacement cost of those assets) is the most widely used measure of growth opportunities. However, measures such as Q alone do not give a complete picture of the market's expectations of growth opportunities. Previous research that uses book-to-market of equity (BM) and earnings-price ratios (EP) as measures of growth opportunities can be viewed as special cases of the residual income valuation model (Penman, 1996). For BM to be a sufficient statistic for growth opportunities it must be true that earnings are completely transitory. Conversely, for EP to be a sufficient statistic requires earnings to be completely permanent. However, it is well known that earnings display a degree of mean reversion in between these two extremes (e.g., Dechow, Hutton, & Sloan, 1999). Thus, using either market-to-book or price-earnings or some arbitrary combination will generate an inefficient estimate of growth opportunities because knowledge of earnings persistence is ignored.

Using the residual income framework, it is possible to construct a parsimonious measure of growth opportunities, incorporating information in market price in conjunction with measures of the value of firm's assets in place as reflected in book value *and* current earnings. I start with the premise that firm value can be decomposed into two components: value of the assets in place, V_{AIP}, and the value of growth opportunities, V_{GO}. So firm value, P, can be represented as:

$$P = V_{AIP} + V_{GO}$$

Firm value, P, is observable. So I need to estimate either V_{AIP} or V_{GO} directly. A natural starting point is to estimate V_{AIP} using the residual income framework. The intuition behind this approach is that the value of assets in

[3] I estimate the investment expectation model across all firms which implies that the average over-investment across firm-years is equal to zero. Obviously, this analysis is subject to the standard criticism of mis-specification in the investment expectation model (with respect to both functional form and the set of included independent variables). To address these concerns, I consider different sets of independent variables in the investment model (see Section 3) and perform analysis using raw and ranked data as well as a portfolio approach that assumes measurement error is uncorrelated across portfolios (discussed in Section 3.2). My results are robust to all of these specifications.

place will manifest itself in current book values and earnings. On the other hand growth opportunities are yet to be accounted for and will represent the difference between observed firm value and an estimate of the value of assets in place.

Assuming price is equal to discounted expected dividends, accounting information articulates via the clean-surplus relation, and abnormal earnings follow an auto-regressive process with persistence parameter, ω, it is possible to express the value of assets in place, V_{AIP} as:

$$V_{AIP} = (1 - \alpha r)BV + \alpha(1 + r)X - \alpha rd$$

where BV is the book value of common equity, X is earnings, r is the discount rate, d is dividends, ω is a fixed persistence parameter restricted to be positive and less than one, and $\alpha = (\omega/(1+r-\omega)$.[4] V_{AIP} reflects the value of the firm indicated by current book values and current earnings. Thus, it provides an estimate of firm value attributable to assets in place. It is useful to note that this specification of firm value introduced by Ohlson (1995) is an estimate of firm value *absent* growth opportunities. Additional research by Feltham and Ohlson (1996) allows for the presence of new positive NPV projects. Under their model, firm value is similar to the algebraic expression above except for an additional term that captures growth opportunities. This framework simultaneously captures market value relative to both book value and earnings in an accepted valuation framework. It is easily implemented, as the only required inputs are price, book value, earnings, dividends, a discount rate and an earnings persistence parameter.[5] Thus, to capture growth opportunities from accounting and market information, *V/P* is measured as the ratio of V_{AIP} to market value instead of the standard Tobin's Q measure.[6]

It is useful to discuss how *V/P* relates to both book-to-market and earnings-to-price ratios. *V/P* is a linear combination of *BM* and *EP* (the numerator of *V/P* is a weighted average of book values and earnings). *BM* can be expressed as the summation of future abnormal return on equity (see e.g., Fairfield,

[4] In the empirical implementation of this model I use a measure of operating earnings. This is driven by practical considerations relating to the predictability of future abnormal earnings. Measures of bottom line earnings do not perform as well as measures of operating earnings in predicting abnormal earnings. This is largely due to the lower persistence of the transitory items that are included in measures of comprehensive or bottom line income (e.g., Dechow et al., 1999).

[5] Specifically, the framework is flexible enough to allow inter-temporal and cross-sectional variation of these last two parameters. However, for my purposes I assume a constant discount rate of 12 percent and the persistence parameter of 0.62 as reported in Dechow et al. (1999). I have re-performed all analyses using (i) industry specific earnings persistence parameters, and (ii) firm specific cost of capital estimates from the CAPM model. The key inference that over-investment is concentrated in firms with positive free cash flow is unaffected by these alternative estimation approaches.

[6] The reciprocal is preferred for two reasons. First, the distribution of the reciprocal is less skewed leading to more desirable properties for statistical tests. Second, the measure is continuous through zero such that firms with negative book values are ranked similar to high growth firms. Note that using the reciprocal (i.e., *V/P*) means that the expected relation between investment and growth opportunities is negative.

1994; Wilcox, 1984). The key driver of *BM* is the expected level of abnormal future return on equity for the remainder of the firm's operating horizon *and* growth in book values. However, it is important to realize that *BM* can be low due to high current performance (see e.g., Fairfield, 1994; Penman, 1991, 1996). Firms such as Coca-Cola and Kroger are good examples. These firms have very low *BM* (in bottom decile) yet they have moderate levels of *V/P* (around the median). Hence, using *BM* alone will mis-classify these firms as having high growth opportunities.

Similarly, using *EP* alone will lead to mis-classification. The key driver of *EP* is the growth in future abnormal earnings. However, *EP* ratios alone are difficult to interpret in the presence of temporarily depressed current earnings. To discriminate between firms that have low *EP* due to transitory earnings, as opposed to growth opportunities, it is necessary to look at the information in *BM*. Firms with low levels of *EP BM* are the firms with the greatest growth opportunities.

I include additional control variables that have been shown in prior research to be determinants of investment decisions, including leverage, firm size, firm age, the level of cash, past stock returns and prior firm level investment (e.g., Barro 1990; Bates, 2005; Hubbard, 1998; Lamont, 2000). Previous research has documented a sensitivity of firm level investment to these measures. Firm level investment is lessened when it is more difficult to raise additional cash to finance the new investment as captured by leverage, firm size, firm maturity and level of cash (e.g., Fazzari et al., 1988; Hubbard, 1998). Prior stock returns is included as an additional variable to capture growth opportunities not reflected in *V/P* (Barro, 1990; Lamont, 2000) and prior firm level investment is included to capture non-modeled firm characteristics that impact investing decisions. I also include indicator variables for industry membership and temporal effects to capture additional variation in investment expenditure that are not explained by my measures of growth opportunities and financing constraints. It is important to note that including these additional variables may reduce the power of my tests to capture over-investment. For example, if over-investment is concentrated in industry groups, in particular time periods or is concentrated in certain firms then the model may inappropriately classify abnormal investment as normal investment, effectively controlling for the effect that I am trying to document. To address this possibility, multiple investment expectation models are examined in Section 3.

1.5. Uses of free cash flow

The focus of this paper is the over-investment of free cash flow. However, over-investment is but one of many alternate uses of free cash flow. Panel D of Fig. 1 depicts the sources and uses of free cash flow. This analysis characterizes all possible uses of the free cash flow derived in Section 1.3. Using information obtained from the statement of cash flows, I am able to allocate free cash flow flows into six categories. This is simply a re-characterization of the statement of cash flows, where cash generated must equal cash used. The six categories are: (i) over-investment, I^{ε}_{NEW}, (ii) net payments to shareholders, $\Delta Equity$, (iii) net principal payments to debt-holders, $\Delta Debt$, (iv) net change in financial assets, $\Delta Financial\ Asset$, (v) *Other Investments* and (vi) miscellaneous cash flows, *Other*. This is represented by the following identity:

$$FCF_t \equiv I^{\varepsilon}_{NEW,t} + \Delta Equity_t + \Delta Debt_t + \Delta Financial\ Asset_t + Other\ Investments_t + Other_t$$

The final two categories contain miscellaneous reconciling items that are not important empirically (very little variation in the sample). The main concern from the perspective of shareholders is the first category, over-investment, because this imposes substantial agency costs on shareholders. However, it is less clear what the best use of free cash flow is beyond avoiding over-investment. Payments to shareholders will be affected by the tax status of the firm's investor base (Allen & Michaely, 2003). In addition, payments to both shareholders and debt-holders will impact the capital structure of the firm. To the extent that management is seeking an optimal capital structure, it is difficult to determine what the optimal distribution of free cash flow should be. Retention of free cash flow in the form of financial assets is also an option available to management. The optimal level of free cash flow to be retained will be a function of firm specific characteristics such as variability of cash flow and ability to access external capital markets (e.g., Harford, 1999). Firms with more volatile cash flows will want to retain cash for future periods when cash flow is low, and firms who find it more difficult to raise external capital will desire larger cash holdings (e.g., Opler et al., 1999). My primary focus is on the extent of over-investment and the role that governance structures can play in mitigating over-investment. I leave detailed examination of how firms use free cash flow (other than over-investing) to future research.

2. Data and sample selection

The main empirical tests employ financial statement data from the *Compustat* annual database (inclusive of active and inactive securities). I exclude financial institutions from my analysis (SIC codes between 6000 and 6999) because the demarcation between operating, investing, and financing activities is ambiguous for these firms. The sample period covers the fiscal years 1988–2002 with 58,053 firm-year observations.

In the empirical analysis that follows I scale all financial variables by average total assets (results are similar using sales as an alternative deflator). To minimize the influence of outliers I delete firms where the deflated value of free cash flow or any of the potential uses of free cash flow exceeds one in absolute value. The measure of growth opportunities, *V/P*, is winsorized by re-coding observations less (greater) than the 1st (99th) percentile to the 1st (99th) percentile. In unreported tests, I re-perform all analyses using rank regressions according to the procedure outlined in Iman and Conover (1979). Results from this analysis are similar to those reported in the text.

3. Results

3.1. Analysis of investment expenditure and free cash flow

Table 1 reports details on investment expenditure and the determination of free cash flow. The average firm undertakes investment activity equal to 13.1% of its asset base. The major component of investment is capital expenditure, followed by research and development expenditure. Of the total investment expenditure, 44% is spent maintaining existing assets in place and the remaining 56% is spent on new investments.[7]

Table 2 reports various specifications of the investment expectation model. This model facilitates the computation of over-investment and expected new investment described in Section 1.3. Over-investment is the residual from the model (I^{ε}_{NEW}), and expected new investment is the fitted value (I^{*}_{NEW}). Model

Table 1 Analysis of investment expenditure

	Mean	Std Dev	P1	Q1	Median	Q3	P99
Panel A: Descriptive statistics for investment expenditure							
$I_{TOTAL,t} = CAPEX_t + Acquisitions_t + RD_t - SalePPE_t$							
$I_{NEW,t} = I_{TOTAL,t} - I_{MAINTENANCE,t}$							
I_{TOTAL}	0.131	0.135	–0.024	0.043	0.094	0.180	0.647
$CAPEX$	0.070	0.083	0	0.023	0.047	0.087	0.406
Acquistions	0.025	0.078	0	0	0	0.005	0.411
RD	0.042	0.088	0	0	0	0.047	0.416
SalePPE	0.006	0.033	0	0	0	0.002	0.111
$I_{MAINTENANCE}$	0.057	0.048	0	0.032	0.048	0.068	0.230
I_{NEW}	0.075	0.134	–0.167	–0.001	0.041	0.119	0.578

This table examines the properties of investing cash flows as a function of growth opportunities. The sample covers 58,053 firm years with available data on *Compustat* for the period 1988–2002

P1 (P99) is the 1st (99th) percentile of the respective distribution

Q1 (Q3) is the lower (upper) quartile of the respective istribution

I_{TOTAL} is total investment expenditure. It is calculated as research and development expenditure, *RD* (item 46) plus capital expenditure, *CAPEX* (item 128) plus acquisition expenditure, *Acquisitions* (item 129) less cash receipts from sale of property, plant and equipment, *SalePPE* (item 107)

$I_{MAINTENANCE}$ is investment expenditure necessary to maintain assets in place. I proxy for this construct using reported depreciation and amortization (item 125)

I_{NEW} is the difference between I_{TOTAL} and $I_{MAINTENANCE}$

All investment expenditure variables are scaled by average total assets (item 6)

[7] The mean firm in my sample undertakes investment expenditure equal to 13.1% of its asset base. Maintenance expenditure for the average firm is equal to 5.7% of the asset base. This constitutes 44% of total investment expenditure (0.057/0.131 = 0.44).

Table 2 Extended analysis of investment expenditure

Variable	Predicted Sign	Model			
		I	II	III	IV
$I_{NEW,t} = \alpha + \beta_1 V/P_{t-1} + \beta_2 Leverage_{t-1} + \beta_3 Cash_{t-1} + \beta_4 Age_{t-1} + \beta_5 Size_{t-1} + \beta_6 Stock\ Returns_{t-1} + \beta_7 I_{NEW,t-1} + \Sigma Year\ Indicator + \Sigma Industry\ Indicator$					
V/P	–	–0.051			–0.013
		(–39.70)			(–26.64)
Leverage	–			–0.052	–0.049
				(–19.15)	(–17.82)
Cash	+			0.124	0.104
				(27.03)	(21.57)
Age	–			–0.006	–0.006
				(–9.84)	(–11.54)
Size	+			0.003	0.003
				(9.16)	(10.64)
Stock Returns	+			0.012	0.010
				(17.75)	(14.88)
I_{NEW},*t*–1	+			0.428	0.386
				(52.24)	(45.65)
Year Indicators		No	Yes	No	Yes
Industry Indicators		No	Yes	No	Yes
Adjusted R^2		0.057	0.111	0.302	0.326

This table develops a model of investment expenditure. The determinants of investment include measures of growth opportunities, leverage, firm age, firm size, cash balance, industry fixed effects and annual fixed effects. The sample covers 58,053 firm years with available data on *Compustat* for the period 1988–2002

T-statistics are reported in parentheses underneath coefficient estimates based on Huber–White robust standard errors

I_{NEW} is the difference between I_{TOTAL} and $I_{MAINTENANCE}$

I_{TOTAL} is total investment expenditure. It is calculated as research and development expenditure, *RD* (item 46) plus capital expenditure, *CAPEX* (item 128) plus acquisition expenditure, *Acquisitions* (item 129) less cash receipts from sale of property, plant and equipment, *SalePPE* (item 107)

$I_{MAINTENANCE}$ is investment expenditure necessary to maintain assets in place. I proxy for this construct using reported depreciation and amortization (item 125)

V/P is a measure of growth opportunities. It is calculated as the ratio of the value of the firm (V_{AIP}) and market value of equity (item 25 * item 199). V_{AIP} is estimated as $V_{AIP}=(1-\alpha\ r)BV+\alpha(1+r)X-\alpha\ rd$ where, $\alpha=(\omega/(1+r-\omega))$ and r=12% and ω =0.62. ω is the abnormal earnings persistence parameter from the Ohlson (1995) framework, *BV* is the book value of common equity (item 60), *d* is annual dividends (item 21) and *X* is operating income after depreciation (item 178)

Age is the log of the number of years the firm has been listed on CRSP as of the start of the year

Size is the log of total assets (item 6) measured at the start of the year

Leverage is the sum of the book value of short term (item 34) and long term debt (item 9) deflated by the sum of the book value of total debt and the book value of equity (item 60)

Cash is the balance of cash and short term investments (item 1) deflated by total assets measured at the start of the year

Stock Returns is the stock returns for the year prior to the investment year. It is measured as the change in market value of the firm over that prior year

Year Indicators is a vector of indicator variables to capture annual fixed effects

Iundustry Indicators is a vector of indicator variables to capture industry fixed effects. There are 43 industry indicator variables (using Fama-French, 1997 groupings) in this regression

All investment expenditure variables are scaled by average total assets (item 6)

I comprises only the accounting based measure of growth opportunities, *V/P*. The regression estimates reported in this table are for the pooled sample with Huber–White robust standard errors, which are a generalization of the White (1980) standard errors that are robust to both serial correlation and heteroskedasticity (Rogers, 1993). The coefficient estimate for β_1 is –0.051. To give some economic interpretation to the strength of this relation, an inter-quartile change in *V/P* of 0.582 [the first (third) quartile of the *V/P* distribution is 0.310 (0.892)], corresponds to an additional 0.030 (0.582 * 0.051) in new investment expenditure. Alternatively stated, an inter-quartile change in growth opportunities translates to additional investment equal to three percent of the asset base of the firm. While this number appears small it is important to remember that *V/P* captures the expected benefit from current and expected investment expenditure in *all* future periods. The point estimate from this regression specification captures only investment in the *current* period. In unreported analyses this specification was estimated by industry and industry-year groupings (using Fama & French, 1997 industry definitions and the Fama & Macbeth, 1973 technique of estimating regression coefficients by group and averaging results across groups). The results are very similar to those reported in the table. Across all regression specifications the coefficient on *V/P* is significantly negative.

The model of investment expenditure in the first column of Table 2 includes only growth opportunities as an explanatory variable. The remaining models expand the set of included determinants (each specification reports results with Huber–White robust standard errors). The second model shows that including only industry and annual fixed effects explains 11.1% of the variation in I_{NEW}. The control variables leverage, cash balance, firm age, firm size, prior stock returns and prior firm level investment expenditure explain 30.2% of the variation (model III). Including all of the variables increases the explanatory power to 32.6% (model IV). All control variables load as expected—new investment expenditure is increasing in firm size, prior cash holdings, prior stock returns and prior investment activity and decreasing in firm age and leverage. In subsequent analyses decomposing I_{NEW} into expected investment (I^{*}_{NEW}) and over-investment (I^{ε}_{NEW}) I use model IV. Later results examining the relation between over-investment and free cash flow are similar if I instead use any of the models in Table 2.

Table 3 panel A provides descriptive statistics for the free cash flow measure. The average firm in my sample has cash flow from assets in place equal to 3.8% of its asset base. After subtracting expected investment on new projects (7.5% of asset base for the average firm), the average firm has a cash shortfall (i.e., negative free cash flow) equal to 3.6% of its asset base. Approximately 45% of sample firms have positive values of free cash flow.

Panel B of Table 3 contains the key result that over-investment is a function of free cash flow. I run the following regression:

$$I^{\varepsilon}_{NEW,t} = \alpha + \delta_1 FCF < 0_t + \delta_2 FCF > 0_t + \varepsilon$$

Table 3 Analysis of free cash flow and over-investment

	Mean	Std Dev	P1	Q1	Median	Q3	P99
Panel A: Descriptive statistics for free cash flow							
$FCF_t = CF_{AIP,t} - I^*_{NEW,t}$							
I^*_{NEW} *is the fitted value from:*							
$I_{NEW,t} = \alpha + \beta_1 V/P_{t-1} + \beta_2 Leverage_{t-1} + \beta_3 Cash_{t-1} + \beta_4 Age_{t-1} + \beta_5 Size_{t-1} + \beta_6 StockReturns_{t-1} + \beta_7 I_{NEW,t-1} + \Sigma Year\ Indicator + \Sigma Industry\ Indicator$							
CF_{AIP}	0.038	0.145	–0.445	–0.019	0.042	0.106	0.414
I^*_{NEW}	0.075	0.076	–0.058	0.024	0.059	0.112	0.325
I^ε_{NEW}	0	0.110	–0.249	–0.050	–0.012	0.030	0.414
FCF	–0.036	0.153	–0.573	–0.092	–0.012	0.045	0.288

Panel B: Relation between over-investment (I^ε_{NEW}) *and free cash flow (FCF)*

$I^\varepsilon_{NEW,t} = \alpha + \delta_1 FCF{<}0_t + \delta_2 FCF{>}0_t + \varepsilon$

Model	α	δ_1	δ_2	*Adjusted* R^2
Pooled	0.002	0.111	0.171	0.032
	(2.65)	(15.19)	(13.78)	
F-statistic for test $\delta_1=\delta_2$:				40.87***
Fama-MacBeth (15 years)	0.002	0.115	0.172	0.037
	(1.54)	(9.47)	(12.13)	
T-statistic from annual coefficient estimates for test: $\delta_1=\delta_2$:				2.35***

The table examines the properties of free cash flow and how it relates to over-investment. All variables are scaled by average total assets. The sample covers 58,053 firm years with available data on *Compustat* for the period 1988–2002

T-statistics are reported in parentheses underneath coefficient estimates. ***indicates significant difference at the 1% level

For the pooled regressions I report *t*-values based on Huber–White robust standard errors

For the industry and industry-year group regressions the parameter estimates and are the weighted average (using the square root of the number of observations in each group as the weight) of individual group regression parameters. Test statistics are based on the across group variation in these parameters

P1 (P99) is the 1st (99th) percentile of the respective distribution

Q1 (Q3) is the lower (upper) quartile of the respective distribution

Table 3 continued

I_{NEW} is the difference between I_{TOTAL} and $I_{MAINTENANCE}$

I_{TOTAL} is total investment expenditure. It is calculated as research and development expenditure, *RD* (item 46) plus capital expenditure, *CAPEX* (item 128) plus acquisition expenditure, *Acquisitions* (item 129) less cash receipts from sale of property, plant and equipment, *SalePPE* (item 107)

$I_{MAINTENANCE}$ is investment expenditure necessary to maintain assets in place. I proxy for this construct using reported depreciation and amortization (item 125)

I^{*}_{NEW} is the fitted value from regression model IV in Table 2. It is an estimate of the expected level of investment

I^{ε}_{NEW} is the residual from regression model IV in Table 2. It is an estimate of over-investment

CF_{AIP} is cash flow from operating activities after maintenance investment expenditure. It is calculated as cash from operations (item 308) less $I_{\mathrm{MAINTENANCE}}$ plus research and development expenditure (item 46)

FCF is CF_{AIP} less I^{*}_{NEW}. *FCF* is cash flow beyond that necessary to maintain assets in place (including servicing existing debt obligations) and finance expected new investments (i.e., free cash flow)

$FCF < 0$ ($FCF > 0$) is equal to *FCF* for values of *FCF* less (greater than) zero and zero otherwise

All investment and cash flow variables are scaled by average total assets (item 6)

$FCF < 0$ ($FCF > 0$) is equal to FCF for values of FCF less (greater than) zero and zero otherwise. This allows the relation between over-investment and free cash flow to be asymmetric. In particular, allowing the slope coefficient to vary based on the sign of free cash flow reveals that over-investment is concentrated in firms with positive free cash flow (the estimate of δ_1 is 0.111 and the estimate of δ_2 is 0.171, significantly different at the 1% level). Panel B reports both pooled regression estimates (using robust standard errors) as well as average estimates from annual regressions. Out of the fifteen annual regressions, the estimate for δ_2 is statistically greater than the estimate for δ_1 in eleven years. When firms have do not have free cash flow, (i.e., $FCF < 0$) the possibility of over-investment is mitigated as the firm is forced to access external markets to raise funds necessary for any additional investment. Capital markets serve an additional monitoring role in disciplining managerial use of funds. The regression results in Table 3 support H1 by showing that firms with positive free cash flow are more likely to over-invest on average and then for each additional dollar of free cash flow they over-invest more. It is important to note the relatively low explanatory power from this regression specification. The model describing free cash flow as the determinant of over-investment only explains 3.2% of the variation. However, this explanatory power is incremental to the set of other determinants of firm level investment expenditure (which was 32.6% for model IV). So, the combined framework is able to explain a significant portion of the cross-sectional variation in investment expenditure and find a statistically significant relation between *over*-investment and *free* cash flow.

While not the focus of my paper, the regression results in Table 3 also relate to under-investment. The positive coefficient on δ_1 indicates that firms with negative free cash flow experience less over-investment (or equivalently stated more under-investment as the mean value of over-investment for this sub-sample of firms is negative). This relation is consistent with the notion that firms subject to cash short falls from operating activities scale back on investment activity. But it is important to note that the strength of the relation between abnormal investment and free cash flow is muted for firms with negative free cash flow (i.e., δ_1 is much smaller than δ_2) because these firms are able to raise additional cash from external financial markets.

Panel A of Table 4 reports the distributional properties of the free cash flow measure and the various uses of free cash flow. There is little variation in the ''other investments'' and miscellaneous ''other'' category—I ignore these uses in subsequent discussion. The breakdown of each additional dollar of free cash flow is shown in panel B of Table 4. I examine firm-year observations with positive free cash flow separately from negative free cash flow observations. For each sample, I average the different uses of free cash flow and express each use as a percentage of available free cash flow. This partition on the sample emphasizes how the use of free cash flow varies based on the sign of free cash flow.

For firms with positive free cash flow (44.6% of the sample) the average use of a dollar of free cash flow is as follows: 20% is over-invested, 13% is paid out

Table 4 Analysis of alternative uses of free cash flow. The sample covers 58,053 firm years with available data on *Compustat* for the period 1988–2002

	Mean	Std Dev	P1	Q1	Median	Q3	P99
Panel A: Descriptive statistics for how free cash flow is used							
FCF	–0.036	0.153	–0.573	–0.092	–0.012	0.045	0.288
I^{ε}_{NEW}	0	0.110	–0.249	–0.050	–0.012	0.030	0.414
Δ*Equity*	–0.021	0.132	–0.665	–0.008	0	0.017	0.196
Δ*Debt*	–0.017	0.115	–0.461	–0.041	0	0.025	0.251
Δ *FinancialAsset*	0.001	0.127	–0.409	–0.025	0.000	0.027	0.441
Other Inv.	0.002	0.058	–0.160	0	0	0	0.182
Other	–0.002	0.075	–0.293	–0.003	0	0.008	0.189

Panel B: How free cash flow is used

Sources and Uses	FCF > 0 Firm-years (n = 25,897)		FCF < 0 Firm-years (n = 32,156)	
	Average	Percent (%)	Average	Percent (%)
Sources				
FCF	0.075	100	–0.126	100
Uses				
I^{ε}_{NEW}	0.015	20	–0.012	10
Δ*Equity*	0.009	13	–0.046	37
Δ*Debt*	0.011	15	–0.039	31
Δ*FinancialAsset*	0.031	41	–0.022	18
Other Inv.	0.004	6	0.000	0
Other	0.004	5	–0.006	5

P1 (P99) is the 1st (99th) percentile of the respective distribution

Q1 (Q3) is the lower (upper) quartile of the respective distribution

Δ*Equity* is the net cash returned to shareholders for the period. It is calculated as the sum of repurchases, (item 115) and dividends (item 127) less cash raised from stock issuance (item 108)

Δ*Debt* is the net cash returned to debtholders for the period. It is calculated as long term debt reduction (item 114) less long term debt issuance (item 111) less changes in current debt (item 301)

Δ*Financial Assets* is the change in cash holdings. It is calculated as change in cash (item274) less change in short term investments (item 309)

Other Investments is other investments made. It is calculated as increase in investments (item113) less sale of investments (item 109)

Other includes all other categories on the statement of cash flows not included in Δ*Equity*, Δ*Debt*, Δ*Financial Assets*, I^{ε}_{NEW} and *Other Investments*. It is calculated as the negative of the sum of exchange rate effects (item 314), other investing activities (item 310) and other financing activities (item 312)

FCF is CF_{AIP} less I^{*}_{NEW}. *FCF*s cash flow beyond that necessary to maintain assets in place (including servicing existing debt obligations) and finance expected new investments

CF_{AIP} is cash flow from operating activities after maintenance investment expenditure. It is calculated as cash from operations (item 308) less $I_{MAINTENANCE}$ plus research and development expenditure (item 46)

I_{NEW} is the difference between I_{TOTAL} and $I_{MAINTENANCE}$. I_{NEW} represents investment expenditure after maintenance of existing assets in place. I_{TOTAL} is total investment expenditure. It is calculated as research and development expenditure, *RD* (item 46) plus capital expenditure, *CAPEX* (item 128) plus acquisition expenditure, *Acquisitions* (item 129) less cash receipts from sale of property, plant and equipment, *SalePPE* (item 107). $I_{MAINTENANCE}$ is investment expenditure necessary to maintain assets in place. I proxy for this construct using reported depreciation and amortization (item 125)

Table 4 continued

I^{*}_{NEW} is the fitted value from regression model IV in Table 2. It is an estimate of the expected level of investment

I^{ε}_{NEW} is the residual from regression model IV in table 2. It is an estimate of over-investment

All cash flow and investment variables are scaled by average total assets

to shareholders, 15% is paid out to debt-holders, 41% is retained in financial assets, and the remaining 11% is spread across the other categories. For firms with negative free cash flow, the breakdown is quite different. The free cash flow shortfall is financed as follows: 10% is under-invested, 37% is received from shareholders, 31% is received from to debt-holders, 18% is financed from existing financial assets, and the remaining 5% is spread across the other categories. It is clear that firms with cash shortfalls raise additional funds through equity and debt offerings and also by running down existing cash balances. For firms with positive free cash flow, the two main uses are retention in the form of financial assets and over-investment. Consistent with the regression results in Table 3 and the agency cost explanation, the positive relation between over-investment and free cash flow is concentrated in those observations where free cash flow is positive.

3.2. Robustness tests and limitations for the primary hypothesis

To address concerns about the robustness of the primary finding of a positive relation between over-investment and free cash flow I perform several additional tests (all unreported). The finding that over-investment is concentrated in firms with positive free cash flow is supported by all of these additional tests.

3.2.1. Alternative measures of growth opportunities

I examine the strength of the relation between over-investment and free cash flow for alternative measures of growth opportunities. Alternate measures for growth opportunities include book-to-market of equity, earnings-to-price ratios and Tobin's Q. I examine these variables (along with a factor score combination of the variables) instead of *V/P* and continue to find a strong positive relation between over-investment and free cash flow with these alternate price-based measures of growth opportunities.

There is also the possibility that market price has already incorporated the likelihood of over-investment and the strength of governance mechanisms. This will impact the use of price-based measures to identify over-investment. The bias that this introduces into my empirical analysis is not immediately clear. However, I have replicated my analysis of over-investment and free cash flow using *only* a price-free estimate of growth opportunities (using the industry median level of investment as a benchmark). I compare I_{NEW} for each firm to the industry median level of I_{NEW}, denoted as I^{IND}_{NEW}. My measure of over-investment (I^{ε}_{NEW}) is then the difference between I_{NEW} and I_{NEW}^{IND} and my estimate of expected investment (I_{NEW}^{*}) is equal to I_{NEW}^{IND}. Using this price-free estimation I still find over-investment concentrated in firms with positive values of free cash flow. Re-estimating the regression equation in panel B of Table 3, I find that δ_2 is statistically greater than δ_1 in fourteen out of the 15 years (i.e., the relation between over-investment and free cash flow continues to be concentrated in firms with positive free cash flow consistent with the agency cost explanation).

The algebraic representation of V_{AIP} presented in Section 1.4 is equal to the value of the firm with unbiased accounting and no positive NPV projects. In practice, accounting is systematically biased and firms face positive NPV project choices. Thus, my estimate of growth opportunities will capture not only the positive NPV projects but also the impact of conservative accounting practices. This could be a problem as I include research and development expenditure (RD) as part of investments. To mitigate the problem of conservative accounting on my empirical analysis, I have performed all analyses excluding firm year observations where the market-to-book ratio exceeds 5 or RD exceeds 25% of sales. These exclusions do not impact the key inference that over-investment is concentrated in firms with positive free cash flow.

3.2.2. Measurement error in over-investment and free cash flow

The reduced form investment model that I examine can also be criticized for measurement error. To mitigate this concern, I utilize a portfolio approach to re-estimate the relation between over-investment and free cash flow. I randomly sort firms into 200 portfolios and then calculate the mean value for over-investment and free cash for each portfolio. Next, I perform a regression of mean over-investment on mean free cash flow for these 200 portfolios. The resulting regression has an adjusted R^2 of 0.045 and a coefficient of 0.195 on free cash flow. Similar results are obtained using median values. To the extent that measurement error is uncorrelated across these "averaged" random portfolios the positive relation between over-investment and free cash flow is not attributable to measurement error.[8]

In unreported tests I also include a measure of the volatility of past cash flows as an additional control variable. I do not include the cash flow volatility variable in the main tests as it *greatly* reduces the sample size (to 34,112 firm-year observations) because I require a sufficient time series for each firm to be able to estimate operating cash flow volatility. As expected, this variable is negatively

[8] It is not critical for my analysis that my investment model is free from error. I only need to be able to identify a measure of unexpected (under/over) investment that is correlated with true unexpected (under/over) investment. This is likely to be achieved given that my model of expected investment expenditure is drawn from prior research. The theoretical foundation for the reduced form model, the robustness of the relation (between over-investment and free cash flow) to alternative specifications, the concentration of the relation in firms with positive free cash flow and cross-sectional variation in the relation based on the strength of governance structures (see Section 4) allspeaks to an economic result and not merely a spurious correlation.

related to investment expenditure. More importantly, including this variable does not affect the positive relation between over-investment and free cash flow.

3.2.3. *Is the relation between free cash flow and over-investment mechanical?*

There is a concern of a potential mechanical relation between free cash flow and over-investment as estimated from this framework. This concern arises because the measure of free cash flow can be re-written as (CF_{AIP}– I_{NEW}+ I^{ε}_{NEW}). Thus, any association with over-investment might be mechanical. While this is a valid concern, the results suggest that the relation is non-linear and is concentrated in firms with positive free cash flow. If the relation was purely mechanical, there is no reason to expect this to apply to only a subset of the data. Nonetheless, I conduct additional empirical analyses to address this concern. The simplest way to remove the potential mechanical relation is to examine the association between I_{NEW} (i.e., all new investment expenditure and not the estimated normal level of new investment) and the measure of cash flows generated from assets in place including measures of growth opportunities. In this specification, there is no longer the potential for a pure mechanical relation as I do not subtract the same variable (I^*_{NEW}) from both sides. The following regression specification was performed:

$$I_{NEW,t} = \alpha + \delta_A CF_{AIP}{<}0 + \delta_B CF_{AIP} > 0 + \beta_1 V/P_{t-1} + error$$

CF_{AIP}<0 (CF_{AIP}>0) is equal to CF_{AIP} for values of CF_{AIP} less (greater than) zero and zero otherwise. As with the regression analysis in Table 3, this allows the relation between new investment expenditure and cash flows from assets in place to be asymmetric. The results from this analysis are consistent with the reported results. Specifically, coefficient estimates for δ_A and δ_B are 0.131 and 0.319, respectively (statistically different at conventional levels).

3.2.4. *Alternative treatment of maintenance investment*

The investment decomposition has assumed maintenance investment is a value added activity. Depreciation and amortization is likely to be a reasonable estimate for maintenance investment (of the capital expenditure variety) for firms whose depreciation schedule closely maps with the use of the asset. However, this is not likely to be the case for all firms. Likewise, depreciation and amortization is not likely to be a good approximation of maintenance investment for R&D. An alternate view of the firm is that all investment (including maintaining assets in place) is discretionary. Under such a view, the firm should only replace/repair existing assets to the extent that this is a positive NPV project. To address this issue the entire analysis was repeated removing $I_{MAINTENANCE}$ from the investment calculation. Thus, I_{TOTAL}, rather than I_{NEW}, is decomposed. Results from this analysis yield similar results to those reported in Section 3.1, namely that over-investment is concentrated in firms with positive free cash flow.

3.2.5. General limitations

Finally, a criticism of any research methodology using an expectations model is the quality of that model. Specifically, the inferences I can draw are contingent on the quality of the investment expectation model. I have based my expectations model on existing research, but nonetheless it is still subject to the criticism that non-linearities and correlated omitted variables outside my model may drive the positive relation between my measures of over-investment and free cash flow. However, in the absence of theory, there is little guidance as to alternative functional forms for the investment model.

4. Governance hypotheses

In this section, I examine whether governance structures mitigate the agency costs associated with over-investment. Given the earlier results of an on average over-investment problem, the analysis in this section is exploratory in nature to identify which, if any, of a large set of governance mechanisms mitigates the over-investment of free cash flow.

4.1. Measuring governance and sample selection

There are many mechanisms that stakeholders employ to check the activities of management. Recent academic papers have started to examine extensive sets of governance variables (e.g., Dey, 2005; Larcker et al., 2005). Furthermore, governance rating agencies (such as Institutional Shareholder Services and Governance Metrics International) produce summary rating statistics that are based on hundreds of inputs. For the analysis in this section, I use 13 of the 14 governance factors developed in Larcker et al. (2005) for a sample of 1,417 firms for the 2002 fiscal year. The debt governance factor is excluded as leverage is part of the investment expectation model.

The governance measures fall into six general categories: characteristics of the board of directors, stock ownership by executives and board members, stock ownership by institutions, stock ownership by activist holders, compensation mix variables and anti-takeover devices. The governance data used to construct these factors are obtained primarily from Equilar Inc. and TrueCourse Inc. Notes to Table 5 summarize the 37 component variables that are used to construct the 13 factors (a full description can be found in Larcker et al., 2005).

4.2. Standard linear regression analysis

To examine the impact of the 13 governance factors on the relation between over-investment and free cash flow, I estimate the following regression:

$$\begin{aligned} I^{\varepsilon}_{NEW} = &\alpha + \delta_1 FCF + \\ &\Sigma\phi Governance\ Factors + \Sigma\psi Governance\ Factors * FCF + \varepsilon \end{aligned}$$

Table 5 Relation between governance structures, over-investment and free cash flow

Independent variable	Predicted sign	Coefficient estimate (T-statistic)
$I^{\varepsilon}_{NEW} = \alpha + \delta_1 FCF + \Sigma\phi Governance\ Factors + \Sigma\psi Governance\ Factors * FCF + \varepsilon$		
Intercept		0.001 (0.15)
FCF	+	0.167 (3.06)***
Active	–	–0.268 (–3.11)***
BLOCK	–	–0.083 (–1.37)
Affiliated	+	–0.025 (–0.29)
Insider appointed	+	0.075 (1.13)
Compensation mix	–	–0.045 (–0.74)
Meetings	–	–0.013 (–0.17)
Anti-takeover I	+	0.139 (1.83)*
Old directors	+	–0.037 (–0.37)
Insider power	+	–0.023 (–0.28)
Board size	+	0.094 (1.09)
Lead director	–	–0.046 (–0.61)
Anti-takeover II	+	–0.133 (–1.82)*
Busy directors	+	0.107 (1.10)
Main effects are included but not reported for sake of brevity		
Adjusted R^2 full model		0.018
Adjusted R^2 governance factors only		0.005

The sample covers 815 firms with positive free cash flow for the 2002 fiscal year for which data is available from Equilar Inc. and TrueCourse Inc. to compute relevant governance measures

*, **, ***indicates significance at the 10%, 5%, 1% level respectively

See earlier tables for definition of *FCF*

The 14 governance factors included in the regression are based on a principal components analysis of 39 structural measures of governance as outlined in Larcker et al. (2005). I retain all factors with an eigenvalue greater than unity. This results in 14 factors that retain 61.7% of the total variance in the original data. This reduced solution is then rotated using an oblique rotation that allows the retained factors to be correlated in order to enhance interpretability of the PCA solution. These 14 factors represent the underlying dimensions of corporate governance. For full details of the loadings across component measures see Larcker et al. (2005). The factors are standardized combinations of the following variables (Debt is excluded as leverage is included in the investment expectation model)

Active comprises the number of activist shareholders (as defined in Cremers and Nair, 2003), percentage held by activist shareholders and the fraction of outstanding shares held by the average outside director

Table 5 continued

BLOCK comprises the fraction of outstanding shares owned by block-holders (a block-holder is defined as a shareholder who holds more than 5% of outstanding shares), the number of block-holders and the shareholding of the largest institution

Affiliated comprises the fraction of the audit and compensation committees that are comprised of affiliated (grey) directors and whether the chair of these committees is affiliated. Any outside director who is a former executive or who is mentioned in the ''certain transactions'' section of the proxy statement is classified as affiliated

Insider Appointed captures the fraction of affiliated and outside directors that were appointed by existing insiders

Compensation Mix comprises the details of annual CEO compensation (the portion that is tied to performance plans, stock options, restricted stock grants and annual bonuses)

Meetings comprises the number of meetings of the board and the compensation and audit committees

Lead Director captures whether the firm has a lead director or an insider chair-person

Anti-Takeover I captures whether the firm has a staggered board, has adopted a poison pill and the fraction of outstanding shares held by the average affiliated director

Old Directors comprises the fraction of insider, affiliated and outside directors that are older than 70

Insider Power comprises the fraction of board who are insider (executive) directors, the fraction of outstanding shares held by the average executive director (excluding the holdings of the top executive), the fraction of outstanding shares held by the top executive, and whether the firm has dual class shares

Board Size comprises the size of the board, compensation and audit committees

Anti-Takeover II comprises supermajority provision for takeovers and state of incorporation

Busy Directors comprises the fraction of outside and affiliated directors who serve on 4 or more other boards and the fraction of inside directors who serve on 2 or more other boards

I expect a significantly positive coefficient for δ_1 and negative coefficients for each of the interacted governance factors (i.e., the ψ coefficients) that are increasing in ''good'' governance (Active, BLOCK, Compensation Mix, Meetings, and Lead Director) and positive coefficients for those that are increasing in ''bad'' governance (Affiliated, Insider Appointed, Anti-Takeover I, Old Directors, Insider Power, Board Size, Anti-Takeover II, and Busy Directors). Given the earlier results documented a concentration of over-investment in firms with *positive* free cash flow, I limit the analysis of governance structures to this subset of firms.

The regression results are presented in Table 5. Consistent with the earlier analysis, there is a strong positive relation between over-investment and free cash flow (the coefficient δ_1 is 0.167 and is significantly different from zero). Of the 13 governance factors only three, Active, Anti-Takeover I and Anti-Takeover II are statistically associated with over-investment. Active and Anti-Takeover I are significant in the expected direction. As expected, firms with more activist shareholders experience lower levels of over-investment of free cash flow, and firms with staggered boards and poison pills in place (components of Anti-Takeover I) experience higher levels of over-investment of free cash flow. However, firms with supermajority voting provisions and those firms incorporated in management friendly states experience less over-investment of free cash flow. Collectively, the results in Table 5 suggest that certain governance structures are effective in mitigating the over-investment of free cash flow. However, it is important to note the very low explanatory power of this regression (only 2 percent of the cross-sectional variation in over-investment is explained jointly by free cash flow and the 13 governance factors, and only 0.5% is explained solely by the governance factors).

4.3. Additional governance analyses

The empirical analysis of governance structures and over-investment described in the last section was ex post in nature. In unreported tests, I have also examined the link between governance structures and over-investment from an ex ante perspective. Of course, finding evidence of ex post over-investment of free cash flow (as in Section 3.2) suggests that governance structures are not designed ex ante optimally. Therefore, testing whether there is cross-sectional variation in governance structures as a function of the level of free cash flow, a measure of the propensity for over-investment, may not be a credible null hypothesis. Nonetheless, it is instructive to examine whether the design of governance mechanisms incorporates perceived agency costs (as measured by the propensity of a firm to over-invest).

To examine whether governance structures are designed in response to free cash flow related agency costs, I average annual measures of free cash flow for firms with available Compustat data for the period 1997–2002 and governance data for the 2002 fiscal year. This leaves a sample of 1,496 firms (each firm appears only once in this analysis). Firms are sorted into portfolios based on the magnitude of average free cash flow over the 1997–2002 period. Tests of differences in governance structures across these groups are then performed. There is some evidence of different governance structures for firms with different levels of free cash flow from earlier fiscal periods. For example, firms with higher levels of free cash flow are more likely to have a greater concentration of activist shareholdings, larger boards, have more incentive based compensation for top executives, be incorporated in shareholder friendly regimes, and have supermajority voting provisions (all patterns are statistically significant at conventional levels). Conversely, firms with higher levels of free cash flow are less likely to have affiliated directors on the board and key committees, and less likely to have staggered boards and poison pills (again all patterns are statistically significant at conventional levels).

These relations, however, are not particularly strong. For example, the explanatory power (adjusted R^2) of average free cash flow from 1997 to 2002 for the 13 governance factors (measured as at the end of fiscal 2002) ranged from –0.06% for Meetings to 15.8% for Active. Only Active, Board Size and Anti-Takeover II had an adjusted R^2 greater than 2% (Adjusted R^2 were 15.8, 6.0 and 2.3%, respectively). Given these relative weak associations, care needs to be taken in interpreting that governance structures are designed in response to free cash flow related agency costs. Furthermore, the data examined is measured as at the end of fiscal 2002. Ideally, one would examine changes in governance structures through time and examine how these structures adjust in response to changes in the environment in which the firm operates (e.g., Goodman, 2005).

The absence of a relation between free cash flow and contemporaneous governance structures may not be surprising given that governance structures do not change frequently, especially if free cash flow is not very persistent. To address this issue, an alternate research design is to examine whether governance structures vary based on the *level* of cash (industry-adjusted) reported on the balance sheet. Even with this alternate approach, there is little evidence of any systematic relation between governance structures and the level of cash held by the firm.

5. Conclusion

This paper presents evidence on firm level over-investment of free cash flow. The empirical analysis utilizes an accounting based framework to measure the constructs of free cash flow and over-investment. A comparative advantage of the accounting researcher is in measuring critical constructs from the financial economics literature. The analysis of over-investment and free cash flow is but one example of how accounting information can be better utilized in academic research. The evidence in this paper suggests that over-investment is a common problem for publicly traded US firms. For non-financial firms during the period 1988–2002, the average firm over-invests 20 percent of its available free cash flow. Furthermore, the majority of free cash flow is retained in the form of financial assets. For each additional dollar of free cash flow the average firm in the sample retains 41 cents as either cash or marketable securities. There is little evidence that free cash flow is distributed to external stakeholders, thereby creating the potential for retained free cash flow to be over-invested in the future. Supplemental analysis found only weak evidence that governance structures are effective in mitigating the extent of over-investment.

These findings corroborate recent work that has found significant negative future stock returns from capital investment and significant growth in net operating assets (e.g., Fairfield et al., 2003; Titman et al., 2004). Indeed, Li (2004) finds that future operating performance is lower for firms engaging in investment expenditure and that this negative relation is increasing in contemporaneous free cash flow. A natural explanation for this poor future performance is free cash flow related agency costs.

The framework developed in the paper to measure over-investment and free cash flow can easily be extended to consider abnormal investment more generally. Indeed, some recent research has started to use this framework to examine the impact of accounting information systems on investment decisions and the efficient allocation of capital (e.g., Bushman, Piotroski, & Smith, 2005; Goodman, 2005; Wang, 2003).

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