Non-GAAP Reporting and Investment*

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ABSTRACT

When managers care about their firms' stock prices, their investment decisions become sensitive to transitory items in GAAP earnings. Non-GAAP earnings can remove these transitory items, and thus improve investment efficiency, but also introduce opportunistic bias, and thus hide inefficient investment. We quantify this trade-off by estimating a dynamic model in which a manager makes investment and non-GAAP disclosure decisions, and where investors rationally anticipate his incentives. We find the manager's ability to distort non-GAAP earnings creates inefficient investment choices and destroys firm value. We estimate the magnitude of the loss in the average firm value at just under 1%.

Keywords: Non-GAAP; pro-forma; investment; intangible assets; real effects; structural estimation

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1 Introduction

Efficient allocation of capital requires financial disclosures. Mandatory financial disclosures are prepared according to Generally Accepted Accounting Principles (GAAP). Under GAAP, recognition of certain transitory events—such as contingent liabilities—can result in a difference between GAAP earnings and firms' underlying profitability. This disparity can make managers reluctant to make discretionary expenditures and not to invest in intangible assets, which are mostly expensed, when the impact of a transitory event on earnings is negative. An increasingly common approach to circumvent potential distortions is to provide voluntary performance-related information that does not comply with GAAP and thus can eliminate the impact of transitory items. These supplemental disclosures are known as non-GAAP or pro-forma earnings. Little is known about how well these disclosures mitigate the investment distortions. In this paper, we examine the empirical importance of the interaction between investment in intangible assets and the disclosure of non-GAAP earnings.

Over the past 20 years, non-GAAP earnings have become a pervasive voluntary disclosure, with 97% of S&P 500 firms reporting a non-GAAP metric in 2017 (Audit Analytics, 2018). However, these supplemental disclosures are not without controversy as the FASB has expressed concern that these commonly used disclosures lack credibility, even if firms use them to overcome certain GAAP deficiencies.[1] Managers can use these disclosures not only to better inform investors, but also to mislead. Managers' pressure to mislead depends on how much they care about current stock prices over the firms' fundamentals, as well as the extent to which investors are able to rationally anticipate managers' optimal decisions. We formalize this intuition in a dynamic investment model that features rational pricing of a firm's shares. The model imposes structure on the data necessary to quantify the trade-off between investment and non-GAAP information quality.

Estimating an economic model is one approach to deal with unobservables. We do not observe the extent to which transitory items distort intangible investment or the amount of opportunistic bias in non-GAAP earnings. Because we also cannot observe optimal deci-

[1] See https://www.fasb.org/jsp/FASB/Page/SectionPage&cid=1176168752402

sions under alternative environments, we cannot evaluate how managers' ability to report non-GAAP earnings affects investment, nor can we separate managers' fundamentals-based from the current-stock-price-based incentives as drivers of investment decisions. Meanwhile, a rich literature in economics and finance estimates models of firms' investment decisions. We build on this literature and incorporate non-GAAP reporting into a standard dynamic investment model.

The model targets a number of data moments related to investment, GAAP, and non-GAAP earnings. In the estimated model, an opportunistic bias is on average about one-third of the non-GAAP adjustment.[2] We do not observe this bias in the data; however, we can bound it with detailed non-GAAP reconciliations from Audit Analytics, which we have not used in the estimation. If we naïvely assume all adjustments for recurring items correspond to the bias, the fraction of "biased" adjustments in these data is approximately 55%, that is an upper bound on bias, and the fraction of recurring cash adjustments is 14%, that is a lower bound on bias. Our estimate of the average bias falls within these bounds. When we counterfactually prohibit opportunistic bias in non-GAAP earnings, investment intensity decreases and the average firm value increases by just under 1%, a non-trivial increase. As such, according to the estimated model, managers sub-optimally overinvest when they have an opportunity to report an overly optimistic non-GAAP earnings.

An economic intuition behind these results is provided by the model. In the model, the manager maximizes the sum of cash flows and the current stock price adjusted by the personal cost of misleading investors. If the manager had maximized cash flows only, his incentives would be fully aligned with firm's investors and he would have made efficient investment choices. However, because the manager myopically cares about current stock prices and investors do not know everything that the manager knows, the manager can get away with misleading investors about the firm's profitability at a personal cost of providing inflated non-GAAP earnings. Because the litigation costs over non-GAAP disclosures are minimal, the personal cost mostly captures reputational costs of being persistently overly optimistic about firm's performance.

[2]Non-GAAP earnings is the sum of GAAP earnings and the non-GAAP adjustment. Our focus on the adjustment captures the discretionary aspect of non-GAAP disclosures.

Given these incentives, the manager chooses both an investment into intangible assets and a bias in non-GAAP adjustment over an infinite horizon. His investment feeds the stock of intangible capital that depreciates over time and generates an output according to a decreasing returns production function that features stochastic productivity. As common in the literature, we assume that productivity shock is persistent and that investment is subject to adjustment costs. Cash flows are then equal to the differences between output and investment with adjustment costs. While the manager observes cash flows, investors only observe a noisy version of cash flows that is GAAP earnings. We interpret this noise as non-fundamental transitory noise to earnings that empirically corresponds to transitory items. Although these transitory items can be removed by a non-GAAP adjustment, the manager may not do that completely by introducing bias in an attempt to mislead investors into believing that the firm's profitability is higher than it really is and to hide inefficient investment choices through non-GAAP disclosures.

Information asymmetry enables the manager to mislead investors. While the manager observes both productivity and transitory shocks, investors cannot differentiate between these two shocks and must rely on the information provided by the manager—GAAP and non-GAAP earnings—to price the firm's shares. Both of these signals contain muddled information about cash flows: GAAP earnings muddles cash flows with transitory shocks and non-GAAP earnings muddles cash flows with the bias. To encourage value-maximizing investment, investors have to put a positive weight on cash flows and thus either or both of the signals. Having a positive weight on GAAP earnings would reward the manager for luck, that is for positive transitory shocks, and would encourage wasteful overinvestment. By contrast, having a positive weight on non-GAAP earnings would encourage bias. Depending on parameters, investors might view having a positive weight on non-GAAP earnings as less harmful because the bias is bounded in the equilibrium whereas the transitory shocks are exogenous and random. In the estimated model, investors put a positive weight on non-GAAP earnings and use a negative weight on GAAP earnings to adjust for the impact of the equilibrium bias. We observe similar pattern in the data: the weight on non-GAAP earnings is positive and statistically significant whereas the weight on GAAP earnings is insignificant.

The manager's myopic focus on current stock prices causes deviations from the value-maximizing investment benchmark. A value-maximizing investment would respond to fundamental productivity shocks only and completely ignore transitory shocks. Although the model preserves the positive response of investment to productivity shocks, the myopic focus causes investment to respond to transitory shocks as well. If GAAP earnings had been the only signal available, investment would have increased with transitory shocks, a positive transitory shock would trigger a larger investment in an attempt to convey higher productivity. This investment pattern changes when both GAAP and non-GAAP earnings are available. The relation between investment and transitory shocks reverses and becomes negative because investors now interpret the two signals simultaneously. Because investors put a negative weight on GAAP earnings to prevent inefficient overinvestment in the presence of positive transitory shocks, in equilibrium, the manager gets punished for luck and he starts cutting his other costs by lowering investment and bias. Thus, investors' information set and expectations play a crucial role in how the relation between investment and transitory shocks plays out.

Because our model does not have a closed-form solution, we estimate the model parameters using the simulated method of moments. This approach minimizes the difference between a set of data moments and a set of moments simulated from the model. In the model, we formalize price-earnings relation as a non-linear S-shape function following empirical studies (Freeman and Tse, 1992; Das and Lev, 1994). For each parameter guess at the minimization step, we solve for the stock price as a function of GAAP and non-GAAP earnings. That is, each minimization step involves a search for a rational expectations equilibrium given the manager's optimal investment and non-GAAP disclosure decisions.

The estimated model replicates an empirical relation between investment and non-GAAP disclosures. In the data, we find investment activity and non-GAAP adjustments act as complements: higher intangible investment corresponds to higher non-GAAP adjustments. This pattern was also documented by Rozenbaum (2019) and Laurion (2020). Our estimated model replicates this prominent pattern, in addition to providing novel parameter estimates. For instance, we quantify the volatility of productivity and transitory shocks and find that the volatility of fundamental shocks is much higher than the volatility of transitory earnings. We also find the stock-price-based incentives are about 14 times more important than incentives to maximize cash flows; whereas the average cost of misleading investors via non-GAAP disclosures, relative to cash flows, is about 4%. The first estimate quantifies the commonly cited trade-off that managers face between maximizing fundamental value (i.e., cash flows) and more immediate financial-reporting concerns (e.g., Matsunaga, Shevlin, and Shores, 1992; Bens, Nagar, Skinner, and Wong, 2003; Graham, Harvey, and Rajgopal, 2005).

We contribute to two strands of research. First, we add to the extensive literature on non-GAAP reporting. Prior research finds investors value non-GAAP disclosures, which can affect market prices (Bradshaw and Sloan, 2002). We add to this literature by quantifying the effect of non-GAAP disclosures on another aspect of the economy, namely, investment activity. The non-GAAP literature also shows managers opportunistically define non-GAAP earnings in response to economic outcomes such as benchmark beating (Doyle, Jennings, and Soliman, 2013). We provide another consideration that managers face when they generate non-GAAP earnings, that is, an interaction of non-GAAP reporting with intangible investment.

Our work is related to Laurion (2020), which also finds a positive association between non-GAAP reporting and investment. However, our paper expands upon Laurion (2020) along two important dimensions. First, Laurion (2020) does not provide a mechanism for how non-GAAP reporting enables higher investment. By estimating a dynamic investment model, we test an economic mechanism and quantify how non-GAAP affects investment. Laurion (2020) also does not speak to whether the increase in investment enabled by non-GAAP reporting is optimal. Through counterfactual analysis, we assess how existing investment compare to scenarios where managers only care about fundamentals, firms can only report GAAP earnings, or the manager cannot bias non-GAAP disclosures. We find the ability of the manager to provide non-GAAP earnings leads to overinvestment and destroys firm value.

Second, we add to a growing literature examining the real effect of financial reporting. In surveys, managers admit financial reporting can influence project selection (Graham et al., 2005), and a growing literature has identified several settings where financial reporting affects investment (e.g., Jackson, 2008; Shroff, 2017). In a related paper, Terry, Whited, and Zakolyukina (2020) examine how the potential for misreporting mandatory disclosures—GAAP earnings—affects intangible investment. They estimate the effect of eliminating misreporting of GAAP earnings at 1% decrease in firm value. Although a legal cost from misreporting GAAP earnings is incurred, no legal cost arises for biased non-GAAP disclosures. We add to this literature by examining the real effect of financial reporting, using a pervasive voluntary disclosure and by focusing on intangible investment. In so doing, we answer the call of Leuz and Wysocki (2016) for more research about the effect of disclosure on real firm decisions.

2 Related literature

An important strand of accounting research tries to understand how financial disclosures affect real firm activities (Kanodia and Sapra, 2016). This literature concludes that both accounting measurement and disclosure shape real decisions made by firms. The empirical literature evaluating the interaction between financial disclosures and investment often focuses on mandatory disclosures, such as the Sarbanes-Oxley Act (Bargeron, Lehn, and Zutter, 2010) or specific accounting standards (e.g., Cho, 2015). However, less explored is the role of voluntary disclosures on investment.

We focus on a pervasive voluntary disclosure—non-GAAP earnings. A substantial literature examines the characteristics of these disclosures, and we draw upon much of this research to capture the key features of the non-GAAP setting. Prior research finds non-GAAP earnings can inform investors about "core" earnings when GAAP earnings become less useful for valuation purposes.[3] However, managers also appear to define non-GAAP earnings opportunistically by excluding recurring, non-transitory items.[4] Our model allows for both the informativeness and opportunism of non-GAAP to occur.

[3] See, for instance, Bradshaw and Sloan (2002), Bhattacharya, Black, Christensen, and Larson (2003), Gu and Chen (2004), Heflin, Hsu, and Jin (2015), Leung and Veenman (2018).

[4] See, for instance, Doyle, Lundholm, and Soliman (2003), Black and Christensen (2009), Frankel, McVay, and Soliman (2011), Barth, Gow, and Taylor (2012).

The primary benefit (and cost) of non-GAAP reporting is the weight investors place on the non-GAAP disclosure (Black, Christensen, Ciesielski, and Whipple, 2018). Investors seem to focus on non-GAAP over GAAP earnings (e.g, Bradshaw and Sloan, 2002), as analysts (and investors) often create their own definitions of non-GAAP earnings to better reflect "core" earnings (e.g., Black et al., 2018), and manager-defined non-GAAP earnings can influence these metrics (e.g., Christensen, Merkley, Tucker, and Venkataraman, 2011). However, market participants unwind the more opportunistic adjustments made by managers.[5] We incorporate this feature by allowing the stock price to depend endogenously on non-GAAP earnings in a dynamic model that builds upon the framework of Kanodia (1980) and Stein (1989). In these models, a myopic manager forgoes profitable investments to maximize current earnings. However, the market is not fooled by this myopic behavior, rather, it adjusts the weights on the disclosed signals so that stock price reflects the inefficient behavior.

We focus on intangible assets because of their increasing importance for economic growth (Haskel and Westlake, 2018), and because investments into internally developed intangible assets are (for the most part) expensed and thus have an immediate impact on current-period earnings.[6] In addition, finance and economics literature documents that intangible assets have unique distortions (e.g., Rampini and Viswanathan, 2010; Falato, Kadyrzhanova, and Sim, 2013), which can make external markets especially inefficient (Eisfeldt and Papanikolaou, 2014; Sun and Xiaolan, 2019). Our paper adds to this line of research by showing that increased disclosures can offset some of the frictions unique to intangible assets.

[5]See, for example, Gu and Chen (2004); Marques (2006); Doyle et al. (2013); Bentley, Christensen, Gee, and Whipple (2018); Chen, Gee, and Neilson (2019).

[6]We utilize structural methods from the literature on investment frictions (e.g., Hennessy and Whited, 2007; Nikolov and Whited, 2014; Glover and Levine, 2015). Structural estimation has been adopted in accounting (e.g., Gerakos and Syverson, 2015; Zakolyukina, 2018; Li, 2018; Nikolaev, 2018; Beyer, Guttman, and Marinovic, 2018; Choi, 2018; Bird, Karolyi, and Ruchti, 2019; Breuer and Windisch, 2019; Zhou, 2020), including the literature focusing on real effects (e.g., Terry, 2015; McClure, 2020; Terry et al., 2020).

3 Model

We model an infinitely lived firm in which a manager observes the level of intangible capital, the productivity of the capital, and transitory earnings. In each period, the manager chooses investment and reports GAAP and non-GAAP earnings to investors in order to maximize cash flows and stock prices. Investors use these earnings to form a rational expectation of the firms' stock price.

3.1 Investment and expected cash flows

The firm produces profits before discretionary expenditures, y, that is a function of intangible capital, q, and a productivity shock, ν_y. This shock follows a mean-reverting AR(1) process in natural logarithms:

$$log\nu_y' = \rho_y log\nu_y + \eta_y', \ \eta_y' \sim^{iid} N\left(0, \sigma_y^2\right). \tag{1}$$

Throughout the paper, variables without a prime denote current period t and variables with a prime denote the following period $t+1$. The profit function exhibits decreasing returns to scale and depends on intangible capital (e.g., Falato et al., 2013; Terry, 2015; Saporta-Eksten and Terry, 2018). We define y as

$$y = \nu_y q^{\alpha}, \ \alpha \in (0,1), \tag{2}$$

where α is the elasticity of intangible capital.

To increase profits and to offset the wasting of intangible capital, the manager can increase q through investment w. The choice of w affects the capital stock in the next period, q':

$$q' = (1-\delta) q + w, \tag{3}$$

where δ is the depreciation rate of existing capital.[7] To focus on the relation between financial reporting and investment, we assume the manager cannot sell w and there are

[7]See Li and Hall (2018) p. 3 for the motivation of R&D capital depreciation.

no capital constraints that might limit the manager's investment choices.

Expected cash flows, d, is the combination of profits before intangible expenditures, investment in intangible capital, and the quadratic adjustment cost from investment:

$$d = y - w - \frac{\kappa_w}{2}\left(\frac{w}{q}\right)^2 q. \tag{4}$$

The final term in equation (4) is the expression for the adjustment cost from investment, which is governed by the adjustment-cost parameter κ_w. We follow prior literature (e.g., Hayashi, 1982; Whited, 1994) and assume a standard quadratic form. The expected cash flows, d, differs from cash from operations because d only relates to current-period activities, whereas cash from operations contains cash inflows and outflows that can relate to activities in other periods.

3.2 GAAP and non-GAAP earnings

The manager reports two profitability metrics—GAAP and non-GAAP earnings. The manager truthfully reports GAAP earnings, π, and it comprises of expected cash flows, d, and a transitory earnings component that scales with capital, ν_π:

$$\pi = \underbrace{y - w - \frac{\kappa_w}{2}\left(\frac{w}{q}\right)^2 q}_{d} + \nu_\pi q, \nu_\pi \sim^{iid} N\left(-\mu_\pi, \sigma_\pi^2\right), \mu_\pi \geq 0. \tag{5}$$

We subtract investment costs in GAAP earnings because most internally developed intangible assets are expensed. We also allow for a non-positive mean of transitory earnings, $-\mu_\pi$, to accommodate accounting conservatism because GAAP more readily recognizes losses over gains (Watts, 2003). As a result, on average, transitory items reduce GAAP earnings.

As in Ohlson (1999), we assume the transitory earnings component, ν_π, does not predict future transitory components, earnings, or dividends; thus, ν_π is assumed to be independent and identically distributed. The important difference between ν_π and d is that ν_π is not persistent and only affects current-period earnings; whereas d is persistent and represents "core" earnings used for valuation. The term $\nu_\pi q$ includes non-recurring items such as goodwill impairments, legal settlements, or (part of) restructuring expenses that have no effect on future earnings or cash flows. Although some of these transitory items can be figured out by investors on their own from the financial statement disclosures, it is not the case for all of the items. For instance, firms often characterize (part of) restructuring expenses as non-recurring based on their private information.[8] As a result, investors do not perfectly observe ν_π, and it is difficult for them to ascertain how much of GAAP earnings is a result of fundamental versus non-fundamental shocks. The investors' inability to separate shocks can affect the manager's intangible investment: the manager may overinvest in order to mislead investors into believing that the fundamental productivity shock is high when, in fact, only the transitory shock to earnings is high.

The manager's disclosure of GAAP and non-GAAP earnings implies a non-GAAP adjustment, ψ, which is the exclusions to reconcile non-GAAP to GAAP earnings.[9] This adjustment can eliminate transitory earnings, but the manager can also introduce bias, b, that scales with the level of capital:

$$\psi = (-\nu_\pi + b)\, q. \tag{6}$$

The transitory component of GAAP earnings, $\nu_\pi q$, is subtracted in ψ because the purpose of the non-GAAP adjustment is to reverse transitory items that are not useful for valuation. Removing $\nu_\pi q$ from non-GAAP earnings is consistent with the SEC's regulation, which requires firms to state why non-GAAP earnings are particularly useful for investors.[10] Without bias, $\mathbb{E}(\psi) = -\mathbb{E}(\nu_\pi q) = \mu_\pi q$, which is non-negative and allows for certain positive non-GAAP adjustments to be an (unbiased) effort to undo accounting conservatism in GAAP earnings.

[8] In response to the SEC comment letter on October 3, 2016, the Procter & Gamble Company wrote about excluding part of restructuring expenses related to the multi-year transformational productivity program: "Importantly, the non-GAAP adjustments [...] only include the incremental spending above the amount incurred in the year prior to the commencement of the transformational productivity program [...] Once this program is completed, we expect to revert to the above mentioned ongoing level of restructuring activity and would not present adjustments to our GAAP earnings for that activity." See https://www.sec.gov/Archives/edgar/data/80424/000008042416000226/filename1.htm.

[9] If the manager chooses to not provide a non-GAAP earnings amount, $\psi = 0$.

[10] See Regulation S-K, Item 10(e).

The opportunistic component, b, is added in ψ to inflate non-GAAP earnings so that "core" earnings appear to be higher than they really are (e.g., Bradshaw and Sloan, 2002). Bias can exclude recurring expenses or continue to include transitory gains in non-GAAP earnings (e.g., Curtis, McVay, and Whipple, 2013). Accordingly, if the manager opportunistically biases his non-GAAP adjustment, he biases upwards; that is, $b \geq 0$, so that non-GAAP earnings, which is the sum of GAAP earnings and the non-GAAP adjustment, becomes higher at $d + bq$. The non-negative nature of opportunistic bias in non-GAAP adjustment distinguishes it from accrual-based manipulation (Zakolyukina, 2018; Terry et al., 2020). Accrual-based manipulated is inter-temporal in nature, so the manager can have an incentive to bias GAAP earnings downwards in the current period to benefit from the accrual reversal in future periods. However, there is no future reversal of non-GAAP adjustments so there is no apparent benefit from biasing non-GAAP earnings downwards. Indeed, 94% of non-GAAP adjustments are non-negative in the data (untabulated).

Our specification of π and ψ captures the key trade-off between transitory items and opportunistic bias that investors face when they consider GAAP or non-GAAP earnings. GAAP earnings are an unbiased, but noisy measure of profitability. Non-GAAP earnings can eliminate this noise but can also introduce a bias that managers can use to deceive investors into believing the firm is more profitable.

3.3 Manager's incentives

The manager's current-period payoff is the weighted sum of the current period's expected cash flows and the stock price minus the personal cost from biasing non-GAAP earnings:

$$d_M = d + \theta p - \frac{\kappa_b}{2} b^2 q, \tag{7}$$

where d is the expected cash flows, p is the stock price with θ capturing the short-term stock-price-related incentives relative to the cash-flows-related incentives, and κ_b captures the personal costs that the manager incurs from biasing non-GAAP earnings. We scale the personal costs by q to be consistent with our scaling in ψ, which also parallels our scaling in the quadratic investment costs. The personal costs from biasing include the reputational costs from being overly optimistic about the firm's profitability and, to a lesser extent, the effort required to justify biased non-GAAP earnings to investors and regulators. Although we do not have an explicit budget constraint on biased adjustments, e.g., the manager cannot adjust for a transitory item that does not exist, the personal costs partially, albeit imperfectly, fulfil this role by limiting b.

Like Nikolov and Whited (2014) and Glover and Levine (2017), we do not specify a particular contract for the manager. We remain agnostic as to the manager's compensation contract because many contracts have components that do not combine into a parsimonious model (e.g., Dittmann and Maug, 2007; Frydman and Jenter, 2010). However, survey evidence from Graham et al. (2005) show managers want not only to maximize cash flows, but also to maximize accounting earnings in order to maintain a high stock price because their wealth and the possibility of being terminated often depend on the stock price performance.

These competing incentives can lead to sub-optimal investment decisions (e.g., Bizjak, Brickley, and Coles, 1993; Bens, Nagar, and Wong, 2002). Indeed, if the manager had maximized d only, his incentives would be fully aligned with firm's investors and he would have made efficient investment choices. However, because the manager myopically cares about current stock prices and investors do not know everything that the manager knows, the manager can get away with sub-optimal investment by misleading investors about the firm's profitability using non-GAAP earnings.

3.4 Stock prices

The primary reason to provide non-GAAP disclosures is to influence investors' perceptions about firm values and thus stock prices.[11] At the same time, investors are not easy to fool as they scrutinize non-GAAP earnings and can unwind the most egregious adjustments.[12] We thus assume that investors utilize non-GAAP disclosures in their pric-

[11]See, for instance, Bradshaw and Sloan (2002), Marques (2006), Baik, Billings, and Morton (2008), and Doyle et al. (2013).

[12]See, for instance, Gu and Chen (2004) and Doyle et al. (2013).

ing decisions and do so rationally. Investors might use manager-provided non-GAAP earnings directly in their valuation, create their own definition of non-GAAP earnings from the Regulation G reconciliation table, or utilize analyst-provided pro-forma earnings. Even though this process is not explicitly modeled, by making the stock price a rational expectation of firm value, our model allows for investors to discount manager-provided non-GAAP earnings. There is thus a feedback loop in which investors and analysts influence how manager's define non-GAAP earnings (Bentley et al., 2018), because the manager, knowing that investors are skeptical about egregious adjustments, is unlikely to be overly opportunistic in defining non-GAAP earnings.[13]

We assume investors are aware of the manager's myopia and incentives to distort non-GAAP earnings, but they do not know everything that the manager knows. Investors rely on the manager's disclosures and only observe non-GAAP earnings, $\pi + \psi$, and GAAP earnings, π. They then price the firm by assigning weights to these two signals based on their expectation of firm value, V_F, which is the sum of discounted expected cash flows, d. We assume $\pi + \psi$ and π map to the stock price as follows:

$$p = \beta_0 + \beta_1 g(\underbrace{\pi + \psi}_{d+bq}) + \beta_2 g(\underbrace{\pi}_{d+\nu_\pi q}), \tag{8}$$

where $g(x) = \text{sign}(x)\sqrt{|x|}$. The S-shape function $g(x)$ is plotted in Figure 1. We use this transformation of earnings to capture the empirical S-shape earnings-price relation in the empirical literature (Holthausen and Watts, 2001). This S-shape occurs when investors discount large earnings, both positive and negative, because of the possibility of large transitory items or reporting opportunism (Freeman and Tse, 1992; Das and Lev, 1994).[14] The non-linearities can arise when an error occurs in how accounting earnings

[13] Laurion (2020) proposes the commitment to provide non-GAAP earnings as an alternative reason for aggressive non-GAAP reporting. However, as we show in the online appendix, over 70% of firms oscillate between not reporting and reporting non-GAAP earnings over our sample period. This switching suggests commitment is not common and is unlikely to be a first-order driver of non-GAAP reporting choices.

[14] This formulation also permits investors (or analysts) to create their own definition of non-GAAP even when the manager does not disclose non-GAAP earnings. If the manager does not disclose non-GAAP earnings, then $\psi = 0$ and GAAP earnings becomes "non-GAAP" earnings. However, equation 8 includes the S-shaped function $g(\cdot)$ which can be interpreted as the investor creating an adjusted earnings amount that discounts large transitory items.

measure economic earnings (Riffe and Thompson, 1998), when investment opportunities vary (Kumar and Krishnan, 2008), or when investors are uncertain about the precision of information (Subramanyam, 1996).[15] Although we are not able to show a fully-fledged derivation of this function in our model, we provide an argument for why an S-shape pricing function is consistent with our model in the online appendix.

The two earnings signals represent a trade-off between reliance on cash flows distorted by bias, that is non-GAAP earnings $d + bq$, or by noise, that is GAAP earnings $d + \nu_\pi q$, to value the firm. To encourage value-maximizing investment, investors have to put a positive weight on cash flows d and thus either or both of the signals. Having a positive weight on GAAP earnings would reward the manager for luck, that is for positive transitory shocks, and would encourage wasteful overinvestment. By contrast, having a positive weight on non-GAAP earnings would encourage bias. Estimating the model would allow us to quantify this bias-noise trade-off.

3.5 Manager's problem

The manager observes a state, s, consisting of three state variables, $s = \{q, \nu_y, \nu_\pi\}$. The first state variable, q, is intangible capital. The second and third state variables, ν_y and ν_π, are the productivity shock and transitory shock to earnings, respectively.

Based on these state variables and model parameters, the manager chooses the optimal level of investment, w, and opportunistic bias in the non-GAAP adjustment, b, in order to maximize future cash flows and stock prices adjusted by the personal costs of b. We set the manager's discount rate equal to the investors' discount rate r. Accordingly, the Bellman equation for the manager's optimization problem is

$$V_M\left(q, \nu_y, \nu_\pi\right) = \max_{w,b} \left\{ d_M + \frac{1}{1+r} \mathbb{E}_{\nu_y, \nu_\pi} V_M\left(q', \nu_y', \nu_\pi'\right) \right\}. \tag{9}$$

In this Bellman equation, the manager must weigh expectations of the continuation payoff, $V_M\left(q', \nu_y', \nu_\pi'\right)$, over all possible future values of ν_y' and ν_π'.

[15] Bertomeu, Cheynel, Li, and Liang (2020) also obtain an S-shape pattern using nonparameteric estimation in a structural model of earnings misreporting.

Our model does not have a closed-form solution, and thus we solve equation (9) numerically. The online appendix describes our approach to solving the manager's optimization problem subject to the rational expectations equilibrium for the stock prices.

3.6 Realized and expected cash flows

Not all of the expected cash flows convert into actual cash flows during the current period. This disparity is a major reason for accrual accounting (FASB, 1978). To accommodate this fact, we allow a fraction of d in period t to convert into cash in the period before $t-1$ or after $t+1$. We implement this reshuffling following Dechow and Dichev (2002) and Terry et al. (2020). This reshuffling only affects the observed cash flows produced by the model; it does not affect GAAP or non-GAAP earnings because the purpose of measuring earnings with accruals is to capture expected cash flows, d. For this reason, this reshuffling does not enter into the manager's optimization problem, but allows the simulated data to better match the real data. The online appendix provides the details.

3.7 Optimal policies

It is instructive to first establish a benchmark for GAAP-earnings-only reporting. We do so in Figure 2, Panel (a). As expected, investment increases with the productivity shock (left panel), because, when the productivity is high, investment earns higher future cash flows and thus it is efficient to invest more. In addition, investment increases with the transitory shock to earnings (right panel). If the manager did not care about stock prices, the manager's investment choice would be unaffected by the transitory shock. With the stock-price-based incentives and private information, the manager increases investment when the transitory shock is high because a higher transitory shock makes investment cheaper by partially offsetting its impact. This higher investment can also mislead investors into believing that high productivity shock (rather than high transitory shock) underlies the manager's investment decision. This sensitivity of investment to transitory earnings is similar to Tomy (2018) findings that R&D expense is reduced in response to short-term cash flow shocks.

The optimal policies change once investors observe both GAAP and non-GAAP earnings in Figure 2, Panel (b). Investment still increases with the productivity shock (top-left panel). However, investment now decreases with the transitory shock (bottom-left panel). As discussed in section 3.4, investors have to put a positive weight on cash flows and thus either or both of the signals. In the equilibrium of the estimated model, we find investors put a positive weight on non-GAAP earnings and use a small negative weight on GAAP earnings to adjust for the impact of bias. We observe similar pattern in the data in Figure 1: the weight on non-GAAP earnings is positive and statistically significant whereas the weight on GAAP earnings is insignificant. It thus appears that, in the model, investors view having a positive weight on non-GAAP earnings as less harmful, because bias is bounded in the equilibrium; and, while using a negative weight on GAAP earnings to adjust for bias, they essentially punish the manager for luck. The consequence is that the manager cuts his costs by reducing both investment (bottom-left panel) and bias (bottom-right panel) when the transitory shock is high. Similarly, the bias decreases with the productivity shock (top-right panel) to minimize bias costs when fundamentals are good. In the data, a negative covariance between the non-GAAP adjustment and cash-flow growth supports this pattern, which is broadly consistent with Cain, Kolev, and McVay (2020).

These optimal policies highlight the fact that investors' information set and expectations play a crucial role in how the relation between investment and transitory shocks to earnings plays out. This, in turn, determines the extent of under- or overinvestment, implied loss in firm value, and the equilibrium interaction between investment and opportunistic bias in non-GAAP earnings.

4 Data

We combine quarterly firm-level data from Compustat and non-GAAP earnings from Bentley et al. (2018).[16] We exclude regulated utilities (Standard Industrial Classification

[16] We downloaded the data from Kurt H. Gee's webpage at https://sites.google.com/view/kurthgee/data in October of 2018.

codes 4900–4999), financial firms (6000–6999), and firms categorized as non-operating establishments (9000+). We require the value of total assets to be above $5 million and the ratio of intangible capital to total assets, as defined in Section 4.2, to be greater than 10% in all years a firm is in our sample. To ensure the non-GAAP disclosure decision is relevant, firms enter the sample starting the quarter they first disclose non-GAAP earnings in the Bentley et al. (2018) data. Finally, we require that all variables used in the estimation are non-missing and each firm has at least two observations. To remove outliers, we winsorize all variables at the 1% level. The sample includes 1,416 firms that correspond to 21,216 firm-quarters over the 11-year period from 2006 to 2016. Table 1 provides the variable definitions.

4.1 Non-GAAP adjustments

To compute non-GAAP adjustments, we subtract GAAP earnings "as first reported" in the Compustat preliminary-history data from quarterly non-GAAP earnings data collected by Bentley et al. (2018). These authors collect non-GAAP EPS disclosures from firms' earnings announcements filed in 8-K forms using non-GAAP-related words and phrases.[17] We convert EPS-level adjustments to earnings-level adjustments by multiplying EPS by the number of common shares for diluted EPS as in Bentley et al. (2018). Thus, the GAAP EPS number we use to compute GAAP earnings also corresponds to diluted EPS.

Table 2 provides statistics on line items in non-GAAP adjustments using Audit Analytics data. This granular sample is smaller and only covers 609 S&P 500 firms that correspond to 6,893 firm-quarters over 2014–2018.[18] We find the average (median) number of line items per non-GAAP disclosure is 3.94 (3). We further categorize these items into 23 categories and group them into whether they are likely to recur over time, following Black et al. (2018), and whether they are cash or non-cash related. We find 53.2% (46.8%) are recurring (non-recurring). Despite the SEC encouraging firms to exclude only

[17] Bentley et al. (2018) provide examples of the words and phrases identified in prior research and expanded through extensive hand collection. Among many others, these terms include "adjust," "proforma," "non-GAAP," "core," and "operating earnings."

[18] Audit Analytics collect their data from Regulation G non-GAAP reconciliation tables. We exclude funds from operations (FFO), which is a common non-GAAP metric for real estate investment trusts, because little discretion exists in this industry-defined metric (Baik et al., 2008).

non-recurring items, a significant number of firms still exclude recurring items (Whipple, 2015). We find 42% of items are cash, with over half of these items relating to acquisitions and restructuring charges. Only 31%, i.e., 13.26%/(13.26% + 28.95%), of cash line items are recurring, which is far less than the 69%, i.e., 39.93%/(39.93% + 17.88%), of non-cash charges. Based on this difference, recurring cash charges could be harder to justify as a legitimate non-GAAP exclusion.[19] Although none of these line items are clear indications of outright bias, given the range of exclusions, it is possible for the manager to have sufficient latitude to opportunistically exclude certain items.

4.2 Intangible capital

Internally developed intangible assets are not (for the most part) reported in financial statements. For this reason, previous research uses a set of assumptions to estimate intangible capital and we do the same. We measure intangible capital as the sum of knowledge and organization capital computed using the perpetual inventory method.[20] Following the literature, we interpret R&D expenditures as investment in knowledge capital (Lev and Sougiannis, 1996; Corrado, Hulten, and Sichel, 2005; Corrado and Hulten, 2010; Peters and Taylor, 2017). Similarly, we interpret a fraction of SG&A expenditures as investment in organization capital (Lev and Radhakrishnan, 2005; Eisfeldt and Papanikolaou, 2013, 2014). For example, organization capital can include an investment in human capital, such as training expenses, and brand capital, such as advertising expenses.

Based on the perpetual inventory method, the stock of knowledge and organization capital is computed by cumulating the deflated value of intangible investments

$$q_{it}^{k} = (1 - \delta_k) q_{it-1}^{k} + w_{it}^{k}, \tag{10}$$

where q_{it-1}^{k} is the existing stock of knowledge or organization capital $k = \{R\&D, SG\&A\}$, δ_k is the depreciation rate, and w_{it}^{k} is the investment amount. Investment in knowledge

[19] In the online appendix, we use the Audit Analytics data and re-estimate the model using only cash or non-cash adjustments and find evidence consistent with this intuition.

[20] Because we focus on intangible investments (which are expensed), we ignore externally acquired intangible assets.

capital, $w_{it}^{R\&D}$, is defined as the R&D expense. Investment in organization capital, $w_{it}^{SG\&A}$, is defined as a fraction of SG&A expense.[21] The stock of both intangible capital and investment are deflated by the consumer price index.

To implement the perpetual inventory method, we need an estimate of the initial capital stock, the fraction of SG&A that represents the investment in organization capital, and the depreciation rates for both knowledge and organization capital. We follow Eisfeldt and Papanikolaou (2014) and set the initial value to $q_0^k = \frac{w_{i1}^k}{g_k + \delta_k}$, where g^k is the average industry-specific real growth rate of firm-level investment and w_{i1}^k is the investment during the first year a firm is observed in Compustat. We identify four industries as in Eisfeldt and Papanikolaou (2014).[22]

The literature makes different assumptions about the fraction of SG&A that is contributed to organization capital, $\gamma_{SG\&A}$, the depreciation rates for organization capital, $\delta_{SG\&A}$, and the depreciation rates for knowledge capital, $\delta_{R\&D}$. One common set of assumptions is that the investment in organization capital is equal to 30% of SG&A, that is, $\gamma_{SG\&A} = 0.3$ (Hulten and Hao, 2008; Eisfeldt and Papanikolaou, 2014; Peters and Taylor, 2017). The depreciation rate of organization capital is 20%, that is, $\delta_{SG\&A} = 0.2$ (Falato et al., 2013; Peters and Taylor, 2017; Ewens, Peters, and Wang, 2019). The industry-specific depreciation rate of knowledge capital is from Li and Hall (2018), assumed to be 15% if missing.[23] We use this set of assumptions to compute the stock of intangible capital.

4.3 Summary statistics

Figure 3 plots the fraction of firm-quarters that disclose non-GAAP earnings. This fraction increases over time, ending with 55% of firm-quarters reporting non-GAAP earnings in 2016. In 2016, 70% of high-technology firm-quarters reported non-GAAP earnings, while only 40% of healthcare firm-quarters did. This pattern suggests firms that rely more

[21] We measure SG&A expense as in Peters and Taylor (2017), Appendix B.1

[22] Eisfeldt and Papanikolaou (2014) identify five industries but we do not use finance firms in our analyses. Eisfeldt and Papanikolaou (2014) start with the Fama-French five-industry classification, keeping consumer goods, manufacturing, and healthcare. Next, they refine the definition of high-technology industries (based on the BEA's *Industry Economic Accounts*) and add the finance industry (based on the 48 Fama-French industries of banking and trading). Finally, all other firms are classified as "other."

[23] See Table 3 in Li and Hall (2018) for zero-gestation lag in years.

on intangible capital are also more likely to provide non-GAAP disclosures.[24]

Table 3 contains summary statistics. Average firm assets are $4.41 billion in our sample, which is comparable to the average in the Computstat universe over the same time period at $4.44, and the average intangible investment to capital is 0.066. While the median non-GAAP adjustment to intangible capital is 0, the average ratio of the non-GAAP adjustment to intangible capital is 0.011. This value is substantial and about one-third of the average ratio of earnings to intangible capital at 0.030.

5 Estimation

Our model is described by 14 parameters summarized in Table 1. Three parameters for the pricing function, i.e., intercept β_0, weight on non-GAAP earnings β_1, weight on GAAP earnings β_2, arise endogenously in the model, given the estimated parameters, and are not estimated separately (Panel B). We estimate two of the remaining eleven parameters outside of the model (Panel C). The first of these parameters is the discount rate, r. We assume a quarterly discount rate of 1.5%, which corresponds to the annual discount rate of 6% in Terry et al. (2020). The second is the cash-flow reshuffling parameter discussed in section 3.6, ρ_s, which helps us to better match model-based expected cash flows to data-based cash flows. Our approach to estimating ρ_s is described in the online appendix.

We estimate the remaining nine parameters (Panel D) using the simulated method of moments (SMM). SMM minimizes the weighted-squared distance between empirical and simulated moments.[25] Our weight matrix is the inverse covariance matrix of our data.[26]

[24]The fraction of non-GAAP reporting firms in Figure 3, which comes from Bentley et al. (2018), differs from the fraction reported in Audit Analytics for several reasons. First, the Bentley et al. (2018) data include a wider universe than the Audit Analytics data, which is just the S&P 500 firms. Second, we only use quarterly earnings-related non-GAAP amounts from Bentley et al. (2018), whereas Audit Analytics includes non-earnings-related amounts (e.g., non-GAAP revenue). Third, the frequencies in Figure 3 are on a per-quarter basis, whereas the fractions using Audit Analytics typically are based on whether a firm in *any* quarter for the year used a non-GAAP metric.

[25]For an overview of SMM, see Cameron and Trivedi (2005).

[26]When computing the weight matrix, we remove firm-fiscal-quarter fixed effects from all the variables used to compute our moments, including the variables used to compute mean investment, earnings, cash flows, and non-GAAP adjustment (all scaled by intangible capital). The only exception is the variables we use to compute the AR(1) coefficient of GAAP earnings scaled by capital because these are already de-meaned by firm-fiscal-quarter using the X-differencing approach in Han, Phillips, and Sul (2014). We do not cluster our weight matrix. However, we do double-cluster the co-variance matrix of moments used

We set our simulated data to be 20 times the size of our data to reduce the simulation error (Michaelides and Ng, 2000). To find the parameters that minimize the squared distance between moments, we use a combination of particle-swarm and pattern-search optimization algorithms.

In each iteration of an optimization algorithm, we solve for a rational expectations equilibrium in which the manager, when choosing his investment and disclosure decisions, correctly infers the weights investors place on non-GAAP and GAAP earnings, and investors, when pricing the firm, correctly infer the manager's investment and non-GAAP disclosure decisions. In a non-linear dynamic interaction between the manager and investors, a unique equilibrium is not guaranteed and none to many possible equilibria can occur. We make several refinements to focus on the equilibria that reasonably match what we observe in the data. First, we require the signs of a few simulated moments to match the signs of data moments.[27] Second, we set the initial guess for the price function coefficients in the equilibrium search to their values estimated from the data in Figure 1.

5.1 Identification

The nine parameters we estimate with SMM are: α, the curvature of the profit function; δ, the depreciation of intangible capital; κ_w, the adjustment cost from investment; ρ_y and σ_y, the persistence and volatility of the productivity shock, ν_y; $-\mu_\pi$ and σ_π, the mean and volatility of the transitory shock to earnings, ν_π; κ_b, the personal cost from biasing non-GAAP earnings; θ, the relative importance of the stock price in the manager's objective function.

To identify these nine parameters, we select 23 moments that are sensitive to changes in these parameter values. The first two moments are the average values of investment and earnings, both scaled by intangible capital. We also include the autocorrelation of

to compute standard errors by firm and year. For the discussion of this approach to computing a weight matrix, see Li, Whited, and Wu (2016) and Bazdresch, Kahn, and Whited (2017).

[27] Among the moments described in section 5.1, we require the persistence of earnings and the covariance of investment growth and non-GAAP adjustment growth, conditional on positive non-GAAP adjustment, to be positive. For both the unconditional moments and moments conditional on positive non-GAAP adjustment, we require the covariance of investment growth with earnings and cash flow growth to be negative.

GAAP earnings scaled by intangible capital. We compute this AR(1) coefficient using the X-differencing approach in Han et al. (2014) that removes firm-fiscal-quarter fixed effects. The next six moments relate to covariances, all of which are computed using growth rates following Terry (2015).[28] We remove firm-fiscal-quarter fixed effects from all growth rates. The covariances in this set of moments are all possible combinations of covariances of investment growth, GAAP earnings growth, and cash-flow growth.

To allow for the possibility that firms behave differently when they report non-GAAP earnings, we condition the next 12 moments on the non-GAAP adjustment being positive. We set a lower bound for a positive non-GAAP adjustment at 1 basis-point of intangible capital. We do so to make the actual data and the data simulated from the model comparable because the non-GAAP adjustment ψ, being a continuous variable in the model, can have very small values that would be immaterial in the actual data and thus would not be disclosed. The first two conditional moments are the fraction of positive non-GAAP adjustments and the average positive non-GAAP adjustment to capital. The next ten moments are conditional covariances of growth rates and are all possible combinations of investment growth, GAAP earnings, cash flow, and non-GAAP-adjustment growth. Our last two moments are the coefficients on non-GAAP earnings and GAAP earnings when they are regressed on price as in Figure 1.

Although some moments are sensitive to several parameters, certain moments have strong monotonic relationships with certain parameters and thus are particularly relevant for identifying them. We follow the extant literature and select our moments based on their comparative statics that confirm their monotonic relationships with the parameters they help to identify.[29] For comparative statics, we set our parameters to the baseline estimates in Table 4 and, after that, vary each parameter one by one to create a plot for each simulated moment. Unless specifically noted, when we discuss a parameter's

[28] For the variable x, we define the growth rate as

$$\Delta x = \begin{cases} 0, & \text{if } x = 0 \text{ and } x_{-1} = 0 \\ \frac{2(x - x_{-1})}{|x| + |x_{-1}|}, & \text{otherwise.} \end{cases} \tag{11}$$

These growth rates lie in $[-2; 2]$. Because we use quarterly data, we compute year-over-year growth rates. For instance, to compute a growth rate for Q4 2016, we use data for Q4 2016 and Q4 2015.

[29] See, for instance, Hennessy and Whited (2005), Nikolov and Whited (2014), and Terry et al. (2020).

relation to a particular moment, the discussion applies to both the unconditional and the conditional version of it.

We start with the parameters that govern our production function. The first parameter is the curvature of the production function, α. When α is higher, profit reacts more strongly to capital, which results in higher variance of earnings growth and higher covariance of earnings and cash flow growth. Because the fundamental profitability is higher when α is higher, as α increases, there is less need to inflate non-GAAP earnings and thus the incidence of positive non-GAAP adjustments and covariances of fundamentals, i.e., earnings and cash flows growth, and non-GAAP adjustment growth are lower. The second parameter is the depreciation rate of intangible capital, δ. This parameter is primarily identified using the average ratio of investment to capital because firms need to invest more to overcome higher depreciation. Because firms need to invest more, they are also tempted to reduce the cost of these investments by inflating non-GAAP earnings and thus the incidence of positive non-GAAP adjustments and variance of these adjustments are higher. The third parameter is the adjustment cost from investment, κ_w. Because this parameter governs the quadratic cost of investment, it both reduces the level of investment and volatility of investment growth which, in turn, results in an increase in earnings persistence.

The next two parameters govern the productivity shock, ν_y. The first parameter is the persistence of the productivity shock, ρ_y. A higher persistence increases investment, which results in higher average investment and higher variance of investment growth. The second parameter is the volatility of the productivity shock, σ_y. The higher volatility of the productivity shock mechanically increases the volatility of investment growth and decreases its covariances with growth in fundamentals.

The final four parameters relate to financial reporting and incentives. The first parameter is the volatility of the transitory earnings, σ_π. Mechanically, the higher volatility of transitory earnings results in less persistent earnings and a higher variance of earnings growth. Less mechanical is σ_π's effect on the interaction between investment and fundamentals, which is driven by managerial myopia. As Figure 2 shows, both investment and bias in non-GAAP adjustment respond to transitory earnings. As a result, the covariances between investment growth and growth in fundamentals decrease with σ_π, that is, higher volatility of the transitory earnings divorces investment from fundamentals because the manager is myopic. By contrast, the covariance of investment growth and non-GAAP adjustment growth increases as both respond to the higher volatility of transitory earnings. The complementary relationship between investment and non-GAAP adjustments strengthens as the volatility of transitory earnings increases.

The second parameter is the relative importance of stock price in the manager's objective function, θ, which captures the strength of the manager's myopia. The more important the stock price (and the signals that determine it), the more responsive the manager's investment and non-GAAP adjustment decisions become to transitory earnings. As a result, investment growth is more volatile and covariances of investment growth and growth in fundamentals are lower. Because the manager cares more about stock prices when θ is high, the incidence of positive non-GAAP adjustments increases as he tries to convey superior firm performance to investors by introducing a positive bias to non-GAAP earnings. However, as the manager tries to mislead investors by inflating non-GAAP earnings, investors start to rationally discount non-GAAP disclosures, which results in a lower coefficient on non-GAAP earnings and a higher coefficient on GAAP earnings in the pricing equation.

The third parameter is the manager's personal cost from introducing bias b into non-GAAP adjustment, κ_b. As it becomes more costly to bias non-GAAP earnings, the incidence of positive non-GAAP adjustments and the variance of non-GAAP adjustment growth go down. Our forth and final parameter is the non-positive mean of transitory earnings, $-\mu_\pi$, where $\mu_\pi \geq 0$, which roughly captures an idea of accounting conservatism. Because higher μ_π reduces average earnings, the average earnings to capital declines. Also, because non-GAAP adjustments reverse the larger negative impact of transitory earnings when μ_π increases, the incidence of positive non-GAAP adjustments and their average magnitudes increase.

5.2 Estimation results

The results for our baseline estimation are reported in Table 4. In Panel A, we compare data moments and moments simulated from the model. In Panel B, we report the parameter estimates. In this specification, we rely on manager-provided non-GAAP earnings from Bentley et al. (2018) to measure non-GAAP adjustments. In Table 5, we replace the manager-provided with analyst-provided non-GAAP earnings from IBES. We evaluate the importance of intangible versus fixed assets in Table 6.

5.2.1 Parameter estimates

In Table 4, the first five parameters relate to the firm's production function, and the last four correspond to financial reporting and incentives. Examining the first set of parameters, we find many estimates are similar to those in the extant literature. Our curvature of the profit function parameter, α, is 0.637, which is similar to the productivity parameters used in Bloom, Schankerman, and Van Reenen (2013) and Terry (2015). The (quarterly) depreciation rate of intangible capital, δ, is 0.067. This estimate corresponds to a 26.7% annual depreciation rate, which is in line with several industry-specific BEA estimates for R&D depreciation rates in Li and Hall (2018). The third parameter is the adjustment cost to intangible investment, κ_w. With a value of 0.329, it is lower than the 0.500 for physical capital in Nikolov and Whited (2014), which is conceivable as changing intangible capital is less disruptive than increasing physical capital. The fourth parameter is the persistence of the productivity shock, ρ_y. The estimate of 0.493 is similar to Castro, Clementi, and Lee (2015) and Terry et al. (2020). The final productivity-related parameter is the volatility of productivity, σ_y, estimated as 0.127. When annualized, this quarterly estimate corresponds to 0.254, which is similar to the estimate in Terry et al. (2020).

The last four parameters relate to financial reporting and incentives. The first parameter is the volatility of the transitory earnings shock, σ_π, which is much lower than the volatility of the productivity shock. Because ν_π (and hence, σ_π) scales with capital, our estimated value of σ_π at 0.021 implies approximately 68% of observations have a transitory earnings shock from −3.2% to 1% of capital.[30] The second parameter is the relative importance of cash flows versus stock price incentives, θ, which we estimate at 0.416. It is important to note that a dollar in cash flows is not directly comparable to a dollar in stock price because one is a one-period flow and another is a present value of one-period flows over an infinite horizon. To interpret θ, one then has to bring these two to the same basis, say, by converting a stock price to an equivalent perceived cash flow measure, $\hat{d}$. In our data, the price-to-dividend ratio is close to 34 (untabulated), so that the corresponding weight on $\hat{d}$ then becomes $\theta \times 34 = 14.14$, that is a dollar increase in the perceived cash flows $\hat{d}$ is 14.14 times more important than a dollar increase in the actual cash flows d. Accordingly, the stock-price-related incentives are 14.14 times more important than cash flows or, equivalently, the managers weighs the stock price at 93% and cash flows at only 7%. While the stock-price-related pressure appears to be high, any attempts by the manager to mislead investors by inflating non-GAAP earnings are constrained by investors rationally anticipating the manager's behavior. This estimate quantifies the trade-off that managers make between cash flows and stock-price-related incentives documented in Graham et al. (2005).

The third parameter is the manager's personal cost of bias in non-GAAP earnings, κ_b, which is reported in all the tables after dividing by 10. At this estimate of κ_b and the average levels of bias b and capital q, the manager's personal cost of bias is approximately 4% relative to cash flows. Accordingly, the personal cost of bias seems small and the more important constraint on the bias is the discipline investors impose through their weighing of non-GAAP and GAAP earnings when determining the stock price. Finally, our last parameter is the non-positive mean of the transitory earnings shock, $-\mu_\pi$, for which we estimate μ_π at 0.011. Because ν_π scales with capital, this estimate implies the absolute value of the average transitory earnings is about 1.1% of capital.

[30] This estimate is a result of 32% of observations drawn from a normal distribution being at least one standard deviation away from the mean, which is −1.1% based on the estimate of μ_π.

5.2.2 Model fit and sensitivity of parameter estimates

In Table 4, we also compare data moments and moments simulated from the model. There are no statistically significant differences in nine of 23 moments. For the remaining 14 moments with statistically significant differences, most are not economically different. The notable exceptions are the simulated data having: a lower persistence of earnings, more volatile investment growth, less volatile cash flow growth, and a higher coefficient on non-GAAP earnings and a lower coefficient on GAAP earnings in the pricing equation. Note that, in the actual data, the coefficient on GAAP earnings is not statistically significant in Figure 1, while it turns negative in the simulated data. Despite the differences for some of the moments, we believe the model provides an overall reasonable fit, especially given the high degree of overidentification and large sample. The formal test of overidentifying restrictions rejects the hypothesis that all 23 simulated moments equal the empirical moments at the 1% confidence level (untabulated). Thus, the data reject the model. This finding is not particularly surprising, given that we can reject any model with enough data.

We also report sensitivities of parameter estimates to moments following Andrews, Gentzkow, and Shapiro (2017) in the online appendix. The sensitivity measure represents a local approximation that maps moments to estimated parameters. Because sensitivities are computed locally around the estimated parameters, conclusions about the strength of the mapping between moments and parameters based on sensitivities can differ from the discussion of identification in section 5.1. We can use sensitivities to compare the relative importance of different moments for an estimated parameter when the moments are measured in the same units. For instance, a relative importance comparison can be made within a group of moments that are variances and covariances of growth rates.

Overall, parameter estimates are more sensitive to the moments conditional on non-GAAP adjustments being positive than to the unconditional moments. There are three moments in the variance-covariance group of growth rates to which estimated parameters are generally more sensitive. First, the variance of cash flow growth, both unconditional and conditional on positive non-GAAP adjustments, are important for estimating all of the parameters except for the depreciation rate, δ, the adjustment cost of investment, κ_w, and the mean of the transitory earnings shock, μ_π. Second, the covariance of cash flow growth and non-GAAP adjustment growth is important for estimating the depreciation rate, δ, and the adjustment cost of investment, κ_w. Finally, the variance of non-GAAP adjustment growth is important for estimating the volatility of the transitory earnings, σ_π, and the mean of the transitory earnings shock, μ_π. These sensitivities provide qualitative benchmarks for the informativeness of different moments in estimation.

5.2.3 The dynamics of investment and non-GAAP adjustments

As an additional external validity check on the model, we examine whether our model can replicate the dynamics of investment and non-GAAP adjustments that we observe in the data. Because in the model the manager cares about the stock price that is sensitive to both non-GAAP and GAAP earnings, he can bias non-GAAP earnings to convey an overly optimistic performance that would partially mitigate the negative impact of intangible investment on GAAP and non-GAAP earnings. In addition, the stock price in the estimated equilibrium has a positive weight on non-GAAP earnings and a small negative weight on GAAP earnings. Thus, there is no point to cutting investment to boost GAAP earnings because GAAP earnings is subtracted in the equilibrium stock price to adjust for the manager's opportunistic bias in non-GAAP earnings. The manager therefore does not cut investment to boost GAAP earnings and increase bias to boost non-GAAP earnings simultaneously. Instead, he depresses GAAP earnings by overinvesting in order to convey a larger productivity shock and to exploit the small negative weight on GAAP earnings in the equilibrium stock price; he offsets the resulting low GAAP earnings by adding an inflated non-GAAP adjustment in non-GAAP earnings. The direct implication from this behavior is that a spike in intangible investment would coincide with a positive non-GAAP adjustment as non-GAAP earnings cover for low GAAP earnings. This exact pattern holds in the data in Figure 4.

In Figure 4, we regress intangible investment, w, on indicators for a positive non-GAAP adjustment for the quarters $[-2, 2]$ around the quarter in which the company provided a positive non-GAAP adjustment, along with industry, year, and quarter fixed effects:

$$w_{jt} = \sum_{k=-2}^{2} \beta_k \mathbb{I}(\text{Positive non-GAAP adj.})_{jt+k} + f_{ind} + g_{year} + g_{qtr} + \varepsilon_{jt}. \tag{12}$$

In this regression, $\mathbb{I}$ indicates whether the firm j issued positive non-GAAP adjustment in quarter t, and f_{ind}, g_{year}, and g_{qtr} are industry, year, and quarter fixed effects, respectively. We cluster standard errors by firm and plot the coefficients for the non-GAAP indicators. The figure shows a positive relation between investment and non-GAAP adjustments, which confirms investment is supported by inflated non-GAAP earnings.

We next examine whether this positive relation manifests in our simulated data. Although we restrict the sign of the covariance between investment growth and non-GAAP adjustment growth to be positive in our estimation, the dynamic pattern in Figure 4 was not targeted in our estimation explicitly, so if we can replicate this pattern, it suggests that our model captures a key economic tension between non-GAAP reporting and investment. We replace the indicator for positive non-GAAP adjustment in Figure 4 with the indicator for sufficiently positive non-GAAP adjustment because non-GAAP adjustments are always positive in the model and thus in the simulated data. We define "sufficiently" as a non-GAAP adjustment being above 1-percentile of its distribution in the simulated data. Similar to Figure 4, Figure 5 replicates the positive relation between investment and non-GAAP adjustment.

5.2.4 Analyst-provided non-GAAP earnings

Although our model focuses on manager-provided non-GAAP earnings, sell-side analysts commonly report their own non-GAAP earnings to the market and these analyst-provided non-GAAP earnings can influence managers' decisions (Black, Christensen, Kiosse, and Steffen, 2019). Even though this feedback arises implicitly in the rational expectations equilibrium of the model, in Table 5, we re-estimate our model using IBES analyst-provided non-GAAP earnings instead of the manager-provided amounts from Bentley et al. (2018). The data and simulated moments in Panel A are similar to our baseline moments in Table 4. For example, the IBES data has a similar incidence and mean of positive non-GAAP adjustments. If analysts removed bias from manager-provided non-GAAP amounts, we would expect a lower mean of positive non-GAAP adjustments, but it is not the case.[31] The parameter estimates in Panel B are also very similar to our baseline estimates in Table 4, which suggests a convergence in non-GAAP definitions between analysts and managers. This convergence arises naturally in our model because of the rational expectations equilibrium and is consistent with a substantial theoretical and empirical literature that finds analysts bias their reports to curry favor with management (e.g., Dunbar, 2000; Lim, 2001; Clarke, Khorana, Patel, and Rau, 2007).

5.2.5 Intangible capital intensity

With the rise of the "New Economy," intangible investment is increasingly important (e.g., Corrado et al., 2005; Falato et al., 2013) and is particularly difficult to observe under GAAP (Lev and Gu, 2016). In Table 6, we re-estimate our model using firms for which intangible capital is less important, the lowest tercile of intangible capital intensity, or more important, the highest tercile. We define intangible capital intensity as the fraction of total capital that is intangible, where the total capital is the sum of intangible capital and plant, property, and equipment, net. Looking at the moments in Panel A, the model fits reasonably well for both low- and high-intangible firms. In Panel B, the first (second) row is the parameter estimates for the low-intangible (high-intangible) firms. High-intangible firms have a higher quadratic cost from biasing, κ_b, which likely reflects the heightened importance of non-GAAP disclosures for them. High-intangible firms also have a larger mean of the transitory shock, μ_π , which is consistent with their higher likelihood of transitory events such as intangible-specific impairment losses and litigation (Kempf and Spalt, 2019). Consistent with long-term investors encouraging intangible investment (Edmans, 2009), high-intangible firms seem to be less myopic by having a lower weight on current stock prices, θ, compared to low-intangible firms.

[31] Although the moments are similar to Table 4, the differences lead to poorer model fit as only 8 moments are insignificantly different between the data and simulated moments, and the test statistics for those that are different are higher. This poorer fit is not surprising because we have replaced manager-provided with analyst-provided non-GAAP earnings in a model focused on a manager's reporting choices.

5.3 Counterfactual analyses

In Table 7, we quantify the effect of non-GAAP reporting on investment and firm value. We present four sets of counterfactual experiments based on the four sets of parameter estimates in Tables 4–6. For each of these parameter sets, we adjust the manager's problem to reflect hypothesized scenarios not observed in the data. This approach allows us to quantify the magnitude of particular aspects of the manager's decision. We focus on the average bias scaled by gross non-GAAP adjustments, change in investment intensity, and the change in firm value.

In addition to our model as-estimated (column 1), we examine three counterfactuals: a model without myopia (column 2), a model without non-GAAP reporting (column 3), and a model with non-GAAP reporting where the manager cannot lie (column 4). The model without myopia is implemented by setting $\theta = 0$. The model without non-GAAP reporting is implemented by excluding non-GAAP signal from the stock price function. The model with non-GAAP reporting where the manager cannot lie is implemented by setting non-GAAP earnings equal to expected cash flows, so that investors have an accurate signal of the firm's profitability, but the manager still cares about the stock price.

The counterfactuals for our baseline estimation are in Panel A. The mean bias scaled by gross non-GAAP adjustments is 30.20%, that is about one-third of non-GAAP adjustments is an opportunistic bias that inflates non-GAAP earnings. We do not observe this bias in the data; however, we can bound it with detailed non-GAAP reconciliations from Audit Analytics, which we have not used in the estimation. If we naïvely assume all adjustments for recurring items correspond to the bias, the fraction of "biased" adjustments in these data is approximately 55%, that is an upper bound on bias, and the fraction of recurring cash adjustments is 14%, that is a lower bound on bias. Our estimate of the average bias falls within these bounds, which provides some assurance that the model captures key features of the data.

Without myopia, intangible investment intensity would decrease from 60.39% to 46.18%. The myopic manager, who has the ability to inflate non-GAAP earnings to offset investment, overinvests, resulting in a 1.23% decline in firm value. Without non-GAAP reporting, investment intensity declines further to 20.75% because the manager can only provide GAAP earnings that contain a (typically) negative transitory items, which he must offset with lower investment. Inability to report non-GAAP earnings results in a trivial 2 basis-points decline in firm value. Lower investment intensity and a negligible effect on firm value suggests the manager uses non-GAAP reporting opportunistically to overinvest. Our no-bias counterfactual shows slightly lower investment intensity compared to as-estimated values. Despite slightly lower investment in the absence of bias, the firm value increases by 94% basis-points, that is the cost from biasing non-GAAP earnings is just under 1% of firm value.

Analyst-provided non-GAAP earnings from IBES data (Panel B) have a similar level of bias, investment intensity, and change in firm value as the baseline case (Panel A). This similarity is not surprising given how close the estimated parameters are to our baseline estimates. The counterfactuals for the low- and high-intangible firms subsamples are in Panels C and D. Low-intangible firms have higher bias and larger changes in firm value across the counterfactuals. This amplification is expected given that low-intangible firms have higher weight on stock prices (greater myopia) than high-intangible firms.

Overall, our counterfactual analyses suggest that managerial myopia destroys firm value, and non-GAAP reporting facilitates overinvestment. The benefits of a better disclosure of expected cash flows using non-GAAP earnings are mostly offset by the opportunistic bias that masks inefficient investment. Thus, the effect on firm value of restricting firms to report GAAP earnings only is negligible. However, the cost of biasing non-GAAP earnings is non-trivial at just under 1% of firm value. The magnitude of this effect is similar to the effect of eliminating misreporting in GAAP earnings by Terry et al. (2020) but of the opposite sign. The difference in the sign arises from investment and misreporting of GAAP earnings being substitutes in Terry et al. (2020) model, whereas investment and misreporting of non-GAAP earnings being complements in our model. In Terry et al. (2020), eliminating misreporting of GAAP earnings causes about 1% drop in firm value; whereas in this paper, eliminating the bias in non-GAAP reporting causes just under 1% increase in firm value.

5.4 Additional results

To corroborate the intuition behind the model, we re-estimate the model and countefactuals in different subsamples in Tables 8, 9, and 10. Note that although it is intuitive that the parameter estimates in the subsamples should be a weighted average of the baseline results, by estimating all of the parameters, the point estimates for some parameters can be above (or below) estimates from the pooled sample.

We first examine how analyst following influences the interaction of non-GAAP reporting and investment. Because higher analyst scrutiny can induce managers to focus more on stock prices (e.g., Fuller and Jensen, 2002; He and Tian, 2013), we should see high-coverage firms being more myopic, resulting in larger losses in firm value. We report parameter estimates for low-coverage firms, the lowest tercile of analyst following, and the high-coverage firms, the highest tercile, in Table 8 and the corresponding conterfactuals in Table 10, Panels A and B. High-coverage firms are more myopic, which results in higher bias in their non-GAAP adjustments. High-coverage firms also have larger firm value changes in the counterfactual analyses. The changes range from 3.12% to 3.95% for high-coverage firms versus from 0.07% to 0.80% for low-coverage firms. Overall, in high-coverage firms, non-GAAP reporting has a greater effect on intangible investment efficiency because managers are under greater pressure to maintain high stock prices.

We next partition observations by fiscal quarter, i.e., the first three quarters (Q1–Q3) versus the fourth quarter (Q4). Because managers often have stronger incentives to maintain high stock prices in Q4, as many compensation plans are based on annual performance measures,[32] managers should be more myopic in Q4 than in Q1–Q3 of the fiscal year. Indeed, in Table 9 Panel A, the data moments for Q4 have higher incidence and mean of positive non-GAAP adjustments, both of which suggest myopia is greater in Q4. Generally, the estimates are similar across quarters in Table 9 Panel B. The two parameters with the largest differences, κ_b and θ, influence the interaction of non-GAAP reporting and investment the most. In addition to the bias being perceived by the manager as less costly in Q4 according to the lower estimate of κ_b, the stock price pressure is higher in

[32]See, for instance, Murphy (1999), Dhaliwal, Gleason, and Mills (2004), Jacob and Jorgensen (2007), and Das, Shroff, and Zhang (2009)

Q4 with $\theta = 0.679$ relative to Q1–Q3 with $\theta = 0.416$. These parameter estimates translate into the bias estimate in Q4 being substantially higher in Table 10, Panels C and D, which indicates that managers have a stronger incentive to inflate non-GAAP earnings at the end of the fiscal year. The better ability to inflate non-GAAP earnings and the greater pressure to maintain high stock prices in Q4 result in firm value changes being much higher in Q4 compared to Q1–Q3 in all three counterfactuals, which range from 4.04% to 4.61% for Q4 observations versus from 0.001% to 1.22% for Q1–Q3 observations.

We perform two additional analyses based on data partitions reported in the online appendix: by industry and by the type of non-GAAP adjustments. We first partition by industry, because different industries have different non-GAAP reporting frequencies in Figure 3 and ways to measure non-GAAP earnings (Baik et al., 2008). We focus on technology and healthcare, which have the highest and lowest non-GAAP reporting frequencies in our sample. The parameter estimates are broadly similar across the two samples. We find similar levels of bias and valuation effects in each of the counterfactuals. These findings suggest that non-GAAP reporting frequency is not the major driver of the level of opportunism in non-GAAP earnings.

Because non-GAAP reporting is often justified as a way to remove transitory non-cash items (e.g., Doyle et al., 2003), we also split by cash versus non-cash adjustments using the detailed Audit Analytics data.[33] Given the small sample size, we cannot re-estimate all of the parameters. Instead, we fix all of the parameters at our baseline estimates—except for κ_b and θ—and permit the endogenous pricing function to converge to a new equilibrium. As cash adjustments are generally harder to justify, we expect the managers who make larger cash adjustments to have a lower personal cost of inflating non-GAAP earnings (i.e., lower κ_b) and a stronger incentive to do so (i.e., higher θ). Although we only find modest differences in the estimates of κ_b and θ between the two definitions of non-GAAP adjustments, they are directionally consistent with our predictions. When we measure non-GAAP adjustments as cash adjustments only, we find a slightly higher myopia and a lower level of personal cost. Accordingly, the estimate for the bias is higher as well as

[33] We cannot use non-GAAP data from Bentley et al. (2018), because they provide the total amount on non-GAAP adjustment only.

the valuation effects in each of the counterfactuals, consistent with non-GAAP earnings being less informative when managers use cash adjustments (e.g., Whipple, 2015; Black et al., 2018).

6 Conclusion

Regulators have expressed the concern that, because non-GAAP disclosures do not have GAAP's recognition and measurement principles, they lack credibility and are particularly ripe for opportunism. Firms, however, contend that non-GAAP earnings adjust for deficiencies in GAAP by offering a profitability disclosure that better reflects core earnings. Non-GAAP adjustments can remove transitory items and thus eliminate the distortions in discretionary expenditures under GAAP, such as intangible investment. In this paper, we examine the interaction between non-GAAP reporting and intangible investment, and quantify the effect of opportunism in non-GAAP reporting on firm value.

Because a reduced-form approach is unable to provide appropriate inferences for our research question, we build a dynamic model of investment and non-GAAP reporting in which a manager seeks to maximize cash flows and stock prices. Our model suggests complementarity between non-GAAP earnings and intangible investment decisions in that the ability to report non-GAAP earnings allows the manager to overinvest. When we estimate our model, we find a manager's stock-price-based incentives are significantly larger than the cash-flows incentives. We estimate this myopia decreases firm value by 1.23%. We also quantify the cost of allowing the manager to inflate non-GAAP earnings, and find the opportunistic bias, by hiding overinvestment, destroys just under 1% of firm value.

Our results can be of interest to regulators debating the implications of non-GAAP disclosures. Because non-GAAP earnings affect how investors value firms, our findings also highlight managers' responses to changes in the reporting environment. These responses have implications at least for the one aspect of the real economy that we study in this paper—intangible investment. We believe this relatively underexplored effect of non-GAAP disclosures furthers our understanding of the real effect of financial reporting.

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Appendix A Examples of non-GAAP reconciliations

Non-GAAP disclosures have consistently been a focus of standard setters. In 2003, as part of the Sarbanes-Oxley Act, Regulation G established standards for firms' presentation of non-GAAP information, including the requirement that firms must reconcile non-GAAP metrics with their GAAP counterparts. We refer to the reconciliation amounts as the non-GAAP adjustment. In response to concerns that non-GAAP earnings can mislead investors, the SEC issued a Compliance and Disclosure Interpretations update in 2016 to address common questions relating to these disclosures.[34] However, the SEC also acknowledges that non-GAAP "can provide investors with useful information regarding how management monitors performance."[35] Although firms have discretion over what to include (or exclude) in non-GAAP earnings, the SEC encourages firms to provide consistent non-GAAP adjustments between periods and to include recurring expenses necessary for their business.[36]

Below, we present two examples of the non-GAAP reconciliations. The first table reports the reconciliation of adjusted earnings per share (EPS) to reported EPS for Walmart (ticker: WMT) for the fourth quarter of 2018.[37] The second table reports the reconciliation of adjusted net earnings to GAAP income for Johnson and Johnson (ticker: JNJ) for the fourth quarter of 2017.[38]

Figure A.1: Walmart non-GAAP reconciliation, Q4, 2018

	Three Months Ended January 31, 2018		
Diluted earnings per share:			
Reported EPS			$0.73
Adjustments:	**Pre-Tax Impact**	**Tax Impact 1**	**Net Impact**
Restructuring charges 2	$0.40	-$0.12	$0.28
Loss on extinguishment of debt	0.34	-0.13	0.21
Asset impairments and write-offs 3	0.18	-0.06	0.12
Associate lump sum bonus	0.15	-0.06	0.09
U.S. tax reform benefit	—	-0.07	-0.07
Legal settlement recovery	-0.05	0.02	-0.03
Net adjustments			$0.60
Adjusted EPS			$1.33

[34]https://deloitte.wsj.com/cfo/2016/06/03/sec-urges-companies-to-take-a-fresh-look-at-non-gaap-measures/

[35]https://www.sec.gov/news/speech/speech-bricker-040318

[36]https://www.sec.gov/divisions/corpfin/guidance/nongaapinterp.htm

[37]https://www.sec.gov/Archives/edgar/data/104169/000010416918000020/earningsrelease-1312018.htm

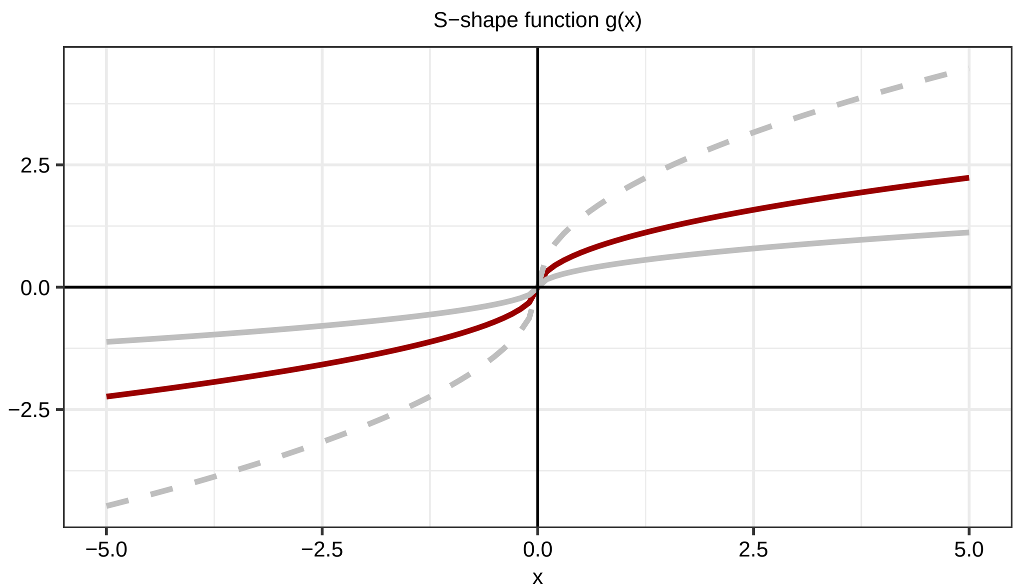
[38]https://www.sec.gov/Archives/edgar/data/200406/000020040618000003/a8k2017q4exhibit992o.htm

Figure A.2: Johnson & Johnson non-GAAP reconciliation, Q4, 2017

	Fourth Quarter	
(Dollars in Millions Except Per Share Data)	2017	2016
Earnings before provision for taxes on income - as reported	$ 2,560	4,324
Intangible asset amortization expense	1,077	344
Litigation expense, net	645	96
Actelion acquisition related cost	217	—
Restructuring/Other (1)	284	298
In-process research and development	408	—
Diabetes asset impairment	35	—
AMO acquisition related cost	25	—
DePuy ASR™ Hip program	—	9
Other	—	32
Earnings before provision for taxes on income - as adjusted	$ 5,251	5,103
Net Earnings/(Loss) - as reported	$ (10,713)	3,814
Impact of tax legislation	13,556	—
Intangible asset amortization expense	926	252
Litigation expense, net	506	80
Actelion acquisition related cost	313	—
Restructuring/Other	237	251
In-process research and development	266	—
Diabetes asset impairment	(116)	—
AMO acquisition related cost	(198)	—
DePuy ASR™ Hip program	—	7
Other	—	(43)
Net Earnings - as adjusted	$ 4,777	4,361

Figure 1: The non-linear relation between the stock price and earnings

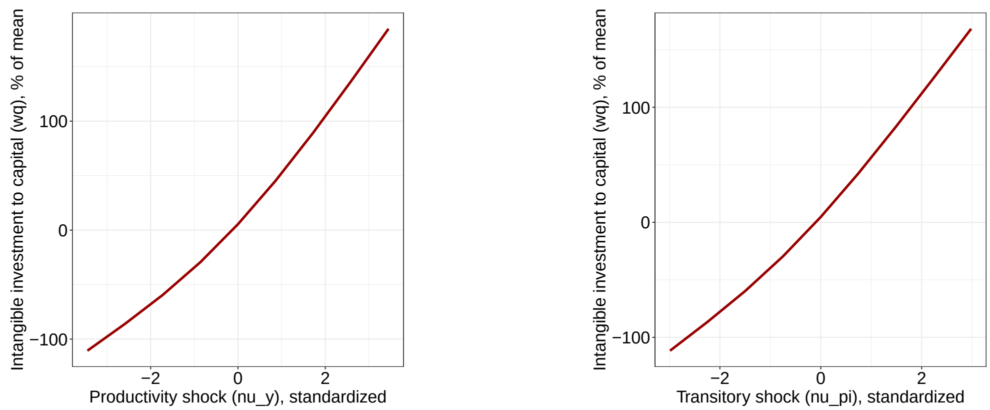
This figure plots the S-shape relation between non-GAAP earnings and the stock price, $g(\cdot)$, where $g(x) = \text{sign}(x)\sqrt{|x|}$. The solid line corresponds to $g(x)$, and the other two lines correspond to $g(x)$ multiplied by 0.5 or 2. The equation shows the coefficient estimates from the linear regression of the firm value V_F/q as defined in Section 3.4 on $g\big((\pi+\psi)/q\big)$ and $g\big(\pi/q\big)$, where $\pi+\psi$ is non-GAAP earnings, π is GAAP earnings, and q is intangible capital. The regression includes firm-fiscal-quarter fixed effects and, thus, the intercept is zero by construction. Robust standard errors clustered by firm are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.



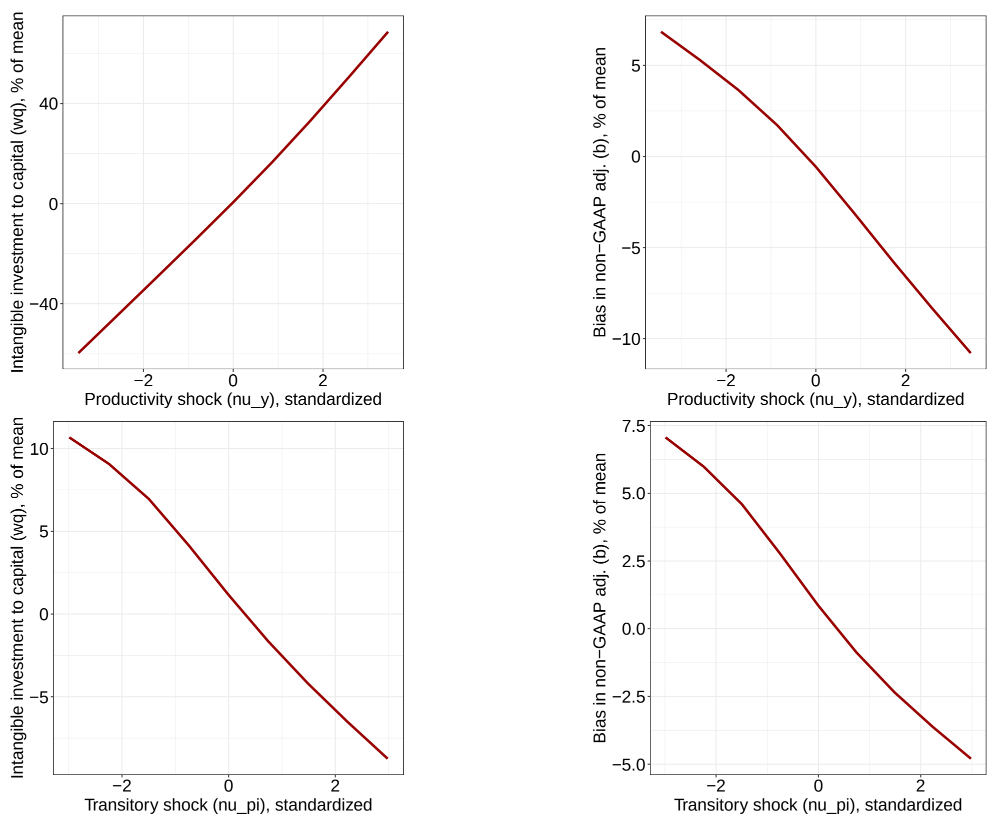
$$\frac{V_F}{q}_{it} = \underset{(0.553)^{***}}{6.073} \cdot g\left(\frac{\pi+\psi}{q}\right)_{it} + \underset{(0.301)}{0.303} \cdot g\left(\frac{\pi}{q}\right)_{it} + f_{firm-qtr} + \varepsilon_{it}$$

Figure 2: Optimal policies

This figure depicts optimal policies for investment when the manager can only report GAAP earnings (a) and GAAP and non-GAAP earnings (b) using parameters reported in Table 4. In both panels, we standardize the shocks (i.e., ν_y and ν_π), report the policy functions (i.e., w/q) *relative to the mean* over the ergodic distribution of the model, and fix the level of capital, q. In panel (a), the row presents the optimal investment as the productivity shock, ν_y, varies (left) and as the transitory shock, ν_π, varies (right). In panel (b), the top row presents the optimal investment (left) and bias (right) as the productivity shock, ν_y, varies. For these two upper plots, we fix the transitory shock, ν_π. The bottom row presents optimal investment (left) and bias (right) as the transitory shock, ν_π, varies. For the two lower plots, we fix the productivity shock, ν_y. We scale investment by capital (i.e., w/q) and bias, $b \geq 0$, is already a fraction of capital.



(a) GAAP-only reporting



(b) GAAP and non-GAAP reporting

Figure 3: Non-GAAP reporting over time

This figure depicts the fraction of firm-quarters that report non-GAAP earnings after excluding regulated utilities (4900–4999), financial firms (6000–6999), and firms categorized as non-operating establishments (9000+). These firms are required to be in Bentley et al. (2018), have non-missing assets and sales, and have the total value of assets above $5 million. The solid line is the fraction for all firms in this sample. The long (short) dashed lines report the fraction for high-tech (health) firms. These dashed lines represent the industry with the highest non-GAAP reporting frequency (i.e., high-tech) as well as the lowest frequency (i.e., health). The dotted line is the frequency for manufacturing firms. We define industries following Eisfeldt and Papanikolaou (2014) as described in Section 4.

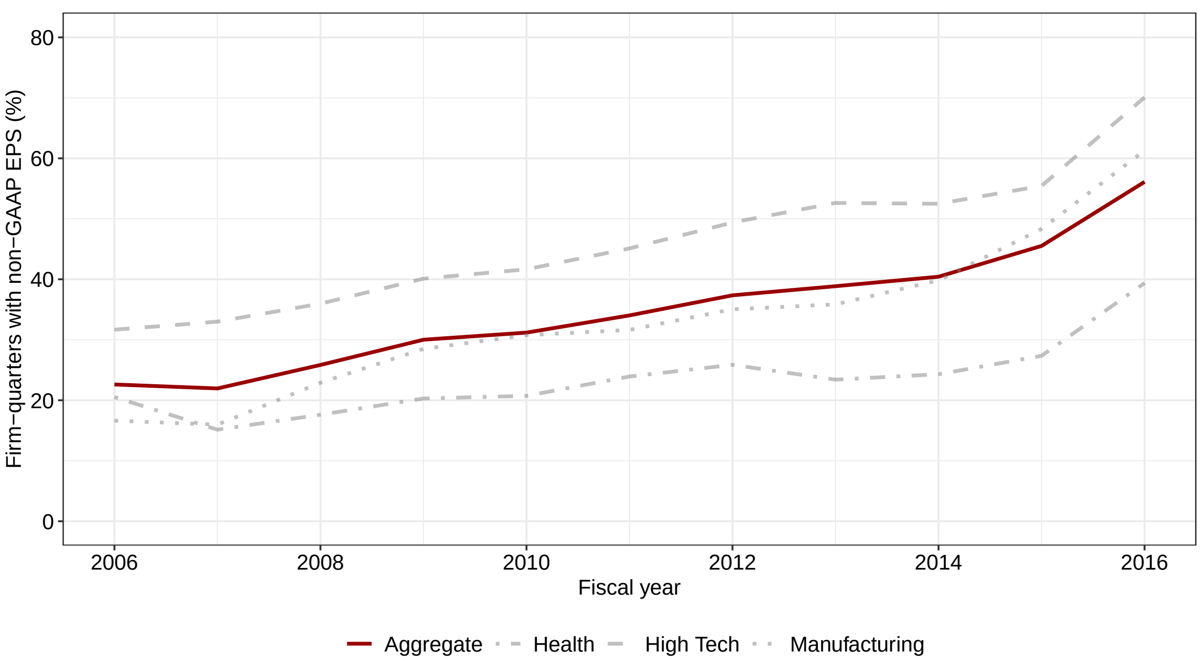


Figure 4: Investment and non-GAAP adjustment around positive non-GAAP adjustment event

This figure depicts the dynamics of investment (left) and non-GAAP adjustment (right) around positive non-GAAP adjustment event. Each solid line plots the estimate coefficients $\beta_k, k = -2, ...2$ from the panel regression $w_{jt} = \sum_{k=-2}^{2} \beta_k \mathbb{I}(\text{Positive non-GAAP adj.})_{jt+k} + f_{ind} + g_{year} + g_{qtr} + \varepsilon_{jt}$, where $\mathbb{I}$ indicates whether the firm j issued positive non-GAAP adjustment in quarter t, and f_{ind}, g_{year}, and g_{qtr} are industry, year, and quarter fixed effects, respectively. The variable w_{jt} is intangible investment or non-GAAP adj., both scaled by capital. The plotted error bands are 95% confidence intervals based on standard errors clustered by firm.

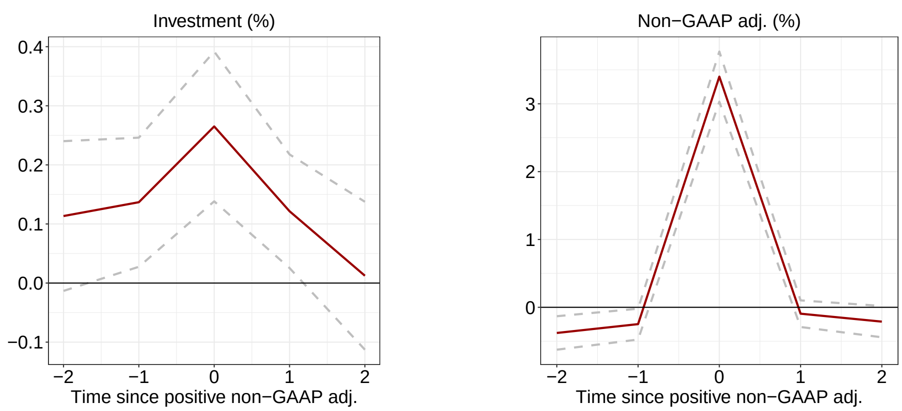


Figure 5: Investment and non-GAAP adjustment around sufficiently positive non-GAAP adjustment event in the simulated data

This figure depicts the dynamics of investment (left) and non-GAAP adjustment (right) around sufficiently positive non-GAAP adjustment event in the simulated data. The data is simulated using the baseline estimates from Table 4. Each solid line plots the estimate coefficients β_k, $k = -2, ...2$ from the panel regression $w_{jt} = \sum_{k=-2}^{2} \beta_k \mathbb{I}(\text{Sufficiently positive non-GAAP adj.})_{jt+k} + \varepsilon_{jt}$, where $\mathbb{I}$ indicates whether the firm j issued sufficiently positive non-GAAP adjustment in quarter t. The variable w_{jt} is intangible investment or non-GAAP adj., both scaled by capital. We define sufficiently positive non-GAAP adjustment as being above 1-percentile of its distribution in the simulated data. The plotted error bands are 95% confidence intervals based on standard errors clustered by firm.

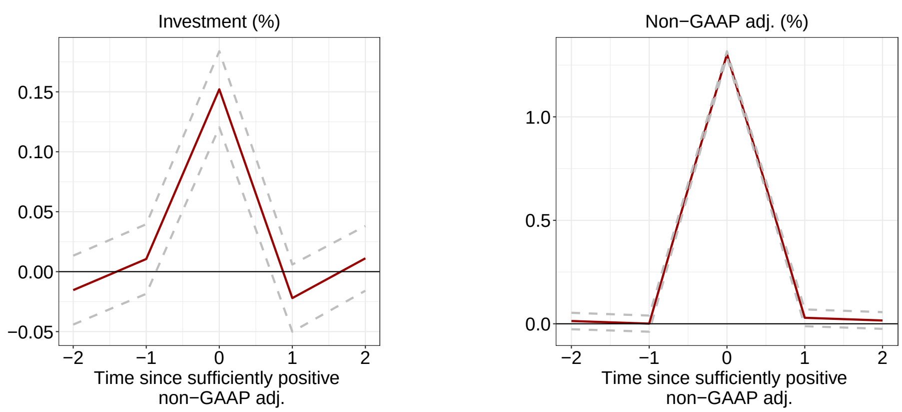


Table 1: Data and parameter definitions

This table presents the definitions and data sources for variables used in the estimation, and parameters. All dollar values are deflated by the consumer price index. Compustat data codes are in parentheses. Panel A presents variables used in estimation. Panel B reports parameters that arise from the endogenous pricing function (i.e., equation 8). Panel C displays parameters that are estimated or assumed from outside the model. Panel D reports parameters that are estimated from the simulated method of moments.

A. Data definitions	
q	Intangible capital stock is computed as the sum of knowledge and organization capital. Knowledge and organization capital are computed using the perpetual inventory method described in Section 4. Compustat.
w	Investment into intangible capital computed as the sum of investment into knowledge and organization capital. Investment into knowledge capital is R&D expense (XRDQ). Investment into organization capital is the fraction of SG&A expense (XSGAQ) as described in Section 4. Compustat.
π	GAAP earnings defined as the product of (diluted) EPS including extraordinary items (EPSFIQ) and common shares for diluted EPS (CSHFDQ). Compustat.
d	Free cash flow calculated as cash from operations (OANCFQ) minus net capital expenditures (CAPXQ - SPPEQ). Compustat.
ψ	Non-GAAP adjustment is the difference between non-GAAP EPS (MGR_NG_EPS) from Bentley et al. (2018) and GAAP EPS (EPSFIQ) multiplied by common shares for diluted EPS (CSHFDQ). Compustat and non-GAAP earnings from Bentley et al. (2018).
B. Endogenous parameters for the pricing function	
β_0	Intercept
β_1	Coefficient on non-GAAP earnings term
β_2	Coefficient on GAAP earnings term
C. Estimated outside of the model	
r	Quarterly discount rate, assumed to be 1.5%; similar to Terry et al. (2020)
ρ_s	Cash flow reshuffling parameter, set to 11.21%
D. Estimated within the model	
α	Curvature of profit function
δ	Quarterly depreciation of intangible capital
κ_w	Adjustment cost from investment
ρ_y	Persistence of the productivity shock
σ_y	Volatility of the productivity shock
σ_π	Volatility of the transitory earnings shock
θ	Relative importance of financial reporting
κ_b	Personal cost from biasing non-GAAP earnings
μ_π	Mean of the transitory earnings shock

Table 2: Non-GAAP reconciliation descriptive statistics

This table presents descriptive statistics for the Regulation G reconciliation line items between GAAP and non-GAAP numbers from Audit Analytics. This sample covers quarterly earnings-related non-GAAP disclosures for S&P 500 firms from 2014 through 2018. We categorize non-GAAP adjustments into 23 separate categories and divide these into recurring (rows 1 through 15) and non-recurring items (rows 16 through 23). Within the recurring/non-recurring split, we further divide categories based on whether they are primarily cash or non-cash related. For each grouping of categories, we report the fraction of adjustments in our sample that fall within that category. Following the *Category* column, column, we report the fraction of adjustments in our sample within the category. The next two columns report the mean and median in millions of $USD. The last two columns report the mean and median of the adjustment scaled by current period sales ($REVTQ$) reported in percentage points. All unbounded amounts are winsorized at 1% and 99%.

						Level (US$ M)		Sales (%)	
	%		%	Category	%	Mean	Med	Mean	Med
Recurring	53.18	Cash	13.25	Interest expense	6.30	88.83	47.00	5.25	3.02
				Capital expenditures	4.02	-431.81	-199.00	-10.93	-7.63
				Cost of goods sold	1.10	17.47	7.00	0.53	0.17
				Dividends	0.90	-150.00	0.10	-2.55	0.04
				Rent	0.64	130.27	19.80	2.59	1.10
				R&D	0.20	114.19	48.00	2.71	0.94
				Working capital	0.09	118.36	4.65	0.83	0.78
		Non-Cash	39.93	Tax expense	10.84	21.35	0.13	0.53	0.02
				Amortization and depreciation	10.34	163.71	78.50	8.89	4.03
				Stock compensation	4.42	67.17	31.05	3.61	2.47
				Minority interest	3.82	-5.37	0.10	-0.44	0.01
				Investment gains/losses	3.07	-4.31	-1.00	-0.09	-0.06
				Fair value	2.90	13.64	2.00	1.43	0.09
				Pension	2.80	73.57	10.00	1.32	0.37
				Currency	1.73	67.99	12.17	1.44	0.52
Non-Recurring	46.82	Cash	28.95	Acquisitions	13.71	30.06	8.62	0.52	0.36
				Restructuring	9.11	40.53	13.00	1.23	0.61
				Legal settlements	3.06	40.63	5.65	1.29	0.27
				Debt extinguishments	2.12	39.60	9.15	1.42	0.43
				Initiative costs	0.94	42.42	17.05	1.17	0.60
		Non-Cash	17.88	Uncommon	10.05	47.38	9.00	1.62	0.41
				Impairments	4.18	157.56	28.99	6.20	1.07
				Tax adjustment	3.65	4.51	-2.39	0.54	-0.11

Table 3: Descriptive statistics

This table presents the descriptive statistics for variables used in the estimation. The sample is based on Compustat and non-GAAP earnings from Bentley et al. (2018). The sample covers the period from 2005 to 2016 at a quarterly frequency. Compustat data codes are in parentheses. *Obs.* is the number of observations per firm. *Market value* is the product of common shares outstanding (CSHOQ) and the quarter-end closing price (PRCCQ). *Total assets* is total assets (ATQ). *Sales* is sales revenue (SALEQ). *Market-to-book* is the sum of market value and total assets minus the book value of equity divided by total assets. *Intangible capital stock* is the sum of knowledge and organization capital computed using the perpetual inventory method as described in Section 4. *Intangible investment* is the sum of knowledge and organization capital investment as described in Section 4. *Earnings* is earnings that include extraordinary items (EPSFIQ × CSHFDQ) with earnings from Compustat preliminary history or, if missing, from Compustat quarterly. *Cash flow* is cash from operations (OANCFQ) minus capital expenditures (CAPXQ - SPPEQ). *Non-GAAP adj.* is the difference between *Earnings* and *non-GAAP* earnings from Bentley et al. (2018). All growth rates are computed as described in Section 5.1 based on year-over-year differences in quarterly amounts. We exclude utilities (4900–4999) and public service, international affairs, or non-operating firms (9000+). All variables are winsorized at the 1st and 99th percentiles.

	Obs.	Mean	Std.Dev	p1	p25	p50	p75	p99
Firm characteristics (N = 1,416)								
Obs.	21,216	21.854	9.749	2.000	14.000	22.000	29.000	41.000
Market value ($bn)	21,216	7.469	21.611	0.026	0.365	1.106	4.167	151.895
Total assets ($bn)	21,216	4.407	12.051	0.027	0.294	0.823	2.654	83.942
Sales ($bn)	21,216	1.154	2.983	0.004	0.072	0.217	0.717	19.440
Market-to-book	21,216	2.869	5.293	0.642	1.235	1.724	2.586	43.461
Intangible capital stock ($bn)	21,216	1.862	4.829	0.022	0.154	0.371	1.138	32.406
Intangible investment ($bn)	21,216	0.116	0.299	0.001	0.010	0.024	0.075	2.043
Variables used in estimation								
Intangible investment to capital	21,216	0.066	0.021	0.023	0.051	0.062	0.077	0.135
Earnings to intangible capital	21,216	0.030	0.070	-0.258	0.000	0.029	0.062	0.241
Cash flows to intangible capital	21,216	0.037	0.093	-0.244	-0.012	0.031	0.080	0.348
Non-GAAP adj. to intangible capital	21,216	0.011	0.029	-0.050	0.000	0.000	0.013	0.183
Intangible investment growth	21,216	0.044	0.210	-0.530	-0.041	0.041	0.127	0.622
Earnings growth	21,216	0.004	1.030	-2.000	-0.426	0.054	0.441	2.000
Cash flows growth	21,216	0.025	1.205	-2.000	-0.692	0.040	0.753	2.000
Non-GAAP adj. growth	21,216	0.093	1.144	-2.000	-0.040	0.000	0.451	2.000

Table 4: Baseline estimation results

The estimation is done with simulated minimum distance estimator, which chooses structural model parameters by matching the moments from a simulated panel of firms to the corresponding moments from the data. Panel A reports the simulated and actual moments and the t-statistics for the differences between the corresponding moments. Panel B reports the estimated structural parameters with standard errors in parentheses. α is the curvature of the profit function. δ is the depreciation rate of capital. κ_w is the adjustment cost of investment. ρ_y is the persistence of the productivity shock. σ_y is the volatility of the productivity shock. σ_π is the volatility of the transitory earnings. θ is the importance of stock price relative to cash flows. κ_b is the manager's personal cost from biasing non-GAAP earnings divided by 10. μ_π is the mean of the transitory earnings shock. The standard errors are double-clustered by firm and year in both panels.

A. Moments

	Data moments	Simulated moments	t-statistics
Mean intang. investment to capital	0.066	0.067	6.42
Mean earnings to capital	0.030	0.049	7.22
Persistence of earnings	0.267	0.048	-6.89
Variance of intang. investment growth	0.033	0.064	28.34
Covariance of investment and earnings growth	-0.010	-0.084	-29.22
Covariance of investment and cash flow growth	-0.013	-0.009	0.71
Variance of earnings growth	0.934	0.970	1.25
Covariance of earnings and cash flow growth	0.189	0.154	-1.95
Variance of cash flow growth	1.322	0.048	-31.02
Incidence of positive non-GAAP adj.	0.442	0.646	10.50
Mean non-GAAP adj., given pos. non-GAAP adj.	0.027	0.028	0.38
Variance of intang. investment growth, given pos. adj.	0.038	0.063	6.91
Cov. of investment and earnings growth, given pos. adj.	-0.020	-0.092	-9.43
Cov. of investment and cash flow growth, given pos. adj.	-0.008	-0.011	-0.61
Cov. of investment and non-GAAP adj. growth, given pos. adj.	0.033	0.063	5.18
Variance of earnings growth, given pos. adj.	1.055	1.059	0.10
Cov. of earnings and cash flow growth, given pos. adj.	0.212	0.173	-1.89
Cov. of earnings and non-GAAP adj. growth, given pos. adj.	-0.533	-0.729	-5.73
Variance of cash flow growth, given pos. adj.	1.261	0.052	-29.73
Cov. of cash flow and non-GAAP adj. growth, given pos. adj.	-0.060	-0.082	-1.20
Variance of non-GAAP adj. growth, given pos. adj.	1.224	1.174	-1.15
Coefficient on non-GAAP earnings in the pricing eqn.	6.073	10.062	7.54
Coefficient on earnings in the pricing eqn.	0.303	-1.065	-2.91

B. Parameter estimates

α	δ	κ_w	ρ_y	σ_y	σ_π	θ	κ_b	μ_π
0.637	0.067	0.329	0.493	0.127	0.021	0.416	28.446	0.011
(0.002)	(0.001)	(0.014)	(0.006)	(0.004)	(0.001)	(0.037)	(0.004)	(0.001)

Table 5: Estimation results using IBES data

The estimation is done with simulated minimum distance estimator, which chooses structural model parameters by matching the moments from a simulated panel of firms to the corresponding moments from the data that defines non-GAAP adj. using IBES. Panel A reports the simulated and actual moments and the t-statistics for the differences between the corresponding moments. Panel B reports the estimated structural parameters with standard errors in parentheses. α is the curvature of the profit function. δ is the depreciation rate of capital. κ_w is the adjustment cost of investment. ρ_y is the persistence of the productivity shock. σ_y is the volatility of the productivity shock. σ_π is the volatility of the transitory earnings. θ is the importance of stock price relative to cash flows. κ_b is the manager's personal cost from biasing non-GAAP earnings divided by 10. μ_π is the mean of the transitory earnings shock. The standard errors are double-clustered by firm and year in both panels.

A. Moments

	Data moments	Simulated moments	t-statistics
Mean intang. investment to capital	0.066	0.067	8.90
Mean earnings to capital	0.030	0.048	36.99
Persistence of earnings	0.266	0.042	-5.11
Variance of intang. investment growth	0.033	0.065	9.08
Covariance of investment and earnings growth	-0.010	-0.088	-27.11
Covariance of investment and cash flow growth	-0.013	-0.010	0.53
Variance of earnings growth	0.930	0.987	1.89
Covariance of earnings and cash flow growth	0.188	0.159	-1.37
Variance of cash flow growth	1.322	0.049	-32.48
Incidence of positive non-GAAP adj.	0.399	0.646	18.39
Mean non-GAAP adj., given pos. non-GAAP adj.	0.034	0.028	-1.69
Variance of intang. investment growth, given pos. adj.	0.034	0.065	10.33
Cov. of investment and earnings growth, given pos. adj.	-0.016	-0.097	-13.89
Cov. of investment and cash flow growth, given pos. adj.	-0.009	-0.013	-0.54
Cov. of investment and non-GAAP adj. growth, given pos. adj.	0.027	0.065	7.93
Variance of earnings growth, given pos. adj.	1.106	1.080	-0.52
Cov. of earnings and cash flow growth, given pos. adj.	0.205	0.179	-1.02
Cov. of earnings and non-GAAP adj. growth, given pos. adj.	-0.538	-0.737	-6.40
Variance of cash flow growth, given pos. adj.	1.276	0.053	-24.64
Cov. of cash flow and non-GAAP adj. growth, given pos. adj.	-0.055	-0.085	-1.50
Variance of non-GAAP adj. growth, given pos. adj.	1.269	1.174	-3.87
Coefficient on non-GAAP earnings in the pricing eqn.	3.194	7.399	25.15
Coefficient on earnings in the pricing eqn.	2.638	-0.823	-9.86

B. Parameter estimates

α	δ	κ_w	ρ_y	σ_y	σ_π	θ	κ_b	μ_π
0.637	0.067	0.329	0.493	0.127	0.021	0.416	28.446	0.011
(0.033)	(0.001)	(0.052)	(0.045)	(0.011)	(0.001)	(0.040)	(7.439)	(0.001)

Table 6: Low vs. high intangible intensity

The estimation is done with simulated minimum distance estimator, which chooses structural model parameters by matching the moments from a simulated panel of firms to the corresponding moments from the data for the sample of firms with low vs. high intangible intensity. Parameters are defined in Table 1. The standard errors are double-clustered by firm and year in both panels.

A. Moments

	Low intangible intensity			High intangible intensity		
	Data moments	Simulated moments	t-statistics	Data moments	Simulated moments	t-statistics
Mean intang. investment to capital	0.063	0.066	60.94	0.067	0.070	81.58
Mean earnings to capital	0.050	0.059	8.09	0.006	0.041	77.39
Persistence of earnings	0.295	0.067	-17.56	0.245	0.048	-5.26
Variance of intang. investment growth	0.029	0.079	20.04	0.042	0.078	9.79
Covariance of investment and earnings growth	0.010	-0.046	-9.09	-0.031	-0.077	-16.05
Covariance of investment and cash flow growth	-0.011	-0.000	1.63	-0.021	-0.002	3.62
Variance of earnings growth	0.795	0.623	-3.99	1.156	1.426	7.98
Covariance of earnings and cash flow growth	0.094	0.106	0.53	0.329	0.186	-3.86
Variance of cash flow growth	1.355	0.046	-26.09	1.396	0.064	-22.29
Incidence of positive non-GAAP adj.	0.345	0.646	13.72	0.502	0.646	9.23
Mean non-GAAP adj., given pos. non-GAAP adj.	0.029	0.026	-1.08	0.029	0.034	7.63
Variance of intang. investment growth, given pos. adj.	0.042	0.077	4.06	0.040	0.074	7.63
Cov. of investment and earnings growth, given pos. adj.	0.008	-0.047	-4.15	-0.035	-0.072	-7.97
Cov. of investment and cash flow growth, given pos. adj.	-0.003	-0.001	0.36	-0.017	-0.003	2.33
Cov. of investment and non-GAAP adj. growth, given pos. adj.	0.016	0.046	2.93	0.043	0.061	3.36
Variance of earnings growth, given pos. adj.	0.964	0.655	-4.91	1.191	1.523	5.64
Cov. of earnings and cash flow growth, given pos. adj.	0.103	0.117	0.43	0.330	0.199	-3.14
Cov. of earnings and non-GAAP adj. growth, given pos. adj.	-0.575	-0.597	-0.38	-0.488	-0.932	-14.61
Variance of cash flow growth, given pos. adj.	1.307	0.048	-19.91	1.321	0.068	-20.74
Cov. of cash flow and non-GAAP adj. growth, given pos. adj.	-0.011	-0.057	-1.54	-0.110	-0.087	0.85
Variance of non-GAAP adj. growth, given pos. adj.	1.430	1.229	-3.36	1.024	1.170	1.76
Coefficient on non-GAAP earnings in the pricing eqn.	6.427	7.650	3.50	3.792	5.325	3.62
Coefficient on earnings in the pricing eqn.	0.664	-0.623	-3.31	0.390	-0.377	-1.79

B. Parameter estimates

α	δ	κ_w	ρ_y	σ_y	σ_π	θ	κ_b	μ_π
Low intangible intensity								
0.611	0.066	0.365	0.480	0.148	0.022	0.618	15.921	0.003
(0.002)	(0.001)	(0.023)	(0.019)	(0.000)	(0.000)	(0.057)	(3.013)	(0.000)
High intangible intensity								
0.677	0.070	0.479	0.516	0.161	0.025	0.419	23.403	0.012
(0.027)	(0.001)	(0.066)	(0.011)	(0.000)	(0.003)	(0.078)	(1.037)	(0.000)

Table 7: Non-GAAP reporting vs. value:
Counterfactual experiments

This table reports the results of our counterfactual experiments. The first column provides results from the baseline model. Column 2 reports results when the manager cannot disclose non-GAAP adjustments. Column 3 reports results when the manager can disclose non-GAAP earnings but cannot introduce opportunistic bias. The first row of this table reports the fraction of non-GAAP adjustments that are opportunistic, i.e., $\mathbb{E}[b/(b+|\nu_\pi|)]$. The second row of this table reports the average intangible investment to GAAP earnings before investment for each counterfactual, i.e., $\mathbb{E}[w/(\pi + w + \frac{\kappa_w}{2}\left(\frac{w}{q}\right)^2 q)]$. The last row reports the change in fundamental value relative to the baseline results. All amounts are in percentage points.

	Estimated	Fundamentals	GAAP only	No bias
A. Baseline estimation				
Biased adjustment (%)	30.197	0.000	0.000	0.000
Investment intensity (%)	60.389	46.178	20.753	56.789
Change in value (%)	0.000	1.226	-0.023	0.944
B. Estimation results using IBES data				
Biased adjustment (%)	30.179	0.000	0.000	0.000
Investment intensity (%)	60.442	45.821	20.825	56.759
Change in value (%)	0.000	1.221	-0.028	0.939
C. Low intangible intensity				
Biased adjustment (%)	40.542	0.000	0.000	0.000
Investment intensity (%)	54.316	25.263	32.211	47.154
Change in value (%)	0.000	2.306	2.181	1.999
D. High intangible intensity				
Biased adjustment (%)	33.599	0.000	0.000	0.000
Investment intensity (%)	68.651	50.898	19.698	62.140
Change in value (%)	0.000	1.770	0.855	1.332

Table 8: Low vs. high analyst following

The estimation is done with simulated minimum distance estimator, which chooses structural model parameters by matching the moments from a simulated panel of firms to the corresponding moments from the data for the sample of firms with low vs. high analyst following. Parameters are defined in Table 1. The standard errors are double-clustered by firm and year in both panels.

A. Moments

	Low analyst following			High analyst following		
	Data moments	Simulated moments	t-statistics	Data moments	Simulated moments	t-statistics
Mean intang. investment to capital	0.058	0.067	104.72	0.073	0.074	2.10
Mean earnings to capital	0.012	0.046	69.31	0.047	0.045	-1.80
Persistence of earnings	0.232	0.035	-6.45	0.270	0.043	-5.37
Variance of intang. investment growth	0.041	0.063	4.72	0.028	0.083	24.74
Covariance of investment and earnings growth	-0.014	-0.115	-52.70	-0.013	-0.047	-10.25
Covariance of investment and cash flow growth	-0.017	-0.014	0.61	-0.004	-0.004	0.01
Variance of earnings growth	1.201	1.199	-0.08	0.691	0.964	6.85
Covariance of earnings and cash flow growth	0.239	0.206	-1.03	0.153	0.156	0.18
Variance of cash flow growth	1.575	0.062	-30.95	0.996	0.073	-22.11
Incidence of positive non-GAAP adj.	0.356	0.646	22.91	0.542	0.646	3.76
Mean non-GAAP adj., given pos. non-GAAP adj.	0.030	0.030	-0.26	0.025	0.026	2.06
Variance of intang. investment growth, given pos. adj.	0.048	0.061	1.55	0.037	0.081	8.40
Cov. of investment and earnings growth, given pos. adj.	-0.032	-0.121	-8.96	-0.021	-0.047	-2.86
Cov. of investment and cash flow growth, given pos. adj.	-0.019	-0.016	0.39	0.000	-0.004	-0.91
Cov. of investment and non-GAAP adj. growth, given pos. adj.	0.033	0.085	4.86	0.037	0.039	0.17
Variance of earnings growth, given pos. adj.	1.342	1.307	-0.56	0.863	1.031	2.46
Cov. of earnings and cash flow growth, given pos. adj.	0.257	0.227	-0.56	0.178	0.171	-0.38
Cov. of earnings and non-GAAP adj. growth, given pos. adj.	-0.639	-0.834	-3.30	-0.460	-0.750	-5.26
Variance of cash flow growth, given pos. adj.	1.567	0.068	-26.32	0.933	0.075	-15.72
Cov. of cash flow and non-GAAP adj. growth, given pos. adj.	-0.069	-0.116	-1.19	-0.029	-0.072	-1.48
Variance of non-GAAP adj. growth, given pos. adj.	1.323	1.169	-3.53	1.098	1.206	1.73
Coefficient on non-GAAP earnings in the pricing eqn.	3.914	6.194	6.94	8.926	3.660	-8.45
Coefficient on earnings in the pricing eqn.	0.316	-0.687	-2.98	0.404	-0.269	-1.13

B. Parameter estimates

α	δ	κ_w	ρ_y	σ_y	σ_π	θ	κ_b	μ_π
Low analyst following								
0.638	0.067	0.402	0.492	0.129	0.022	0.472	26.608	0.011
(0.030)	(0.001)	(0.033)	(0.007)	(0.005)	(0.003)	(0.047)	(0.679)	(0.002)
High analyst following								
0.704	0.074	0.644	0.448	0.169	0.021	0.507	23.028	0.005
(0.025)	(0.001)	(0.067)	(0.008)	(0.000)	(0.001)	(0.066)	(0.112)	(0.001)

Table 9: Q1–Q3 vs. Q4 reporting

The estimation is done with simulated minimum distance estimator, which chooses structural model parameters by matching the moments from a simulated panel of firms to the corresponding moments from the data for the sample of firms with Q1–Q3 vs. Q4 reporting. Parameters are defined in Table 1. The standard errors are double-clustered by firm and year in both panels.

A. Moments

	Q1–Q3 reporting			Q4 reporting		
	Data moments	Simulated moments	t-statistics	Data moments	Simulated moments	t-statistics
Mean intang. investment to capital	0.064	0.067	4.91	0.070	0.074	4.54
Mean earnings to capital	0.030	0.049	35.90	0.029	0.047	4.17
Persistence of earnings	0.301	0.050	-9.35	0.209	0.051	-2.94
Variance of intang. investment growth	0.033	0.063	5.85	0.032	0.045	14.82
Covariance of investment and earnings growth	-0.008	-0.074	-17.36	-0.016	-0.041	-9.67
Covariance of investment and cash flow growth	-0.014	-0.006	2.04	-0.008	-0.000	1.77
Variance of earnings growth	0.889	0.914	1.89	1.085	0.891	-4.42
Covariance of earnings and cash flow growth	0.182	0.142	-2.56	0.212	0.130	-1.74
Variance of cash flow growth	1.383	0.046	-36.21	1.116	0.054	-16.82
Incidence of positive non-GAAP adj.	0.428	0.646	13.40	0.489	0.646	10.83
Mean non-GAAP adj., given pos. non-GAAP adj.	0.025	0.028	11.35	0.033	0.028	-1.61
Variance of intang. investment growth, given pos. adj.	0.039	0.062	3.29	0.035	0.044	3.18
Cov. of investment and earnings growth, given pos. adj.	-0.019	-0.080	-7.16	-0.024	-0.043	-3.26
Cov. of investment and cash flow growth, given pos. adj.	-0.009	-0.008	0.48	-0.006	-0.001	0.87
Cov. of investment and non-GAAP adj. growth, given pos. adj.	0.033	0.059	1.80	0.031	0.035	0.91
Variance of earnings growth, given pos. adj.	1.014	0.993	-0.84	1.173	0.954	-3.67
Cov. of earnings and cash flow growth, given pos. adj.	0.212	0.159	-2.30	0.212	0.145	-1.01
Cov. of earnings and non-GAAP adj. growth, given pos. adj.	-0.480	-0.703	-9.81	-0.689	-0.710	-0.32
Variance of cash flow growth, given pos. adj.	1.342	0.049	-31.84	1.023	0.056	-13.61
Cov. of cash flow and non-GAAP adj. growth, given pos. adj.	-0.046	-0.075	-1.41	-0.100	-0.064	1.04
Variance of non-GAAP adj. growth, given pos. adj.	1.190	1.166	-0.40	1.322	1.185	-1.59
Coefficient on non-GAAP earnings in the pricing eqn.	6.435	10.586	5.08	4.975	7.495	6.45
Coefficient on earnings in the pricing eqn.	0.391	-1.135	-1.86	0.324	-0.552	-2.96

B. Parameter estimates

α	δ	κ_w	ρ_y	σ_y	σ_π	θ	κ_b	μ_π
Q1–Q3 reporting								
0.637	0.067	0.329	0.488	0.128	0.021	0.416	29.331	0.011
(0.007)	(0.000)	(0.012)	(0.007)	(0.002)	(0.002)	(0.005)	(0.008)	(0.003)
Q4 reporting								
0.693	0.074	0.689	0.510	0.134	0.021	0.679	20.765	0.004
(0.001)	(0.000)	(0.009)	(0.001)	(0.006)	(0.001)	(0.001)	(0.007)	(0.001)

Table 10: Non-GAAP reporting vs. value:
Additional counterfactual experiments

This table reports the results of our counterfactual experiments. The first column provides results from the baseline model. Column 2 reports results when the manager cannot disclose non-GAAP adjustments. Column 3 reports results when the manager can disclose non-GAAP earnings but cannot introduce opportunistic bias. The first row of this table reports the fraction of non-GAAP adjustments that are opportunistic, i.e., $\mathbb{E}[b/(b+|\nu_\pi|)]$. The second row of this table reports the average intangible investment to GAAP earnings before investment for each counterfactual, i.e., $\mathbb{E}[w/(\pi + w + \frac{\kappa_w}{2}\left(\frac{w}{q}\right)^2 q)]$. The last row reports the change in fundamental value relative to the baseline results. All amounts are in percentage points.

	Estimated	Fundamentals	GAAP only	No bias
A. Low analyst following				
Biased adjustment (%)	33.281	0.000	0.000	0.000
Investment intensity (%)	62.681	39.281	19.657	55.290
Change in value (%)	0.000	0.798	0.073	0.486
B. High analyst following				
Biased adjustment (%)	38.187	0.000	0.000	0.000
Investment intensity (%)	63.756	53.913	38.348	59.119
Change in value (%)	0.000	3.948	3.120	3.405
C. Q1–Q3 reporting				
Biased adjustment (%)	31.724	0.000	0.000	0.000
Investment intensity (%)	60.187	47.198	20.678	56.824
Change in value (%)	0.000	1.217	0.001	0.926
D. Q4 reporting				
Biased adjustment (%)	45.393	0.000	0.000	0.000
Investment intensity (%)	62.804	25.097	38.529	53.624
Change in value (%)	0.000	4.610	4.393	4.040