The joint decision between investment, financing, and accounting discretion: Evidence from a structural model*

First draft: July 12, 2019

This draft: May 10, 2022

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Abstract

We model a manager making joint decisions over investment, financing, and accounting discretion. We match accruals in our model to performance-matched discretionary accruals to identify parameters related to short-termism. We find that the emphasis managers place on short-term earnings benchmarks are relatively high while the costs of earnings management are relatively low. We perform tests showing that existing proxies for abnormal accruals can be rationalized with aggregate meet or beat behavior but not earnings smoothing. Finally, we perform counterfactual tests that demonstrate the tradeoffs managers face when engaging in accounting discretion. Our paper answers the call in the literature for empirical models accounting for the tensions between accruals and investment and financing decisions.

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* The views expressed here are those of the authors and not necessarily the views of the Office of Financial Research or the U.S. Department of the Treasury and do not establish financial system risks or essential research. The authors are grateful for comments received from Pietro Bonaldi. The authors also thank seminar participants at Carnegie Mellon University and Claremont McKenna College. Batta (george.batta@claremontmckenna.edu) is at the Robert Day School of Economics and Finance, Claremont McKenna College; Ruchti (thomas.ruchti@ofr.treasury.gov) is at Carnegie Mellon University and the Office of Financial Research, Department of the Treasury. Any errors are our own.

1. Introduction

A key challenge in earnings management research is identifying a firm's true underlying economics, given that accounting numbers are a key source of information about those economics. Researchers have come to rely on models that define normal accruals according to regressions estimated at the industry-year level (Kothari, Leone, and Wasley 2005), or estimated within firm, controlling for industry-year-specific shocks (Stubben 2010). Recent work calls into question the benefits of defining normal vs. abnormal accruals (Ball 2016), but the quantitative relevance of such measures to outcomes of interest is tremendous (Dechow, Ge, and Schrand 2010; Leuz and Wysocki 2016). While a nascent literature argues in favor of the statistical power of accruals models (e.g., Nikolaev 2018; Breuer and Schutt 2021), Nezlobin, Sloan, and Zha Giedt (2021) show that simulated earnings produce estimates that are inconsistent with the purpose of such measures. Still, limited research has evaluated the quantitative implications of accruals models for their explicit economic content. In this paper, we evaluate a dynamic structural model of firms' investment, financing, and earnings management decisions that takes discretionary accruals as a data input. One advantage of structural modeling is that we can anchor our understanding of a firm's underlying economics to investment and financing decisions, whose measurement is typically less subject to accounting distortion than other financial statement line items.

We model a firm run by a manager. The firm has a profitable business technology, such as a factory or an online retail website. The manager makes joint decisions between investing in that technology, financing the operations of the firm, and applying accounting discretion to current period earnings.[1] The manager cares about the overall cash flows of the firm but is allowed to care about current period earnings and how the market reacts to the firm meeting or missing earnings benchmarks. The weight the manager places on short-term performance (see Nikolov and Whited 2014) could be due to earnings-based compensation (Terry 2018; Edmans, Fang, and Huang 2018; Marinovic and Varas 2019) or equity-based compensation in the presence of temporary deviations of equity prices from their long-run values.

If the manager uses accounting discretion to nudge earnings upward, this has the benefit of increasing current-period earnings (and, potentially, the manager's compensation) but has two shadow costs, in addition to any non-pecuniary earnings management costs (Zakolyukina 2018; Terry, Whited, and Zakolyukina 2022). The first shadow cost is that the market's benchmark for next period's earnings will be higher. The second is that accruals reverse, which artificially pushes earnings down in the period following upward earnings management. Both of these make it more difficult for a manager to meet subsequent earnings benchmarks. Conversely, the manager could use accounting discretion to suppress current-period earnings, which could make it easier to meet next period's benchmark, both because it is lower and because of the subsequent accruals reversal.

We find our parameters using simulated method of moments (McFadden 1989), wherein calculations from simulated data using our model are matched to best fit calculations from data from Compustat, CRSP, and I/B/E/S. We find that we are able to fit

[1] We add accounting discretion to the model of DeAngelo, DeAngelo, and Whited (2011). Their approach examines the dynamics of firms' leverage ratios, whereas we attempt to understand the role of investment and financing in the face of accounting manipulation.

averages and correlations from the data without economically meaningful deviations of simulated data from actual data (Eisenhauer, Heckman, and Mosso 2015). From this, we uncover key parameters of interest, such as the persistence and volatility of productivity shocks, and capital adjustment costs, which comport with those found in the literature (DeAngelo, DeAngelo, and Whited 2011). However, we find substantially lower capital productivity, higher debt limits, and a substantial weight placed on the quadratic cost of equity issuance, compared to work that does not consider accounting discretion.

We uncover two key findings. First, we find that the non-pecuniary costs of earnings management are insignificant when compared to long-term equity incentives—a one standard deviation increase in discretionary accruals amounts to a cost that is only 10% of the equity market incentives managers face. This makes sense when one considers the shadow costs of earnings management: reversals and increased capital market expectations for future earnings.

The second finding relates to rationalizing, or justifying, the extent of earnings management implied by discretionary accruals models. We fit our model using performance-matched discretionary accruals (Kothari, Leone, Wasley 2005), based on a modified Jones (1992) model.[2] The data implies that managers place a weight of 80% on current period earnings when compared to long-term value of the firm. This amounts to a 44%/56% breakdown between short-term and long-term incentives for the manager. This means that managers would need to place sizable weight on the short-term, something that

[2] We do this to feasibly solve our dynamic structural model, which would require additional dimensions in the state space to accommodate a more complicated accruals process.

may not be explicitly incentivized in the typical equity compensation package (Cadman and Sunder 2014; Li and Wang 2016).

Because we model accounting discretion only using discretionary accruals for our estimation purposes, that leaves additional moment tests to evaluate how well our model explains the data. In actual data, 57.2% of firms meet or beat the market's forecast for earnings, a number similar to that found in the literature (Burgstahler and Dichev 1998; Roychowdhury 2006; Zang 2012; Bird, Karolyi, and Ruchti 2019). Our simulated data is able to match this statistic closely, with 59.9% of firms meeting earnings benchmarks.

However, we are not able to match Biddle and Hilary (2006) calculations for smoothing. In particular, our simulated data produces a correlation of –0.12 between total accruals and changes in operating cash flows, whereas data from Compustat produces a correlation of –0.38. Past work has shown that firms smooth using accruals (Biddle, Hilary, and Verdi 2009), something our estimation can only partially rationalize. This is the second piece of evidence that discretionary accruals models may report accruals that are too high, given the tradeoffs managers face.

Using our structural approach, we can trace out patterns in investment, leverage, and discretionary accruals following large economic shocks. Unsurprisingly, we find firms experiencing negative shocks to profitability decrease their investment but increase their discretionary accruals, as one might expect. We also find the opposite pattern for firms experiencing positive shocks to profitability. Because our model is dynamic, we explore how long it takes for accruals to normalize following a negative or positive shock. While accruals are moderately positive following a negative shock, they normalize only after eight years. Accruals are twice as negative following an equally positive shock, but they normalize after three years. On average, negative accruals are pocketed for the future and positive accruals are spread out more over time.

Our structural method also allows us to perform comparative statics that could inform policy debates over penalties for misreporting and the short-termism incentives provided to management. Moreover, comparative statics allow us to demonstrate the dynamics between investment, financing, and accounting discretion. As one might expect, we find that increasing the non-pecuniary cost parameter for earnings management leads to decreased accounting discretion, just as does reducing the weight placed on current period earnings in manager incentives.

Perhaps more surprisingly, firms over-invest when managers place too much weight on short-term incentives. The opposite is true for the costs of earnings management. Empire building incentives are typically justified by compensation or career concerns that may be tied to remaining in control of the firm.[3] However, we find that managers take advantage of the fact that investors expect larger enterprises to be less profitable (potentially due to decreasing returns to scale). With lower expected profits, it is easier for managers to beat expectations using accounting discretion, so managers over-invest to manage expectations. This may be related to manager incentives to emphasize growth and opportunities in their disclosures.

Equity issuance is greatest when short-term incentives are the greatest, either through weight placed on current period earnings or through lower costs of earnings management. Managers use equity financing to over-invest in assets, which again allows

[3] There is also a literature exploring the role of manager ego in empire building (Ham, Seybert, and Wang 2018).

managers to more easily beat expectations using accounting discretion. Managers' equity distributions net of issuance is correspondingly lower. Correspondingly, managers adopt less leverage, net of cash, when short-term incentives are greater. When managers focus more on the long-term, they opt to avoid costly equity financing through greater employment of debt financing; when managers focus more on the short-term, they place less weight on these costs, and also are less inclined to efficiently distribute cash to shareholders, ultimately driving down net leverage.

Finally, firm operations are valued most highly when the non-pecuniary penalties for earnings management are high or when weight placed on current-period earnings are low. This is intuitive when one considers that investment could be suboptimally high when there is also greater earnings management, with net distributions to equityholders correspondingly lower. Because greater focus on current period earnings leads to greater investment, but lower operations valuation, the market capitalization of firms is actually highest for a moderate level of costs and a moderate level of short-termism incentives.

Our approach provides scope for a dynamic strategy containing both income-increasing and income-decreasing earnings management choices; this differs from Bird, Karolyi, and Ruchti (2019) who only allow for income-increasing earnings management. This dynamic strategy interplays with financing and investment in important ways. As in Terry, Whited, and Zakolyukina (2022) and Zakolyukina (2018), we incorporate non-pecuniary earnings management costs.[4]

[4] See also Choi (2021) for a treatment of the value of accruals and Beyer, Guttman, and Marinovic (2019) for an approach modeling noise in financial reporting. Other structural papers include estimation of the Dye (1985), Jung and Kwon (1988) model statically in Bertomeu, Ma, and Marinovic (2020) and dynamically in Bertomeu, Marinovic, Terry, and Varas (2022) and a Zhou (2021)'s work on investor learning-induced disclosure.

We make three main contributions to the accounting and finance literatures. First, we theoretically incorporate accounting manipulation into a quantitative model of firm investment and financing, which has been identified by the literature as key to understanding the real effects of reporting choices (Kanodia 2006; Beyer, Cohen, Lys, and Walther 2010).[5] Our approach considers dynamic firm optimization of debt and equity issuance, investment, and discretionary accruals, providing a framework for future analysis. Because firms endogenously choose all these quantities, the relationships we document can be considered and controlled for in other empirical studies of accounting manipulation. Our model can flexibly incorporate different investor expectations functions and therefore could be used to compare and contrast models of investor beliefs. Moreover, our approach highlights the quantitative importance of accounting to the literature on the investment-financing relationship (Hennessy and Whited 2005, 2007).

Second, our structural approach allows for the identification of parameters that may be difficult to identify using traditional regression techniques or even structural estimation of accruals quality (Nikolaev 2018). We answer the call from the literature on financial reporting and investment to better measure managerial myopia (Roychowdhury, Shroff, and Verdi 2019).[6] Because our modeling is dynamic in nature, our empirical results quantify the tradeoff between present decisions and future benefits and costs to identify a myopia parameter. This parameter could in principle be estimated for specific subsets of firm-years, allowing one to use our methodology to better understand patterns in myopia

[5] As Kanodia (2007) states, p.167, "how accountants measure and report firms' economic transactions, earnings and cash flows to capital markets has strong effects on firms' real decisions and on resource allocation in the economy."

[6] "Continuous improvements and refinements to the measurement of myopia are necessary and welcome," (Roychowdhury, Shroff, and Verdi 2019, p. 12).

in the cross section (Edmans 2009; Edmans, Fang, and Lewellen 2017; Kolasinski and Yang 2018) and over time (Brochet, Loumioti, and Serafeim 2015; Kraft, Vashishtha, and Venkatachalam 2018). Moreover, any updates we make to parameters typically estimated without discretionary accruals (DeAngelo, DeAngelo, and Whited 2011) informs practitioners and academics about the quantitative impact of financial reporting for firms in their financing and investment decisions.

We find that earnings management may be lower than what is quantitatively implied by discretionary accruals models. While this has been argued in the past (Bird, Karolyi, and Ruchti 2019), our dynamic model finds that management dynamically trades off the future consequences of managing earnings upward and downward. This is enough to place considerable constraints on management's actions, without external monitoring. Our approach therefore demonstrates both theoretically and empirically the importance of modeling dynamic considerations in earnings management and, specifically, accruals research.

Finally, we contribute several counterfactual experiments that are often impossible without a structural model. We find that reducing myopia by half leads to lower discretionary reporting that is 1.6 percentage points of assets lower, and increases investment efficiency by 0.6 percentage points of assets. Similarly, an increase in the costs of earnings management (due to enforcement or improved governance) results in debt increasing by 5 percentage points of assets, and investment lower by 0.2 percentage points of assets. While these outcomes by no means take into account all facets of the real economy, they could help inform policymakers and standard setters when developing policies and standards to improve stewardship. We leave further extensions and more probing policy analysis to future research.

2. Model

A firm's manager selects investment, financing, and accounting discretion to maximize her utility. She places some weight on positive accounting performance, and also receives an ownership share. As in Nikolov and Whited (2014) and Terry, Whited, and Zakolyukina (2022), we do not solve for the optimal contract between owners and managers.

2.1 *Gross and operating margin technology*

The firm's per period cost of services function is $g(k,z)$, in which k is capital, and z is a demand shock observed by managers each period before making investment, work performance, and financing decisions. One can view this shock as a set of firm orders for the firm's services or products, upon which it can earn a particular markup. We model this as a cost function with markup,[7] rather than as a profit function (DeAngelo, DeAngelo, and Whited 2011) to facilitate the representation of a normal accruals process. The firm should have normal accruals, and according to the Jones (1991), these are a function of revenues. The cost of services function $g(\cdot,\cdot)$, which we will refer to also as a *COGS shock* interchangeably, is continuous and concave in k, with $g(0,z)=0$, $g_z(k,z)>0$, $g_k(k,z)>0$, $g_{kk}(k,z)<0$, and $\lim_{k\to\infty} g_k(k,z) = 0$. We specify the functional form as

$$g(k,z) = zk^{\theta}$$

[7] This could alternatively be modeled by revenue with a profit margin.

The shock z takes values in the interval $[\underline{z}, \overline{z}]$, and follows a first-order Markov process with transition probability $f(z', z)$. We adopt an AR(1) process in logs parameterization:

$$\ln(z') = \rho \ln(z) + \zeta' \quad (1)$$

where z' is the next period productivity shock and ζ' has a truncated normal distribution with mean zero and variance σ^2.

Throughout, we assume that markups are a percentage ω of the $COGS\ shock\ zk^{\theta}$; the amount of revenue that can be generated from this is then equal to $zk^{\theta}(1 + \omega)$. We therefore define true revenue, COGS, and Gross profit,

$$Revenue \equiv g(k, z)(1 + \omega)$$

$$COGS \equiv g(k, z)$$

so,

$$Gross\ profit = g(k, z) * \omega$$

Investment is defined as $I' = k' - (1 - \delta)k$, where k' is next period capital and δ represents the depreciation rate on capital. The firm purchases and sells capital at a price of one, and faces convex capital adjustment costs equal to:

$$A(k', k) = \frac{a}{2}\left(\frac{k' - (1 - \delta)k}{k}\right)^2$$

There are also per-period fixed operating expenses of Λk, with $\Lambda > 0$.

2.2 *Nondiscretionary accruals*

We model non-discretionary accruals according to the Jones (1991) model for parsimony, where non-discretionary accruals are driven primarily by firm size and changes in revenue, although the method could flexibly use alternative accruals models. That is, given a COGS shock zk^{θ} and previous year's COGS shock $z^{-}k^{-\theta}$, and this year's capital k, nondiscretionary accruals divided by capital are given by

$$NA = \xi_1 * k + \xi_2 \Delta REV$$

or

$$NA = \xi_1 * k + \xi_2 \left[zk^{\theta} - z^{-1}k^{-1^{\theta}} \right] * (1 + \omega)$$

Note that we exclude the level of property, plant, and equipment from this equation, as we assume that depreciation expense is a constant percentage of capital levels. ξ and β both represent parameters estimated from Compustat data; details of this estimation are included in the Appendix.

We define actual *accrual-based* operating profit, before depreciation, taxes, capital adjustment costs, and accounting discretion as:

$$\pi_a(k, z) \equiv g(k, z) * \omega - \Lambda k,$$

cash flows differ slightly from *accrual-based* operating profit, which are adjusted for each period's nondiscretionary accruals. The firm's *cash-based* operating profit before depreciation, taxes, and capital adjustment costs is then:

$$\pi_c(k, k^{-}, z, z^{-}) = g(k, z) * \omega - NA - \Lambda k$$

or

$$\pi_c(k, k^{-}, z, z^{-}) = g(k, z) * \omega - \left[\xi_1 k + \xi_2 \big(g(k, z) - g(k^{-}, z^{-}) \big) * (1 + \omega) \right] - \Lambda k$$

which reduces to

$$\pi_c(k, k^{-}, z, z^{-}) = \big(\omega - \beta_1 (1 + \omega) \big) * g(k, z) + \big(\xi_2 (1 + \omega) \big) * g(k^{-}, z^{-}) - (\xi_1 + \Lambda) k$$

where the first additive term is cash flows from operations in the current period, the second term is cash flows resulting from previous period accruals, with an adjustment for intercept and a fixed cash charge of operations.

2.3 Discretionary accruals

Managers can also make operating margin-decreasing or -increasing accounting discretion decisions d, as a proportion of the markup on the cost of services, $dg(k, z)$. While these choices may not constitute restatements, and are therefore not inconsistent with GAAP reporting, they may depart from strict adherence to GAAP, in contrast to the normal accruals described above. Any amount by which operating profit is manipulated this period is immediately reversed in the following period, absent any manipulation in future periods to stave off the reversal. The manager is thus allowed to gradually reverse long-term accruals; for example, the manger could impair property and equipment excessively, to produce lower depreciation expense going forward. The manager could also defer impairments to a future period by offsetting the initial overstatement in subsequent periods. However, doing so requires "maintenance" manipulations going forward, which entail both non-pecuniary costs (described below) and retaining earnings expectations at elevated levels.

The firm's *reported accrual-based* operating profit before depreciation, taxes, and capital adjustment costs π_r is then:

$$\pi_r(k', k, d', d, z, z^-) = \pi_a(k, z) + d' E(z'|z)k'^{\theta} - dE(z|z^-)k^{\theta}$$

Of note, the decision regarding current period accounting report π_r is a function of next period's expected cost of sales, $E(z'|z)k'^{\theta}$ and is labeled d'. The reversal is naturally subtracted in the next term. We assume that the manager bears non-pecuniary earnings management costs, denoted by υ that are linear in the absolute value of the discretionary accruals $d'E(z'|z)k^{\theta}$, $|d'E(z'|z)k^{\theta}|$, with υ>0.[8]

2.4 *Incentives and Contracting*

We specify the manager's financial reporting utility as a function that is concave in reported profits π_r, relative to expectations $E(\pi_r)$:

$$st(k', k, d', d, z, z^-) = \iota_1 * k + \iota_2 * (\pi_r - \mathrm{E}(\pi_r)) + \iota_3 * \phi_b * (\pi_r - \mathrm{E}(\pi_r))$$

In this function, $\iota_1$represents a portion of utility tied to the size of the firm; ι_2 >0 the weight placed on negative earnings surprises; ϕ_b equal to 1 if the surprise is positive, and zero otherwise; and ι_3 <0 the incrementally negative weight placed on positive earnings surprises. Note that this may not necessarily correspond with any actual bonus percentage attached to the firm's earnings surprise; it is simply a weight placed on reported accrual-based profits, driven by actual bonuses and stock-based compensation as a percent of positive profit surprises; by managerial myopia; by limited liability; or by personal tax rates. This is a simpler way of modeling payouts to managers that are convex in accounting earnings, relative to Zakolyukina (2018) and Terry, Whited, and Zakolyukina (2022).

To measure expectations, we initially assume investors only observe π_r and k in forming expectations, and in doing so, assume that managers are not engaging in earnings management, unless earnings lie outside boundaries we specify below, which we call the

[8] In untabulated analysis, we examined specifications with a separate costs term that was quadratic in the absolute value of discretionary accruals and found that it was not well identified. We decided to exclude it from our model. We discuss the issue of the implicit and explicit tradeoffs involved in earnings management in Section 5.

believability bounds. That is, they assume π_r ==π_a. We assume also that they have correct beliefs about ω, θ, ρ , and σ. From π_r, then, they arrive at (potentially incorrect) beliefs about z, which we label z_w; their expectation of next-period earnings is thus $E(z'|z)k'^{\theta} * \omega - \Lambda k'$. For computational tractability, we also assume that any reported earnings that lie outside the range of $[\pi_a(k, \underline{z}), \pi_a(k, \overline{z})]$ are capped at $\pi_a(k, \overline{z})$ if above that value or floored at $\pi_a(k, \underline{z}), \pi_a$. Essentially, we assume investors take reported earnings at face value, and use it to infer the z shock. However, given believability bounds, and constraints on managerial misbehavior due to earnings management's effect on expectations; accrual reversals; and non-pecuniary earnings management costs, investors can be assured that earnings management typically remains within reasonable bounds, and that excessive earnings management will eventually be revealed when earnings fall well below expectations[9].

We also assume the manager enjoys a share of the firm's dividends η, to ensure some degree of incentive alignment, based on valuing the equity as if the market observed true cash flows π_c.

2.5 *Financing*

The manager also chooses a level of *net* debt p to finance its investments, up to an exogenously-specified positive net debt limit, $\overline{p}$, which may reflect creditor rationing of

[9] Graham, Harvey, and Rajgopal (2005) note, in executive interviews, that investor belief in earnings management prevalence is common: "The common belief is that a well-run and stable company should be able to 'produce the dollars'` necessary to hit the earnings target, even in a year that is otherwise somewhat down." In other words, because of the common belief that everyone plays the earnings game, missing earnings indicates that a company has no available slack to deliver earnings. Therefore, "the market might assume that not delivering earnings means that there are potentially serious problems at the firm (because the firm apparently is so near the edge that it can not produce the dollars to hit earnings, and hence must have already used up its cushion)."

funds due to adverse selection and asset substitution problems. We assume that creditors allow for a level of net debt that ensures the risk-free rate r is earned in all states of the world; in subsequent estimation, we evaluate whether simulated equity values fall below zero. An exogenously specified limit to net debt is also specified, as half of the positive net debt limit $\overline{p}$. A hard cash limit can result from corporate governance policies that demand disgorgement or productive use of cash beyond a certain limit.

Managers may also choose to finance via equity issuance. We assume, as in DeAngelo, DeAngelo, and Whited (2011) and Hennessey and Whited (2007) that equity incurs both linear and quadratic issuance costs. Define $e(k', k, k^{-}, p', p, z, z^{-})$ as net distributions to equityholders. If $e(\cdot) > 0$, dividends and repurchases exceed equity issuance. If $e(\cdot) < 0$, equity issuance exceeds dividends and repurchases. The external equity-cost function is linear-quadratic and weakly convex:

$$\phi\big(e(k', k, k^{-}, p', p, z, z^{-})\big) = \Phi_e * [\Upsilon_1 e(k', k, k^{-}, p', p, z, z^{-}) - \frac{1}{2}\Upsilon_2 e(k', k, k^{-}, p', p, z, z^{-})^2]$$

$$\Upsilon_i \geq 0, i = 1,2$$

The indicator function Φ_e equals one if $e(\cdot) < 0$, and zero otherwise. This means that net equity issuance and distributions amount to $e(\cdot) + \phi(e(\cdot))$.

2.6 *Utility function*

Since the manager receives an equity share, before we determine the manager's utility, we must define payments to equityholders, where τ_c is the corporate tax rate. We assume that corporate taxes will be levied on reported income. Net issuance must be equal to the firm's sources and uses of funds:

$e(\cdot) + \phi(e(\cdot)) =$

$$(1-\tau_c)\pi_c(k, k^-, z, z^-) + \; p' - \; p(1 + r(1-\tau_c)) - \; (k' - \; (1 - \; \delta)k) - \; A(k, k')$$

We assume managers have a utility function that is linear in dividends and positive reported earnings surprises. Later, we evaluate the model's robustness to using a constant absolute risk aversion framework. The weight placed on reported accounting profitability allows for some distortion of incentives towards earnings misreporting, while ownership share of dividends allows for some incentive alignment:

$$u(k', k, k^-, p', p, d', d, z, z^-)$$

$$= \alpha * st(\, k', k, d', d, z, z^-) - \nu * abs\left[d' E(z'|z) k^{\theta} * \omega\right] + \eta[e(k', k, k^-, p', p, z, z^-)$$

$$+ \phi(e(k', k, k^-, p', p, z, z^-)]$$

= Short-term earnings incentive + discretionary accruals cost + manager share of dividends

The Bellman equation for the manager's problem can then be expressed as:

$$U(k, k^-, p, d, d^-, z, z^-)$$

$$= \max_{k', p', d'} \left\{ \mathrm{u(k', k, k^-, p', p, d', d, z, z^-)} + \frac{1}{1+r} \int \mathrm{U(k', k, p', d', z', z) df(z', z)} \right\}$$

$$\text{s.t.} \qquad p \;\leq\; \overline{p} \qquad (1)$$

To match empirical equity value moments, we assume external equityholders use the following equation to value the firm's equity, based on managers' utility-maximizing decisions:

$$V(k, k^-, p, d, d^-, z, z^-)$$

$$= \underset{k', p', d'}{max^*} \left\{ e(\mathrm{k', k, k^-, p', p, d', d, z, z^-}) + \phi\big(e(\mathrm{k', k, k^-, p', p, d', d, z, z^-})\big) \right.$$

$$\left. + \frac{1}{(1+r)} \int \mathrm{V(k', k, p', d', z', z) df(z', z)} \right\}$$

2.7 Optimal policies without manipulation

To demonstrate optimal financing and investment decisions, we first modify the above framework to allow for managerial/shareholder incentive alignment, and to exclude outside-of-GAAP accounting discretion. In this case, modified dividends are equal to:

$$e_m(\cdot) + \phi(e_m(\cdot))$$
$$= (1-\tau_c)(\pi_c(k,k^-,z,z^-) - \Lambda\mathrm{k}) + p' - p(1+r(1-\tau_c)) - (k' - (1-\delta)k) - A(k,k')$$

The manager's no-manipulation utility function is then:

$$u_{nm}(k',k,k^-,p',p,z,z^-) = \eta[\cdot]$$

And her Bellman equation is:

$$U_{nm}(\mathrm{k},\mathrm{k}^-,\mathrm{p},\mathrm{z},\mathrm{z}^-)$$
$$= \max_{k',p'}\left\{u_m(\mathrm{k'},\mathrm{k},\mathrm{k}^-,\mathrm{p'},\mathrm{p},\mathrm{z},\mathrm{z}^-) + \frac{1}{1+r}\int U_{nm}(\mathrm{k'},\mathrm{k},\mathrm{p'},\mathrm{z'},\mathrm{z})\mathrm{df}(\mathrm{z'},\mathrm{z})\right\}$$
$$\text{s.t.} \quad \mathrm{p} \le \overline{\mathrm{p}} \qquad (1)$$

Importantly, the debt limit $\overline{p}$ must factor into this optimization problem. Assume the manager optimally chooses current cash flows and then debt to finance its physical investment. However, if the investment in physical assets exceeds current cash flows retained for investment, then there is a need to increase the firm's net debt. The model is essentially as in DeAngelo, DeAngelo, and Whited (2011), leaving a first order condition for debt of

$$1 + (\lambda_1 - \lambda_2 e(\cdot))\Phi_e = -\frac{1}{1+r}\int \mathrm{U}_3(\mathrm{k'},\mathrm{k},\mathrm{p'},\mathrm{d'},\mathrm{z'},\mathrm{z})\mathrm{df}(\mathrm{z'},\mathrm{z})$$

2.8 Optimal within- and outside-of-GAAP acceleration and deferral

In this section, we return to the full model, with weight placed on current period earnings and the ability to adjust the timing of revenue and profit recognition, in defiance of GAAP. From before,

$$u(k', k, k^-, p', p, d', d, d^-, z, z^-)$$
$$= \alpha \, \mathrm{st}(\cdot) + v_1 abs\left[d' E(z'|z) k^{\theta} * \omega\right] + \eta[e(k', k, k^-, p', p, z, z^-) + \phi(e(k', k, k^-, p', p, z, z^-)]$$

And the Bellman equation,

$$U(k, k^-, p, d, d^-, z, z^-)$$
$$= \max_{k', p',, d'} \left\{ \mathrm{u}(\mathrm{k}', \mathrm{k}, \mathrm{k}^-, \mathrm{p}', \mathrm{p}, \mathrm{d}', \mathrm{d}, \mathrm{z}, \mathrm{z}^-) + \frac{1}{1+r} \int \mathrm{U}(\mathrm{k}', \mathrm{k}, \mathrm{p}', \mathrm{d}', \mathrm{z}', \mathrm{z}) \mathrm{df}(\mathrm{z}', \mathrm{z}) \right\}$$

s.t. $p \leq \overline{p}$ (1), repeated

Utility for the manager now includes a portion of cash dividends paid to shareholders and myopic incentives based on the extent to which reported earnings exceed the market's expectation of earnings. We must therefore specify the shape of investors' expectation function. Investors are also aware of the parameters of the production technology, θ, as well as markups, ω, fixed costs, Λ, and the range of the levels of productivity shocks, $z \in [\underline{z}, \overline{z}]$, and the parameters of the associated shock process, ρ and σ^2. We assume that investors are aware of the levels of investment, k, and debt, p and can observe reported EBITDA. Investors are assumed to respond as if reported EBITDA is unmanaged, indicating that the market is unaware of earnings management or at least that it rewards earnings that are managed the same as earnings that are not (Bhojraj, Hribar, Picconi, and McInnis 2009; Bird, Karolyi, and Ruchti 2019).

To determine the benchmark for earnings, investors assume the past period's reported EBITDA came from the equation $z_i^- k^{-\theta} * \omega - \Lambda k^-$, investors then infer the level of the shock z_i^-. From z_i^-, investors form an expectation of the next period's shock, $E(z_i|z_i^-)$. This next-period shock enters the expectation of EBITDA to form $E(z_i|z_i^-)k^\theta * \omega - \Lambda k$. Reported profits are as stated in equation before,

$$\pi_r^-(k, k^-, d, d^-, z^-, z^{--}) = z_i^- k^{-\theta} * \omega - \Lambda k^- + dE(z|z^-)k^\theta - d^- E(z^-|z^{--})k^{-\theta}$$

where the market assumes that these reported profits are unmanaged EBITDA, meaning that investors update their beliefs of the shock z_i^-

$$E(z_i^-|\pi_r^-) = \frac{\pi_r^- + \Lambda k^- - dk^\theta + d^- k^{-\theta}}{k^{-\theta} * \omega}$$

Given a log-normal autoregressive z_i process, the market's belief of the next period shock is

$$E(z_i|\pi_r^-) = e^{\rho \ln\left(\frac{\pi_r^- + \Lambda k^- - dE(Z|Z^-)k^\theta + d^- E(Z^-|Z^{--})k^{-\theta}}{k^{-\theta} * \omega} + \frac{\sigma^2}{2}\right)}$$

which makes the expectation of profits π_r

$$\mathrm{E}(\pi_r|\pi_r^-) = e^{\rho \ln\left(\frac{\pi_r^- + \Lambda k^- - dE(Z|Z^-)k^\theta + d^- E(Z^-|Z^{--})k^{-\theta}}{k^{-\theta} * \omega} + \frac{\sigma^2}{2}\right)} k^\theta * \omega - \Lambda k$$

The difference between π_r and $\mathrm{E}(\pi_r)$ is then

$$\pi_r - E(\pi_r)$$

$$= \left[z_i - e^{\rho \ln\left(\frac{\pi_r^- + \Lambda k^- - de^{\rho \ln z^- + \frac{1}{2}\sigma^2} k^\theta + d^- e^{\rho \ln z^{--} + \frac{1}{2}\sigma^2} k^{-\theta}}{k^{-\theta} * \omega} + \frac{\sigma^2}{2}\right)} \right] k^\theta * \omega$$

$$+ d' E(z'|z)k'^\theta - dE(z|z^-)k^\theta$$

The manager's first order condition on d' is:

$$(\alpha\ (\iota_2\ + \phi_b \iota_3) - \nu \frac{abs(d')}{d'}) * E(z'|z)k'^{\theta} = -\frac{1}{1+r}\int \mathrm{U}_4(\mathrm{k}', \mathrm{k}, \mathrm{p}', \mathrm{d}', \mathrm{z}', \mathrm{z})\mathrm{df}(\mathrm{z}', \mathrm{z})$$

The manager benefits from boosting near-term earnings, but also must weigh the associated reputational and legal costs. The first term in the parentheses represents the marginal benefit to short-term earnings today (weighted by the myopia parameter α). The second term in parentheses represents the linear costs of higher discretionary accruals. Both of these are multiplied by the expected contribution margin. These higher short-term earnings and discretionary accruals costs are traded off with the future costs.

To see what these future costs are more precisely, we use the envelope condition, which can be written as:

$$-\mathrm{U}_4(\mathrm{k}, \mathrm{k}-, \mathrm{p}, \mathrm{d}, \mathrm{z}, \mathrm{z}\,-) = \left(e^{\rho \ln z^- + \frac{1}{2}\sigma^2} + E(z|z\,-)\right) * \alpha(\iota_2\ + \phi_b \iota_3) * k^{\theta}$$

$\phi_b$equals 1 if $\pi_r - E(\pi_r)$ is greater than zero, and equal to zero otherwise. The first term in parentheses describes the effect of increasing discretionary accruals on expectations of earnings: more persistent and more volatility shocks will serve to increase this cost. The second term is the effect of reversals on earnings. The higher are prior period discretionary accruals, the lower are reported profits. As a result, the manager may instead choose to avoid income-increasing accruals in the current period. In other words, the manager may find it advantageous to generate income-*decreasing* accruals in the current period, especially when earnings are naturally high, which both smooths expectations and pockets accruals that will reverse to raise reported earnings the next period. Reduced expectations and the boost due to reversal make it easier to beat expectations in the next period.

This demonstrates the analytical foundations of an argument for small to moderate accrual usage by managers to beat earnings benchmarks. Managers trade off present incentives with future opportunity. Discretionary accruals allow the manager to achieve short-term benchmarks, but have several drawbacks. The first is that there may be an administrative, legal, or reputational cost to using discretion in boosting reported earnings. For discretionary accruals to change investor expectations, there must be some uncertainty with respect to the reporting process (Fischer and Verrecchia 2000), as rational expectations means that any manipulation is unraveled by the market (Stein 1989). The second is therefore that increased discretionary accruals raises the market's expectations of earnings in the future, making it harder to hit future benchmarks. The third is that accruals must reverse, meaning that using discretion to hit a benchmark this year makes it that much more difficult to hit a benchmark in the next period, absent costly, offsetting accruals in future periods. These three costs create a self-limiting constraint on management to avoid using discretion in reporting earnings.

The relationship between these tradeoffs, the short-term benefit and the future costs, is a quantitative one. That is, it is up to the data to determine which of these forces prevail and in which circumstances. However, a clear tension lies between beating benchmarks with reported earnings and driving shareholder value through increased cash flows. A greater α, or weight placed on short-term benchmarks, means that the manager should be more willing to use discretion in reporting earnings. However, this tension, between reported earnings and cash flows, resides in every period, meaning that the manager faces the challenge of both meeting short-term benchmarks and increasing cash flows in the next year. A manager concerned with the future, whether it is her future tenure at the firm, career concerns, or performance-vesting equity find the increased expectations and reversals due to higher discretionary accruals sobering. In other words, short-term incentives will only lead to rampant use of benchmark-beating accruals only in a short-sighted manager.

3. Data and Estimation

3.1 Data

We derive data primarily from the intersection of the CRSP/Compustat Merged Fundamentals Annual and the I/B/E/S Summary History files. We remove all regulated firms (4000-4999), financial firms (SIC codes 6000-6999), and unclassified firms (SIC code greater than 9000) from the sample. We begin our sample in 2003, the first full year after the Sarbanes-Oxley Act of 2002 was signed into law, and end it in fiscal year 2016, the last full year before the 2017 Tax Cuts and Jobs Act was signed into law. Doing so helps better ensure parameter stability in the earnings management cost parameters and assumed tax rate. We exclude firm-years with total assets less than $10M in 1982 dollars and require at least two yearly observations for each firm. We also exclude firms with sales or asset growth greater than 200%, with missing asset information, with sales equal to or less than zero, and with Net Assets (defined below) less than zero. After these screens, if there is a break in a firm's time series, we select the longest continuous streak of years available, breaking ties randomly. The final panel contains 2,452 firms, with 13,987 total firm-years.

Table I contains the variable definitions. All variables listed are obtained from the CRSP/Compustat Merged database, except for the Moody's Baa corporate yield, which we obtain from FRED. All flow variables are scaled by beginning-of-period net assets, whereas ratios consisting exclusively of stock variables (leverage and Tobin's q) use end-of-period values. We include capitalized operating leases in the definition of assets for the firm. For consistency, we include this in the definition of firm indebtedness. We also include imputed investment in leased assets, calculated as the change in capitalized operating leases plus the estimated depreciation on leased assets using the Moody's Inc. method of allocating 2/3 of reported rent expense to depreciation (Moody's 2006). Finally, since net debt is a choice variable, we subtract liquidity cash from both total assets and book debt in investment and leverage calculations, respectively, using 50% of cash and short-term investments, given results in (Lins, Servaes, and Tufano 2010) on the typical portion of liquid assets reserved for liquidity versus operating purposes. All variables used in estimation are winsorized at the 1% level.

3.2. Estimation

3.2.1 Calibrated parameters

Most of the model parameters are estimated via simulated method of moments (SMM). However, some model parameters are either directly observed or estimated separately. We set the risk-free rate at 0.015, which is approximately the level of the three-month T-bill rate less the growth rate of the Consumer Price Index over the time period. We set the managerial ownership level at 0.048, from Xiong (2016), who examines a similar set of firms over a similar time period, and counts both ownership shares and unexercised options. This is similar in magnitude to ownership shares for public firms in Nikolov and Whited (2014); however, note that all other components of the manager's utility function are estimated parameters, so this only sets a benchmark value for comparing these components. We set the tax rate at 0.35, the maximum federal corporate tax rate over the time period. We set the depreciation rate at 0.098, equal to the mean of the ratio of depreciation and amortization expense (DP) plus two-thirds of rent (XRENT), divided by each fiscal year's average of the sum of PPEGT, INTAN, and capitalized operating leases, less GDWL.

To measure nondiscretionary accruals, we estimate the relationship between nondiscretionary accruals and changes in sales, using a two-stage process. First, we estimate performance-matched modified-Jones model discretionary accruals (Kothari, Leone, and Wasley 2005) at the two-digit SIC level for each fiscal year, requiring at least ten firms within each SIC code for estimation, winsorizing the data at the 1% level. Nondiscretionary accruals are then estimated as Operating Income less Discretionary Accruals, less the sum of operating cash flows (OANCF), cash tax payments (TXPD), cash interest payments (INTPN), and rent expense (XRENT), with all items scaled by beginning-of-period Net Assets.[10] We then estimate the sample-wide relationship between nondiscretionary accruals and the change in sales, using demeaned data at the firm-level to remove unobserved heterogeneity (but adding back the sample mean before the regression model is estimated). This results in an estimated intercept term of -0.016, corresponding to ξ_1 in the model, and coefficient estimate on the change in sales of 0.065, corresponding to ξ_2 in the model. Both of these are used directly within the model to derive operating cash flows from earnings before discretionary accruals, for inputting into modeled and simulated net equity issuance.

[10] We add back cash payments for tax and interest since the accrual income measure in the model is income before taxes, interest, and depreciation. We set TXPD to tax expense (TXT) when TXPD is missing, and INTPN with net interest expense (XINT-IDIT) when INTPN is unavailable (though only with XINT if the interest expense footnote in Compustat (XINT_FN) says that XINT is already net of interest income).

A final parameter estimated outside of the SMM procedure is the fixed cost parameter, which we estimated using a regression of reported operating income before unusual items [(OIBDP + XRENT)/Beginning-of-period Net Assets] on net asset turnover (SALE/beginning-of-period Net Assets). Since unusual items by definition contain transitory, rather than fixed components, we exclude them from the dependent variable in this regression. The estimated intercept term of 0.048 is multiplied by beginning-of-period capital in the model and simulations, to calculate per-period fixed costs.

3.2.1 Parameters estimated with SMM

Remaining parameters are estimated using SMM. The estimated parameters consist of θ, capital productivity; ρ and σ, the shock persistence and standard deviation; a, the quadratic capital adjustment costs; $\bar{p}$, the upper limit to debt, as a multiple of the steady-state capital stock; υ, the linear earnings management cost parameter; α, the positive earnings surprise myopia parameter; Υ_1 and Υ_2, the linear and quadratic costs of equity issuance; and ω, the markup parameter.

SMM consists of generating a simulated panel of data using the solution to the model. The simulations produce investment choice, k', net debt, p', discretionary accruals, d', a productivity shock, z, and the value function, V(), for each simulated firm year which we use to construct all simulated moments necessary for our estimation. SMM selects model parameters that produce simulated data as close as possible to actual data, based on the moments we calculate, weighting on covariances to better use variation in the model to uncover parameters. Further details of the SMM procedure can found in the Appendix.

3.3 Identification

To identify the capital productivity parameter, we use the mean of Investment and Operating Income. To identify the quadratic adjustment cost parameter, we use the variance and third central moment of Investment. The variance and autocorrelation of Operating Income help identify the shock standard deviation and autocorrelation. The mean and variance of Net Leverage help identify the upper limit to indebtedness. The variance of discretionary accruals and mean of the absolute value of Discretionary Accruals identify the linear costs of earnings management. The mean of Tobin's q identifies the myopia parameter, while the mean and variance of equity issuance (equal to Net Equity Issuance when it is greater than zero, and equal to zero when negative) identify the linear and quadratic costs of equity issuance. Finally, the mean of Operating Income helps identify the markup parameter.

4. Results

4.1 Moment Matching and Parameter Estimates

Our model follows the previous literature (DeAngelo, DeAngelo, and Whited 2011; Nikolov and Whited 2014) in using mean and variance of investment, mean and variance of net leverage, mean and variance of operating income (in addition to its persistence), as well as the mean of q and the mean and variance of equity issuance. These and other moments that we match are shown in Table 3, Panel A. While there are statistically significant differences in many of the moments we match, we appeal to the recent literature and argue that the economic magnitudes are nonetheless close. While mean of investment, the mean of net leverage (and its variance), the variance of operating income, and the mean of q are in fact quite close in our estimation, the variance of investment, the persistence of operating income, and moments of equity issuance see more meaningful departures.

Our estimation focuses on parameters related to accounting discretion, the emphasis on current-period earnings and the cost of earnings management, so we naturally choose moments that can support identification of these underlying primitives. Of these, we match the mean of the absolute value of discretionary accruals (measured using performance-matched discretionary accruals from the modified Jones (1991) model) as well as the variance of discretionary accruals. While we are able to match the mean of the absolute value of discretionary accruals in terms of economic magnitude, we have more trouble matching the variance. While moment matching is key to identifying the model, this could be related to the underlying tradeoffs driving accounting discretion and the empirical proxies of discretionary accruals used by the literature (Ball 2013; Breuer and Schütt 2021).[11]

In Panel B of Table 3, we explore our parameter estimates. Following DeAngelo, DeAngelo, and Whited (2011), we estimate capital productivity, the persistence of economic shocks, and shock volatility. We find smaller values for both capital productivity and shock persistence as in DeAngelo, DeAngelo, and Whited (2011), but this could be due to our differing samples or potentially the differences in our models. Our estimate of shock volatility is actually quite similar (0.288 vs. 0.284) to DeAngelo, DeAngelo, and Whited (2011). Also relatively similar is quadratic adjustment costs, although we see a departure in comparing debt limit as a proportion of steady-state capital, wherein we find a

[11] In untabulated analysis, we attempted to match the persistence of discretionary accruals and could not rationalize the data using our model.

significantly larger magnitude. While DeAngelo, DeAngelo, and Whited (2011) finds a larger linear component to equity issuance costs, our equity issuance costs are significantly more quadratic. This is in keeping with debt maintaining a greater focus when capital needs are greater.

We naturally estimate parameters relating to short-termism that are not estimated in previous models as well as a support parameter (markups) to accommodate the accruals structure inherent to accounting discretion. Of particular emphasis in our design is the weight placed on meeting short-term earnings expectations, α. As previously noted, this construction is similar to the weight placed on short-term earnings as in Nikolov and Whited (2014). We are interested in earnings management, specifically accounting discretion as applied to earnings benchmarks. We find that α is 0.036, or roughly 80% of the weight placed on long-term value of the firm (calibrated from ownership share in the data). This amounts to a 44%/56% breakdown between short-term and long-term incentives for the manager. Such a focus on short-term performance may be striking when one considers that long-term value naturally includes short-term performance in its sum of *all* future payoffs.

Our short-termism parameter is matched by a relatively small linear cost of earnings management. Overall, our findings indicate that short-term incentives are important for pushing the manager to engage in accounting discretion. Because our model is dynamic, the manager naturally trades off the future when making any choice. Accounting discretion has two shadow costs, in addition to the linear cost we estimate in our model. The first is that accounting discretion reverses as a matter of course in the accruals process. Any shifting of earnings to the present, whether by moving revenues forward, costs back, or both, results in lower earnings in the future. The value of the firm naturally involves limited discounting of the future, so any shift will have downside the manager will consider. The second shadow cost is that boosting earnings, if not unraveled by the market, should push expectations of the firm higher.[12] In other words, any benefit to pushing earnings upward is met with linear costs of earnings management, a reversal the next period, and a higher benchmark in the future. Naturally, managers may be less inclined to manage earnings if they are not highly motivated to do so. Our model demonstrates that rationalizing data on discretionary accruals requires managers place substantial weight on short-term earnings benchmarks.

4.2 Comparative Statics

Structural estimation allows for deep tests of theory, the ability to model equilibrium tensions between more than two variables simultaneously, as well as modeling counterfactual behavior. In Table 4 we explore what happens to firm behavior, particularly related to investment, financing, and accounting discretion, when we change the equilibrium parameters related to short-termism, in particular the linear cost of earnings management, ν, and the weight managers place on short-term earnings benchmarks, α. It is natural to think that market regulators or independent governance agencies could apply greater pressure to ensure greater accounting oversight, leading potentially to greater costs in accounting discretion. It is also natural to imagine firms changing the way they

[12] While this means expectations are less driven by such choices, it also means any discretion choices made by the manager are costly (due to impacts on effort or reputation) but would supply less impact on markets.

contract with managers, placing a different emphasis on long-term firm performance. We thus focus on these two parameters in our counterfactual analysis.

Our point estimate for the linear costs of earnings management, ν, is 0.006 and in Table 4, we explore what happens to key variables when we vary it between 0.000 and 0.050 in increments of 0.005. We find that k, the level of assets in the firm decreases in the costs of earnings management. This pattern is substantiated by decreased investment. However, we see that net leverage, or debt dependence, is increasing in the costs of earnings management. So short-term incentives lead managers to both invest more and also depend on net debt less; since leverage is net of liquidity cash, it suggests managers are less compelled to efficiently distribute cash to investors, and to avoid costly equity financing via efficient use of debt. Tobin's-q is higher with greater earnings management costs, indicating that any emphasis placed on the short term is value destroying. However, and due to the incentives to make the firm larger when managers have greater focus on the short term, enterprises have their greatest equity value for a middling level of earnings management costs. This indicates that in the presence of short-term incentives, firms could even have larger market capitalization, but their assets will be valued proportionally less as this incentive increases, to the point that these larger enterprises could be valued even less.

The absolute value of discretionary accruals naturally decreases with costs of earnings management, but reported EBITDA divided by total assets increases, indicating that these smaller, more efficient firms perform better when managers place less emphasis on the short term. Related to this, net income surprise divided by total assets decreases as earnings management decreases, but net income expectations actually rise, again pointing to a more efficient firm. Finally, equity issuance is greater when earnings management costs are lower, which is to be expected given debt dependence is lower, and the converse is true for equity distribution.

4.3 Dynamics of Investment, Financing, and Accounting Discretion

Firms experience heterogeneity in productivity over time. This heterogeneity should impact investment decisions and should in turn impact financing dynamically (Hennessy and Whited 2005). In turn, we add accounting discretion to this model and ask how discretionary accruals decisions interact with investment and ultimately leverage of the firm. Because of our structural equations and ability to simulate the model, we can explore this using impulse response functions, where investment, leverage, and discretionary accruals are plotted in the years following a productivity shock, either low or high. In this way, we can trace out the choices of firms to the economics generating profitability.

In Figure 1, we plot three variables, *Investment*, the incremental allocation of capital to the assets, *Leverage*, the ratio of debt to assets, and *Discretionary Accruals*, the proportion by which the manager chooses to shift forward or defer earnings. All three variables are standardized to have a mean of zero and a standard deviation of one for comparison purposes. These variables are plotted for the 20 years following, in Panel A, a shock to fundamentals (z) that is two standard deviations below the average productivity level, and following, in Panel B, a shock that is two standard deviations above the average productivity level.

Low productivity should be met with lower investment, on the margin, given that profitable opportunities are lower, which is exactly what we see in Panel A of Figure 1. In fact, investment does not return to normal levels, denoted by zero on the y-axis, until years 8-10, denoted on the x-axis. Discretionary accruals follow a similar but opposite pattern, only returning to normal levels in year 8. Leverage increases in the first two years, but then normalizes by year 12, indicating that firms in fact raise more debt following a negative shock to productivity. It appears that firms experiencing low productivity shocks invest less but also tend to bring earnings forward, on average, in the years following that shock.

An opposite pattern should arise for firms experiencing high productivity shocks, which we find in Panel B of Figure 1. However, reactions are more exaggerated, potentially due to the nature of the productivity shocks firms face. We see that investment is raised for 8 years following high productivity shocks but the pattern for discretionary accruals is different. While discretionary accruals are relatively low (pocketing high profits for the future) for two years, after three years, accruals levels have normalized. Leverage falls over a similar period, approximately four years, and then returns to normal after 12 years. Firms experiencing positive shocks both pocket greater accruals in the first few years following the shock and also pay down debt. These actions indicate that firms increase their ability to meet benchmarks in the future at the same time that they increase their financing flexibility.

Overall, our results indicate that accruals are used less liberally but over a greater period of time following a negative shock. Firms also increase their debt for two years before beginning to pay it down in year four. Following a positive shock to productivity, firms aggressively pocket accruals and pay down debt but then turn to renormalizing their use of accruals and debt. That accruals are used to prop up profitability in times of low productivity is not surprising. That the use of accruals is quite conservative following a negative shock to productivity corroborates our model intuition that it is quite costly to bring profits forward. Following a high productivity shock, large negative accruals occur but quickly normalize. Overall, our model finds consistent but small positive accruals and more immediate and larger negative accruals to pocket those accruals for the future.

4.4 Additional moment tests

Our estimation allows us to provide two moment comparisons that were not used to explicitly fit our model. The first relates to Biddle and Hilary (2006)'s measure of earnings smoothing, or the correlation between total accruals and operating cash flows. This is essentially the degree to which accruals offset operating cash flows. The second is net income surprise with respect to earnings benchmarks. Both of these should be relatively close if our empirical model reflects reality.

In Table 5 we report both statistics. In particular, I/B/E/S data indicate that firms meet or beat earnings expectations 57.2% of the time, something that occurs in our simulated data 59.9% of the time. While our simulated data can only mathematically model the function highly-motivated human analysts serve, the fact that we are able to roughly match this moment in the data without explicitly trying to match it helps to rationalize both our model and Jones (1991) accruals that we use to fit our structural parameters relating to short termism.

Also in Table 5 are our estimates of Biddle and Hilary (2006) smoothing. We find, over 10 simulated panels, a correlation of –0.1176, which is significantly smaller than that found in Compustat data, –0.3759. As a result, we cannot argue that the empirical smoothing that appears to occur in the data is met in our simulated model. If anything, our results demonstrate mixed findings regarding the economic content of traditional accruals models when jointly modeling investment, financing, and accounting discretion. Papers in the future could expand the scope of such models to include such elements as different earnings benchmark payoffs, alternative formulations of accounting discretion, or potentially the role of revenue recognition.

5. Conclusion

We model a manager making joint decisions over investment, financing, and accounting discretion. Using performance-matched discretionary accruals from the modified Jones (1991) model, we match accruals in our model to empirical proxies for earnings management to identify parameters related to short-termism. We find that the emphasis managers place on short-term earnings benchmarks are relatively high while the costs of earnings management are relatively low. We perform tests showing that existing proxies for abnormal accruals can be rationalized with aggregate meet or beat behavior but not earnings smoothing. Finally, we perform counterfactual tests that demonstrate the tradeoffs managers face when engaging in accounting discretion. Our paper answers the call in the literature for empirical models accounting for the tensions between accruals and investment and financing decisions. In this paper, we evaluate whether firms' accounting discretion practices are consistent with firms' optimized investment and financing choices.

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Appendix

A.1. Model Solution

We set a finite state space for *k*, *p*, *d*, and *z* to get to a numerical solution. For z and z-, we use a 5-point state space by transforming (1) into a discrete-state Markov chain on the interval [-4σ, 4σ], using the method of Tauchen (1986). For k, we use a 13-point state space. The highest level of *k*, $\bar{k}$, is set equal to the highest level of k for which any further investment is always unprofitable, given $\bar{z}$, the highest possible level of z. The state space of k is then set as [$\bar{k}(1-\delta)^{12}$, $\bar{k}(1-\delta)^{11}$…,$\bar{k}(1-\delta)^{2}$,$\bar{k}(1-\delta)$, $\bar{k}$]. We let *p* have 5 gridpoints, setting the highest level at the estimated parameter $\bar{p}$, and the lowest at -$\bar{p}/2$, representing a negative net debt position, as in DeAngelo et al (2011). All other points are equally space in between. Finally, we allow *d* to have 5 equally-spaced gridpoints between -0.30 and 0.30, representing the smallest and largest percentages of expected cost of sales.

For k-, we coarsen the state space to 5 gridpoints. We retain the highest, lowest, and middle levels of k as in the 13-point space. We set the second point to $\bar{k}(1-\delta)^{2}$, and the fourth point to $\bar{k}(1-\delta)^{9}$. For calculation of accrual reversals for next-period earnings expectation calculations, we translate the coarsened value of k to the nearest (in absolute value) level of the broader, 13-point state space.

We solve the model using value function iteration on the Bellman equation (), which produces a utility function U() for the manager, and policy function *p(k,p,d,z)*. Given the manager's utility-maximizing choices, we then solve for the equity value function V(). In the model simulations, we expand z to 15 gridpoints, using interpolation to find values of *k*, *p*, *d*, and *V*.

SMM Estimation

A.2. Panel data

The SMM algorithm requires us to deal with unobserved heterogeneity in the data and define the weight matrix $\overline{W}$. For nearly all moments, data are first demeaned at the firm level to deal with unobserved heterogeneity, with the overall data mean added back for mean moments. For the two autocorrelation moments, we use the raw data, but employ the Han and Phillips (2010) double-differencing method to calculate the persistence. The weight matrix we use is the inverse of the covariance matrix of the moments, which we calculate by covarying the influence functions of the data moments.

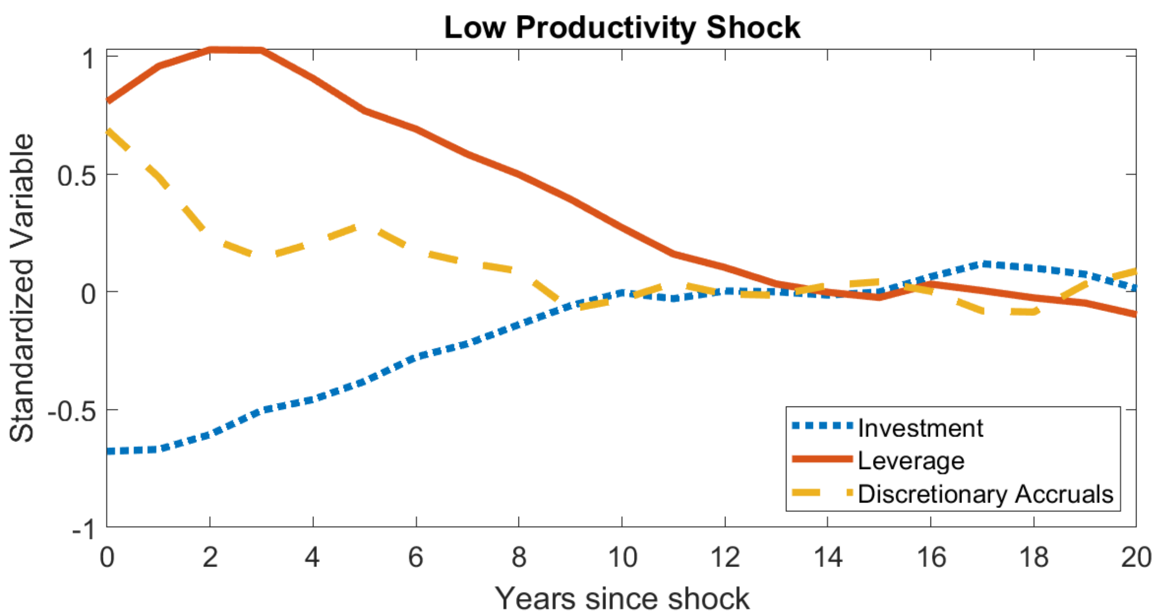
In calculating test statistics, we employ a clustered covariance matrix of the moment influence functions, as the above-described covariance matrix does not account for temporal dependence in the data. We estimate it using the actual moment vector, which means we do not account for fixed effects in estimating means, but do so for variances and autocorrelation coefficients.

Table A1. Assumed and Separately Estimated Parameters

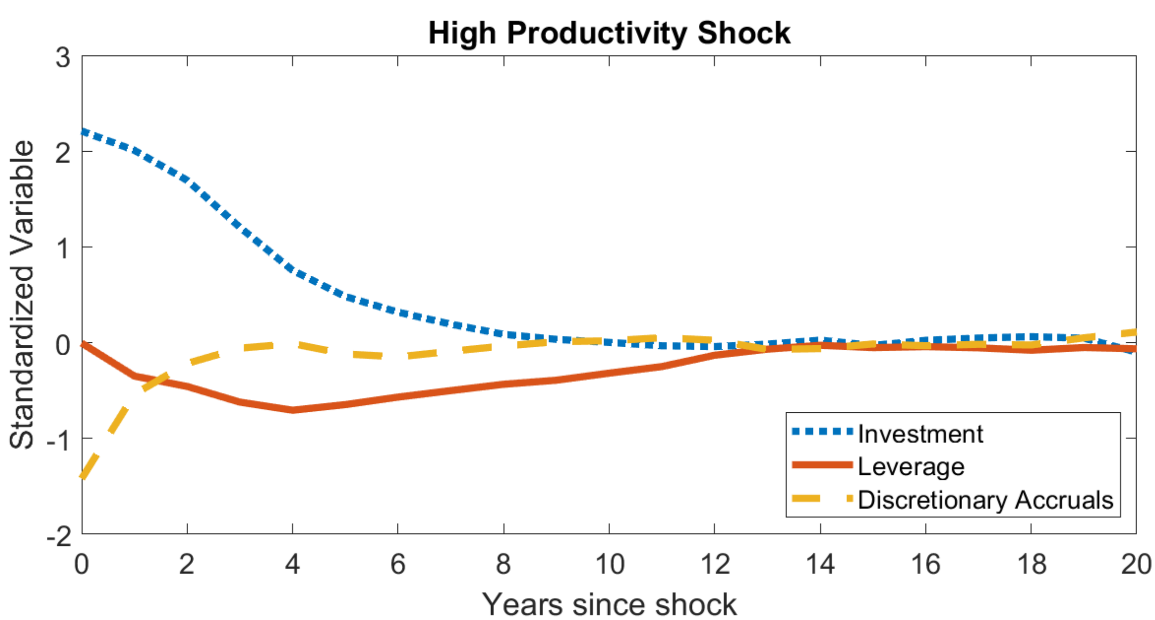
risk-free rate	r	0.015
managerial ownership share	η	0.048
depreciation rate	δ	0.100
fixed costs (as % of k)	λ	0.048
coefficient on capital in $st(\cdot)$ function	ι_0	0.004
slope on negative earnings surprise in $st(\cdot)$ function	ι_1	1.420
slope on positive earnings surprise in $st(\cdot)$ function	ι_2	1.140
Tax rate	τ	0.350
coefficient on capital in NA	ξ_1	-0.016
slope on Δ in NA	ξ_2	0.098

Figure 1: Dynamics of Investment, Leverage, and Discretionary Accruals

This figure depicts dynamics for investment, leverage, and discretionary accruals following shocks to productivity. Panel A depicts 20 years of investment, leverage, and discretionary accruals following a *low* productivity (z) shock, or a shock that is two standard deviations below average productivity. Panel B depicts 20 years of investment, leverage, and discretionary accruals following a *high* productivity (z) shock, or a shock that is two standard deviations above average productivity. *Investment* is depicted as a dotted line, *Leverage* is depicted as a solid line, and *Discretionary Accruals* is depicted as a dashed line.



Panel A.



Panel B.

Table I
Data Definitions

Variable	**Definition**
Net Assets	Total Assets (AT) plus Capitalized Operating Leases - 0.5 x Cash & Short-term Investments (CHE)
Capitalized Operating Leases	The present value of scheduled operating leases (MRC1-MRC5) plus the present value of the thereafter portion (MRCTA), with equal amounts assumed for 10 years in the thereafter. All payments are discounted at the Moody's seasoned Baa Corporate Bond Yield rate at each fiscal year-end.
Net Distributions to Equity	Dividends (DVC) and purchases of stock (PRSTKC) less cash share issuance (SSTK)
Equity Issuance	Equal to the negative of Net Distributions to Equity when Net Distributions to Equity is less than zero, and equal to zero otherwise.
Net Debt	Book debt (DLTT + DLC), plus Capitalized Operating Leases, less 0.5 x Cash and Short-term Investments (CHE)
Investment	(Net Capital Expenditures (CAPX - SPPE) plus change in Capitalized Operating Leases, plus imputed depreciation on operating leases (0.66 x rent expense (XRENT)/Beginning-of-period Net Assets
Leverage	Net Debt / Net Assets
Discretionary Accruals	Performance-matched modified-Jones-model discretionary accruals as a percentage of beginning-of-period Net Assets, estimated as in Kothari et al (2005). Models are estimated at the two-digit SIC level each fiscal year, with a minimum of 10 firms, and performance matching on ROA (IB/Beginning-of-Period Net Assets)
Operating Income	(EBITDA after unusual items (OIBDP + XRENT + SPI))/Beginning-of-period Net Assets
Q	(Equity Value (PRCC_F * CSHO), plus Net Debt)/Net Assets

Table 2: Summary Statistics

Table 2, Panel A, shows summary statistics from the sample, which contains data at the intersection of Compustat and I/B/E/S for non-financial and non-regulated industries for the 2001-2016 sample period. All variables are winsorized at the 1% level. Panel B shows statistics for the entire Compustat non-financial, non-regulated industry universe, for the 2001-2016 sample period.

Panel A: Sample, obs=13,987, nfirms=2,452

	Mean	**sd**	**p25**	**p50**	**p75**
Total book assets ($M)	7,354.8	16,209.8	527.8	1,724.9	5,680.0
Market cap ($M)	7,529.3	16,731.8	491.1	1,566.5	5,469.5
Net Income/Total book assets	0.017	0.151	0.003	0.043	0.079
Market-to-book-equity	2.852	4.581	1.293	2.117	3.455
Total accruals/Total book assets	(0.069)	0.101	(0.092)	(0.053)	(0.023)
Gross Debt/Total book assets	0.255	0.211	0.087	0.228	0.371

Panel B; Compustat, obs=54,043

Total book assets ($M)	4,116.7	12,557.9	99.2	441.5	2,074.9
Market cap ($M)	4,285.6	12,977.9	111.2	489.0	2,109.4
Net Income/Total book assets	(0.059)	0.283	(0.062)	0.028	0.072
Market-to-book-equity	3.034	5.158	1.222	2.103	3.711
Total accruals/Total book assets	(0.079)	0.138	(0.107)	(0.055)	(0.018)
Gross Debt/Total book assets	0.210	0.221	0.005	0.161	0.333

Table 3: Estimation results

Table 3, Panel A, shows statistics for the 2001-2016 period for nonfinancial, nonregulated firms at the intersection of Compustat and I/B/E/S. Simulated moments are derived from SMM, with t-statistics listed for differences between simulated and actual moments. All moments are based on definitions from Table 1. Operating income persistence is based on the double-differencing method of Han and Phillips (2010). Panel B shows results of parameter estimation.

Panel A	**Actual moments**	**Simulated moments**	**Difference**	**t-Stats**
Mean of investment	0.109	0.103	0.007	4.08
Variance of investment	0.010	0.007	0.003	13.97
Mean ABS(disc. accruals)	0.066	0.057	0.010	37.17
Mean of net leverage	0.230	0.228	0.002	1.07
Variance of net leverage	0.010	0.009	0.000	1.99
Mean operating income	0.129	0.142	(0.013)	(8.13)
Variance of operating income	0.007	0.008	(0.001)	(7.17)
Operating income persistence	0.492	0.312	0.180	15.70
Variance of disc. accruals	0.007	0.005	0.002	118.48
Mean of Q	1.615	1.622	(0.007)	(1.22)
Mean of equity issuance	0.019	0.006	0.013	15.84
Variance of equity issuance	0.003	0.000	0.003	22.26

Panel B		**Parameter estimate**	**t-Stat**
capital productivity	θ	0.532	77.959
shock persistence	ρ	0.643	68.261
shock volatility	σ	0.288	38.245
quadratic capital adjustment costs	a	0.172	2.681
debt limit as % of steady-state capital	$\overline{p}$	1.580	26.734
linear EM costs	ν	0.006	2.533
weight placed on meeting earnings expectations	α	0.036	10.713
linear equity issuance costs	γ_1	0.090	0.194
quadratic equity issuance costs	γ_2	0.113	0.054
markup over costs	θ	0.541	42.733

	Chi-sq
J-test of overidentifying restrictions	42.733

Table 4: Comparative Statics

Table 4 shows comparative statics, where means of the statistics listed are given for different levels of parameters, holding all other parameters equal. All flow variables are expressed as a percentage of beginning-of-period net assets. Panel A shows comparative statics where the exogenous cost of earnings management (ν) is varied. Panel B shows comparative statics where the weight placed on earnings surprises (α) is varied.

Panel A: Exogenous cost of earnings management (ν)

parameter value	k	Inves tment	Lever-age	Q	Equity Value	Abs(Net Disc. Acc. Accruals)	Reported EBITDA	Net Equity Dis-tributions	Equity issuance	Net Income Expec-tations	Net Income Surprise
(baseline) 0.006	10.778	0.102	0.229	1.621	14.950	0.056	0.141	0.034	0.006	0.005	0.021
–	11.584	0.106	0.148	1.435	14.690	0.060	0.135	0.031	0.007	0.000	0.022
0.005	10.910	0.103	0.215	1.609	15.105	0.057	0.140	0.034	0.006	0.004	0.021
0.010	10.576	0.101	0.261	1.731	15.518	0.050	0.143	0.035	0.005	0.007	0.019
0.015	10.383	0.099	0.288	1.795	15.679	0.043	0.145	0.036	0.004	0.010	0.018
0.020	10.191	0.098	0.340	1.846	15.442	0.042	0.147	0.037	0.004	0.011	0.018
0.025	10.234	0.098	0.341	1.848	15.481	0.039	0.146	0.037	0.004	0.016	0.013
0.030	10.058	0.098	0.355	1.859	15.188	0.029	0.148	0.038	0.003	0.021	0.008
0.035	10.062	0.098	0.357	1.865	15.190	0.014	0.148	0.038	0.003	0.027	0.002
0.040	10.035	0.098	0.357	1.875	15.260	0.011	0.148	0.039	0.003	0.028	0.002
0.045	10.035	0.098	0.357	1.875	15.260	0.011	0.148	0.039	0.003	0.028	0.002
0.050	10.035	0.098	0.357	1.875	15.260	0.007	0.148	0.038	0.003	0.028	0.001

Panel B: Weight on earnings surprise (α)

parameter value	k	Inves tment	Lever-age	Q	Equity Value	Abs(Net Disc. Acc. Accruals)	Reported EBITDA	Net Equity Dis-tributions	Equity issuance	Net Income Expec-tations	Net Income Surprise
(baseline)											
0.036	10.778	0.102	0.229	1.621	14.950	0.056	0.141	0.034	0.006	0.005	0.021
–	10.035	0.098	0.358	1.874	15.221		0.149	0.039	0.003	0.033	-0.003
0.005	10.035	0.098	0.357	1.875	15.260	0.011	0.148	0.039	0.003	0.028	0.002
0.010	10.037	0.097	0.354	1.852	15.180	0.041	0.147	0.038	0.003	0.014	0.015
0.015	10.048	0.097	0.354	1.852	15.209	0.041	0.147	0.038	0.003	0.012	0.018
0.020	10.064	0.097	0.353	1.847	15.185	0.041	0.147	0.038	0.003	0.011	0.018
0.025	10.282	0.099	0.338	1.829	15.433	0.050	0.145	0.036	0.005	0.009	0.019
0.030	10.558	0.101	0.269	1.759	15.724	0.054	0.143	0.035	0.005	0.007	0.020
0.035	10.802	0.103	0.221	1.631	15.146	0.057	0.141	0.034	0.006	0.005	0.021
0.040	11.461	0.105	0.139	1.428	14.574	0.057	0.136	0.032	0.007	0.001	0.021
0.045	11.708	0.106	0.126	1.255	13.023	0.056	0.134	0.030	0.008	0.000	0.022
0.050	12.183	0.109	0.096	1.008	10.954	0.055	0.131	0.028	0.007	-0.003	0.022

Table 5: Additional moment tests

Table 5 shows differences between actual and simulated moments that were not used to estimate model parameters. The Biddle and Hilary (2005) measure is the correlation of changes in total accruals to changes in operating cash flows (divided by beginning-of-period assets). The percentage of positive EPS surprises is the proportion of I/B/E/S Actual less mean consensus EPS estimates that are greater than zero.

	Actual	Simulated
Biddle and Hilary (2006) smoothing measure	(0.376)	(0.118)
Percentage of positive EPS surprises	0.572	0.599