# The stock price reaction to investment news: New evidence from modeling optimal capex and capex guidance

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**Abstract**

Extant literature documents a weak positive stock price reaction to the announcement of new investments. A weak reaction is likely due to the lack of identification for the optimal investment levels and an omission of concurrent investment guidance. To address the lack of identification, I develop an accounting-variable-based model to proxy for optimal capital expenditures (capex) at the firm-year level. To address the omission of concurrent investment guidance, I employ recently available data on capex guidance. I hypothesize and find that when a firm's capex diverges from the estimated optimal level, its stock price declines. Given divergence, the stock price decline is more severe when the firm overinvests. Moreover, controlling for self-selection, there is a positive market reaction to the issuance of capex guidance. Lastly, I hypothesize that capex guidance reduces information asymmetry between management and investors. I find that the negative stock price reaction to divergence disappears when a firm issues capex guidance, consistent with investors aligning their views about the optimal capex level with a manager's guidance.

# 1 Introduction

Investments precede revenues and earnings. If an efficient market perceives an investment to have a positive net present value (NPV), then announcement of the investment increases the stock price. The extant empirical literature, in general, finds weak positive stock price reactions to investment announcements. In this paper, I entertain two possible explanations for such weak reactions. One is the lack of identification for the optimal investment level. Prior literature generally assumes new investments are positive NPV. Because of diminishing marginal returns on investment, this is not always the case. The other explanation is the omission of concurrent investment news. A firm's investment in a single year generally constitutes a small portion of major projects. Many managers bundle investment announcements with investment guidance to convey additional information about projects undertaken. Investment guidance is an important part of investment news, and so far has been overlooked because of data limitations.[1]

This paper addresses both shortcomings and re-examines the investment-return relation by modeling firm-year-level optimal capex and investigating capex guidance on a large sample. In principle, I could examine a broader set of investments, including R&D and M&A. I focus on capex because of the availability of capex guidance data. Concentrating on capex also has other advantages. Capex are generally undertaken in-house, whereas R&D can be either undertaken in-house or contracted. Compustat only reports in-house R&D, raising the question of measurement errors in R&D. M&A are too unpredictable to model. Moreover, market reactions to M&A announcements are likely affected by factors that facilitate the M&A decision. Above all, capex remain the predominant investment form, consisting of about 67% of the sum of capex, R&D, and M&A.[2] Whether and to what extent the results of this paper generalize to all investments is a judgment call.

I proceed in two steps. In the first step, I develop a model to proxy for the unobservable optimal capex level at which all NPV projects are undertaken and the firm value is maximized. The capex model employs only accounting variables, including depreciation, accumulated depreciation, sales growth, cash stocks, and leverage. The estimated optimal capex level is a function of the first three variables. Though the true optimal capex level is unobservable, I indirectly validate the accounting-variable-based (AVB) model. I rank firms from the most underinvesting to the optimally investing to the most overinvesting. I show an inverted U-shape relation between the ranking and forward returns on assets, peaking at the estimated optimum. Among the many desirable feature of the AVB model, most distinguishes it from other models in extant literature is that it estimates capex optima before the actual capex are announced; this allows for event studies upon the capex announcements. If a firm's announced capex are further from the estimated optimum than the preannouncement market consensus, they *diverge* from the estimated optimum; otherwise they *converge* to the estimated optimum.

I model firms' choices to issue capex guidance on a recently available large data set. Consistent with prior literature and theories of guidance, I find that capex guidance is prompted by the firm's past capex guidance practice, peer firms' capex guidance practice, analyst forecast dispersion, the firm's capex intensity, etc.; it is deterred by capex volatility. I use the result from estimating capex guidance issuance to control for self-selection, and I compare managers' capex guidance to the prevailing market consensus of the firms' future capex to determine capex guidance surprise.

In the second step, I examine the market reactions to capex news. I compile a sample of U.S. firms' annual earnings announcements from 2008 to 2014 that include capex announcements and capex guidance. (This is also the sample for capex guidance issuance estimation.) I predict that diverging from the optimal capex level is detrimental to firm value, and I find that when firms diverge from the estimated optima, stock prices decline during the (–1, 1) trading day window around the announcement by 0.4% and by a further

1.5% over the next 60 trading days. I find that the market does not react to firms that converge to the estimated optima. This is likely because of the extent that firms can converge to the optima is capped by the difference between the prevailing market consensus and the optima.

Next, I examine whether the negative market reaction to divergence is related to whether the firm over- or underinvests. Overinvestment is defined as the actual capex larger than the estimated optimum. Overinvestment is outlay costs, and underinvestment is opportunity costs. The market reaction that ensues from overinvestment is likely stronger than that pertaining to underinvestment because overinvestment reduces earnings and is easier to identify than underinvestment. Accordingly, I find that for firms that diverge from the estimated optima, the market reacts more negatively for those that overinvest. The stock prices decline during the $(-1, 1)$ trading day window around the announcement by 0.6% and by a further 3.0% over the next 60 trading days.

I predict that a firm's stock price positively reacts to the issuance of capex guidance. Capex guidance contains important information about the firm's future plans and prospects, so it reduces information asymmetry and thus the cost of capital. Managers who provide capex guidance signal their superior ability in capital planning and project picking. Additionally, compared with earnings or revenues, capex are less susceptible to external influences, such as shocks to product demand, and are also easy to verify. By issuing capex guidance, firms commit to their investment plans and, in so doing, reduce their cost to contract with capital providers. Although I do not find immediate stock price reactions to capex guidance issuance, cumulative abnormal returns for capex guidance issuance increase to about 3.7% over the 60 trading days after the guidance.

Because managers have more information than do external investors, the optimal capex level derived from managers' information likely differs from the level derived from outsiders' information. Given this difference, even when managers act to maximize shareholder value, their choices of capex level may appear to diverge from the outsiders' perceived optimum. Managers signal the optimality of their choices by bundling capex guidance with capex announcements. When they succeed in convincing the market that their capex level is the true optimal level, no negative market reaction should ensue from the appearance of divergence. Consistent with my prediction, I find that stock prices do not decline for firms that diverge from the estimated optima and provide capex guidance, whereas stock prices decline by 1.7% for firms that diverge from the estimated optima and provide no capex guidance.

My paper is related to several strands of literature. First, it supplements the empirical literature on investment modeling. Extant literature usually uses one of the following two strategies to model investments. One is to model investments as time series. Because big projects usually span several fiscal periods, autoregressive models are highly effective in describing (high $R^2$) and predicting (low predictive error) investments. A disadvantage of time-series models is that as long as we consider sub-optimal investment, the time-series-generated prediction also contains a sub-optimal portion. The other strategy is to model investments with contemporaneous variables. This strategy allows for identifying over- and underinvestment. However, extant research only identifies over- and underinvestment *ex post* by the sign of the regression residual sign, subject to the constraint that the aggregate net overinvestment of the sample is zero. The accounting-variable-based model is the first (to my knowledge) capable of estimating optimal capex levels *ex ante*, not subject to a zero net overinvestment constraint.

Second, my paper supplements the established literature on the information content of financial reports. Extant research has investigated the information content of investments. However, due to a lack of identification for investment news, earlier papers only relate returns to investment surprises. My paper contributes to the literature by establishing a directional link between sub-optimal capex and stock price reactions and, in so doing, reconciles the debate of whether the market reacts overoptimistically to investment news, prompted by the observation that stock prices increase upon positive investment surprises (McConnell and Muscarella 1985), even while long-term performance deteriorates (Titman et al. 2004).

Third, my paper is part of the emerging literature on investment guidance. Previous research identifies the phenomenon of investment guidance and models investment guidance issuance (Lu and Tucker 2012; Tucker et al. 2013) on small samples. My paper updates early results with a large sample and advances the literature by examining and documenting the market reaction to capex guidance. My paper is not only the first to document stock price reactions to capex guidance but it also points out a possible mechanism via which capex guidance reconciles the discrepancy between management's investment decisions and the market's perception.

The remainder of this paper proceeds as follows. Section 2 reviews the related literature and develops empirical predictions. Section 3 describes the sample and data. Section 4 models optimal capex and evaluates the model. Section 5 models the issuance of capex guidance. Section 6 reports descriptive statistics and elaborates on the empirical results. Section 7 summarizes and concludes the paper.

# 2 Related literature and empirical predictions

## 2.1 Determinants of investments

Business investment is of great interest in economic literature. Early studies are mostly normative. The maintained assumption is that firms do not make sub-optimal investments. A typical paper develops an optimal investing theory and examines its theory empirically (Jorgenson 1963). A theory is judged by how well it explains the observed data. Because this literature usually models aggregated investments as a time series, the $R^2$s are high.

Analytically speaking, the first-best investment rule is to finance all positive NPV projects. At the firm level, sub-optimality arises when considering frictions such as principal-agent conflicts or financing constraints. One principal-agent conflict is between owner-managers and outside shareholders. Jensen and Meckling (1976) show that managers underinvest as long as there are bonding costs, but Jensen (1986a, 1986b) also argues that managers aspire to run larger firms and thus tend to overinvest to maximize firm size. Stein (1989) contends that managers underinvest to boost earnings even if the market is efficient, but Philippon and Kedia (2009) show that, with endogenous earnings management costs, low-productivity firms in equilibria overinvest to pool with high-productivity firms.

Another principal-agent conflict is between shareholders and creditors. Jensen and Meckling (1976) predict that firms using debt financing invest in more risky projects. The paper and its contemporaries and followers, such as Myers (1977), Myers and Majluf (1984), John (1987), and de Jong and Veld (2001), recognize the interdependence between investing and financing. The mainstream literature believes that firms would first prefer to use internally generated funds, then debt, and then equity to finance new projects (pecking order theory). Recently, Hennessy et al. (2010) predict that firms with negative private information issue equity and overinvest. Morellec and Schurhoff (2011) predict that firms with positive information overinvest and erode the value of waiting. In summary, the analytical literature identifies factors that determine investments, and leverage and cash flows/stock are among the most general and widely available. How exactly these factors affect investment depends on the assumptions made in each model.

The empirical literature on the determinants of investments is less developed, because many investment-decision-related variables are not observable. Hubbard (1998) reviews early empirical research on modeling firm-level investments. Among the variables that explain investments, the most extensively studied are growth opportunities and cash flows/stocks. Growth opportunities are proxied by either Tobin's $q$ (market/book ratio) (Biddle and Hilary 2006) or revenue growth rate (Biddle et al. 2009). The literature (Kaplan and Zingales 1997; Ovtchinnikov and McConnell 2009) finds that cash flows and investments are positively correlated, even though they should not be in perfect markets. Jensen (1986a) argues that positive cash flow shocks result in increases in investment, and Rauh (2006) shows that financial constraints (such as mandatory pension fund contributions) reduce investments. Sapienza and Polk (2009) show that firms with ample cash or debt capacity waste resources in negative NPV projects when their stocks are overvalued and forgo positive investment opportunities when their stocks are undervalued.[3]

This paper belongs to the literature that examines the information content of investment news. Early empirical research in this literature does not explicitly model investment. Instead, it generally assumes that investments follow a random walk (McConnell and Muscarella 1985; Livnat and Zarowin 1990; Kerstein and Kim 1995) or another time-series process (Titman et al. 2004). Investment surprise is then used to explain stock returns or other dependent variables. Later literature examines the consequences of sub-optimal investment decisions. A typical paper first models investment in the cross-section, either parsimoniously (Biddle et al. 2009; Chen et al. 2011) or extensively (Richardson 2006). The sign of the regression residual determines whether a firm over- or underinvests.[4] This approach suffers from several shortcomings. First, current data for all firms is required to run cross-sectional regressions. Even if over-/underinvestment is properly identified, the identification is *ex post*, disallowing for short-window event studies for investment news. Second, some elaborated models employ variables that contribute to sub-optimal investments, such as past investments, cash, and leverage. As a result, the residuals merely proxy for unexplained investments, not sub-optimal investments. Third, associating overinvestment and underinvestment with the sign of the residuals implicitly assumes that the aggregated net overinvestment is zero, which is likely false. With these shortcomings in mind, in Section 4, I develop an accounting-variable-based capex model that is capable of estimating optimal capex levels *ex ante*, not subject to a zero net overinvestment constraint.

## 2.2 Market reaction to investment news

The accounting for investments is straightforward. Investing firms incur some expenses, either upfront (e.g., R&D) or over the useful life of the acquired assets (e.g., depreciation, amortization, and depletion); earnings are suppressed until revenues are generated by the new investments. Because the investment payoff is both uncertain and long-term, one must make assumptions about how the market forms expectations of the investment payoff in order to relate investment news with market reaction.

The literature so far mostly concentrates on relating investment surprises to stock market returns.[5] Analytically, John and Mishra (1990) predict that higher-than-expected investments in growth industries trigger positive price reactions. Also, Hennessy et al. (2010) show that a high investment rate induces positive abnormal returns. Empirically, McConnell and Muscarella (1985) document a small positive stock price reaction to investment increases for industrial firms, but not for utility firms. Chan et al. (1990) obtain similar results for R&D announcements. A series of papers re-examines the positive investment-return relation under alternative settings. Some confirm the positive relationship (Kerstein and Kim 1995; Lamont 2000), and others provide results that question it (Livnat and Zarowin 1990). This literature further examines the strength of the investment-return relation based on firm characteristics, for instance, investment reduction from leveraged recapitalizations (Denis and Denis 1993), growth opportunities

(Chung et al. 1998; Brailsford and Yeoh 2004; Ovtchinnikov and McConnell 2009), focused firms versus diversified firms (Chen 2006), and CEO reputation (Jian and Lee 2011).

The literature provides three explanations for a small positive association between investments and returns, a typical finding. First, the market efficiently evaluates the benefits of investments (McConnell and Muscarella 1985). Second, the market is overly optimistic about the initial investment announcements. In particular, Titman et al. (2004) report that firms with large investment surprises eventually underperform by both accounting metrics and market returns. Some researchers (Brennan 1990; Hirshleifer 1993; Hirshleifer and Teoh 2009) express concern that the positive investment-return relation may induce overinvestment. Third, Fama and French (1998) speculate that investments convey positive information about future prospects beyond the variables they control for, including earnings, R&D, dividends, and debt variables.

The papers in this literature share a common lack of identification for the optimal investment level. This agnosticism pertains to the debate on whether or not the market reacts to investment announcements overoptimistically (Dittmann 2010), given that the market positively reacts to investment announcements, while mid- and long-run stock/accounting performance disappoint. Once we identify the optimal investment level, for which Section 4 is dedicated to proxy, then the market reaction to investment announcements depends only on the relative size of (1) the prevailing market consensus of investments (*expected*), (2) the market's perceived optimal level of investments, which is known before the investment announcements (*optimal*), and (3) the actual level of investments (*actual*). If the distance between *actual* and *optimal* is smaller than the distance between *expected* and *optimal*, I refer to this situation as *convergence*. Similarly, if the distance between *actual* and *optimal* is larger than the distance between *expected* and *optimal*, I call the situation *divergence*. That is,

$$\begin{aligned} \text{Convergence: } |\,actual - optimal\,| &< |\,expected - optimal\,|, \\ \text{Divergence: } |\,actual - optimal\,| &> |\,expected - optimal\,|. \end{aligned} \tag{1}$$

Figure 1.A illustrates how to determine convergence versus divergence. When *actual* falls on the dotted line, that is, $(2\times optimal - expected, expected)$, it is closer to *optimal* than *expected*, and therefore it *converges* to the optimum. When *actual* falls on the two segments of thick solid lines, that is, $(-\infty, 2\times optimal - expected) \cup (expected, +\infty)$, it is further from *optimal* than *expected* is, and therefore it *diverges* from the optimum. The definitions for convergence and divergence in (1) are parsimonious, mutually exclusive, and collectively exhaustive. The two *diverging* segments likely have different implications, the discussion of which is postponed until Prediction 2.

The value implications for *convergence* and *divergence* are straightforward:

**Prediction 1.** *Stock prices increase when actual investment levels converge to the optimal levels, and stock prices decrease when actual investment levels diverge from the optimal levels.*

Note that *convergence* is bounded within $(2\times optimal - expected, expected)$, so if $|\,expected - optimal\,|$ is small, positive stock price reactions are harder to observe than the negative stock price reactions to *divergence*.

Now consider another concept, where *over-/underinvestment* is defined as

$$\begin{aligned} \text{overinvestment: } actual &> optimal, \\ \text{underinvestment: } actual &< optimal. \end{aligned} \tag{2}$$

An illustration is presented in Figure 1.B. The determination of *over-* and *underinvestment* disregards the market expectation. Both over- and underinvestments are sub-optimal.

However, their value implications differ from each other. Overinvestment represents outlay costs, and underinvestment represents opportunity costs. How market participants perceive and react to over- and underinvestment, especially whether they react to underinvestment, is an empirical issue. Becker et al. (1974) show that managers sometimes do not incorporate opportunity cost analyses when making decisions. Moreover, it is much harder to identify what counterfactual projects the firm should have invested in than to identify the actual projects in which they should not have invested. Therefore, the negative market reactions triggered by overinvestment are stronger than by underinvestment. Because the market does not react to what is already expected, I interact *over-* and *underinvestment* with *converging* and *diverging* and make Prediction 2.

**Prediction 2.** *When firms diverge from investment optima, the market reaction is negative. This negative reaction is stronger for firms that overinvest than for firms that underinvest.*

Interacting *over-* and *underinvestment* with *convergence* and *divergence* results in four possible categorizations: *overinvestment* × *convergence*, *overinvestment* × *divergence*, *underinvestment* × *convergence*, and *underinvestment* × *divergence*. Prediction 2 does not cover all categories because of ambiguous value implications.

## 2.3 Investment/capex guidance

Early literature on information content of investment news does not distinguish between investment announcements and investment guidance, at least not explicitly so (Dittmann 2010). Only recently have researchers (Lu and Tucker 2012) used the word "guidance" to refer to future investment plans. The literature to date concentrates on why firms provide investment guidance. Harvey et al. (2005) report that corporate executives hesitate to provide voluntary disclosures to avoid giving away "company secrets" or otherwise harming their competitive position. Li (2010) finds that potential product market competition is positively associated with investment disclosure, but this effect is less pronounced for industry leaders. Recently, Tucker et al. (2013) model the issuance of "segregated" guidance, and Lu and Tucker (2012) model capital expenditure guidance.[6] These papers find that earnings-return correlation, earnings guidance surprise, R&D and capex intensity, analyst earnings and sales forecast dispersion, and peer firms' earnings and capex guidance practice are associated with the issuance of segregated and/or capex guidance.

The empirical literature presents limited evidence as to the effects of investment guidance. Bryan (1997) reports that planned capex disclosure is strongly correlated with one-year-ahead capital expenditures but is only weakly correlated with two-year-ahead sales and three-year-ahead earnings. Lu and Tucker (2012) test whether capex guidance reduces spreads or increases depths around the date of guidance issuance and find no association. I am unaware of any study that shows that stock prices react to investment guidance. The lack of results may be the result of a couple of reasons. One is small sample size. Previous guidance research heavily relies on First Call's Company Issued Guidance (CIG) file, which covers mostly earnings (EPS) guidance. To study alternative guidance, researchers must hand-collect data; doing so severely limits the sample size.[7] The other reason is self-selection. Despite efforts to model investment guidance, when evaluating the market's reaction to investment guidance, most papers do not correct for self-selection.

In theory, the market should react positively to investment (capex) guidance. Any model with a single costly signal must have a positive announcement effect; otherwise, absent other reasons (e.g., litigation) insiders would not signal (John 1987). Diamond and Verrecchia (1991) identify a channel by which disclosure reduces information asymmetry, which improves liquidity, and therefore increases investor demand and, ultimately, the stock price. Moreover, compared with earnings and revenue, capex are less susceptible to external influences (such as changes in product demand) and are easier to verify, so managers give more reliable guidance on capex.[8] As a result, investment (capex) guidance is a commitment tool and reduces the contracting cost. Lastly, a positive reaction to investment (capex) guidance is consistent with the "management talent signaling hypothesis" (Trueman 1986).[9] Therefore, I make Prediction 3.

**Prediction 3.** *The market reacts positively to investment* (*capex*) *guidance.*

To overcome the aforementioned self-selection in capex guidance issuance, I model firms' capex guidance choice and apply the Heckman correction in Section 5.

In addition to observing capex guidance issuance, market participants also compare the guidance with their prevailing expectations and learn which is higher. Since capex guidance induces positive market reactions by reducing information asymmetry, the sign of the guidance surprise should not incrementally explain stock returns. Hutton et al. (2003) examine how the market responds differently to management's earnings guidance when it is bundled with other disclosures. In a similar spirit, I entertain a mechanism through which information asymmetry is reduced by capex guidance. Divergence is bad news and inherently demands an explanation. Meanwhile, managers make investment decisions based on a larger information set than that available to outsiders; this suggests an optimal capex level different from the outsiders' beliefs. When managers act on their private information to maximize shareholder value, they can provide capex guidance to justify their divergence from the outside investors' perceived capex optima. When the capex guidance succeeds in aligning the beliefs of the market and the mangers, the optimal perception held by outside investors is reset to a new level, $optimal^*$, which overlaps with *actual*, that is, $optimal^* \leftarrow actual$. In this case, there would be no negative market reaction to the "divergence." Even if the capex guidance does not reset the market's belief to the exact level of *actual*, as long as the market's revised optimal capex level $optimal^*$ is closer to *actual* than *expected*, the negative reactions to divergence are mitigated. That is,

$$\begin{aligned} \text{Appearance of divergence: } & |\,actual - optimal\,| > |\,expected - optimal\,|, \\ \text{Revised optimal: } & |\,actual - optimal^*\,| < |\,expected - optimal^*\,|. \end{aligned} \quad (3)$$

We can state this formally as Prediction 4.

**Prediction 4.** *The negative market reaction to divergence is less negative when firms issue capex guidance than when firms do not issue capex guidance.*

There are two potential challenges in interpreting the test result for Prediction 4. First, *optimal*$^*$ is unobservable. Even if negative market reactions to divergence are mitigated by capex guidance, the link between capex guidance and *optimal*$^*$ remains missing. In untabulated analyses, I find that analysts revise their capex forecast after capex guidance, and the direction and magnitude of the revision are highly correlated with the direction and magnitude of the capex guidance surprise. This finding partially bridges the missing link. Second, prior to the announcement, the firm may have issued capex guidance that would affect the market's formation of the *optimal*, but the construction of the preannouncement *optimal* (see Section 4) is a function of only past accounting information. This observation does not necessarily constitute an internal inconsistency. Firms' capex guidance with regard to the current fiscal period is given at the announcement of last period's financials, and the capex guidance is only about the issuing firm.[10] On the other hand, *optimal* is formed right before the current announcement and incorporates financials released during the past year from all firms. As a result, the information set used to derive *optimal* is much greater than the mere capex guidance at the beginning of the fiscal period. Moreover, because issuing firms and their competitors both likely react to the capex guidance and the reactions are reflected in their financials, the marginal contribution of the initial capex guidance is therefore unimportant.

## 3 Sample and data

Firms disclose their investment decisions via periodic financial statements, as well as via stand-alone guidance. Investing and financing decisions are usually made jointly and announced together, especially for stand-alone announcements. As a result, periodic financial statements deem a better setting to circumvent the concurrency of financing and investing announcements. Capital budgeting is generally conducted on an annual basis, and unused capital budgets may be lost the year's end (Callen et al. 1996), so I consider only annual announcements.

I retrieve capex announcements, both actual and guidance, from IBES.[11] I also retrieve earnings and revenue announcements and guidance to account for concurrent news. I treat guidance as bundled with financial announcements as long as it is announced on the same day as the latter.[12] To determine actual and guidance surprise, I compare each announced figure with the market consensus, which equals the analyst consensus, if available.[13] Otherwise, it equals the most recent guidance, if any, or it equals the realized amount from the previous year. If a firm provides guidance for multiple fiscal years, I sum the guidance surprise four years into the future.[14]

Past guidance research heavily uses First Call's CIG file, the reliability of which has been questioned (Miller et al. 2013). Unlike First Call, which almost exclusively records EPS guidance, IBES collects several other metrics, including capital expenditures, revenues, gross margin, EBITDA, GAAP EPS, and net income.[15] IBES started collecting capital expenditure guidance in late 2007, so my sample begins in 2008. The sample ends in 2014.

The broader coverage of IBES mitigates some criticism of CIG. To further validate the data, I benchmark my sample against Lu and Tucker's (2012) hand-collected data. In their Table II, they report that for fiscal year 2005, 309 (63%), 226 (46%), and 192 (39%) out of

488 S&P 500 firms bundle earnings, revenue, and capex guidance, respectively. In my subsample of S&P 500 firms in 2008 (497 firms, untabulated), the percentages issuing earnings, revenue, and capex guidance are 54%, 36%, and 39%, respectively. The reduction of earnings guidance is consistent with the recent trend to refrain from giving earnings guidance. If revenue guidance is given to explain and provide additional credibility to earnings guidance (Hutton et al. 2003), then its occurrence likely decreases with that of the earnings guidance. Notably, the percentage of firms that give capex guidance in 2008 is almost the same as in 2005.

Table 1 tabulates the full sample's composition by calendar year. The *pooled* column reports the total number of firm-year observations. There are 20,972 firm-years in total. The observations monotonically fall from 3,592 in 2008 to 2,771 in 2012 and rebound to 2,872 in 2014. I break up the observations based on whether they contain any type of guidance. The sample size decrease only affects the *no guidance* group, which likely contains smaller firms that dropped out of IBES during the recession. Conditional on issuing any guidance, firms provide earnings guidance only 55.4% out of all annual announcements, revenue guidance 60.3%, and capex guidance 52.2%. Other types of guidance occur in 45.9% of my sample.

In this paper, I use abnormal stock returns at various windows from one (trading) day before the earnings announcement to 60 days after as a proxy for information content. I obtain abnormal stock returns via the Eventus software. Financial data are from Compustat. Analyst data are from IBES. Institutional holdings data are from Thomson Reuters's s34 file. All data are commercially available. Appendix A provides the definitions of all the variables.

# 4 Estimating optimal capital expenditures

## 4.1 Method

Capex generally fall into one of two categories: replacing and expansive. I categorize capex to replenish productive capital assets for depreciation, amortization, and disposition as "replacing," and those induced by growth opportunities and agency problems as "expansive." Negative expansion (shrinking) is possible. I propose the following accounting-variable-based (AVB) model to explain capital expenditures:

$$\begin{aligned} Capex = \alpha\,(Size)_{-1}^{-1} + \beta_1\left(Depreciation\right)_{-1} + \beta_2\left(Accumulated\ depreciation\right)_{-1} \\ + \beta_3\left(Revenue\ growth\right)_{-1} + \beta_4\,(Cash\ stocks)_{-1} + \beta_5\left(Leverage\right)_{-1} + \varepsilon, \quad (4) \end{aligned}$$

where *capex* is capital expenditures, $size^{-1}$ is the inverse of the book value of total assets, *depreciation* is periodic depreciation expenses, *accumulated depreciation* is the ratio of accumulated depreciation and depletion to total gross PP&E, *revenue growth* is the growth rate of revenue from the previous year to the current year, *cash stocks* is the cash balance, *leverage* is the ratio of debt to equity, and $\varepsilon$ is disturbance, that is, capex not captured by the model. The subscript −1 on the independent variables denotes data pertaining to the beginning of the year. Dollar-denominated variables, *capex*, *depreciation*, and *cash stocks*, are deflated by the beginning-of-the-year total assets.

In eq. (4), replacing capex are explained by *depreciation* and *accumulated depreciation*. For expansive capex, growth opportunities are proxied by *revenue growth*, cash flow agency problems by *cash stocks*, and the debt-overhang and risk-shifting problems by *leverage*. The model controls for size using $size^{-1}$, which can also be interpreted as the intercept deflated by total assets. Since *capex*, *depreciation*, and *cash stocks* are also deflated by total assets, the estimation of eq. (4) is effectively weighted by total assets.

I estimate the optimal capex level with the following procedure. To begin, I estimate eq. (4) within each Fama-French 48 industry-year. All data required for estimating eq. (4) are from Compustat. To minimize adverse effects from data errors and extreme values, the sample is trimmed each year at 1% in both tails.[16] To further remove the effect of extreme values, I remove observations with Cook's distance larger than 1 from each industry-year regression and re-estimate until each observation's Cook's distance is under 1. Industry-years with fewer than 20 observations are eliminated from the analyses.

Then I apply the obtained coefficients to the year 0 dependent variable to generate a prediction of *capex* for year +1:[17]

$$\begin{aligned} E_{1-}(Capex_{+1}) = a\,(Size)^{-1} + b_1\left(Depreciation\right) + b_2\left(Accumulated\ depreciation\right) \\ + b_3\left(Revenue\ growth\right) + b_4\,(Cash\ stocks) + b_5\left(Leverage\right), \end{aligned} \quad (5)$$

where the coefficients $a$ and $b$ are estimations of $\alpha$ and $\beta$ from eq. (4), and the subscript 1– denotes the expectation formed before $capex_{+1}$ is revealed at the $t = 1$ earnings announcement. Next, I linearly decompose $E_{1-}(Capex_{+1})$ into two components:

$$E_{1-}(Capex_{+1}) = E_{1-}(Capex^*_{+1}) + E_{1-}(Net\ overinvestment_{+1}),$$

where $E_{1-}(Capex^*_{+1}) \equiv Optimal$ is the proxy for the optimal capex level and $E_{1-}(Net\ overinvestment_{+1})$ is the expected net overinvestment. Specifically,

$$\begin{aligned} E_{1-}(Capex^*_{+1}) = a\,(Size)^{-1} + b_1\left(Depreciation\right) \\ + b_2\left(Accumulated\ depreciation\right) + b_3\left(Revenue\ growth\right), \end{aligned} \quad (6)$$

$$E_{1-}(Net\ overinvestment_{+1}) = b_4\,(Cash\ stocks) + b_5\left(Leverage\right). \quad (7)$$

Finally, I compare $capex_{+1}$, $E_{1-}(capex^*_{+1})$ and the preannouncement market consensus (*actual*, *optimal*, and *expected*, respectively, in the terms of Section 2.1) and determine whether each firm's capex converge to or diverge from the estimated optimum and whether the firm over- or underinvests.

As is shown from the procedure, it is necessary to restrict the independent variable in eq. (4) at the beginning of the year, despite the fact that the relationship between some of the independent variables and capex are contemporaneous. However, variables such as $size^{-1}$, *depreciation*, *leverage*, and *cash stocks* are relatively invariant over time, at least during one year. Therefore, replacing them with lagged values should not be problematic.

A notable exclusion in eq. (4) is past capex. The economics literature shows that past capex has great predictive power on current and future capex (Jorgenson 1963). But this line of economic literature is largely normative. Control theory/dynamic programming (Weitzman 2003) can solve investment problems and specify exactly how much to invest in each period (for instance, for continuous-time modeling), but disregarding managers may deliberately choose a sub-optimal investment level. Once we admit this possibility (that managers may deliberately choose a sub-optimal investment level), including past capex in eq. (4) obscures the linear decomposition in eqs. (6) and (7). This necessitates the exclusion of past capex. However, the exclusion of past capex in eq. (4) does not make the AVB model less dynamic than it would otherwise be. A firm's balance sheet and income statement, as well as its operating environments, are functions of its and competitors' past capex. Past capex are reflected in the AVB model by the dependent accounting variables. The AVB model assumes that firms solve optimal investment problems in each period with the status quo as the new initial condition, regardless of whether or not its (and its peers') past investment choices are optimal.

There are other variables that I consider including in eq. (4). I consider the *sales of PP&E* because disposition of used assets is indicative of acquiring replacement assets. However, when a firm intends to replace a used asset, it is likely to purchase the replacement asset prior to the sale of the old asset to ensure continuous operation, so lagged *sales of PP&E* is a poor proxy for asset replacements. I also consider *M&A* because to build (*capex*) or to buy (*M&A*) are two alternative means to the same end. To control for the substitution effect of *M&A* on *capex*, I need contemporary *M&A*, for which the lagged *M&A* is a poor proxy. As a result, I omit both *sales of PP&E* and *M&A* in eq. (4).

## 4.2 Estimation and validation

Table 2.A reports the number of observations and the adjusted $R^2$ for each industry-year. Each year column refers to the year of the dependent variable, *capex*. For instance, in the 2014 column, the model uses accounting variables from 2013 statements to estimate capex for 2014.

Table 2.B reports coefficients estimated from eq. (4) in the *coefficient estimate* column group. To conserve space, the panel presents only the average coefficients by industry pooled, year pooled, and industry-year pooled. The coefficients are multiplied by 100 for presentation. Overall, inter-industry variations are larger than temporal variations. The estimate $b_1$ (*depreciation*) is significantly positive, but less than unity (100). The estimate $b_2$ (*accumulated depreciation*) is negative, and I offer a couple of explanations. First, *accumulated depreciation* is correlated with depreciation, and its effect is likely absorbed by *depreciation*. Second, firms may not divest depreciated assets in a timely manner, so *accumulated depreciation* also captures the age of assets. The investment rate of mature firms with older assets is likely lower than that for their younger counterparts. The estimate $b_3$ (*revenue growth*) is positive, consistent with firms with growth opportunities investing in such opportunities. The estimate $b_4$ (*cash stocks*) is always positive, as expected. The estimate $b_5$ (*leverage*) is very weak. Since the forces determining firms' leverage are complex and multi-fold, it is

not surprising to obtain a zero overall effect for *leverage*.

Because the optimal capex level is unobservable even ex post, there is unfortunately no direct way to evaluate how well my procedure proxies for the optimal investment level. I conduct the following analyses to offer some indirect validation.

First, I calculate how much firms over- or underinvest and their forward return on assets (ROA). If my procedure correctly estimates the optimal capex level, then the forward ROA will be the highest for firms that invest at the estimated optimal level and lower for firms that over- or underinvest. I visualize the data in Figure 2. Because forward data are needed, to maintain the sample size I shift the sample period to 2004–2010. There are 21,950 firm-years for this analysis. I rank the firm-years into 11 ranks. The under- and overinvestment rank is on the $x$ axis. The lowest rank (–6) represents the firms that underinvest the most and the highest rank (+4) represents the firms that overinvest the most. Rank 0 contains firms that invest closest to the estimated optima. I connect the current, two-year-ahead, and four-year-ahead median ROA along the ranks. The current ROA ($t$ = 0) is monotonically increasing in overinvestment.[18] This is consistent with profitable firms overinvesting (Kanodia and Lee 1998). Two years later ($t = 2$), the monotonicity becomes an inverted U shape. By four years later ($t$ = 4), the convexity of the U shape increases. I estimate $Median\ ROA_t = \alpha_t + \beta_{1,t} Rank + \beta_{2,t} Rank^2$. The implied axes of symmetry ($-\beta_{1,t}/2\beta_{2,t}$) for $t$ = 2 and 4 are at $rank$ = 0.74 and 0.05, respectively.

An alternative explanation for the inverted U shape is that investment increases total assets and thus mechanically decreases ROA for high-ranking firms. To address this concern, I recalculate $ROA_t$ by dividing the $t$ net income by the $t = 0$ total assets, thus overstating ROA for high-ranking firms. The inverted U shape is again obtained with the axes of symmetry for $t$ = 2 and $t$ = 4 at $rank$ = 1.39 and 0.83, respectively.

Second, I examine how the over-/underinvestment rank of firms evolves over time. The motivation behind this analysis is the following. Firms may have certain long-term capital stock targets. During the process to reach their capital stock targets, they may accelerate or decelerate capex based on economic conditions at the time being. If firms overinvest (underinvest) to compensate underinvestment (overinvestment) in prior years, their aggregated capex over a long period may still be optimal. This, on average, is not the case. Using the same sample for the previous analysis, I track the mean over-/underinvestment ranks to $t = 4$. Figure 3 shows that firms that overinvest (underinvest) continue to overinvest (underinvest) in the following years, although the magnitude of their overinvestment (underinvestment) is attenuated.[19] Rank 0 remains close to rank 0.

Last, I compare the out-of-sample capex prediction performance of my model with that of the simple random walk model. Observations with predicted or current period capex less than 0 or over 100% of total assets are excluded. In Table 2.B, under the *prediction evaluation* column group, column $\bar{e}$ reports the mean predictive error of the AVB model. Column $\overline{e_{RW}}$ reports the mean predictive error of the random walk model. To level the playing field, the comparison is made on a common sample in which both the AVB model and the random walk model are able to make a prediction. $|\bar{e}| < |\overline{e_{RW}}|$ ($|0.22| < |0.70|$) shows that the AVB model is less biased than is the random walk model, which ignores growth and tends to under-estimate subsequent investments. To further quantitatively evaluate both models, I also compute the mean squared errors ($\sqrt{\sum e^2/n^2}$ versus $\sqrt{\sum e_{RW}^2/n^2}$). Since mean squared errors penalize extreme errors more severely, the advantage of the AVB model, whose errors for extreme values tend to be larger, narrows. However, it is still safe to conclude that the AVB model is at least on par with the random walk model in the sense of prediction. The performance is non-trivial given that the AVB model does not use past capex to make its prediction.

# 5 Modeling capex guidance issuance

In this section I model firms' decisions to issue capex guidance. The modeling serves a couple of purposes. Due to small sample size, previous research has had limited empirical success to explain capex guidance issuance with proposed frameworks. Therefore, one goal of this paper is to update this research with a large sample. Moreover, this paper aims to examine the capex-returns relation, and since capex guidance is non-random, the other purpose is to provide correction for the self-selection bias in capex guidance issuance for the return analyses in Section 6.

Capex guidance shall not be studied in isolation. Miller and Skinner (2015) point out an overall financial reporting and disclosure strategy with which managers convey their views about their firms. Reporting and disclosure likely supplement each other in this overall strategy. One can extend this idea and argue that guidance on different metrics supplements each other. As a result, in addition to capex guidance, I also model earnings and revenue guidance.

## 5.1 Empirical model

I loosely follow the framework of Tucker et al. (2013) to identify determinants of guidance. I consider a couple of broad categories. The first category is pertinent to the demand and supply in the information market.

Consider the demand side. First, because of conditional conservatism, when a firm reports positive surprises to the market, the market demands elaborations. The firm can issue guidance to bridge the information gap. The previous literature uses declines in earnings to predict earnings guidance issuance and shows a high correlation between the two. I test whether declines in capex (revenue) prompt capex (revenue) guidance without prejudice. Declines in capex may indicate lowered investment opportunity, and increases in capex may indicate an increased information gap between the managers and the market on the new investments. Both cases demand an explanation. Declines in capex do not necessarily prompt more capex guidance than do increases in capex. Second, when a firm has more analyst coverage, it likely issues more guidance to satisfy the information needs of analysts. Third, when a firm is held by more institutional investors, it faces stronger demand from these investors. The second and third factors are especially relevant in the post reg-FD era, since private communication between the management and analysts/institutional investors is stifled. Fourth, when analysts have disperse forecasts, managers issue guidance to dispel analysts' dispersion.

Now consider the supply side. First, when a firm is capex intensive, it has more information about its projects than a less capex-intensive firm. Therefore, it issues more capex guidance. Second, when a firm's capex are volatile, it indicates that the firm is operating in a volatile environment, which makes it difficult for a firm to issue capex guidance. Third, when a firm operates in a more competitive environment, the release of proprietary information may jeopardize the firm's competitive advantage, so capex guidance decreases with competition intensity. Fourth, when a firm is in the growth and shake-out phase of its life cycle, there is inherently more information about the firm. Therefore, the firm guides more during such life-cycle stages. Lastly, risk is associated with both the demand and supply of guidance. There are many channels through which risk affects guidance issuance. I test whether and how it is associated with guidance issuance without prejudice.

The second category is pertinent to temporal and cross-sectional correlations of guidance issuance. Temporal correlation refers to the stickiness of guidance issuance. Van Buskirk and Rogers (2013) argue that once a firm initiates guidance issuance, the market expects it to continue. Tang (2012) empirically documents this observation for earnings guidance. Cross-sectional correlation refers to herding behavior among firms (Tse and Tucker 2010) or the spillover effect of firms that initiate guidance. A firm's past guidance issuance decisions and its peers' guidance issuance decisions are both likely to prompt it to issue guidance again. The rationale applies equally well for earnings, revenue, and capex guidance.

Based on the discussion above, the resultant guidance model is the following:

$$\begin{aligned}\mathbf{P}(\textsc{m}\ \textit{guidance}) = f(&\textsc{m}\ \textit{decline}, \textit{Analyst following}, \textit{Institutional holdings},\\ &\textit{Forward analyst}\ \textsc{m}\ \textit{forecast dispersion}, \textit{Capex intensity}, \textit{Capex volatility}, \textit{Herfindahl index},\\ &\textit{Life-cycle stage}, \textit{CAPM beta}, \textsc{m}\ \textit{guidance history}, \textit{Peer}\ \textsc{m}\ \textit{guidance}) + \varepsilon. \quad (8)\end{aligned}$$

$\mathbf{P}(\textsc{m}\ \textit{guidance})$ is the probability of issuing M guidance, where M ("m" for measure in IBES) can be earnings, revenue, or capex. M *decline* equals 1 when the corresponding metric is less than the previous year. *Analyst following* is the logarithm of 1 plus the number of analysts giving earnings forecasts. *Institutional holdings* is the percentage of shares held by institutional investors. *Forward analyst* M *forecast dispersion* is the standard deviation of analysts' forecast of M for one year after the current fiscal year. *Capex intensity* is the ratio of net PP&E to total assets. *Capex volatility* is the deflated standard deviation of *capex* for the past 5 years. *Herfindahl index* is the sum of the square of market shares (revenue). *Life-cycle stage* is defined in Dickinson (2011). *CAPM beta* is the beta from the capital asset pricing model. M *guidance history* equals 1 when the firm issues corresponding guidance during the past year at least once. *Peer* M *guidance* is the percentage of peer firms that issue corresponding guidance at least once during the past year. $\varepsilon$ is the disturbance. Detailed explanations and variable derivations are provided in Appendix A.

## 5.2 Estimation

Table 3.A reports the descriptive statistics for this analysis. For dummy variables, only the means are reported. The mean incidence of *earnings*, *revenue*, and *capex guidance* issuance is 29.4%, 32.0%, and 27.7%, respectively. Table 3.B shows the frequency of each possible guidance combination under the *data* columns. It is striking that there are 2,314 observations that only issue capex guidance; this number is much higher than the number of observations with solely revenue guidance (1,476) or solely earnings guidance (930). It shows the importance of capex guidance and suggests that capex guidance issuance is governed by different economic forces. Under the *independent* columns, I calculate the expected frequency and percent for guidance combinations under the assumption that each type of guidance follows the Bernoulli distribution independently. A comparison between *data* and *independent* strongly suggests that the guidance decisions are not independent. This raises the econometric complexity of the task to estimate eq. (8). The econometric literature so far only offers a double-selection model (Tunali 1986). To at least recognize the inter-dependence of the guidance choices, this paper uses multivariate probit to estimate the guidance choices and reports the correlation among the disturbances.

Table 3.C reports the trivariate probit estimation. A firm's capex guidance issuance choice (the rightmost column) is positively associated with a decline in capex, analyst coverage, institutional ownership, analyst forecast dispersion, capex intensity, being in the growth and shake-out life-cycle stages, the firm's past capex guidance practice, and peer firms' capex guidance practice. The capex guidance choice is negatively associated with capex volatility and competition intensity. These results are consistent with the analysis above, except that the coefficient on *Herfindahl index* is positive. Untabulated analysis shows that capex guidance is usually larger than future realization. Firms in low competition industries likely issue capex guidance to deter entrance of potential competitors. This

argument remains to be tested.

The results on earnings and revenue guidance are, in general, sound and consistent with the extant literature and the theories of guidance. There are a couple of variables that require reconciliation. First, the coefficient on *forward analyst* M *forecast dispersion* is negative for earnings and revenue guidance but positive for capex guidance. Note that earnings and revenue are *performance* metrics. That analysts have diverse opinions indicates that the uncertainty about the firm's performance is high. It is possible that even the firm itself is so uncertain about its future performance that it is not able to guide; on the contrary, capex is an *input* metric over which the firm itself has full control. Second, the coefficient on *capex intensity* is negative for earnings and revenues guidance but positive for capex guidance. This is because investments have uncertain payoffs. The more a firm invests, the more uncertain will be its earnings and revenue. Therefore, more capex-intensive firms guide less on earnings and revenue. On the other hand, again, because firms have full control over capex, and more capex-intensive firms face stronger demands in information about their investments, they issue more capex guidance in response.

The correlations between the disturbances, which are significantly positive as expected, are at the end of Table 3.C. I also individually estimate the three types of guidance. The coefficients for the univariate and the trivariate estimations are very close to each other. The residual from the trivariate probit is then used to calculate the inverse Mills ratios. In Appendix B, I describe the econometrics of the Heckman correction in brief. Following Tucker (2007), I use two inverse Mills ratios for each type of guidance. Consequently, each observation has six inverse Mills ratios.

# 6 The investment-return relation re-examined

In this section I re-examine the investment-return relation with results from modeling optimal capex (Section 4) and capex guidance (Section 5). Section 6.1 reports descriptive statistics. Section 6.2 reports empirical results pertinent to stock price reactions to capex announcements. Section 6.3 reports empirical results pertinent to stock price reactions to capex guidance.

## 6.1 Descriptive statistics

Table 4.A reports the descriptive statistics for subsequent analyses. The market reaction variables, *CAR*s, are multiplied by 100 to show more significant digits. There is a downward shift in the mean as the window widens, but the median remains relatively stable.

*Divergence* equals 1 when the announced capex are further from the estimated optimal level than is the prevailing market consensus. *Convergence* equals 1 when the announced capex are closer. The sum of their means is less than 1, because (1) some firms do not report capex in the initial earnings announcements, and (2) the fundamentals-based model does not generate an optimal investment proxy for some observations. *overinvestment* equals 1 when the announced capex are higher than the estimated optimal level, regardless of the prevailing market consensus. *underinvestment* equals 1 when the announced capex are lower. *Capex actual surprise* > 0 equals 1 when the announced capex are higher than the prevailing market consensus. The untabulated mean of its counterparty, *capex actual surprise* < 0, is 0.328. There are more negative than positive capex actual surprises. To the contrary, more than half of the sample reports positive earnings and revenue actual surprises. That more firms report lower-than-expected capex is consistent with firms reducing capex to meet current earnings targets (Harvey et al. 2005).

Guidance issuance variables are the same as reported in Table 3.A and not repeated.

Conditional on guidance being issued, I compare the guided number to the prevailing market consensus to determine whether the guidance constitutes a positive surprise. Contrary to the actual surprises, capex guidance surprises are mostly positive and earnings and revenue guidance surprises are mostly negative. These observations are consistent with firms using guidance to revise market expectations downward prior to earnings announcements. In subsequent analyses, the guidance surprise variables for observations that do not issue guidance are set to 0.

Table 4.B reports both Pearson (upper right) and Spearman (lower left) correlation coefficients of selected variables. *CAR*s appear uncorrelated with *divergence*, positively correlated with *convergence* for the shorter windows, negatively correlated with *overinvestment* for the longer windows, positively correlated with *underinvestment*, and positively correlated with *capex guidance*. These univariate results are consistent with (or at least do not contradict) my empirical predictions.

## 6.2 Stock price reaction to capex announcements

This and the next sections present multi-variable regression results of capex news on abnormal stock returns. The analyses are in an identical format. Each set of independent variables is regressed on four windows of *CAR*, $(-1, 1)$, $(-1, 14)$, $(-1, 30)$, and $(-1, 60)$, where $t = 0$ is the capex (earnings) announcement date. All are estimated using ordinary least squares. I report White's estimator to correct for possible heteroscedasticity. There is no sign of extreme values affecting the estimation. All specifications include *capex actual surprise* $> 0$, *capex guidance*, and *capex guidance surprise* $> 0$ and their counterparts of earnings and revenue, and the six inverse Mills ratios explained in Section 5 and Appendix B.

I examine the market's response to capex announcements to test Predictions 1 and 2. The coefficients on the dummy variables *divergence* and *convergence* in Table 5 correspond to Prediction 1. These coefficients can be interpreted as the abnormal returns from a hypothetical equal-weighted portfolio that has a long position in the stocks for which the dummy variable equals 1 after controlling for other variables.

The relationship between *divergence* and the announcement period abnormal returns is significantly negative. The stock price decline starts with 0.4% for the $(-1, 1)$ window and increases to 1.5% for the $(-1, 60)$ window. Meanwhile, for *convergence*, I find no significant reaction. As discussed in Section 2.2, the absence of any market reaction to *convergence* is not surprising because the potential benefits of *convergence* is capped by $|\,expected - optimal\,|$.

The coefficients of the capex variables vary greatly as the *CAR* window varies, whereas the coefficients on other variables are most invariant. To gain more insights, I regress $CAR(-1, t), t = 0, 1, \ldots, 60$ on the same set of explanatory variables used in Table 5 and plot the coefficients on *divergence* and *convergence* in Figures 4.A and 4.B. The estimated coefficients are on the $y$ axes and $t$ is on the $x$ axes. The shaded area represents the heteroscedasticity-robust 90% confidence interval. Figures 4.A and 4.B share some general patterns: negative at $t = 0$, moving upward until $t = 10$–15, before moving downward until $t = 40$, and then tilting slightly upward, but the upper bound of *divergence* is below 0 most of the time, whereas the upper bound of *convergence* is above 0 most of the time. Figure 4.C presents the means of raw *CAR*s for both groups of firms in the same chart. The group *divergence* is always beneath the group *convergence*.

Next, I consider Prediction 2, the market's reaction to overinvestment interacted with divergence. For completeness, I interact *divergence* and *convergence* with *overinvestment* and *underinvestment*. As a result, four groups of firms are highlighted, with the non-capex-announcing firms as the control group. There are observations predicted to overinvest instead underinvest, and vice versa. I use the sign of the predicted overinvestment, $E_{1-}(overinvestment_{+1})$ from eq. (7), to determine whether a firm is predicted to overinvest, and I use eq. (2) to determine whether a firm actually does overinvest. I find that when a firm predicted to underinvest instead overinvests, it experiences a significant stock price decline. Because of this value implication, I set the interactive terms to 0 for 1,179 such observations, so they enter the control group. I present the results in Table 6. As expected, *divergence* $\times$ *overinvestment* is significantly negative. The stock price decline starts with 0.6% for the $(-1, 1)$ window and increases to 3.0% for the $(-1, 60)$ window. The magnitude of the stock price decline is larger than that of *divergence* alone in Table 5. The stock price reaction to the other three groups is indistinguishable from zero. The evidence is consistent with Prediction 2 and the analysis in Section 2.2.[20] Similar to *divergence* in Table 5, the coefficient on *divergence* $\times$ *overinvestment* shows variation across different *CAR* windows. That the stock price reacts to capex investments in a gradual manner is unanticipated during my hypothesis development. This is likely attributable to the complexity of analyzing investment news, and perhaps more information arrives at the market after the announcement. This conjecture remains to be tested.

The coefficient on the variable *capex actual surprise* $> 0$ represents the market's reaction to a positive capex surprise after controlling for other factors. In Tables 5 and 6, *capex actual surprise* $> 0$ is negative, especially for longer horizons. However, when I control for *overinvestment*, *capex actual surprise* $> 0$ becomes insignificant.[21] This result supports the argument of Andrade et al. (2001) that in a competitive economy with an efficient capital market, investments are *ex ante* value neutral.

## 6.3 Stock price reaction to capex guidance

The empirical evidence for Prediction 3 is already presented in Tables 5 and 6. The results are very close in these two tables (and later tables). For discussion purposes, I quote numbers from Table 5.

Prediction 3 states that capex guidance is beneficial and that a positive stock price reaction ensues. Depending on how the *CAR* windows are weighed, the results are neutral to supportive. The coefficient on *capex guidance* starts with 0.1% for $t = 1$ but grows to 3.7% for $t = 60$. For $t = 60$, issuing capex guidance is the best news a firm can have.[22] This result has been strengthened by the Heckman correction. If I exclude the inverse Mills ratios from the regression, the coefficient (robust $t$-statistic) on *capex guidance* is only 0.097% (0.44), 0.672% (2.06), 1.250% (2.50), and 1.811% (2.67) for $t = 1, 14, 30$, and 60, respectively. The coefficient is significant at the 5% level for $t = 30$ and 60. Moreover, consistent with the discussion in Section 2.3 that the sign of capex guidance is irrelevant to the stock price reaction, in Tables 5 and 6, the coefficient on *capex guidance surprise* > 0 is indifferent from zero for $t = 1$, 14, and 60; it is significant only at 10% for $t = 30$.

Because the coefficient on *capex guidance* shows large variation on $t$, I also plot it against $t = 0, 1, \ldots, 60$ in Figure 5.A. The specification is the same as Table 5. Figure 5.A shows a steady upswing for *capex guidance* up to $t = 50$ before it flattens out. Figure 5.B plots a flat trace of *capex guidance surprise* > 0. The fact that *capex guidance surprise* > 0 is slightly negative is consistent with the market revising stock prices downward for potential overinvestment embedded in the positive surprise, a scenario not identified in the model.

The empirical results of Prediction 3 and the insignificance of *capex guidance surprise* > 0 lead to the question that if capex guidance is beneficial and the benefit is irrelevant to capex guidance surprises, then what good does capex guidance do? Prediction 4 hypothesizes that firms reduce information asymmetry by communicating why their choice of capex levels are the true optima, and the stock price decline from diverging from optima will be mitigated by capex guidance. Table 7 reports the results. The sample is stratified by whether the firm diverges from or converges to the estimated optimum and whether it issues capex guidance. The coefficient on *capex guidance* $\times$ *divergence* is indifferent from zero for all *CAR* windows, suggesting capex guidance indeed mitigates the negative price reaction to divergence. Meanwhile, the coefficient on (1–*capex guidance*) × *divergence* is more negative than the pooled group *divergence* in Table 5. The evidence supports Prediction 4.

Finally, I examine whether firms use capex guidance to "talk their way" out of overinvestment, that is, does capex guidance mitigate the negative price impact from overinvestment? If the market is able to distinguish overinvesting firms from other firms, then stock prices should decline for overinvesting firms, regardless of whether they guide. I present the analysis in Table 8. Instead of *divergence* and *convergence*, I use *over*- and *underinvestment* to interact with *capex guidance*. The evidence is mixed. For $t = 1$, 14, and 30, there is no significant stock price decline for overinvesting firms that guide. However, for $t = 60$, among overinvesting firms, stock prices for guiders and non-guiders decline by 2.7% and 2.6 %, respectively, both significantly different from zero, and the difference between them is statistically insignificant.[23] Taken together, the evidence indicates that overinvesting firms can use capex guidance to fool the market for 30 trading days, but the market eventually adjusts.

# 7 Summary and conclusion

Investment decisions are vital to corporate success, and market participants strive to understand investment news. So far, the extant literature has had limited success in documenting stock price reactions to investment news. To improve this literature, I model optimal capex to help in better identifying the investment news and model capex guidance to account for previously ignored concurrent news. With these improvements, I hypothesize and find that when a firm's capex diverge from the estimated optimal level, its stock price declines. Given divergence, the stock price decline is more severe when the firm overinvests. Moreover, controlling for self-selection, there is a positive market reaction to the issuance of capex guidance. I hypothesize that capex guidance reduces information asymmetry between management and investors. I find that the negative stock price reaction to divergence disappears when the firm issues capex guidance, consistent with investors aligning their views on the optimal capex level with their managers' guidance.

These results have practical implications. Earlier research expresses concerns that the previously observed positive investment-return association may induce overinvestment. This study denies this view and largely supports the market efficiency hypothesis. Moreover, this paper, to my knowledge, presents the first findings that directly relate capex guidance to stock prices, and it points out a possible mechanism by which information asymmetry between managers and outside investors is reduced. The evidence encourages managers to make sound investment decisions and to communicate future investment plans to the market, especially when the firm is taking a new path that requires new investment plans.

This study calls for further research in several directions. For example, the accounting-variable-based model only estimates the optimal *level* of capex, whereas the optimality of investment choices ultimately depends on the selection of particular projects, that is, the *quality* of capex. The task of empirically identifying optimal investment decisions remains open. Additionally, despite the efforts in this paper to explore Miller and Skinner's (2015) idea about overall financial reporting and disclosure strategy, extant literature lacks a theory that synthesizes the various context-dependent observations. Lastly, having shown that stock investors react to capex news, whether and how other market participants, such as equity analysts or bond investors, respond to capex news could be investigated.

# A Variable definitions

This list defines all of the variables used in the analyses. To avoid repetition, I use м ("m" for measure, or metric) to denote earnings, revenue, or capex. All dollar-denominated variables are deflated by total assets from the previous year's balance sheet, so they become denomination-free.

| Variable | Definition |
|---|---|
| A. Capex and explanatory variables (Table 2) | |
| *Capex* | Capital expenditure; `capx`/lag(`at`) from Compustat |
| *Size*$^{-1}$ | Inverse of total assets; `1/at` from Compustat |
| *Depreciation* | Depreciation, plus amortization; `dp/at` from Compustat |
| *Accumulated depreciation* | Ratio of accumulated depreciation and gross property, plant, and equipment; `dpact/ppegt` from Compustat |
| *Revenue growth* | Growth rate of revenue; `revt`/lag(`revt`) from Compustat |
| *Cash stocks* | Cash stocks deflated by total assets; `ch/at` from Compustat |
| *Leverage* | Ratio of debt and equity; `(dlc+dltt)/at` from Compustat |
| B. Guidance and explanatory variables (Table 3) | |
| м *guidance* | Equals 1 when a firm bundles м guidance with its annual announcement; and otherwise 0 |
| м *decline* | Equals 1 if the announced м is lower than the amount reported in the previous year; and otherwise 0 |
| *Analyst following* | Base *e* logarithm of 1, plus the number of analysts giving earnings forecast 120 calendar days before the announcement |
| *Institutional holding* | Percentage of shares held by institutional investors as of the most recent filing date. Aggregated from Thomson Reuters's Institutional (13f) Holdings s34 file |
| *Forward analyst* м *forecast dispersion* | The standard deviation of analyst forecasts of м for one year after the current fiscal year, deflated by total assets. This variable is set to 0 when there is not enough analyst forecasts to calculate the standard deviation |
| *Capex intensity* | Capital expenditure intensity; `ppentq/atq` from Compustat |
| *Capex volatility* | Standard deviation of *capex* for the past 5 years (requiring at least 3 years of data) deflated by mean of *capex* for the past 5 years |
| *Herfindahl index* | Sum of the square of market shares (revenue) for the Fama-French 48 industry for which the firm belongs |

continues »

| Variable | Definition |
| --- | --- |
| B. Guidance and explanatory variables (Table 3), continued | |
| *Life cycle: Growth* and *Shake-out* | Equals 1 if the firm is in the corresponding life-cycle stage as defined by Dickinson (2011) |
| *CAPM beta* | Beta from the capital asset pricing model; obtained via the Eventus software |
| M *guidance history* | Equals 1 if a firm gives M guidance at least once during the past calendar year before its annual announcement; and otherwise 0 |
| *Peer* M *guidance* | Percentage of peer firms (defined as having identical first three SIC digits) giving M guidance at least once during the past calendar year before a firm's annual announcement |
| C. Market reaction and explanatory variables (Tables 4–8) | |
| $CAR(-1, t)$ | Cumulative abnormal returns around the event (announcement) date; obtained via the Eventus software. $t = 1, 2, \ldots, 60$ |
| *Convergence* | Defined by equation (1) |
| *Divergence* | Defined by equation (1) |
| *Overinvestment* | Defined by equation (2) |
| *Underinvestment* | Defined by equation (2) |
| M *actual surprise* | M announced minus the prevailing market consensus prior to the announcement. Market consensus equals the analyst consensus, if available; otherwise, it equals the most recent guidance, if any, or it equals the realized amount from the previous year. |
| M *actual surprise* > 0 | Equals 1 if M *actual surprise* > 0; and otherwise 0 |
| M *guidance* | Same as defined earlier |
| M *guidance surprise* | M guided minus the market consensus prior to the guidance issuance. Guidance surprise is first calculated for each horizon and then summed for each observation |
| M *guidance surprise* > 0 | Equals 1 if M *guidance surprise* > 0 |
| $IMR_{M,1}$ | Inverse Mills ratio for issuing M guidance. See Section 5 |
| $IMR_{M,0}$ | Inverse Mills ratio for not issuing M guidance. See Section 5 |

# B The econometrics of the Heckman correction

The provision of guidance is voluntary and therefore subject to self-selection. Consider the following general setting, in which we are interested in the effect of the treatment variable $g$ (guidance) on the outcome variable $y$ (stock price reaction), after controlling for an array of other factors $X$:

$$y = \alpha g + X'\beta + \varepsilon. \tag{B.1}$$

The econometric task is to estimate the coefficient of $g$, $\alpha$. Since $g$ is non-random, we can not assume $g$ and $\varepsilon$ are uncorrelated, and thus the ordinary least square estimator of $\alpha$ (and $\beta$) is biased (Greene 2012, 225). There are several ways to address self-selection, and this paper opts for the Heckman correction (Heckman 1979). Instead of eq. (B.1), the Heckman correction approach reframes the problem as the following:[24]

$$\begin{aligned} y_1 &= \alpha_1 + X_1'\beta + \nu_1 \text{ (data observed only when } g = 1),\\ y_0 &= \alpha_0 + X_0'\beta + \nu_0 \text{ (data observed only when } g = 0),\\ g^* &= Z\gamma + \varepsilon, \end{aligned} \tag{B.2}$$

where $g^*$ is the latent variable that governs the assignment of treatment $g$. When $g^*$ is larger than a threshold (normalized to 0), $g = 1$; otherwise, $g = 0$. The task of estimating $\alpha$ in eq. (B.1) becomes estimating $\alpha_1 - \alpha_0$ in eq. (B.2). $\nu_1$, $\nu_0$, and $\varepsilon$ are disturbances. Assume that $(\nu_1, \varepsilon)$ and $(\nu_0, \varepsilon)$ are jointly normal, then

$$\begin{aligned} E\left(y_1\big|_{g=1}\right) &= \alpha_1 + X_1'\beta + E\left(\nu_1\,|_{\varepsilon>-Z'\gamma}\right) = \alpha_1 + X_1'\beta + \sigma_{\varepsilon\nu_1} IMR_1, \text{ and}\\ E\left(y_0\big|_{g=0}\right) &= \alpha_0 + X_0'\beta + E\left(\nu_0\,|_{\varepsilon\leqslant-Z'\gamma}\right) = \alpha_0 + X_0'\beta + \sigma_{\varepsilon\nu_0} IMR_0 \end{aligned} \tag{B.3}$$

hold. In eq. (B.3), $IMR_1$ and $IMR_0$ are inverse Mills ratios, and they equal, $\frac{\phi(Z'\gamma)}{\Phi(Z'\gamma)}$ and $\frac{-\phi(Z'\gamma)}{1-\Phi(Z'\gamma)}$, respectively. The inverse Mills ratios are the market's adjustment for other news leading to the issuance (and non-issuance) of guidance. I do not hypothesize whether good news or bad news leads to guidance, so the sign of the coefficients remains an empirical issue. $\phi(\cdot)$ and $\Phi(\cdot)$ are probability and density distribution functions for the standard normal distribution.

Include the inverse Mills ratios in eq. (B.1) as the following:

$$y = \alpha g + X'\beta + \sigma_{\varepsilon\nu_1} IMR_1 g + \sigma_{\varepsilon\nu_0} IMR_0 \left(1 - g\right) + u, \tag{B.4}$$

then the OLS estimator of $\alpha$ in (B.4) is unbiased since $g$ is uncorrelated with the new disturbance $u$.

# Notes

[1]I use the term investment (capex) *news* to refer to both investment (capex) *announcements*, or *actual* investments (capex), that is, the investments (capex) made in the past fiscal year, and investment (capex) *guidance*, that is, management's voluntary disclosure of the investments (capex) to be made in the future.

[2]For my 2013 sample firms, aggregated capex amounted to $1.26 trillion, and R&D (in-house, per Compustat) and M&A were only $0.36 and $0.26 trillion, respectively. The Compustat population is even more capex intensive than is my sample.

[3]The literature also relates contextual factors to investment. For instance, managers overinvest in their fields of expertise (Shleifer and Vishny 1989) or deliberately invest in long-term projects to defer revelation of failure (Hirshleifer 1993); managers with high ownership of their firms delay investments (Wang and Grenadier 2005); and classified boards depress long-term physical assets investments (Faleye 2007).

[4]Investment efficiency is a concept related to investment optima, and some papers use the strength of the cash-investment association to proxy for investment efficiency. Firm-level investment efficiency must be estimated over several periods, whereas a firm has an optimal investment level for each period.

[5]As an exception, Eberhart et al. (2008) report that R&D has positive effects on bondholder wealth.

[6]By "segregated" guidance, Tucker et al. (2013) mean line items of the income statement. According to their Table 1, 6.8% and 13.4% of the S&P 500 firms issue R&D and depreciation expense guidance from 2005 to 2006.

[7]Lu and Tucker (2012) and Tucker et al. (2013) are both based on the same hand-collected data set of S&P 500 firms from 2005 to 2006. (Lu and Tucker use only the 2005 data.) Li (2010) uses Perl to parse Factiva, but she has to read and code investment guidance manually.

[8]Firms appear to be more confident about their capex guidance. In my sample, 51.0% of capex guidance is issued as points (the rest are intervals), whereas only 8.5% of earnings guidance is issued as points.

[9]Trueman's (1986) setting is earnings guidance, but his argument is fully consistent with investment guidance. Healy and Palepu (2001) summarize several theories for why managers provide guidance and how the market is expected to react.

[10]This paper does not consider firms that update their capex guidance during the year because (1) capital budgeting is done on an annual basis and (2) the data show that the frequency of firms that update capex guidance during a fiscal year is much lower than that of earnings or revenue guidance.

[11]The IBES actual files sometimes record two entries for one fiscal year: one from the announcements and the other from the filings. Because firms bundle guidance on both occasions, I include both entries. The second entry is considered as an update to the first entry, usually with zero surprise.

[12]To ensure that the short-window *CAR*'s are accurate, I exclude annual announcements that bundle guidance not on the announcement day but within two days before or after the announcements. This exclusion affects a very small number of observations.

[13]I assume analysts give forecasts on *actual* capex instead of on *optimal* capex. The basis for these assumptions is that analysts' revision of their capex forecasts closely follows managers' capex guidance, according to untabulated analyses.

[14]Out of firm years bundled with capex guidance, 2.1% provide guidance beyond one year. If a firm provides both quarterly and annual guidance, only the annual guidance is taken. If a firm only provides quarterly guidance, then the quarterly guidance is taken.

[15]The frequency of other metrics is not as high as earnings, revenue, or capex. Additionally, the marginal contribution to the market's information set from extra metrics diminishes. For example, if a firm guides revenue and gross margin, then the user can derive EBITDA from the information by multiplying the two, leaving a separate issuance of EBITDA guidance useless. As a result, I do not consider metrics other than earnings, revenue, and capex.

[16]Winsorization produces similar results.

[17]This prediction of *capex* is merely a by-product from estimating the optimal capex level. When calculating capex surprise, the prevailing market consensus is mostly generated from analyst forecasts and prior guidance, as defined in Appendix A.

[18]The firms that overinvest the most do not have the highest current ROA. They are likely experiencing some strategic changes.

[19]Untabulated analysis shows that the deviation from the estimated optimum, that is, $Capex_t - E_{t-}(Capex_t^*)$, follows an autoregressive process with significant positive coefficients.

[20]Had the interaction terms for the above-mentioned 1,179 observations not been set to 0, the coefficient on *convergence* × *overinvestment* would then be significantly negative at 10% and 5% for CAR windows (–1, 30) and (–1, 60), respectively. The coefficient on *divergence* × *overinvestment* remains the largest in magnitude and statistical significance.

[21]The untabulatd analysis is done as following. I replace *divergence* and *convergence* with *overinvestment* and *underinvestment* in Table 5, and re-estimate. The coefficient (robust *t*-statistic) on *capex actual surprise* > 0 becomes –0.047% (0.30), –0.245% (1.04), –0.389% (1.23), and –0.536% (1.17) for the four *CAR* windows, none of which is significantly different from zero.

[22]The coefficient on *earnings guidance surprise* > 0 is larger (4.5%). However, to evaluate the gross effect of issuing positive earnings guidance, one needs to add the coefficient on *earnings guidance* (–1.8%). The gross effect of issuing positive earnings guidance is therefore only 2.7%.

[23]The $\chi^2$ test statistic and *p*-value for the null hypothesis that the coefficients equal are 0.02 and 0.90, respectively.

[24]The derivation up to eq. (B.4) is adopted and shortened from Tucker (2007).

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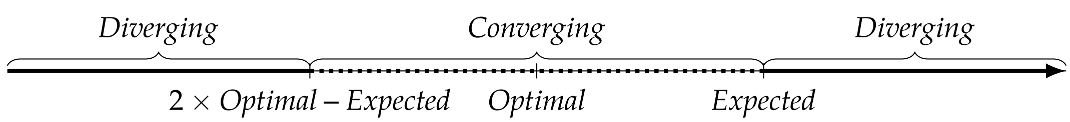
Figure 1: Illustration of converging, diverging, overinvestment, and underinvestment

A. Converging and diverging




B. Over- and underinvestment

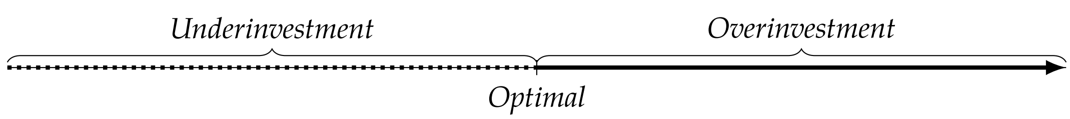
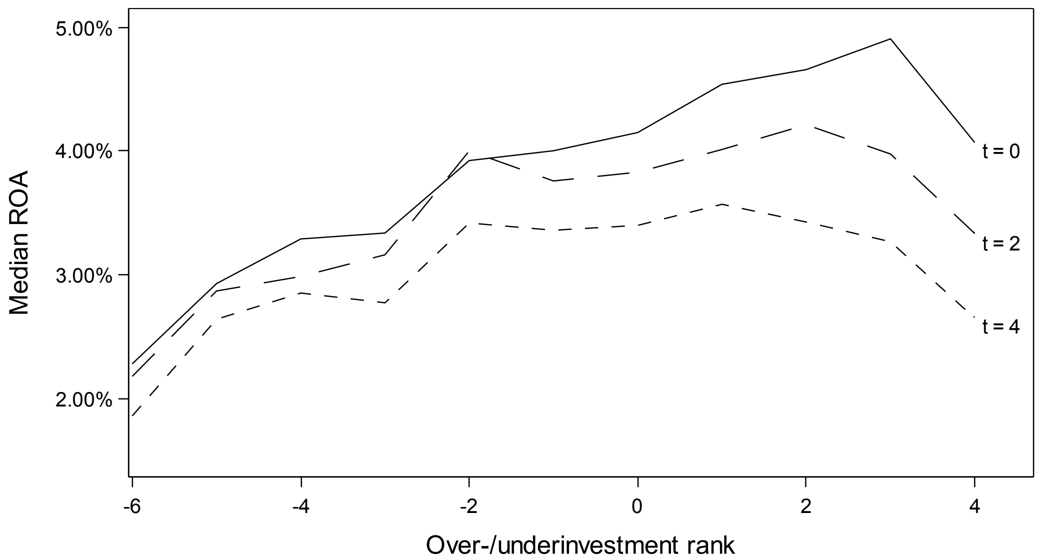
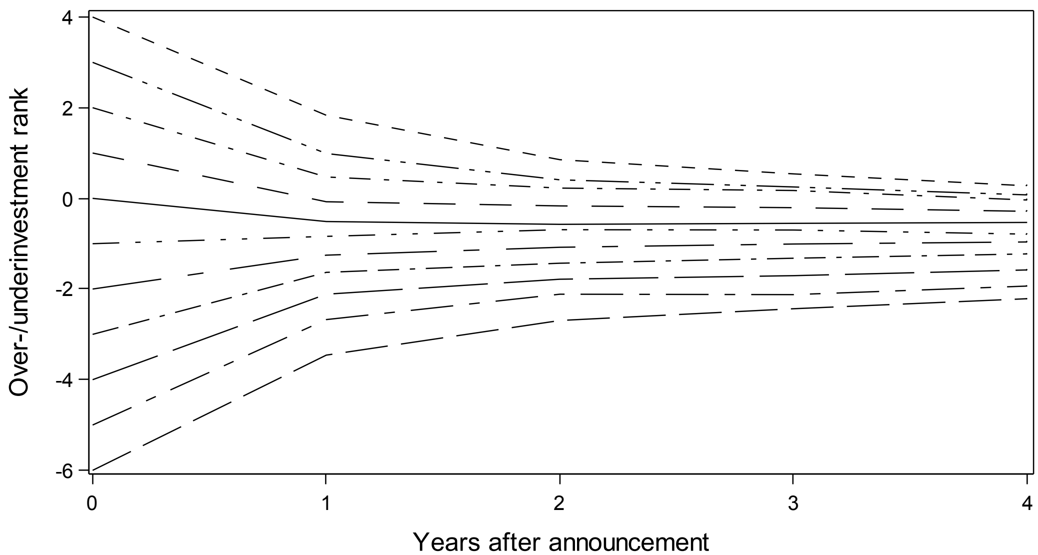


Figure 2: Over-/underinvestment rank and median return on assets




The under- and overinvestment rank is given on the $x$ axis. The lowest rank (–6) represents the firms that underinvest the most, and the the highest rank (+4) represents the firms that overinvest the most. Rank 0 contains firms that invest closest to the estimated optimA. The $y$ axis shows the median ROA. The three series are the current ($t = 0$), two-year-ahead ($t = 2$), and four-year-ahead ($t = 4$) median ROA. The implied axes of symmetry for $t = 2$ and 4 are at $rank = 0.718$ and 0.026, respectively.

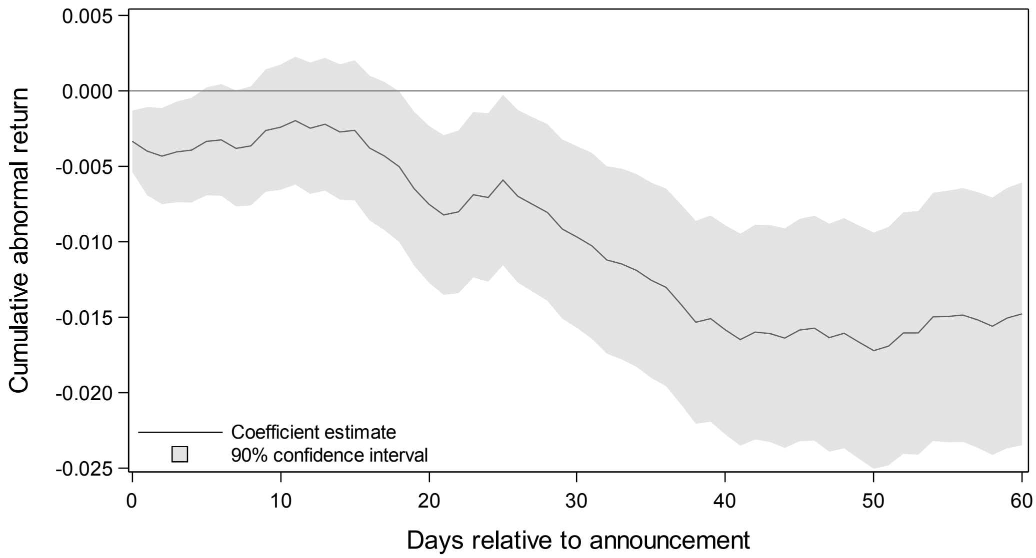
Figure 3: Over-/underinvestment rank over time




Each series represents an over-/underinvestment rank. The lowest rank (–6) represents the firms that underinvest the most, and the highest rank (+4) represents the firms that overinvest the most. Rank 0 contains firms that invest closest to the estimated optimA. Each series tracks the mean over-/underinvestment rank for $t = 0, 1, \ldots, 4$.

Figure 4: Daily stock price reactions to diverging from and converging to optimum

A. *Divergence*




B. *Convergence*

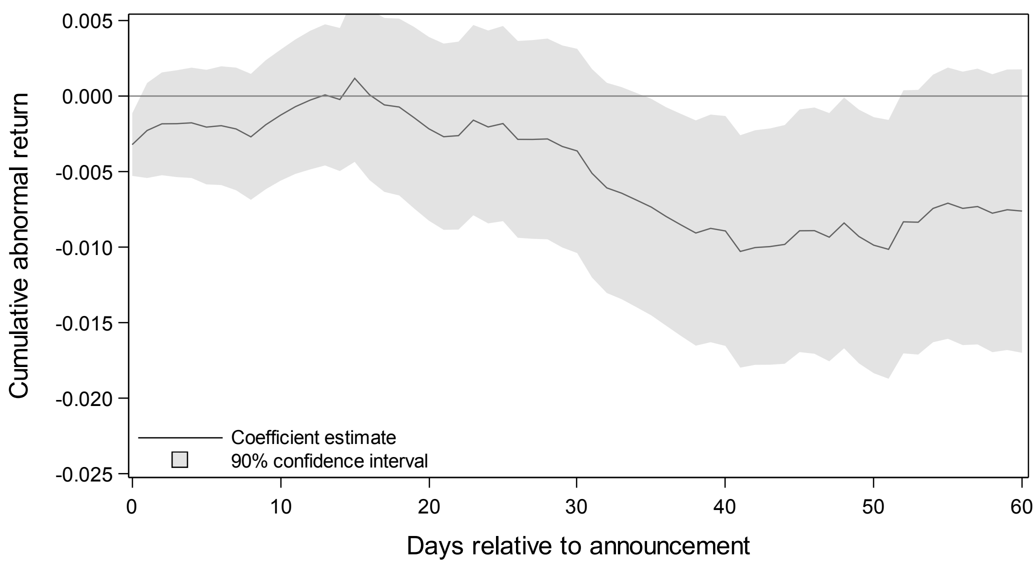
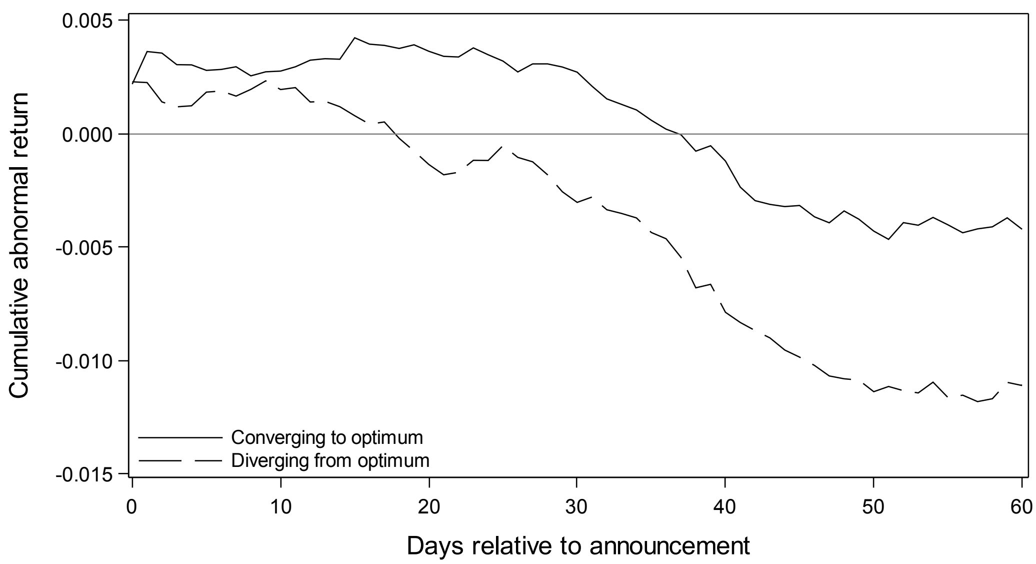


Figure 4: Daily stock price reactions to diverging from and converging to optimum (continued)

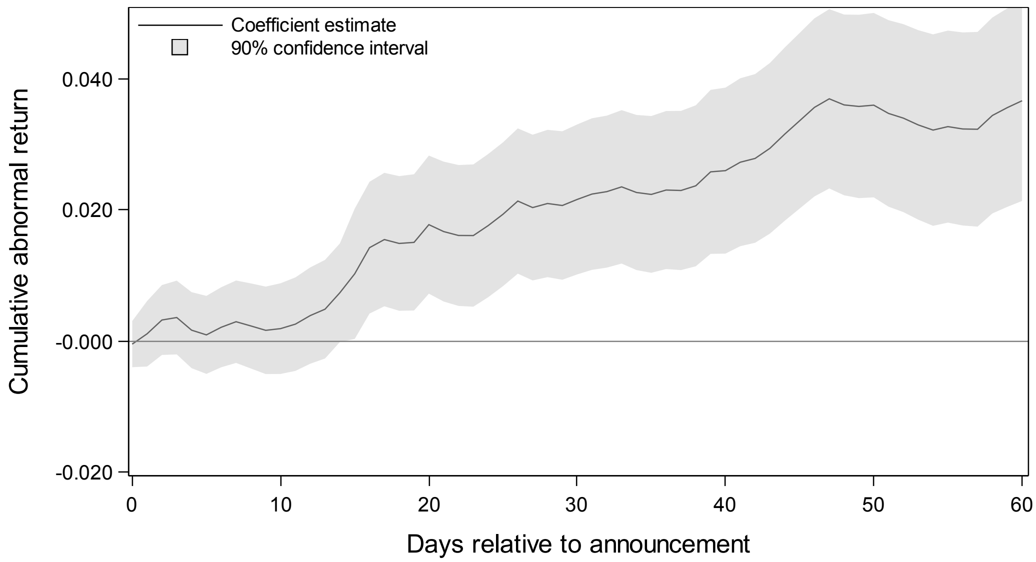
C. Mean raw CAR for *converging to optimum* and *diverging from optimum*



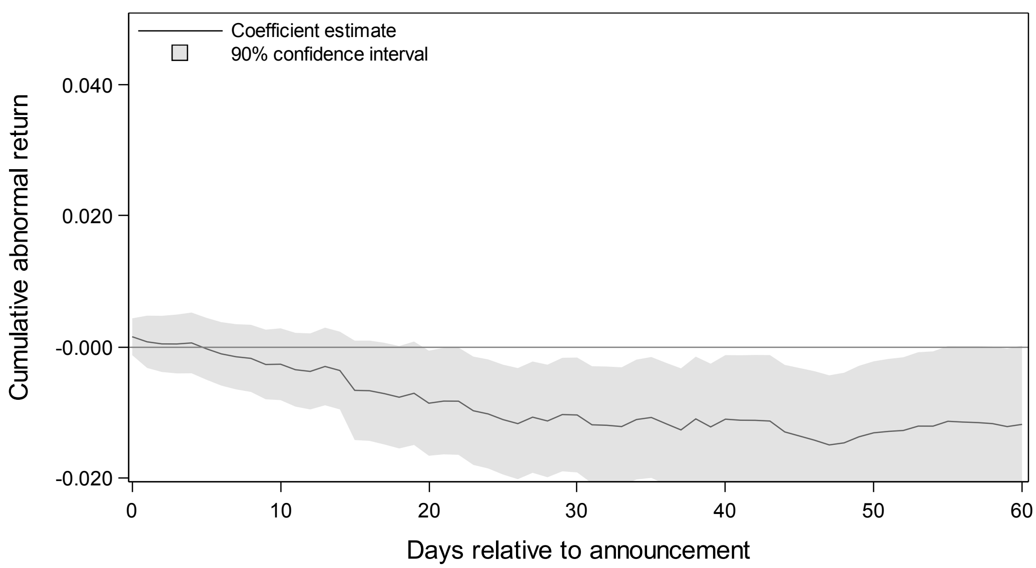

Panels A and B plot the coefficient estimations on *divergence* and *convergence* from regressing the set of explanatory variables of Table 5 on $CAR(-1,t), t = 0, 1, \ldots, 60$. The shaded areas are heteroskedasticity-robust 90% confidence intervals. Panel C plots the mean raw $CAR(-1,t)$ of *converging* and *diverging* firms.

Figure 5: Daily stock price reaction to capex guidance issuance and surprise

A. *Capex guidance*




B. *Capex guidance surprise* > 0




Panels A and B plot the coefficient estimations on *capex guidance* and *capex guidance surprise* > 0 from regressing the set of explanatory variables of Table 5 on $CAR(-1, t), t = 0, 1, \ldots, 60$. The shaded areas are heteroskedasticity-robust 90% confidence intervals.

Table 1: Sample composition

This table provides the sample composition by year. Each observation is an annual earnings announcement or financial statement filing. *Pooled* reports the total number of observations in each calendar year. *No guidance* reports the number of observations without any guidance. The column *N* under *With guidance* reports the number of observations that have bundled guidance. *Earnings*, *Revenue*, *Capex*, and *Other* report the percentage of the preceding *N* that contains earnings, revenue, capital expenditure, and other guidance, respectively.

| | Pooled | No guidance | With guidance | | | | |
|---|---|---|---|---|---|---|---|
| Year | N | N | N | Earnings (%) | Revenue (%) | Capex (%) | Other (%) |
| 2008 | 3,592 | 2,002 | 1,590 | 62.1 | 62.4 | 46.8 | 44.3 |
| 2009 | 3,140 | 1,621 | 1,519 | 54.3 | 56.2 | 54.6 | 41.1 |
| 2010 | 2,960 | 1,360 | 1,600 | 54.1 | 59.9 | 51.7 | 45.4 |
| 2011 | 2,820 | 1,237 | 1,583 | 55.1 | 60.5 | 52.4 | 46.4 |
| 2012 | 2,771 | 1,143 | 1,628 | 53.4 | 60.5 | 53.1 | 46.9 |
| 2013 | 2,817 | 1,178 | 1,639 | 53.1 | 60.1 | 54.9 | 47.8 |
| 2014 | 2,872 | 1,299 | 1,573 | 55.4 | 62.5 | 51.7 | 48.9 |
| Total | 20,972 | 9,840 | 11,132 | 55.4 | 60.3 | 52.2 | 45.9 |

Table 2: Estimation and prediction of the fundamental model

This table tabulates fit statistics, coefficient estimates, and prediction evaluation metrics of the fundamental investment model, eq. (4), which is reprinted here:

$$\begin{aligned} Capex = \alpha\,(Size)_{-1}^{-1} + \beta_1\ \left(Depreciation\right)_{-1} + \beta_2\ \left(Accumulated\ depreciation\right)_{-1} \\ + \beta_3\ \left(Revenue\ growth\right)_{-1} + \beta_4\ (Cash\ stocks)_{-1} + \beta_5\ \left(Leverage\right)_{-1} + \varepsilon. \end{aligned}$$

The model is fitted for each Fama-French 48 industry-year. The variables are defined in Appendix A. Panel A reports the number of observations used and the adjusted $R^2$ for each industry-year estimation. Soda, smoke, textiles, fabpr, ships, guns, coal, and boxes have been excluded due to a small sample size. Panel B is split into two sections. The *coefficient estimate* section reports the coefficient estimates averaged by industry pooled, year pooled, and industry-year pooled. Coefficients $a$ and $b$ are the estimation of $\alpha$ and $\beta$. The *prediction evaluation* section presents out-of-sample prediction performance of the fundamental model and the random walk model: $\bar{e}$ is the mean of the prediction error of the fundamental model; $\sqrt{\sum e^2/n^2}$ is the mean square error; and $\overline{e_{RW}}$ and $\sqrt{\sum e_{RW}^2/n^2}$ are their counterparts for the random walk model. All elements in Panel B are multiplied by 100 to show more significant digits.

Table 2: Estimation and prediction of the fundamental model (continued)

A. Number of observations and fit statistics

| | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2014 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Industry | N | $R^2$ | N | $R^2$ | N | $R^2$ | N | $R^2$ | N | $R^2$ | N | $R^2$ | N | $R^2$ |
| Agric | | | | | 22 | 0.64 | 20 | 0.69 | | | | | | |
| Food | 74 | 0.76 | 76 | 0.48 | 76 | 0.71 | 75 | 0.70 | 75 | 0.75 | 66 | 0.79 | 68 | 0.72 |
| Beer | | | | | | | | | | | 21 | 0.80 | 20 | 0.59 |
| Toys | 35 | 0.68 | 30 | 0.71 | 30 | 0.79 | 27 | 0.80 | 26 | 0.69 | 26 | 0.82 | 26 | 0.75 |
| Fun | 67 | 0.40 | 69 | 0.44 | 65 | 0.67 | 58 | 0.66 | 58 | 0.58 | 60 | 0.59 | 67 | 0.62 |
| Books | 33 | 0.87 | 26 | 0.75 | 28 | 0.62 | 26 | 0.76 | 22 | 0.77 | 22 | 0.28 | 22 | 0.83 |
| Hshld | 68 | 0.39 | 64 | 0.64 | 61 | 0.73 | 58 | 0.70 | 56 | 0.64 | 59 | 0.63 | 59 | 0.52 |
| Clths | 62 | 0.71 | 64 | 0.74 | 63 | 0.71 | 62 | 0.68 | 51 | 0.73 | 46 | 0.83 | 42 | 0.84 |
| Hlth | 85 | 0.53 | 88 | 0.61 | 79 | 0.66 | 71 | 0.65 | 63 | 0.58 | 61 | 0.66 | 70 | 0.42 |
| MedEq | 163 | 0.38 | 154 | 0.47 | 151 | 0.53 | 142 | 0.30 | 140 | 0.51 | 137 | 0.55 | 162 | 0.40 |
| Drugs | 330 | 0.21 | 318 | 0.26 | 292 | 0.26 | 282 | 0.28 | 283 | 0.19 | 309 | 0.27 | 357 | 0.43 |
| Chems | 101 | 0.60 | 101 | 0.53 | 102 | 0.51 | 99 | 0.43 | 95 | 0.60 | 90 | 0.65 | 99 | 0.63 |
| Rubbr | 31 | 0.57 | 27 | 0.57 | 25 | 0.91 | 22 | 0.68 | 24 | 0.67 | 20 | 0.76 | 23 | 0.78 |
| BldMt | 74 | 0.61 | 71 | 0.42 | 72 | 0.43 | 71 | 0.40 | 72 | 0.57 | 77 | 0.66 | 77 | 0.33 |
| Cnstr | 41 | 0.84 | 40 | 0.84 | 42 | 0.80 | 40 | 0.63 | 42 | 0.68 | 48 | 0.61 | 50 | 0.71 |
| Steel | 60 | 0.75 | 68 | 0.49 | 71 | 0.42 | 69 | 0.69 | 66 | 0.58 | 67 | 0.50 | 60 | 0.78 |
| Mach | 141 | 0.58 | 139 | 0.57 | 137 | 0.54 | 134 | 0.54 | 126 | 0.68 | 126 | 0.46 | 130 | 0.58 |
| ElcEq | 86 | 0.58 | 92 | 0.40 | 89 | 0.40 | 76 | 0.55 | 75 | 0.52 | 71 | 0.38 | 71 | 0.18 |
| Autos | 70 | 0.74 | 67 | 0.71 | 67 | 0.80 | 75 | 0.35 | 74 | 0.74 | 80 | 0.67 | 75 | 0.75 |
| Aero | 25 | 0.72 | 27 | 0.76 | 20 | 0.89 | 23 | 0.83 | | | 21 | 0.74 | | |
| Gold | 28 | 0.82 | 29 | 0.75 | 32 | 0.80 | 32 | 0.85 | 36 | 0.82 | 43 | 0.58 | 53 | 0.63 |
| Mines | 33 | 0.67 | 42 | 0.52 | 40 | 0.66 | 39 | 0.67 | 34 | 0.76 | 37 | 0.72 | 41 | 0.67 |
| Oil | 231 | 0.64 | 225 | 0.70 | 225 | 0.60 | 225 | 0.66 | 222 | 0.71 | 243 | 0.69 | 251 | 0.67 |
| Util | 256 | 0.70 | 264 | 0.78 | 252 | 0.80 | 252 | 0.74 | 246 | 0.75 | 244 | 0.73 | 239 | 0.81 |
| Telcm | 213 | 0.64 | 195 | 0.75 | 189 | 0.70 | 184 | 0.69 | 181 | 0.72 | 162 | 0.76 | 155 | 0.74 |
| PerSv | 53 | 0.65 | 52 | 0.71 | 64 | 0.60 | 62 | 0.61 | 52 | 0.62 | 48 | 0.52 | 51 | 0.41 |
| BusSv | 573 | 0.36 | 552 | 0.42 | 537 | 0.41 | 518 | 0.50 | 524 | 0.49 | 541 | 0.45 | 584 | 0.38 |
| Comps | 186 | 0.46 | 183 | 0.56 | 159 | 0.61 | 145 | 0.56 | 140 | 0.65 | 133 | 0.63 | 125 | 0.65 |
| Chips | 344 | 0.58 | 336 | 0.53 | 340 | 0.44 | 314 | 0.61 | 291 | 0.65 | 285 | 0.63 | 265 | 0.49 |
| LabEq | 105 | 0.56 | 98 | 0.53 | 100 | 0.55 | 89 | 0.61 | 84 | 0.59 | 80 | 0.70 | 76 | 0.63 |
| Paper | 52 | 0.63 | 56 | 0.48 | 53 | 0.71 | 52 | 0.64 | 52 | 0.69 | 48 | 0.51 | 42 | 0.68 |
| Trans | 167 | 0.62 | 168 | 0.54 | 167 | 0.49 | 160 | 0.60 | 161 | 0.71 | 159 | 0.61 | 163 | 0.52 |
| Whlsl | 150 | 0.60 | 152 | 0.39 | 143 | 0.61 | 147 | 0.60 | 146 | 0.57 | 138 | 0.35 | 140 | 0.44 |
| Rtail | 226 | 0.70 | 213 | 0.68 | 217 | 0.76 | 210 | 0.69 | 209 | 0.73 | 209 | 0.71 | 203 | 0.75 |
| Meals | 76 | 0.80 | 81 | 0.68 | 77 | 0.72 | 79 | 0.71 | 73 | 0.77 | 75 | 0.83 | 83 | 0.72 |
| Banks | 59 | 0.42 | 58 | 0.70 | 61 | 0.67 | 61 | 0.74 | 58 | 0.71 | 66 | 0.58 | 62 | 0.57 |
| Insur | 100 | 0.73 | 101 | 0.64 | 102 | 0.58 | 92 | 0.73 | 89 | 0.70 | 88 | 0.51 | 86 | 0.73 |
| RlEst | 45 | 0.52 | 47 | 0.40 | 47 | 0.19 | 40 | 0.53 | 34 | 0.40 | 44 | 0.31 | 42 | 0.48 |
| Fin | 128 | 0.10 | 126 | 0.13 | 126 | 0.17 | 123 | 0.10 | 115 | 0.12 | 118 | 0.06 | 124 | 0.07 |
| Other | 27 | 0.41 | 32 | 0.32 | 35 | 0.51 | 33 | 0.25 | 29 | 0.67 | 30 | 0.82 | 28 | 0.57 |
| None | 23 | 0.70 | 20 | 0.67 | 23 | 0.74 | 28 | 0.59 | 25 | 0.72 | 27 | 0.70 | 25 | 0.73 |
| *Pooled* | 4,621 | 0.60 | 4,551 | 0.57 | 4,481 | 0.61 | 4,315 | 0.60 | 4,149 | 0.63 | 4,225 | 0.60 | 4,316 | 0.60 |

## Table 2: Estimation and prediction of the fundamental model (continued)

### B. Estimation and fit evaluation

| | Coefficient estimate | | | | | | Prediction evaluation | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100× | $a$ | $b_1$ | $b_2$ | $b_3$ | $b_4$ | $b_5$ | $\bar{e}$ | $\overline{e_{RW}}$ | $\sqrt{\frac{\sum e^2}{n^2}}$ | $\sqrt{\frac{\sum e^2_{RW}}{n^2}}$ |
| *By industry* | | | | | | | | | | |
| Agric | –1.94 | 96.49 | –18.30 | 13.65 | –8.28 | –9.46 | –3.12 | 1.10 | 1.15 | 0.69 |
| Food | –5.88 | 88.84 | –6.13 | 4.37 | 6.39 | –1.88 | –0.40 | 0.43 | 0.28 | 0.27 |
| Beer | 59.34 | 109.53 | –7.95 | 4.10 | 48.71 | –8.64 | –1.96 | 0.35 | 2.61 | 0.95 |
| Toys | –5.39 | 33.43 | 0.60 | 1.39 | –1.35 | –1.59 | –0.23 | –0.32 | 0.14 | 0.17 |
| Fun | –24.29 | 31.82 | –0.17 | 2.03 | 7.18 | 1.17 | –0.59 | –0.09 | 0.55 | 0.49 |
| Books | 149.53 | 34.78 | 1.04 | 0.73 | –0.78 | –1.51 | –0.49 | –0.28 | 0.19 | 0.17 |
| Hshld | –8.18 | 56.14 | –3.77 | 3.84 | 3.74 | –1.36 | 0.20 | 0.38 | 0.24 | 0.23 |
| Clths | –39.20 | 100.77 | –6.22 | 4.59 | 0.85 | –4.35 | –0.31 | 0.26 | 0.16 | 0.14 |
| Hlth | –9.63 | 49.43 | –2.12 | 3.03 | 2.54 | –0.69 | –0.13 | 0.13 | 0.25 | 0.20 |
| MedEq | –2.82 | 38.93 | –0.44 | 1.47 | 1.84 | –0.50 | –0.01 | 0.12 | 0.18 | 0.14 |
| Drugs | –0.23 | 32.60 | –0.68 | 0.99 | 0.99 | 0.07 | –0.15 | 0.40 | 0.17 | 0.12 |
| Chems | –21.69 | 28.64 | –4.67 | 5.46 | 10.80 | –0.34 | 0.01 | 0.58 | 0.29 | 0.26 |
| Rubbr | –10.13 | 50.93 | –4.53 | 4.96 | 3.60 | –0.97 | 0.39 | 0.44 | 0.51 | 0.48 |
| BldMt | –4.47 | 34.36 | –4.75 | 5.17 | –0.36 | –0.99 | 0.01 | 0.26 | 0.32 | 0.30 |
| Cnstr | –48.21 | 89.79 | –2.23 | 1.40 | 2.63 | –1.44 | 0.07 | 0.24 | 0.22 | 0.19 |
| Steel | –10.17 | 68.51 | –3.77 | 2.95 | 10.47 | –1.04 | 0.23 | 0.39 | 0.28 | 0.27 |
| Mach | –3.67 | 67.88 | –4.17 | 3.37 | 2.40 | –0.92 | –0.19 | 0.15 | 0.18 | 0.17 |
| ElcEq | –0.49 | 41.76 | –3.51 | 2.17 | 8.67 | 2.09 | 0.11 | 0.70 | 0.37 | 0.34 |
| Autos | –10.94 | 41.01 | –0.33 | 2.76 | 2.89 | –0.11 | 0.33 | 0.78 | 0.61 | 0.54 |
| Aero | –21.37 | 102.78 | –3.70 | 2.05 | 6.68 | –3.15 | –0.07 | 0.18 | 0.25 | 0.24 |
| Gold | 302.50 | –43.60 | 6.82 | 7.09 | 16.47 | 9.72 | –1.32 | 1.77 | 1.07 | 0.79 |
| Mines | –110.85 | 0.47 | –2.58 | 6.74 | 24.92 | –1.55 | –0.32 | –0.35 | 0.69 | 0.61 |
| Oil | –35.17 | 97.29 | 3.58 | 6.73 | 4.67 | 0.20 | 3.54 | 4.25 | 0.75 | 0.68 |
| Util | 196.59 | 124.36 | –3.14 | 5.04 | –12.62 | –1.96 | 0.06 | 0.52 | 0.14 | 0.09 |
| Telcm | –32.06 | 87.29 | –4.72 | 3.24 | 4.13 | –1.23 | 2.87 | 3.44 | 3.00 | 3.00 |
| PerSv | –16.55 | 135.91 | –12.87 | 4.99 | 2.37 | –0.84 | –0.20 | 0.29 | 0.50 | 0.32 |
| BusSv | –1.66 | 58.71 | –4.90 | 2.36 | 4.23 | 0.72 | –0.54 | 0.32 | 0.12 | 0.08 |
| Comps | 0.13 | 42.68 | –2.26 | 2.16 | 0.97 | –0.80 | 0.05 | 0.14 | 0.11 | 0.10 |
| Chips | –0.74 | 57.97 | –4.55 | 3.65 | 1.03 | –0.15 | 0.06 | 0.30 | 0.18 | 0.14 |
| LabEq | –1.95 | 62.78 | –0.74 | 1.54 | –0.40 | –3.02 | 0.09 | 0.16 | 0.15 | 0.15 |
| Paper | 24.82 | 71.61 | –6.16 | 6.22 | 7.84 | –6.65 | –0.36 | 0.35 | 0.30 | 0.23 |
| Trans | –54.42 | 128.07 | –12.33 | 5.32 | 12.40 | –0.20 | 0.80 | 1.20 | 0.38 | 0.36 |
| Whlsl | –0.64 | 106.21 | –5.14 | 2.93 | 1.80 | –0.19 | –0.09 | 0.56 | 0.22 | 0.16 |
| Rtail | –18.82 | 81.19 | –7.77 | 5.75 | 3.09 | –1.69 | –0.04 | 0.27 | 0.12 | 0.09 |
| Meals | 3.46 | 106.86 | –11.20 | 8.28 | 1.99 | –5.79 | –0.64 | –0.02 | 0.38 | 0.31 |
| Banks | –43.29 | 111.16 | –3.92 | 1.27 | 0.75 | 2.34 | 0.03 | 0.24 | 0.21 | 0.18 |
| Insur | –10.82 | 52.48 | –0.70 | 0.43 | 1.40 | 1.13 | –0.10 | 0.07 | 0.07 | 0.05 |
| RlEst | –34.13 | 104.95 | –5.68 | 2.66 | –0.64 | –0.15 | –0.15 | –0.16 | 0.52 | 0.53 |
| Fin | –2.09 | 24.99 | –1.04 | 1.16 | 2.10 | 0.53 | 0.14 | 0.13 | 0.24 | 0.21 |
| Other | –7.40 | 86.90 | –5.17 | 1.44 | 26.21 | 2.64 | –1.29 | –0.13 | 0.72 | 0.47 |
| None | –59.89 | 75.14 | –4.20 | 3.23 | 2.49 | –4.09 | –2.22 | –0.36 | 0.62 | 0.26 |
| *By estimation year* | | | | | | | | | | |
| 2008 | –15.62 | 71.32 | –4.17 | 3.49 | 5.38 | 0.43 | –0.42 | 0.62 | 0.16 | 0.13 |
| 2009 | –16.43 | 39.44 | –1.63 | 3.08 | 3.04 | –0.94 | –1.97 | –1.80 | 0.11 | 0.10 |
| 2010 | 16.05 | 56.69 | –3.21 | 3.49 | 4.75 | –0.13 | 1.59 | 1.18 | 0.16 | 0.14 |
| 2011 | 43.26 | 64.20 | –2.90 | 3.19 | 4.57 | –0.80 | 0.34 | 1.50 | 0.16 | 0.14 |
| 2012 | 1.42 | 74.79 | –3.63 | 3.73 | 4.05 | –1.69 | 0.38 | 0.82 | 0.16 | 0.14 |
| 2013 | –19.43 | 79.00 | –4.94 | 3.94 | 5.99 | –1.64 | 1.26 | 1.58 | 0.96 | 0.96 |
| 2014 | –2.64 | 77.19 | –5.30 | 3.94 | 4.98 | –1.08 | 0.54 | 1.21 | 0.20 | 0.18 |
| *Average* | 1.08 | 66.06 | –3.68 | 3.55 | 4.68 | –0.83 | 0.22 | 0.70 | 0.14 | 0.14 |

## Table 3: Probit estimation of the guidance issuance model

This table reports the trivariate probit estimation of the guidance decision model, eq. (8), reprinted below:

$$\mathbf{P}(\text{M } \textit{guidance}) = f(\text{M } \textit{decline}, \textit{Analyst following}, \textit{Institutional holdings}, \textit{Forward analyst } \text{M } \textit{forecast dispersion}, \textit{Capex intensity}, \textit{Capex volatility}, \textit{Herfindahl index}, \textit{Life cycle stage}, \textit{CAPM beta}, \text{M } \textit{guidance history}, \textit{Peer } \text{M } \textit{guidance}) + \varepsilon.$$

The variables are defined in Appendix A. Panel A reports the descriptive statistics. Only the means are printed for the dummy variables. Panel B tabulates the frequency for each possible guidance combination. Panel C reports the estimation. ρ's are the correlation between the disturbance ε's. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level (two-tailed).

A. Descriptive statistics

| Variable | N | Mean | SD | 1st pctl | 1st qtl | Median | 3rd qtl | 99th pctl |
|---|---|---|---|---|---|---|---|---|
| *Earnings guidance* | 20,972 | 0.294 | | | | | | |
| *Revenue guidance* | 20,972 | 0.320 | | | | | | |
| *Capex guidance* | 20,972 | 0.277 | | | | | | |
| *Earnings decline* | 20,972 | 0.370 | | | | | | |
| *Revenue decline* | 20,972 | 0.268 | | | | | | |
| *Capex decline* | 20,972 | 0.230 | | | | | | |
| *Earnings guidance history* | 20,972 | 0.357 | | | | | | |
| *Revenue guidance history* | 20,972 | 0.386 | | | | | | |
| *Capex guidance history* | 20,972 | 0.361 | | | | | | |
| *Peer earnings guidance* | 20,972 | 0.296 | 0.226 | 0.000 | 0.079 | 0.294 | 0.455 | 1.000 |
| *Peer revenue guidance* | 20,972 | 0.337 | 0.273 | 0.000 | 0.053 | 0.308 | 0.587 | 0.900 |
| *Peer capex guidance* | 20,972 | 0.333 | 0.253 | 0.000 | 0.116 | 0.286 | 0.500 | 1.000 |
| *Forward analyst earnings forecast dispersion* | 20,972 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 |
| *Forward analyst revenue forecast dispersion* | 20,972 | 0.036 | 0.082 | 0.000 | 0.002 | 0.017 | 0.040 | 0.354 |
| *Forward analyst capex forecast dispersion* | 20,972 | 0.004 | 0.030 | 0.000 | 0.000 | 0.000 | 0.002 | 0.060 |
| *Analyst following* | 20,972 | 1.902 | 0.885 | 0.000 | 1.386 | 1.946 | 2.565 | 3.526 |
| *Institutional holdings* | 20,972 | 0.644 | 0.280 | 0.011 | 0.443 | 0.711 | 0.876 | 1.000 |
| *Capex intensity* | 20,972 | 0.229 | 0.246 | 0.000 | 0.038 | 0.131 | 0.348 | 0.898 |
| *Capex volatility* | 20,972 | 0.388 | 0.332 | 0.000 | 0.166 | 0.333 | 0.539 | 1.514 |
| *Herfindahl index* | 20,972 | 0.060 | 0.056 | 0.016 | 0.031 | 0.051 | 0.064 | 0.242 |
| *Life cycle: Growth* | 20,972 | 0.050 | 0.219 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| *Life cycle: Shake-out* | 20,972 | 0.263 | 0.440 | 0.000 | 0.000 | 0.000 | 1.000 | 1.000 |
| *CAPM Beta* | 20,972 | 1.224 | 0.508 | 0.143 | 0.884 | 1.196 | 1.537 | 2.533 |

Table 3: Probit estimation of the guidance issuance model (continued)

B. Guidance combination frequency

| | | | Data | | Independent | |
|---|---|---|---|---|---|---|
| Earnings | Revenue | Capex | Frequency | Percent | Frequency | Percent |
| 0 | 0 | 0 | 10,252 | 48.88 | 7,279 | 34.71 |
| 0 | 0 | 1 | 2,314 | 11.03 | 2,788 | 13.29 |
| 0 | 1 | 0 | 1,476 | 7.04 | 3,428 | 16.34 |
| 0 | 1 | 1 | 766 | 3.65 | 1,313 | 6.26 |
| 1 | 0 | 0 | 930 | 4.43 | 3,030 | 14.45 |
| 1 | 0 | 1 | 762 | 3.63 | 1,161 | 5.53 |
| 1 | 1 | 0 | 2,506 | 11.95 | 1,427 | 6.80 |
| 1 | 1 | 1 | 1,966 | 9.37 | 547 | 2.61 |

Table 3: Probit estimation of the guidance issuance model (continued)

C. Parameter estimates

| *P*(M *guidance*) M: | *Earnings* | *Revenue* | *Capex* |
|---|---|---|---|
| *...decline* | –0.235*** | –0.082*** | 0.014 |
| | (8.89) | (3.16) | (0.55) |
| *Analyst following* | 0.171*** | 0.142*** | 0.159*** |
| | (9.40) | (8.80) | (9.97) |
| *Institutional holdings* | 0.598*** | 0.308*** | 0.652*** |
| | (9.76) | (6.03) | (12.93) |
| *Forward analyst...forecast dispersion* | –61.985** | –0.697*** | 2.052* |
| | (2.34) | (2.97) | (1.74) |
| *Capex intensity* | –0.282*** | –0.532*** | 0.428*** |
| | (4.57) | (8.54) | (8.19) |
| *Capex volatility* | –0.211*** | –0.185*** | –0.113*** |
| | (4.29) | (4.53) | (2.83) |
| *Herfindahl index* | 0.035 | 0.082 | 0.446** |
| | (0.15) | (0.40) | (2.35) |
| *Life cycle: Growth* | 0.012 | 0.125** | 0.095* |
| | (0.20) | (2.42) | (1.92) |
| *Life cycle: Shake-out* | 0.060** | 0.115*** | 0.054** |
| | (2.03) | (4.21) | (2.12) |
| *CAPM beta* | –0.172*** | –0.055** | 0.014 |
| | (5.90) | (2.15) | (0.60) |
| *...guidance history* | 2.337*** | 1.922*** | 1.477*** |
| | (80.29) | (75.32) | (61.09) |
| *Peer...guidance* | 0.819*** | 1.054*** | 0.874*** |
| | (13.93) | (21.56) | (17.44) |
| ρ(·, *Revenue guidance dummy*) | 0.783*** | | |
| | (82.11) | | |
| ρ(·, *Capex guidance dummy*) | 0.380*** | 0.432*** | |
| | (21.95) | (27.97) | |
| Sample size | 20,972 | 20,972 | 20,972 |
| –2× log-likelihood | 36295.0 | | |

Table 4: Descriptive statistics and correlation coefficients

This table presents descriptive statistics and correlation coefficients. The variables are defined in Appendix A. Panel A reports the descriptive statistics. Only the means are printed for the dummy variables. *CAR*'s are multiplied by 100 to show more significant digits. Statistics for M *guidance surprise* and M *guidance surprise* > 0 are conditional on corresponding guidance issuance. Panel B reports Pearson (upper right) and Spearman (lower left) correlation coefficients among a group of selected variables. Coefficients in **bold** are significant at 5%.

A. Descriptive statistics

| Variable | N | Mean | SD | 1st pctl | 1st qtl | Median | 3rd qtl | 99th pctl |
|---|---|---|---|---|---|---|---|---|
| *CAR* (–1, 1) ×100 | 20,972 | 0.157 | 9.617 | –27.322 | –3.896 | 0.081 | 4.268 | 25.874 |
| *CAR* (–1, 14) ×100 | 20,972 | –0.117 | 14.495 | –41.814 | –6.385 | 0.002 | 6.548 | 38.728 |
| *CAR* (–1, 30) ×100 | 20,972 | –0.217 | 19.532 | –52.481 | –8.626 | 0.101 | 8.380 | 50.642 |
| *CAR* (–1, 60) ×100 | 20,972 | –0.866 | 27.319 | –76.105 | –13.124 | 0.081 | 11.901 | 71.635 |
| *Divergence* | 20,972 | 0.280 | | | | | | |
| *Convergence* | 20,972 | 0.295 | | | | | | |
| *Overinvestment* | 20,972 | 0.281 | | | | | | |
| *Underinvestment* | 20,972 | 0.295 | | | | | | |
| *Capex actual surprise* > 0 | 20,972 | 0.297 | | | | | | |
| *Capex guidance surprise* > 0 | 5,808 | 0.567 | | | | | | |
| *Earnings actual surprise* > 0 | 20,972 | 0.554 | | | | | | |
| *Earnings guidance surprise* > 0 | 6,164 | 0.367 | | | | | | |
| *Revenue actual surprise* > 0 | 20,972 | 0.542 | | | | | | |
| *Revenue guidance surprise* > 0 | 6,714 | 0.471 | | | | | | |
| *Earnings actual surprise* ×100 | 20,972 | –0.400 | 61.702 | –22.151 | –0.166 | 0.025 | 0.293 | 14.851 |
| *Earnings guidance surprise* ×100 | 6,164 | –0.084 | 18.819 | –6.190 | –0.498 | –0.102 | 0.112 | 2.948 |

Table 4: Descriptive statistics and correlation coefficients (continued)

B. Correlation coefficients

| # | Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *CAR* (–1, 1) | | **0.70** | **0.52** | **0.37** | 0.00 | **0.01** | –0.01 | **0.02** | 0.00 | 0.01 | **0.02** |
| 2 | *CAR* (–1, 14) | **0.66** | | **0.75** | **0.56** | 0.01 | **0.02** | –0.00 | **0.03** | 0.00 | **0.02** | **0.02** |
| 3 | *CAR* (–1, 30) | **0.52** | **0.78** | | **0.76** | –0.00 | **0.02** | **–0.02** | **0.03** | –0.01 | **0.02** | 0.01 |
| 4 | *CAR* (–1, 60) | **0.36** | **0.55** | **0.73** | | –0.01 | 0.01 | **–0.03** | **0.03** | –0.01 | **0.02** | 0.01 |
| 5 | *Divergence* | 0.00 | 0.01 | –0.00 | –0.00 | | **–0.40** | **0.30** | **0.28** | **0.23** | **0.16** | **0.15** |
| 6 | *Convergence* | **0.02** | **0.02** | **0.02** | 0.01 | **–0.40** | | **0.29** | **0.32** | **0.26** | **0.17** | **0.14** |
| 7 | *Overinvestment* | –0.00 | –0.00 | **–0.02** | **–0.02** | **0.30** | **0.29** | | **–0.40** | **0.33** | **0.20** | **0.18** |
| 8 | *Underinvestment* | **0.02** | **0.03** | **0.03** | **0.03** | **0.28** | **0.32** | **–0.40** | | **0.16** | **0.13** | **0.12** |
| 9 | *Capex actual surprise* > 0 | 0.01 | 0.01 | –0.00 | –0.01 | **0.23** | **0.26** | **0.33** | **0.16** | | **0.15** | **0.17** |
| 10 | *Capex guidance* | 0.01 | **0.02** | **0.02** | **0.02** | **0.16** | **0.17** | **0.20** | **0.13** | **0.15** | | **0.70** |
| 11 | *Capex guidance surprise* > 0 | **0.02** | **0.02** | 0.01 | 0.01 | **0.15** | **0.14** | **0.18** | **0.12** | **0.17** | **0.70** | |

Table 5: Stock price reaction to investments diverging from optimum

| | $CAR(-1,1)$ | $CAR(-1,14)$ | $CAR(-1,30)$ | $CAR(-1,60)$ |
|---|---|---|---|---|
| *Divergence* | –0.004** | –0.003 | –0.010*** | –0.015*** |
| | (2.32) | (1.06) | (2.70) | (2.81) |
| *Convergence* | –0.002 | –0.000 | –0.004 | –0.008 |
| | (1.23) | (0.10) | (0.90) | (1.36) |
| *Capex actual surprise* > 0 | –0.001 | –0.003 | –0.006* | –0.008* |
| | (0.60) | (1.40) | (1.83) | (1.81) |
| *Capex guidance* | 0.001 | 0.007 | 0.022*** | 0.037*** |
| | (0.38) | (1.63) | (3.11) | (3.95) |
| *Capex guidance surprise* > 0 | 0.001 | –0.004 | –0.010* | –0.012 |
| | (0.34) | (0.99) | (1.94) | (1.61) |
| *Earnings actual surprise* > 0 | 0.033*** | 0.037*** | 0.035*** | 0.030*** |
| | (24.23) | (17.79) | (12.34) | (7.65) |
| *Earnings actual surprise* | 0.001 | 0.004*** | 0.005*** | 0.005** |
| | (1.60) | (4.43) | (3.12) | (2.49) |
| *Earnings guidance* | –0.017*** | –0.015*** | –0.014*** | –0.018*** |
| | (7.17) | (4.23) | (3.05) | (2.73) |
| *Earnings guidance surprise* > 0 | 0.039*** | 0.044*** | 0.043*** | 0.045*** |
| | (17.46) | (13.95) | (10.96) | (7.85) |
| *Earnings guidance surprise* | 0.001 | –0.002 | –0.006 | 0.001 |
| | (0.19) | (0.32) | (0.84) | (0.06) |
| *Revenue actual surprise* > 0 | 0.016*** | 0.015*** | 0.014*** | 0.014*** |
| | (12.23) | (7.28) | (4.95) | (3.60) |
| *Revenue guidance* | –0.015*** | –0.009** | –0.002 | 0.001 |
| | (5.53) | (2.19) | (0.38) | (0.09) |
| *Revenue guidance surprise* > 0 | 0.029*** | 0.020*** | 0.021*** | 0.021*** |
| | (13.07) | (6.14) | (4.99) | (3.48) |
| $IMR_{Capex,0}$ × (1–*Capex guidance*) | –0.007*** | –0.016*** | –0.025*** | –0.037*** |
| | (2.75) | (4.49) | (5.01) | (5.75) |
| $IMR_{Capex,1}$ × *Capex guidance* | 0.003 | 0.006* | –0.001 | –0.007 |
| | (1.13) | (1.68) | (0.14) | (1.03) |
| $IMR_{Earnings,0}$ × (1–*Earnings guidance*) | 0.002 | –0.003 | –0.006 | –0.002 |
| | (0.85) | (0.81) | (1.25) | (0.36) |
| $IMR_{Earnings,1}$ × *Earnings guidance* | 0.001 | 0.005 | 0.007 | 0.012 |
| | (0.27) | (1.28) | (1.34) | (1.38) |
| $IMR_{Revenue,0}$ × (1–*Revenue guidance*) | –0.001 | 0.001 | 0.003 | 0.002 |
| | (0.41) | (0.40) | (0.62) | (0.30) |
| $IMR_{Revenue,1}$ × *Revenue guidance* | –0.002 | –0.006 | –0.011* | –0.011 |
| | (0.62) | (1.48) | (1.94) | (1.27) |
| Intercept | –0.024*** | –0.035*** | –0.035*** | –0.041*** |
| | (16.27) | (14.60) | (10.81) | (8.90) |
| *F* statistics | 83.17 | 42.17 | 22.70 | 11.94 |
| *p*-value | <.001 | <.001 | <.001 | <.001 |
| Observations | 20,972 | 20,972 | 20,972 | 20,972 |
| Adj. $R^2$ | 0.069 | 0.036 | 0.019 | 0.010 |

Models are estimated with ordinary least squares. Heteroscedasticity-robust *t*-statistics are in the parentheses. ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% level, respectively. The variable definitions are in Appendix A.

Table 6: Interactive effects of diverging from optimum and overinvestment

| | $CAR(-1,1)$ | $CAR(-1,14)$ | $CAR(-1,30)$ | $CAR(-1,60)$ |
|---|---|---|---|---|
| *Divergence* × *Overinvestment* | –0.006*** | –0.007** | –0.020*** | –0.030*** |
| | (3.02) | (2.12) | (4.82) | (5.00) |
| *Divergence* × *Underinvestment* | –0.000 | 0.006 | 0.012 | 0.015 |
| | (0.10) | (1.07) | (1.62) | (1.36) |
| *Convergence* × *Overinvestment* | –0.003 | 0.001 | 0.002 | –0.006 |
| | (0.95) | (0.20) | (0.27) | (0.51) |
| *Convergence* × *Underinvestment* | 0.001 | 0.003 | 0.003 | 0.005 |
| | (0.41) | (0.79) | (0.66) | (0.71) |
| *Capex actual surprise* > 0 | –0.002 | –0.007 | –0.018** | –0.022** |
| | (0.63) | (1.53) | (2.54) | (2.08) |
| *Capex guidance* | 0.001 | 0.008* | 0.022*** | 0.038*** |
| | (0.36) | (1.67) | (3.21) | (4.05) |
| *Capex guidance surprise* > 0 | 0.001 | –0.004 | –0.010* | –0.012 |
| | (0.33) | (0.99) | (1.93) | (1.61) |
| *Earnings actual surprise* > 0 | 0.033*** | 0.037*** | 0.035*** | 0.030*** |
| | (24.16) | (17.76) | (12.27) | (7.57) |
| *Earnings actual surprise* | 0.001 | 0.004*** | 0.005*** | 0.005** |
| | (1.60) | (4.44) | (3.13) | (2.49) |
| *Earnings guidance* | –0.017*** | –0.015*** | –0.014*** | –0.018*** |
| | (7.19) | (4.23) | (3.04) | (2.73) |
| *Earnings guidance surprise* > 0 | 0.039*** | 0.044*** | 0.043*** | 0.044*** |
| | (17.40) | (13.90) | (10.88) | (7.75) |
| *Earnings guidance surprise* | 0.001 | –0.002 | –0.006 | 0.001 |
| | (0.22) | (0.30) | (0.81) | (0.15) |
| *Revenue actual surprise* > 0 | 0.016*** | 0.015*** | 0.014*** | 0.014*** |
| | (12.23) | (7.29) | (4.97) | (3.61) |
| *Revenue guidance* | –0.015*** | –0.009** | –0.002 | 0.001 |
| | (5.56) | (2.18) | (0.36) | (0.11) |
| *Revenue guidance surprise* > 0 | 0.029*** | 0.020*** | 0.021*** | 0.022*** |
| | (13.12) | (6.18) | (5.03) | (3.55) |
| $IMR_{Capex,0}$ × (1–*Capex guidance*) | –0.007*** | –0.016*** | –0.025*** | –0.037*** |
| | (2.72) | (4.54) | (5.12) | (5.86) |
| $IMR_{Capex,1}$ × *Capex guidance* | 0.003 | 0.006* | –0.001 | –0.007 |
| | (1.17) | (1.70) | (0.11) | (0.99) |
| $IMR_{Earnings,0}$ × (1–*Earnings guidance*) | 0.002 | –0.003 | –0.006 | –0.002 |
| | (0.84) | (0.79) | (1.21) | (0.33) |
| $IMR_{Earnings,1}$ × *Earnings guidance* | 0.001 | 0.005 | 0.007 | 0.012 |
| | (0.28) | (1.27) | (1.33) | (1.37) |
| $IMR_{Revenue,0}$ × (1–*Revenue guidance*) | –0.001 | 0.002 | 0.003 | 0.002 |
| | (0.37) | (0.43) | (0.70) | (0.39) |
| $IMR_{Revenue,1}$ × *Revenue guidance* | –0.002 | –0.006 | –0.011* | –0.011 |
| | (0.63) | (1.49) | (1.96) | (1.29) |
| Intercept | –0.025*** | –0.035*** | –0.035*** | –0.042*** |
| | (16.42) | (14.61) | (10.89) | (9.05) |
| *F* statistics | 75.59 | 38.48 | 21.60 | 12.13 |
| *p*-value | <.001 | <.001 | <.001 | <.001 |
| Observations | 20,972 | 20,972 | 20,972 | 20,972 |
| Adj. $R^2$ | 0.070 | 0.036 | 0.020 | 0.011 |

Models are estimated with ordinary least squares. Heteroscedasticity-robust *t*-statistics are in the parentheses. ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% level, respectively. The variable definitions are in Appendix A.

Table 7: Interactive effects of investments guidance and diverging from optimum

| | $CAR(-1,1)$ | $CAR(-1,14)$ | $CAR(-1,30)$ | $CAR(-1,60)$ |
|---|---|---|---|---|
| *Capex guidance* × *Divergence* | –0.002 | –0.000 | –0.004 | –0.014 |
| | (0.68) | (0.03) | (0.59) | (1.37) |
| (1–*Capex guidance*) × *Divergence* | –0.004** | –0.004 | –0.012*** | –0.017*** |
| | (2.14) | (1.27) | (2.79) | (2.82) |
| *Capex guidance* × *Convergence* | 0.000 | 0.001 | –0.001 | –0.017 |
| | (0.12) | (0.16) | (0.12) | (1.59) |
| (1–*Capex guidance*) × *Convergence* | –0.003 | –0.000 | –0.004 | –0.003 |
| | (1.45) | (0.09) | (0.85) | (0.54) |
| *Capex actual surprise* > 0 | –0.001 | –0.003 | –0.006* | –0.008* |
| | (0.57) | (1.34) | (1.74) | (1.76) |
| *Capex guidance* | –0.001 | 0.006 | 0.018** | 0.041*** |
| | (0.22) | (0.92) | (2.16) | (3.45) |
| *Capex guidance surprise* > 0 | 0.000 | –0.004 | –0.011** | –0.011 |
| | (0.20) | (1.06) | (2.02) | (1.53) |
| *Earnings actual surprise* > 0 | 0.033*** | 0.037*** | 0.035*** | 0.030*** |
| | (24.23) | (17.80) | (12.36) | (7.65) |
| *Earnings actual surprise* | 0.001 | 0.004*** | 0.005*** | 0.005** |
| | (1.60) | (4.44) | (3.13) | (2.49) |
| *Earnings guidance* | –0.017*** | –0.015*** | –0.014*** | –0.018*** |
| | (7.18) | (4.21) | (3.03) | (2.70) |
| *Earnings guidance surprise* > 0 | 0.039*** | 0.044*** | 0.043*** | 0.045*** |
| | (17.47) | (13.95) | (10.97) | (7.84) |
| *Earnings guidance surprise* | 0.001 | –0.002 | –0.006 | 0.001 |
| | (0.18) | (0.32) | (0.83) | (0.11) |
| *Revenue actual surprise* > 0 | 0.016*** | 0.015*** | 0.014*** | 0.014*** |
| | (12.26) | (7.28) | (4.97) | (3.59) |
| *Revenue guidance* | –0.015*** | –0.009** | –0.002 | 0.000 |
| | (5.50) | (2.18) | (0.36) | (0.06) |
| *Revenue guidance surprise* > 0 | 0.029*** | 0.020*** | 0.021*** | 0.021*** |
| | (13.07) | (6.13) | (4.96) | (3.44) |
| $IMR_{Capex,0}$ × (1–*Capex guidance*) | –0.007*** | –0.016*** | –0.025*** | –0.036*** |
| | (2.83) | (4.52) | (5.05) | (5.64) |
| $IMR_{Capex,1}$ × *Capex guidance* | 0.003 | 0.007* | –0.000 | –0.008 |
| | (1.21) | (1.73) | (0.05) | (1.07) |
| $IMR_{Earnings,0}$ × (1–*Earnings guidance*) | 0.002 | –0.003 | –0.006 | –0.002 |
| | (0.87) | (0.81) | (1.24) | (0.38) |
| $IMR_{Earnings,1}$ × *Earnings guidance* | 0.001 | 0.005 | 0.008 | 0.012 |
| | (0.28) | (1.28) | (1.35) | (1.37) |
| $IMR_{Revenue,0}$ × (1–*Revenue guidance*) | –0.001 | 0.001 | 0.003 | 0.002 |
| | (0.43) | (0.39) | (0.61) | (0.31) |
| $IMR_{Revenue,1}$ × *Revenue guidance* | –0.002 | –0.006 | –0.011* | –0.011 |
| | (0.61) | (1.48) | (1.94) | (1.28) |
| Intercept | –0.024*** | –0.035*** | –0.035*** | –0.042*** |
| | (15.99) | (14.34) | (10.49) | (8.84) |
| *F* statistics | 75.28 | 38.17 | 20.59 | 10.96 |
| *p*-value | <.001 | <.001 | <.001 | <.001 |
| Observations | 20,972 | 20,972 | 20,972 | 20,972 |
| Adj. $R^2$ | 0.069 | 0.036 | 0.019 | 0.010 |

Models are estimated with ordinary least squares. Heteroscedasticity-robust *t*-statistics are in the parentheses. ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% level, respectively. The variable definitions are in Appendix A.

Table 8: Interactive effects of investments guidance and overinvestment

| | $CAR(-1,1)$ | $CAR(-1,14)$ | $CAR(-1,30)$ | $CAR(-1,60)$ |
|---|---|---|---|---|
| *Capex guidance* × *Overinvestment* | –0.002 | –0.003 | –0.011 | –0.027*** |
| | (0.63) | (0.54) | (1.59) | (2.71) |
| (1–*Capex guidance*) × *Overinvestment* | –0.007*** | –0.007** | –0.018*** | –0.026*** |
| | (3.33) | (2.07) | (3.90) | (4.04) |
| *Capex guidance* × *Underinvestment* | –0.001 | 0.002 | 0.005 | –0.002 |
| | (0.24) | (0.39) | (0.64) | (0.21) |
| (1–*Capex guidance*) × *Underinvestment* | –0.001 | 0.001 | –0.002 | –0.001 |
| | (0.55) | (0.38) | (0.40) | (0.09) |
| *Capex actual surprise* > 0 | –0.000 | –0.002 | –0.004 | –0.005 |
| | (0.22) | (1.00) | (1.17) | (1.18) |
| *Capex guidance* | –0.000 | 0.006 | 0.017** | 0.039*** |
| | (0.11) | (1.00) | (2.13) | (3.31) |
| *Capex guidance surprise* > 0 | 0.000 | –0.004 | –0.011** | –0.011 |
| | (0.19) | (1.05) | (2.02) | (1.53) |
| *Earnings actual surprise* > 0 | 0.033*** | 0.037*** | 0.035*** | 0.030*** |
| | (24.14) | (17.73) | (12.27) | (7.58) |
| *Earnings actual surprise* | 0.001 | 0.004*** | 0.005*** | 0.005** |
| | (1.60) | (4.44) | (3.13) | (2.49) |
| *Earnings guidance* | –0.017*** | –0.015*** | –0.014*** | –0.018*** |
| | (7.18) | (4.22) | (3.02) | (2.71) |
| *Earnings guidance surprise* > 0 | 0.039*** | 0.044*** | 0.043*** | 0.044*** |
| | (17.47) | (13.93) | (10.90) | (7.76) |
| *Earnings guidance surprise* | 0.001 | –0.002 | –0.006 | 0.001 |
| | (0.20) | (0.30) | (0.78) | (0.17) |
| *Revenue actual surprise* > 0 | 0.016*** | 0.015*** | 0.014*** | 0.014*** |
| | (12.26) | (7.30) | (5.00) | (3.64) |
| *Revenue guidance* | –0.014*** | –0.008** | –0.001 | 0.001 |
| | (5.47) | (2.13) | (0.24) | (0.20) |
| *Revenue guidance surprise* > 0 | 0.029*** | 0.020*** | 0.021*** | 0.022*** |
| | (13.09) | (6.17) | (5.03) | (3.54) |
| $IMR_{Capex,0}$ × (1–*Capex guidance*) | –0.007*** | –0.017*** | –0.026*** | –0.038*** |
| | (2.89) | (4.61) | (5.21) | (5.83) |
| $IMR_{Capex,1}$ × *Capex guidance* | 0.003 | 0.007* | –0.000 | –0.007 |
| | (1.21) | (1.74) | (0.00) | (1.02) |
| $IMR_{Earnings,0}$ × (1–*Earnings guidance*) | 0.002 | –0.003 | –0.006 | –0.002 |
| | (0.88) | (0.79) | (1.20) | (0.33) |
| $IMR_{Earnings,1}$ × *Earnings guidance* | 0.001 | 0.005 | 0.007 | 0.012 |
| | (0.27) | (1.26) | (1.31) | (1.34) |
| $IMR_{Revenue,0}$ × (1–*Revenue guidance*) | –0.001 | 0.002 | 0.003 | 0.002 |
| | (0.41) | (0.41) | (0.66) | (0.35) |
| $IMR_{Revenue,1}$ × *Revenue guidance* | –0.002 | –0.006 | –0.011** | –0.011 |
| | (0.66) | (1.51) | (2.00) | (1.33) |
| Intercept | –0.024*** | –0.035*** | –0.035*** | –0.042*** |
| | (16.13) | (14.45) | (10.55) | (8.88) |
| $F$ statistics | 75.59 | 38.46 | 21.40 | 11.94 |
| $p$-value | <.001 | <.001 | <.001 | <.001 |
| Observations | 20,972 | 20,972 | 20,972 | 20,972 |
| Adj. $R^2$ | 0.070 | 0.036 | 0.020 | 0.011 |

Models are estimated with ordinary least squares. Heteroscedasticity-robust $t$-statistics are in the parentheses. ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% level, respectively. The variable definitions are in Appendix A.