Modeling Managers As EPS Maximizers[*]

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Abstract

How much leverage will a firm use? When will it repurchase shares? Will the firm pay equity for a new acquisition? When will it accumulate cash? Textbook corporate-finance theory assumes that firm managers answer these sorts of questions by choosing the policy which maximizes the net present value of discounted cash flows. But when you ask the people in charge of large public corporations, they tell you that they choose policies to maximize their earnings per share (EPS). Perhaps firm managers should not be EPS maximizers. No matter. We take them at their word when they tell us that this is what they are doing and show how EPS maximization provides a single unified explanation for a wide range of important decisions.

Keywords: Earnings Per Share, Corporate Policies, Earnings Yield, Value vs. Growth, Leverage, Equity Issuance, Share Repurchases, M&A Payment Method, Accretion, Dilution, Cash Holdings

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1 Introduction

Textbook corporate-finance theory assumes that firm managers aim to maximize the net present value of discounted cash flows. If a policy increases this net present value (NPV), they do it. If it does, they do not.

The trouble is that if managers are NPV maximizers, then many important corporate decisions are completely irrelevant in simple models. For example, Modigliani and Miller (1958) shows that, in a frictionless information-symmetric world, there is no best choice of capital structure. So, to explain patterns in firms' leverage choices, textbook theory tells researchers to go looking for realistic complications that nudge NPV-maximizing managers in the desired direction.

This "explanation by complication" approach has not been overwhelmingly successful (Myers, 2001; DeAngelo, 2022; Graham, 2022). "Extant research has explained only a portion of observed capital structure behavior. [. . .] Many individual fixes have recently been made. . . but it is still not clear what it all adds up to. (Graham and Leary, 2011)"

What's more, the complications in researchers' models rarely show up in managers' own testimonies (Graham, 2022). For example, when modeling firm capital structure, researchers focus on things like interest tax shields (Modigliani and Miller, 1963), agency costs (Jensen and Meckling, 1976), and signaling (Myers and Majluf, 1984). But when you ask a firm manager why she used more debt than equity, she is unlikely to mention any of these factors.

In this paper, we propose a different approach to doing corporate-finance theory. Rather than simply assuming that firm managers are NPV maximizers, we suggest listening to what firm managers say they are doing. When asked, the people in charge of large public corporations say they choose whichever policy increases their earnings per share (EPS) the most. They are EPS maximizers.

"Firms view earnings, especially EPS, as the key metric for an external audience, more so than cash flows. (Graham, Harvey, and Rajgopal, 2005)" EPS is what gets talked about on earnings calls (Matsumoto, Pronk, and Roelofsen, 2011). It is what gets forecasted by analysts (O'brien, 1988) and by managers (Houston, Lev, and Tucker, 2010). Moreover, managers get paid based on whether they hit their EPS forecasts (Bettis, Bizjak, Coles, and Kalpathy, 2010).

Perhaps firm managers should be pursuing some other objective. While EPS maximization is not always an error, there are clearly times when it leads to suboptimal outcomes. Researchers have been trying to convince managers to abandon EPS for decades (May, 1968; Pringle, 1973; Stern, 1974). Maybe one day they will succeed. But, right now, the overwhelming majority of firm managers are EPS maximizers. "Investors demand a simple metric of performance… [and] the market has selected EPS to fulfill this role. (Almeida, 2019)"

By studying the problem that real-world firm managers are trying to solve, we can give a single unified explanation for a wide range of corporate policies. EPS maximization accounts for (a) how much leverage firms use, (b) when they decide to repurchase shares, (c) whether firms pay equity for an M&A target, and (d) under what conditions firms accumulate cash.

Going forward, when researchers want to predict how a firm manager will actually behave (and not how she should behave), they should model this manager as an EPS maximizer (and not an NPV maximizer). This should be the starting point of the model. That is the central premise of our paper.

1.1 Paper Outline

First, in Section 2, we document how the managers of large public corporations describe themselves as EPS maximizers. This is a consistent finding across decades of survey research. We also document evidence of EPS maximization in corporate filings and shareholder communications. For example, "EPS dilution… is the most cited reason for companies reluctance to issue equity. (Graham and Harvey, 2002)" In the few instances where practitioners do appear to use NPV calculus, they "implement [it] in a way that almost turns it into a multiples exercise. (Mukhlynina and Nyborg, 2020)"

Firm managers are EPS maximizers. In Section 3, we give a first example showing how this starting point helps explain firm behavior. We analyze a manager who is in the process of acquiring a company. The manager will finance the purchase by issuing *#Shares* of equity and borrowing *LoanAmt* dollars at interest rate i. We want to predict how much leverage she will use when making this purchase, $\ell \overset{\text{def}}{=} \mathit{LoanAmt}/\mathit{PurchasePrice} \in [0, 1)$.

We specifically set up our model so that all Modigliani and Miller (1958) assumptions hold. Cash flows are fixed. Prices are correct. There are no market frictions, information asymmetries, or taxes. Hence, textbook theory says that there is no optimal choice of leverage in our model. Nevertheless, we prove that there is still a unique choice of leverage that maximizes

$$EPS(\ell) \overset{\text{def}}{=} \underbrace{\big(\,\mathrm{E}[NOI_1] - i(\ell) \cdot LoanAmt(\ell)\,\big)}_{\mathrm{E}[Earnings_1(\ell)]} \,/\, \#Shares(\ell) \tag{1}$$

Our model allows us to fully characterize the difference between NPV and EPS maximization. An EPS-maximizing manager i) fails to risk adjust her expected earnings, ii) disregards changes in long-term assets and liabilities, and iii) ignores the value of her default option. When EPS maximization leads to bad outcomes, some combination of these three factors is at fault.

But we want to emphasize that EPS maximization does not always lead to bad outcomes. For example, Modigliani and Miller (1958) applies in our baseline model, so every choice of leverage is equally good. EPS maximization is merely a selection criteria in this setting. It is also important to point out that there is no arbitrage in our model. Thus, EPS maximization requires neither managers nor markets to make mistakes. It does not fit neatly into the existing behavioral corporate-finance paradigm (Baker and Wurgler, 2013).

We show that an EPS-maximizing manager will pick her leverage by comparing her earnings yield, $EY(\ell) \overset{\text{def}}{=} \mathrm{E}[Earnings_1(\ell)] \,/\, ValueOfEquity(\ell)$, to an interest rate that has been adjusted by the elasticity $\delta(\ell) \overset{\text{def}}{=} \ell \cdot [i'(\ell)/i(\ell)]$

$$\begin{array}{ccccl} EY(\ell) & > & i(\ell) \cdot [1 + \delta(\ell)] & \Rightarrow & \text{increase leverage, equity is expensive} \\ \underset{\text{earnings yield}}{EY(\ell)} & < & \underset{\text{adjusted interest rate}}{i(\ell) \cdot [1 + \delta(\ell)]} & \Rightarrow & \underset{\text{(if possible)}}{\text{decrease leverage, equity is cheap}} \end{array} \tag{2}$$

If the manager's earnings yield is higher, she views equity as expensive and borrows more. If her adjusted interest rate is higher, she views debt as expensive and borrows less. The EPS-maximizing leverage level, $\ell_\star$, requires no further adjustment in either direction, $EY(\ell_\star) = i(\ell_\star) \cdot [1 + \delta(\ell_\star)]$.

This comparison suggests that an EPS-maximizing manager will think about her earnings yield as the cost of equity capital, which implies that value and growth firms should finance themselves in radically different ways. When running a growth firm with a high P/E ratio (low earnings yield), an EPS-maximizing manager should view equity as the cheapest financing option. By contrast, if she were running a value firm with a low P/E ratio (high earnings yield), the same manager should view equity as expensive and lean towards debt financing.

Moreover, this value-vs-growth distinction will not just matter for leverage. We study three more applications of the principle of EPS maximization in Section 4: When do managers repurchase shares? When do they pay equity for an M&A target? And under what conditions do firms accumulate cash? In every application, the principle of EPS maximization leads value and growth managers to adopt different policies. These predictions do not come from fine-tuning our model so that managers care about P/E. All we do is ask WW(EMM)D? What would an EPS-maximizing manager do?

Finally, in Section 5, we give empirical evidence supporting our prediction related to each application of the principle of EPS maximization. For identification, we exploit the fact that EPS-maximizing managers will make different choices for value and growth firms. We consistently find large qualitative differences between the corporate policies chosen by value and growth firms as defined by our theory. These differences are all in the direction implied by our theoretical analysis, and the effect sizes are economically massive.

1.2 Related Work

This paper borrows from and builds on much of the existing corporate finance literature. Our starting point is a large survey literature, which documents that firm managers describe themselves as EPS maximizers (Graham, 1947; Petty et al., 1975; Baker et al., 1981; Gitman and Maxwell, 1987; Block, 1999; Graham and Harvey, 2001; Bancel and Mittoo, 2004; Graham et al., 2005; Brounen et al., 2006; Baker et al., 2011; Dichev et al., 2013; Pinto et al., 2019; Mukhlynina and Nyborg, 2020). We are asking academic researchers to listen to what managers say in these surveys. This connects our paper to work that uses surveys to identify the problem agents are trying to solve rather than the beliefs agents hold about some important parameter value (Chinco, Hartzmark, and Sussman, 2022).

EPS is correlated with capital-structure decisions (Lintner, 1963; Ellis, 1965; Frank and Weygandt, 1970; Taub, 1975; Hovakimian et al., 2001; Ronen, 2008; Axelson et al., 2013; Huang et al., 2014; Malenko et al., 2023; Acharya and Plantin, 2019; Pennacchi and Santos, 2021). It is related to share repurchases in the data (Hertzel and Jain, 1991; D'Mello and Shroff, 2000; Grullon and Michaely, 2004; Hribar et al., 2006; Oded and Michel, 2008; Almeida et al., 2016; Asness et al., 2018). CEO compensation is often directly linked to EPS targets (Bens et al., 2003; Kim and Yang, 2010; De Angelis and Grinstein, 2015; Bennett et al., 2017). And EPS accretion/dilution is a predictor of M&A activity (Shleifer and Vishny, 2003; Garvey et al., 2013; Dasgupta et al., 2023). We show that, by treating EPS maximization as the core problem that firm managers are trying to solve, it is possible to give a single unified explanation for all these corporate policies.

Many important decisions are irrelevant to an NPV-maximizing manager in an idealized model (Modigliani and Miller, 1958). So, to explain corporate policies, the existing literature tells researchers to go looking for realistic complications (Tirole, 2010). Unfortunately, the resulting models have had little empirical success (Gebhardt et al., 2001; Lemmon et al., 2008; Frank and Goyal, 2009; DeAngelo, 2022; Gormsen and Huber, 2022; Hommel et al., 2023). Practitioner rules of thumb often do a better job of predicting corporate policies than theory-implied factors. These papers motivate our search for a new approach.

Finally, we note that there was a time before Modigliani and Miller (1958) reigned supreme. Academic researchers did not always think about managers as NPV maximizers. Instead, researchers used to assume that managers maximized earnings multiples (Berle and Means, 1933; Graham and Dodd, 1934; Solomon, 1963; Gordon, 1962). When we take the survey literature seriously and model managers as EPS maximizers, we are arguing for a return to this earlier paradigm. When trying to predict how a firm manager will actually behave (and not how she should behave), researchers should model her as an EPS maximizer (and not an NPV maximizer).

2 In Their Own Words

This paper is based on a simple observation. When you ask firm managers how they make decisions, they do not talk about trying to maximize the net present value (NPV) of discounted cash flows (DCFs). Instead, firm managers say that they make decisions with an eye towards maximizing EPS. This section documents the fact that firm managers describe themselves as EPS maximizers. That is what they say they are doing. The rest of the paper then shows that, by taking firm managers at their word, it is possible to give a single unified explanation for a wide range of corporate policies.

2.1 Survey Evidence

As far back as Lintner (1956), academic researchers have been using surveys to probe the motives behind managers' decisions. Collectively, this literature paints a clear picture: firm managers maximize EPS rather than the net present value (NPV) of discounted cash flows (DCFs). For CFOs of large public corporations, EPS is the single most critical performance metric (Graham, Harvey, and Rajgopal, 2005; Dichev, Graham, Harvey, and Rajgopal, 2013).

Table 1 summarizes how financial executives report making decisions. Different papers focus on different kinds of decisions that firm managers have to make. Panel (a) includes papers that ask about a managers' broad goals and objectives. Panel (b) includes papers that ask about how a manager chooses her capital structure. Panel (c) includes papers that ask managers about repurchasing and issuing shares. Panel (d) includes papers that ask managers about why they hold cash. And Panel (e) includes papers that ask managers about their thought process with regards to capital budgeting.

The first thing you notice about Table 1 is that there are many more check marks in column (2) than in column (1). Regardless of which corporate policy you study, when you ask the managers of large public corporations how they make decisions, they are more likely to talk about maximizing EPS than about maximizing NPV or DCFs. What's more, when participants do talk about using NPV logic or a DCF model, they often "implement [it] in a way that almost turns it into a multiples exercise. (Mukhlynina and Nyborg, 2020)"

Participants in study…	Are you making decisions based on… NPV/DCF? say “Yes” (1)	EPS? say “Yes” (2)	not asked (3)
(a) Broad objectives			
Graham et al. (2005)		✓	
Dichev et al. (2013)		✓	
(b) Capital structure			
Pinegar and Wilbricht (1989)		✓	
Graham and Harvey (2001)	✓		⊗
Bancel and Mittoo (2004)	✓		⊗
Brounen et al. (2006)	✓		⊗
(c) Repurchases/issuance			
Baker et al. (1981)		✓	
Tsetsekos et al. (1991)		✓	
Graham and Harvey (2001)		✓	
Brav et al. (2005)		✓	
Brounen et al. (2006)		✓	
(d) Cash holdings			
Lins et al. (2010)	✓		⊗
(e) Capital budgeting			
Schall et al. (1978)	✓	✓	
Gitman and Maxwell (1987)		✓	
Graham and Harvey (2001)	✓	✓	
Baker et al. (2011)	✓	✓	

Table 1. Column (1): managers reported using either NPV and/or DCF reasoning. Column (2): managers said they maximized EPS. Column (3): managers were not given opportunity to talk about EPS maximization. Panel (a): papers about managers' broad objectives. Panel (b): papers about how managers chose their capital structure. Panel (c): papers about share repurchases and issuance. Panel (d): papers about cash holdings. Panel (e): papers about capital budgeting.

Panel (a) shows that firm managers point to EPS maximization as their overarching objective. Panel (b) shows that, across multiple surveys, firm managers consistently say that they make debt-vs-equity decisions based on EPS. "Despite the efforts of academics to demonstrate that EPS dilution should be irrelevant to stock valuation…[this] was the most cited reason for companies' reluctance to issue equity. (Graham and Harvey, 2002)"

Panels (c) and (d) report similar findings for share buybacks/issuance and cash holdings. EPS is the main consideration when making all these decisions. For instance, Brav, Graham, Harvey, and Michaely (2005) specifically reports that "managers favor repurchases…to increase earnings per share." Finally, panel (e) shows that managers do capital budgeting with an eye on EPS. Managers are unwilling to take on projects that will reduce their EPS.

For the most part, whenever participants say they are maximizing NPV, these participants also report following the principle of EPS maximization. There are only a couple of surveys that offer no evidence that managers are EPS maximizers. And, in these cases, the lack of evidence is likely due to the fact that participants were given no opportunity to express this view (column 3).

We would have liked to include more papers in Table 1. However, our sample is limited by the poor design of many surveys. Many surveys ask questions that are unable to discriminate between EPS and NPV maximization. For example, firm managers often state "maximizing shareholder value" as their objective. But this objective is consistent with both EPS and NPV maximization. As Figure 1 shows, many managers use EPS as a measure of shareholder value.

Academic researchers have a strong bias against EPS maximization. This makes it all the more surprising that managers so consistently say: "I maximize EPS." There is a huge experimenter demand effect working in the opposite direction (Schwarz, 1999). Put yourself in the shoes of a CFO who graduated from business school 10 years ago. Your favorite professor has just called to interview you about how you make decisions. It would be rude to tell him that all his in-class NPV calculations are irrelevant in the real world. Yet, in spite of a strong motivation to reinterpret their choices through the lens of NPV maximization, firm managers consistently cop to being EPS maximizers.

		% that mention…	
	#	EPS	NPV or DCF
	(1)	(2)	(3)
2001–2022	1,694,415	21.2%	1.8%
2001–2005	358,385	18.9%	1.3%
2006–2010	463,869	20.9%	1.5%
2011–2015	377,502	22.2%	2.0%
2016–2020	349,907	22.8%	2.4%
2021–2022	144,752	21.0%	1.8%

Table 2. Summary of 8-K filings for all firms from January 1st 2001 through December 31st 2022. Data come from EDGAR. #: total number of 8-K filings. EPS: percent of 8-K filings that include either "earnings per" or "EPS". NPV or DCF: percent of 8-K filings that include at least one of the following terms: "NPV", "present discounted value", "DCF", "discounted value", "discounted cash flows", or "economic value added".

2.2 Corporate Announcements

Suppose a public company has a shareholder vote, its CEO leaves, or the firm takes out a large loan. In these sorts of situations, the Securities and Exchange Commission (SEC) requires the company to file a Current Report on Form 8-K within four business days. The information contained in this 8-K filing allows investors to revise previously filed quarterly reports on Form 10-Q and/or Annual Reports on Form 10-K.

Earlier research has shown that EPS is the standard metric that companies use when evaluating the economic impact of corporate events in 8-K filings (Amel-Zadeh and Meeks, 2019). We perform our own analysis and confirm this finding. Companies are 12× more likely to talk about EPS than either NPV or discounted cash flows (DCFs) combined.

Table 2 summarizes the content of 1,694,415 filings from 2001 to 2022. Column (1) reports the total number of 8-K filings in EDGAR during the sample period. Column (2) gives the percent of these filings that include either "earnings per" or "EPS". We do not require "share" because in some cases the earnings are reported differently, e.g., per a partnership unit. Adding a "share" requirement reduces the total fraction across the sample in column (1) to 18.9%. Column (3) gives the percent of all 8-K filings that include at least one of the following terms: "NPV", "present discounted value", "DCF", "discounted value", "discounted cash flows", or "economic value added" (an alternative to EPS promoted by Stern, Stewart, and Chew, 1995; Stern, Shiely, and Ross, 2002).

Not every corporate event involves a financing decision. For example, many 8-K filings report the outcome of a shareholder vote. This is why EPS only gets mentioned in 21.2% of all 8-K filings. However, whenever there is a corporate event that is related to financing decisions, the associated 8-K filing almost always mentions EPS. By contrast, terms related to NPV and/or DCFs are only included in around 1.8% of all 8-K filings. Moreover, when we examine these filings, these terms are rarely talked about as a central concern.

A January 9th 2023 8-K filing by Humana Inc is representative of the broader pattern (Humana Inc, 2023). Here is how the company thought about the effect of an increase in its expected membership growth:

> "The Company intends to reiterate its commitment to grow 2023 Adjusted earnings per common share ("Adjusted EPS") within its targeted long-term range of 11–15 percent from its expected 2022 Adjusted EPS of approximately $25.00. As communicated on the Company's third quarter 2022 earnings call on November 2, 2022, it expects the consensus estimate of approximately $27.90 to be in line with its initial Adjusted EPS guidance."

If there were ever a time for a firm to use NPV logic, Humana should be using it here. An increase in expected membership growth directly translates into one of the key parameters in the standard Gordon-growth DCF model. Yet the 8-K filing contains no discussion of future cash flows or how Humana planned on discounting them. There was also no discussion of risk adjustments. It is just EPS, EPS, and more EPS. That was all Humana felt the need to talk about in this official legally-binding form submitted to the SEC.

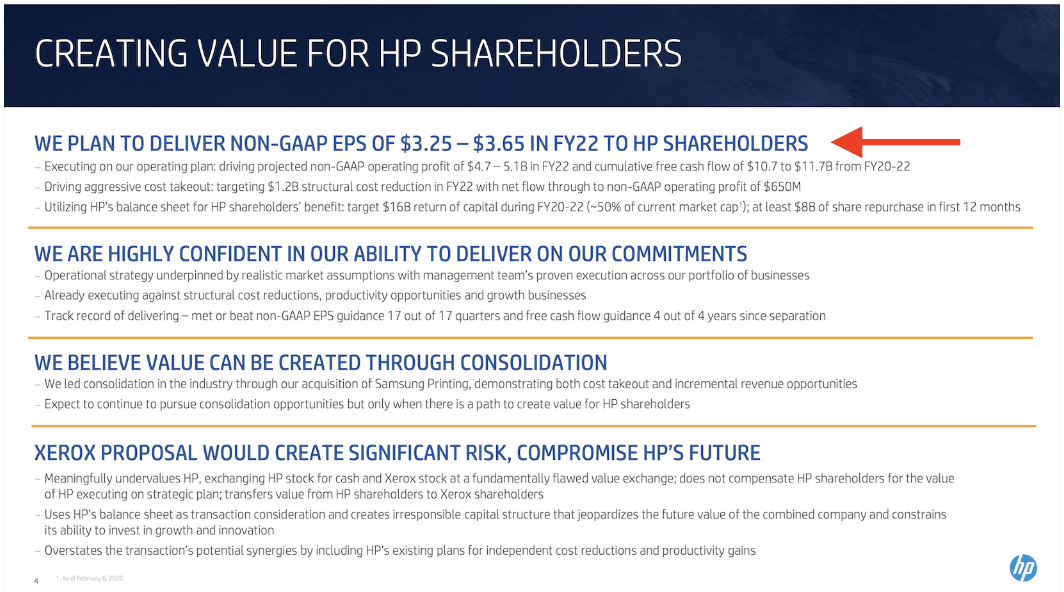
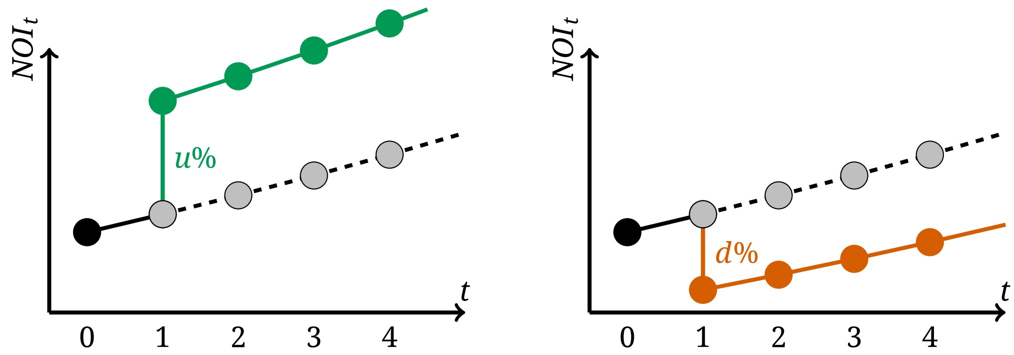


Figure 1. First slide from a February 2020 presentation made by HP's CEO to the company's shareholders in opposition to Xerox's proposed takeover. Full slide deck is available at `https://s2.q4cdn.com/602190090/files/doc_financials/2020/q1/Value-Creation-for-web-posting-(1).pdf`.

We find a similar pattern in other kinds of shareholder communications, too. For example, in early 2020, Xerox announced a plan to acquire Hewlett-Packard Co. HP's management team strongly opposed the takeover because Xerox's was trying to acquire HP at a P/E ratio of only 7. Like good EPS-maximizing managers, the people running HP were thinking about their earnings yield as a cost of equity capital. And, on that basis, Xerox was making a lowball offer for HP's earnings stream.

In February 2020, HP's CEO made a presentation to shareholders explaining why they should refuse Xerox's offer. Figure 1 shows the first slide from the CEO's presentation. It is titled "Creating Value for HP Shareholders," and the first bullet point on this first slide is "We plan to deliver non-GAAP EPS of $3.25-$3.65 in FY22 to HP shareholders." While HP's CEO talked a lot about the company's future operating profits, he never once mentioned the present discounted value of these cash flows. It was just EPS, EPS, and more EPS. That was all HP's CEO felt the need to talk about when addressing shareholders.



(a) Up state　　**(b)** Down state

Figure 2. Left panel: Realized cash flows if up state is realized in year $t = 1$. Right panel: Realized cash flows if down state is realized. **(Black dots)** Initial value of NOI_0 in year $t = 0$; same in both panels. **(Gray dots)** $\mathrm{E}[NOI_t]$ in years $t = 1, 2, 3, 4$; same in both panels. **(Green dots)** Realized NOI_t in years $t = 1, 2, 3, 4$ following positive shock, $NOI_1 = (1 + \boldsymbol{u}) \cdot \mathrm{E}[NOI_1]$. **(Red dots)** Realized NOI_t in years $t = 1, 2, 3, 4$ following negative shock, $NOI_1 = (1 - \boldsymbol{d}) \cdot \mathrm{E}[NOI_1]$.

3 Capital Structure

This section looks at a first application of how EPS maximization can explain corporate decisions. We study a firm manager who is buying a company today in year $t = 0$. In year $t = 1$, she will collect its cash flows and then sell its assets. Our goal is to predict how much leverage she will use.

The textbook approach assumes that the firm manager cares about the net present discounted value of future equity payouts. In our benchmark setup, this renders the manager's leverage choice irrelevant (Modigliani and Miller, 1958). So, to explain why she might prefer one leverage over another, researchers would have to introduce some market friction or information asymmetry.

By contrast, we propose that the manager chooses her leverage level to maximize her EPS. We characterize how these two objectives differ and show that a unique EPS-maximizing leverage exists even in our frictionless information-symmetric benchmark. Because an EPS-maximizing manager will think about her earnings yield as the cost of equity capital, our approach also predicts that value and growth firms will finance themselves in different ways.

3.1 Economic Framework

We study an infinitely lived firm with net operating income NOI_t in year $t = 1, 2, 3, \ldots$ As shown in Figure 2, cash flows are uncertain at time $t = 1$

$$NOI_1 = \begin{cases} (1+u) \cdot \mathrm{E}[NOI_1] & \text{in the up state} \\ (1-d) \cdot \mathrm{E}[NOI_1] & \text{in the down state} \end{cases} \tag{3}$$

$u > 0\%$ and $d \in (0\%, 100\%)$ are proportional shocks to expected cash flows. p_u is the probability that the up state is realized in year $t = 1$, and $p_d = 1 - p_u$ is the probability of the down state being realized in year $t = 1$.

From year $t = 2$ onward, the firm's cash flows grow $g > 0\%$ per year

$$NOI_t = (1+g) \cdot NOI_{t-1} \qquad \text{for } t = 2, 3, 4, \ldots \tag{4}$$

The average growth rate in year $t = 1$ is equal to the deterministic growth rate g. This imposes a constraint that $p_u \cdot (1+u) = 1 - p_d \cdot (1-d)$.

Let $r > g$ denote the rate at which the market discounts the firm's cash flows. Together, the discount rate and the growth rate determine the value of the firm's assets

$$ValueOfAssets_t = \frac{\mathrm{E}_t[NOI_{t+1}]}{r-g} \tag{5}$$

The firm manager must pay $PurchasePrice \stackrel{\text{def}}{=} ValueOfAssets_0$ for the firm in year $t = 0$. She sells the firm's assets for $SalePrice \stackrel{\text{def}}{=} ValueOfAssets_1$ in year $t = 1$. The total value of owning the firm in year $t = 1$ is $ValueOfFirm_1 \stackrel{\text{def}}{=} NOI_1 + ValueOfAssets_1$.

Let q_u denote the price in year $t = 0$ of an asset pays out \$1 in year $t = 1$ iff the up state is realized; similarly, let q_d denote the current price of an asset that pays out \$1 iff the down state is realized. These state prices are given by

$$q_u = \frac{PurchasePrice - \left(\frac{ValueOfFirm_d}{1+r_f}\right)}{ValueOfFirm_u - ValueOfFirm_d} \qquad q_d = \frac{\left(\frac{ValueOfFirm_u}{1+r_f}\right) - PurchasePrice}{ValueOfFirm_u - ValueOfFirm_d} \tag{6}$$

$r_f > 0\%$ is the riskfree rate, which satisfies the condition $\frac{\$1}{1+r_f} = q_u + q_d$.

3.2 NPV Maximization

Here is the textbook approach to analyzing the manager's leverage decision. This approach assumes that the manager is an NPV maximizer—i.e., that she maximizes the present discounted value of future equity payouts net of costs.

Let $\ell \in [0,1)$ denote the fraction of the company's purchase price that the manager finances using debt

$$\mathit{LoanAmt} \overset{\text{def}}{=} \ell \cdot \mathit{PurchasePrice} \tag{7}$$

In return for giving the manager *LoanAmt* dollars today, the lender will receive debt payments in year $t = 1$ that are worth

$$\begin{aligned} \mathit{ValueOfDebt} = q_u \cdot \{(1+i) \cdot \mathit{LoanAmt}\} \\ + q_d \cdot \min\{(1+i) \cdot \mathit{LoanAmt}, \mathit{ValueOfFirm}_d\} \end{aligned} \tag{8}$$

If the up state is realized in year $t = 1$, the firm manager will repay her entire loan amount plus interest. However, if the down state is realized, she will default whenever promised debt repayment exceeds firm value.

Let $i(\ell) \geq r_f$ denote the fair interest rate on the firm manager's loan. When using sufficiently low leverage, $0 \leq \ell \leq \ell_{\max r_f}$, the firm manager will repay her debt in the down state, allowing her to borrow riskfree

$$\ell \leq \ell_{\max r_f} \overset{\text{def}}{=} \frac{1}{1+r_f} \cdot \left(\frac{\mathit{ValueOfFirm}_d}{\mathit{PurchasePrice}} \right) \qquad \Rightarrow \qquad i(\ell) = r_f \tag{9}$$

However, if the firm manager borrows enough money, $\ell > \ell_{\max r_f}$, then her lender must demand $i(\ell) > r_f$ to break even

$$\ell > \ell_{\max r_f} \quad \Rightarrow \quad i(\ell) = \frac{(\$1 - q_u) \cdot \mathit{LoanAmt}(\ell) - q_d \cdot \mathit{ValueOfFirm}_d}{q_u \cdot \mathit{LoanAmt}(\ell)} \tag{10}$$

The firm manager borrows *LoanAmt* of the total purchase price of the company from her lender. She raises the rest of the purchase price

$$\mathit{PriceOfEquity} \overset{\text{def}}{=} \mathit{PurchasePrice} - \mathit{LoanAmt} \tag{11}$$

by selling shares of equity in year $t = 0$. Anyone who buys a share is entitled to the remaining firm value left over after repaying any debt obligations in year $t = 1$. Today in year $t = 0$, these future equity payouts are worth

$$\begin{aligned} \mathit{ValueOfEquity} = q_u \cdot \{\mathit{ValueOfFirm}_u - (1+i) \cdot \mathit{LoanAmt}\} \\ + q_d \cdot \max\{\mathit{ValueOfFirm}_d - (1+i) \cdot \mathit{LoanAmt}, \$0\} \end{aligned} \tag{12}$$

For there to be a preferred leverage level under the textbook approach, there would need to be some value that maximizes the ratio of the present discounted value of future equity payouts, *ValueOfEquity*, to the upfront cost of purchasing the rights to receive them, *PriceOfEquity*. But Modigliani and Miller (1958) tells us no maximum exists. There is no optimal leverage for an NPV-maximizing manager in our model. Her leverage decision is ill-posed. Any choice of leverage is just as good as any other.

Proposition 3.2 (Modigliani and Miller, 1958)**.** *Assume that a) cash flows are fixed; b) prices are correct; and c) there are no frictions, information asymmetries, and taxes. In this idealized benchmark, the present discounted value of future equity payouts is equal to the upfront price of purchasing these claims*

$$\frac{\mathit{ValueOfEquity}(\ell)}{\mathit{PriceOfEquity}(\ell)} = 1 \qquad \text{for every } \ell \in [0, 1) \tag{13}$$

To make the problem well-posed, you would need to introduce two additional ingredients. The first should encourage the firm manager to take on more leverage while the second should ensure she does not take on too much. For example, tradeoff theory (Taggart, 1977) argues that managers lever up to exploit the interest tax shield but do not use infinite leverage due to bankruptcy costs.

In a sense, NPV maximization leads to a similar workflow as the limits-to-arbitrage paradigm in behavioral finance (Shleifer and Vishny, 1997). Both require researchers to explain by introducing pairs of ad hoc features. The first feature causes agents to deviate from an idealized benchmark. The second ensures that the deviation is not infinitely large.

3.3 EPS Maximization

Textbook theory assumes that firm managers are NPV maximizers. Under this approach, there is no optimal leverage in our frictionless information-symmetric benchmark model. So textbook theory asks researchers to explain patterns in firm capital structure by pointing to specific deviations from this idealized benchmark.

Researchers have been following this script for 60+ years now with limited success. It could be that they have not yet found the right deviations from the benchmark model. However, this paper argues for a different solution. When you talk to them, it is clear that real-world firm managers are not NPV maximizers. They have an entirely different objective in mind. They aim to maximize their EPS as defined in Equation (1).

This subsection characterizes the difference between these two objectives and proves that there is a unique EPS-maximizing leverage level even in a frictionless information-symmetric model. It also describes an additional prediction that follows from the EPS-maximization paradigm: value and growth firms should finance themselves in radically different ways.

How NPV Differs From EPS. While textbook theory assumes that firm managers are NPV maximizers, firm managers say that they are maximizing EPS. We start by characterizing how these two objectives differ by comparing $\mathit{ValueOfEquity}/\mathit{PriceOfEquity}$, the ratio that an NPV-maximizing manager cares about in Proposition 3.2, to $\mathit{EPS} = \mathrm{E}[\mathit{Earnings}_1]/\#\mathit{Shares}$, the ratio that an EPS-maximizing manager cares about.

Notice that the amount of money the firm manager raises via equity markets will always be proportional to the number of shares she sells

$$\mathit{PriceOfEquity} = \mathit{PricePerShare} \cdot \#\mathit{Shares} \tag{14}$$

where the constant of proportionality is the *PricePerShare*. So, without loss of generality, we choose $\mathit{PricePerShare} = \$1$. Any other price will generate the same economics and require us to carry around a meaningless constant.

Ignoring dimensions, this implies $\mathit{PriceOfEquity} = \#\mathit{Shares}$. So, when thinking about the difference between NPV maximization and EPS maximization, we can focus on the difference $\mathit{ValueOfEquity} - \mathrm{E}[\mathit{Earnings}_1]$. After defining two new terms, we will be able to characterize the three ways that this difference can arise.

First, if the firm manager takes out a large enough loan, she will default in year $t = 1$ in the down state whenever the required debt payment is larger than the value of the firm, $(1 + i) \cdot \mathit{LoanAmt} > \mathit{ValueOfFirm}_d$. We define $\mathit{DefaultSavings}_1$ as the money the firm manager saves by defaulting. Since the manager only defaults in bad times, we have $\mathit{DefaultSavings}_u \stackrel{\text{def}}{=} \$0$ and

$$\mathit{DefaultSavings}_d \stackrel{\text{def}}{=} \max\{(1 + i) \cdot \mathit{LoanAmt} - \mathit{ValueOfFirm}_d, \$0\} \tag{15}$$

Second, let $X_1 = (X_u, X_d)$ denote any arbitrary random variable with realizations in both the up and the down state in year $t = 1$. We will use

$$\tilde{\mathrm{E}}[X_1] \stackrel{\text{def}}{=} q_u \cdot X_u + q_d \cdot X_d \tag{16}$$

denote the risk-neutral expectation of this variable. By contrast, $\mathrm{E}[X_1] = p_u \cdot X_u + p_d \cdot X_d$ represents the variable's expectation under the physical measure.

Proposition 3.3a (How NPV Differs From EPS)**.** *The difference between the present discounted value of future equity payouts and expected earnings is*

$$\begin{aligned} \mathit{ValueOfEquity} - \mathrm{E}[\mathit{Earnings}_1] = (\tilde{\mathrm{E}} - \mathrm{E})[\mathit{NOI}_1 - i \cdot \mathit{LoanAmt}] \\ + \tilde{\mathrm{E}}[\mathit{ValueOfAssets}_1 - \mathit{LoanAmt}] \\ + \tilde{\mathrm{E}}[\mathit{DefaultSavings}_1] \end{aligned} \tag{17}$$

Proposition 3.3a tells us that firm managers are ignoring three things when they maximize EPS rather than NPV. The first term, $(\tilde{\mathrm{E}} - \mathrm{E})[\mathit{NOI}_1 - i \cdot \mathit{LoanAmt}]$, is the difference between the risk-neutral and physical expectations of the company's earnings. This term captures the idea that an EPS-maximizing manager is ignoring risk. *ValueOfEquity* is calculated using risk-neutral probabilities in Equation 12 while $\mathrm{E}[\mathit{Earnings}_1]$ contains no risk adjustment.

The second term, $\tilde{\mathrm{E}}[\mathit{ValueOfAssets}_1 - \mathit{LoanAmt}]$, is the present discounted value of the company's book equity. This term shows up in Equation (17) because an EPS-maximizing manager will ignore any changes in long-term assets and/or liabilities. $\mathit{ValueOfAssets}_1$ never shows up in expected earnings, and $\mathit{LoanAmt}$ only affects expected earnings via the size of the interest payment. This is why people complain that EPS maximization leads to short-term thinking.

The third term, $\tilde{\mathrm{E}}[\mathit{DefaultSavings}_1]$, is the present discounted value of the default option on the company's debt. This term reflects the fact that an EPS-maximizing manager is optimizing with respect to an accounting variable, and GAAP accounting standards say that earnings should reflect a company's promised payments to its creditors. This is true even if both the firm manager and her lender anticipate that she will default if the down state is realized.

It is important to understand the reasons why $\mathrm{E}[\mathit{Earnings}_1]$ might differ from *ValueOfEquity* (and by extension, why EPS maximization might differ from NPV maximization). Proposition 3.3a says that $\mathrm{E}[\mathit{Earnings}_1]$ a) fails to risk adjust expected earnings, b) ignores changes in long-term assets and liabilities, and c) does not consider the value of the firm manager's default option. When an EPS-maximizing manager makes a bad choice, one of these three things is at fault. However, as we will see shortly, it is also possible that ignoring all three produces no error at all.

How Firm Managers Think. We now characterize how an EPS-maximizing manager would choose her leverage. Imagine that the manager was initially planning on using some leverage level $\ell_0 \in [0, 1)$. Then, she asks herself: How would a slight increase in this initial leverage level, $\ell_0 \longrightarrow \ell_\epsilon = (\ell_0 + \epsilon)$, affect my EPS? If I made that change, would my EPS go up or down?

On one hand, an ϵ increase in the manager's leverage will lower her expected earnings next year since it increases her promised debt repayment. She will have to pay interest on a loan that is $\epsilon \cdot \mathit{PurchasePrice}$ larger. And if the manager's debt was already risky, $\ell_0 > \ell_{\max r_f}$, then levering up further will increase her interest rate, $i(\ell_\epsilon) = i(\ell_0) \cdot [1 + \delta(\ell_0)]$ where $\delta(\ell) \overset{\text{def}}{=} \ell \cdot [i'(\ell)/i(\ell)]$ is the elasticity of the interest rate with respect to her leverage.

But, on the other hand, using more debt financing will allow the firm manager to issue fewer shares since $PriceOfEquity = (1 - \ell) \cdot PurchasePrice$ and $\#Shares = PriceOfEquity / PricePerShare$. Under the normalization that $PricePerShare = \$1$, an ϵ increase in the manager's leverage would reduce her share count by $(\epsilon \cdot PurchasePrice)/\$1$.

Proposition 3.3b (How Firm Managers Think)**.** *If a firm manager increases her leverage* $\ell_0 \to \ell_\epsilon = (\ell_0 + \epsilon)$ *and issues* $(\epsilon \cdot PurchasePrice)/\$1$ *fewer shares, then*

$$\tfrac{\mathrm{d}}{\mathrm{d}\epsilon}\big[EPS(\ell_0 + \epsilon)\big]_{\epsilon=0} = \frac{1}{1-\ell_0} \cdot \Big(EY(\ell_0) - i(\ell_0) \cdot [1 + \delta(\ell_0)] \Big) \tag{18}$$

Before pulling the trigger on a deal to buy her target company using leverage $\ell_0 \in [0, 1)$, the firm manager first checks whether she could increase her EPS by adjusting her leverage a little bit, $\ell_0 \to \ell_\epsilon = (\ell_0 + \epsilon)$. The first-order condition in Equation (18) says that, if the manager's earnings yield is higher than her adjusted interest rate on debt, she will view equity financing as expensive compared to debt, $\frac{\mathrm{d}}{\mathrm{d}\epsilon}\big[EPS(\ell_0 + \epsilon)\big]_{\epsilon=0} > 0$. So she will try to boost her EPS by increasing her leverage slightly, $\ell_\star > \ell_0$. Conversely, if the manager's earnings yield is lower than her adjusted interest rate at her initial leverage level, equity financing will look cheap compared to debt, $\frac{\mathrm{d}}{\mathrm{d}\epsilon}\big[EPS(\ell_\star + \epsilon)\big]_{\epsilon=0} < 0$. So she will try to boost her EPS by reducing her leverage, $\ell_\star < \ell_0$ whenever $\ell_0 > 0$.[1]

It is common to hear firm managers talk about earnings yield as a cost of equity capital (Graham and Harvey, 2001). Proposition 3.3b shows how this line of reasoning follows from EPS maximization. Equation (18) implies that equity financing is more expensive in EPS terms when earnings yield is high.

EPS-maximizing managers are constantly thinking to themselves: "A high earnings yield implies that equity financing is more costly. A high earnings yield implies that equity financing is more costly. [...] A high earnings yield implies that equity financing is more costly." Recite this mantra enough times, and you too would start thinking of the earnings yield as the cost itself.

[1] Note that a firm manager cannot increase her EPS with a reverse stock split. Following a stock split (or a reverse split), a company is required to retroactively update all previously reported EPS values to reflect its new share count. See Appendix C for a more detailed discussion.

We are not arguing that firm managers should be conflating these two ideas. A stock's dividend yield is not the same thing as its expected return. Likewise, a company's earnings yield is not the same thing as its cost of equity capital. We are simply taking managers at their word when they tell us that they are EPS maximizers. Proposition 3.3b then shows that, in that case, it will be common for managers to view earnings yield as the cost of equity capital.

Unique EPS-Maximizing Leverage. We now show that there is a unique leverage level that maximizes EPS. This is true even in a frictionless information-symmetric model where Modigliani and Miller (1958) holds. When the manager's earnings yield is high, she levers up a bit. When her earnings yield is low, she tries to reduce her leverage. And, given any initial leverage level, $\ell_0 \in [0, 1)$, iterating on this process will lead her to the single optimal leverage level.

Proposition 3.3c (Unique EPS-Maximizing Leverage)**.** *Either $EPS(\ell)$ is maximized at the $\ell = 0$ boundary or there is a unique interior choice of leverage $\ell \in (0, 1)$ that satisfies*

$$\tfrac{\mathrm{d}}{\mathrm{d}\epsilon}\big[EPS(\ell + \epsilon)\big]_{\epsilon=0} = 0 \tag{19}$$

Either way, a gradient-descent algorithm based on Equation (18) will find the single EPS-maximizing leverage level, $\ell_\star$, given any initial value $\ell_0 \in [0, 1)$.

Notice that, in our benchmark model, it is not a mistake for the firm manager to choose the EPS-maximizing leverage $\ell_\star$ as defined in Proposition 3.3c. Because this model satisfies all the Modigliani and Miller (1958) conditions, every choice of leverage is just as good as any other. EPS maximization in our setting is best thought of as a selection criteria rather than a behavioral error.

The principle of EPS maximization also does not require asset markets to be making any errors. In fact, there is no need to alter standard asset-pricing theory at all to accommodate EPS-maximizing managers. All risky payouts in our model are correctly priced using the state prices given in Equation (6). We can characterize these state prices in closed form. Thus, while it can sometimes lead managers to make bad choices, the EPS-maximization paradigm requires neither managers nor markets to be irrational.

Microfoundation For Value vs. Growth. The principle of EPS maximization predicts that growth and value firms will finance themselves in different ways. This will be a theme throughout the rest of the paper. The distinction follows from thinking about the special case of zero leverage, $\ell_0 = 0$. In this special case, the trade-off described in Proposition 3.3b simplifies in a revealing way.

On one hand, Equation (1) tells us that earnings are the same as cash flows in the absence of debt. So Gordon-growth logic implies that $EY(0) = r - g$ since

$$\frac{1}{EY(0)} = \frac{\mathit{ValueOfEquity}(0)}{\mathrm{E}[\mathit{Earnings}_1(0)]} = \frac{\mathit{PurchasePrice}}{\mathrm{E}[\mathit{NOI}_1]} = \frac{1}{r-g} \tag{20}$$

On the other hand, Equation (9) says that the first \$1 that a manager borrows will be riskless. Hence, when $\ell_0 = 0$, the adjusted interest rate is $i(0) \cdot [1 + \delta(0)] = r_f$.

Lemma 3.3 (Unlevered First-Order Condition). *When $\ell_0 = 0$, an ϵ increase in leverage yields*

$$\tfrac{\mathrm{d}}{\mathrm{d}\epsilon}\big[EPS(0+\epsilon)\big]_{\epsilon=0} = \underbrace{(r-g)}_{\text{cap rate}} - r_f \tag{21}$$

To see why this special case matters, first think about the scenario where the firm manager is thinking about doing an all-equity purchase for a company with a low cap rate, $r - g < r_f$. Equation (21) tells us that she would like to reduce her leverage even further. But $\ell_0 = 0$ is as low as she can go. So she would do the next best thing and follow through on her initial plan, $\ell_\star = \ell_0 = 0$.

Now suppose that the same manager is targeting a company with a high cap rate, $r - g > r_f$. Again, her initial plan is to do the transaction using no debt, $\ell_0 = 0$. This was optimal last time. Is it still optimal? No. Equation (21) indicates that the manager could increase her EPS by borrowing just a little, $\ell_\star > \ell_0 = 0$. The first \$1 of debt is less expensive than the last share of equity issued.

What would you call a stock with a really low cap rate? A growth stock. The Gordon-growth logic implies that a stock with a low cap rate will have a high P/E. Conversely, a value stock is a company with a high cap rate and a low P/E. Hence, Lemma 3.3 implies that a firm manager will prefer to finance the purchase of a growth firm using all equity, $\ell_\star = \ell_0 = 0$; whereas, she will use at least a little bit of debt when buying a value firm, $\ell_\star > \ell_0 = 0$.

Proposition 3.3d (Microfoundation For Value vs. Growth). *Define a growth firm as any company whose cap rate is below the riskfree rate, $r - g < r_f$. A value firm is defined as a company with a cap rate above the riskfree rate, $r - g > r_f$. And the EPS-maximizing leverage level jumps discontinuously*

$$\ell_\star \begin{cases} = 0 & \text{if } r - g < r_f \\ \geq \ell_{\max r_f} & \text{if } r - g > r_f \end{cases} \tag{22}$$

Proposition 3.3d offers a new definition of value and growth stocks. Is a company's cap rate below the riskfree rate? If "yes," then it is a growth stock. If "no," then it is a value stock. This definition does not involve sorting the cross-section of stocks based on their P/E. It also does not impose an ad hoc top/bottom 30% cutoff. EPS maximization points to an economically meaningful cutoff that distinguishes value and growth firms, and it allows the number of value and growth firms to vary over time (Lettau, Ludvigson, and Manoel, 2018).

Growth firms use no debt. By contrast, Proposition 3.3d implies that value firms never borrow just a little. There is a discontinuous jump in leverage. Why? Because earnings yield initially increases as a value manager issues fewer shares but the cost of debt capital is the same for any riskfree loan

$$i(\ell) \cdot [1 + \delta(\ell)] = r_f \qquad \text{for all } \ell \in [0, \ell_{\max r_f}] \tag{23}$$

If it makes sense for a value manager to borrow one dollar, $EY(0) > r_f = i(0) \cdot [1 + \delta(0)]$, it makes even more sense for her to borrow two, $EY(\epsilon) > EY(0) > r_f = i(\epsilon) \cdot [1 + \delta(\epsilon)]$. And the third dollar of debt looks even more attractive, $EY(2 \cdot \epsilon) > EY(\epsilon) > EY(0) > r_f = i(2 \cdot \epsilon) \cdot [1 + \delta(2 \cdot \epsilon)]$. This positive feedback loop continues until the maximum riskfree leverage is reached, $\ell_{\max r_f}$.

Hence, EPS maximization naturally generates a large qualitative difference between value and growth firms' leverage choices. There is also nothing in the problem setup that suggests a P/E ratio discontinuity. We did not introduce some friction or information asymmetry with this goal in mind. Instead, the discontinuity naturally emerges as part of our analysis. And it reappears over and over again in all future applications.

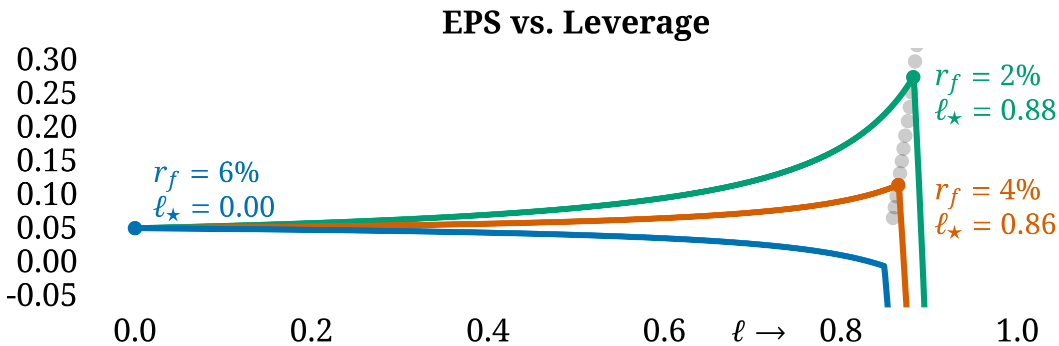


Figure 3. x-axis: leverage level, $\ell \in [0, 1)$. y-axis: earnings per share, $EPS(\ell)$. Each line reports results for a different riskfree rate, $r_f \in \{2\%, 4\%, 6\%\}$. All other parameters are the same for all three lines: $\mathrm{E}[NOI_1] = \$5.00$, $u = 27\%$, $d = 18\%$, $r = 10\%$, $g = 5\%$, and $p_u = 40\%$. $\ell_\star$ denotes the EPS-maximizing leverage level—i.e., the point on the x-axis where the line for a particular r_f value peaks. The grey dots indicate EPS-maximizing leverage levels associated with other riskfree rates less than 5% at 25bps increments.

3.4 Numerical Simulations

We conclude this section with a pair of numerical simulations that illustrate how firm managers choose leverage to maximize EPS. We want to highlight how leverage gets determined by the trade off between earnings yield and adjusted interest rates. We want to show the shape of this curve as well as why we should expect it to have a unique highest point. We also want to illustrate the sharp difference between the leverage choices of value and growth firms.

We start with Figure 3, which reports $EPS(\ell)$ over the full range of leverage levels $\ell \in [0, 1)$. There are three lines. Each one is associated with a different riskfree rate, $r_f \in \{2\%, 4\%, 6\%\}$. Everything else is the same for all three lines: $\mathrm{E}[NOI_1] = \$5.00$, $u = 27\%$, $d = 18\%$, $r = 10\%$, $g = 5\%$, and $p_u = 40\%$. We are not conducting a calibration exercise here. These parameter values were not chosen to match real-world moments. We are simply trying to illustrate the economic intuition behind the principle of EPS maximization.

When $\boldsymbol{r_f = 6\%}$, the target firm is a growth stock, $r - g = 10\% - 5\% = 5\% < 6\% = r_f$. In this scenario, the highest point on the blue line is indicated by the dot all the way on the left-hand side of the figure. The firm manager maximizes her EPS by doing an all-equity transaction, $\boldsymbol{\ell_\star = 0.00}$.

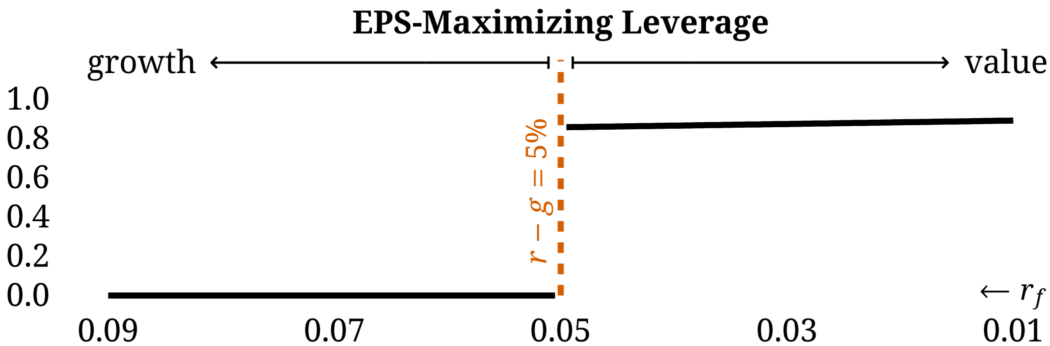


Figure 4. x-axis: riskfree rate in reverse order, $r_f \in (9\%, 1\%)$. y-axis: EPS-maximizing choice of leverage, $\ell_\star$. Parameter values: $\mathrm{E}[NOI_1] = \$5.00$, $u = 27\%$, $d = 18\%$, $r = 10\%$, $g = 5\%$, and $p_u = 40\%$. The vertical red dashed line is the target company's cap rate, $\boldsymbol{r - g = 5\%}$. To the left of this line, the high riskfree rate makes the target company a growth firm, $\ell_\star = 0$. To the right of this line, the low riskfree rate makes the target company a value firm, $\ell_\star \geq \ell_{\max r_f}$.

By contrast, when $\boldsymbol{r_f = 2\%}$ and when $\boldsymbol{r_f = 4\%}$, the target company is a value firm. In both cases, the firm's cap rate, $r - g = 5\%$, is larger than the riskfree rate. So a firm manager maximizes her EPS by using a substantial amount of leverage, $\boldsymbol{\ell_\star = 0.88}$ and $\boldsymbol{\ell_\star = 0.86}$. Even when $(r - g) - \boldsymbol{r_f} = 5\% - 4\% = 1\%$, the EPS-maximizing leverage level is already $\boldsymbol{\ell_\star = 86\%}$ of the purchase price.

Figure 4 offers another way of highlighting how EPS maximization generates a gap between value and growth firms. The thick black line shows the EPS-maximizing choice of leverage as the prevailing riskfree rate drops from $r_f = 9\%$ to $r_f = 1\%$. Just like in Figure 3, the target company always has the same cap rate, $\boldsymbol{r - g = 5\%}$, which is denoted by a vertical dashed red line. Its NOIs are discounted at $r = 10\%$ per year, and these cash flows grow at a rate of $g = 5\%$ annually. All parameter values are also the same in both figures: $\mathrm{E}[NOI_1] = \$5.00$, $u = 27\%$, $d = 18\%$, and $p_u = 40\%$.

On the right-hand side of the figure, a firm manager uses lots of debt because the riskfree rate is low enough that they are buying a value firm, $r_f < \boldsymbol{r - g = 5\%}$. On the left-hand side, the same manager uses no debt because the riskfree rate is high enough to make their target firm a growth stock, $r_f > \boldsymbol{r - g = 5\%}$. And there is a large discontinuous jump in the EPS-maximizing leverage as the riskfree rate crosses over the target firm's cap rate.

4 More Applications

When you ask firm managers how they make decisions, they tell you that they choose the policy that maximizes their EPS. The central premise of this paper is that, if you take firm managers at their word, then it is possible to give a single coherent explanation for a wide range of corporate policies. We have already shown how EPS maximization can explain firm leverage. We now study three more applications of this same organizing principle: When will a firm repurchase shares? When finalizing an M&A deal, will it choose to pay target shareholders with equity? And under what conditions will it accumulate cash?

4.1 Share Repurchases

Academics and policymakers have debated long and hard about how to explain managers' decision to repurchase shares (Gutierrez and Philippon, 2017; Kahle and Stulz, 2021). But there is not much to explain once you recognize that firm managers are maximizing EPS and not the present discounted value of future equity payouts. When you ask firm managers, the main concern that they raise about issuing shares is EPS dilution (e.g., Graham and Harvey, 2001). The decision to repurchase shares is the other side of the same coin. A firm manager will borrow to repurchase shares whenever this will boost her EPS.

In the previous section, we thought about a firm manager who was in the process of acquiring a company. So it made sense to interpret $\ell_0 \in [0, 1)$ as her initial idea about how much leverage to use. In this section, we assume the acquisition is complete and the manager has been running the company for some time. We interpret ℓ_0 as the leverage inherited by the manager from the previous period. Everything else is the same.

If she increases her leverage by ϵ, the firm manager will be able to repurchase $(\epsilon \cdot \mathit{PurchasePrice})/\$1$ shares. But she will also have to pay interest on a loan that is $\epsilon \cdot \mathit{PurchasePrice}$ larger next year. If the firm's debt was already risky, $\ell_0 > \ell_{\max r_f}$, this will also entail paying a slightly higher interest rate on the new larger loan, $i(\ell_\epsilon) = i(\ell_0) \cdot [1 + \delta(\ell_0)] > i(\ell_0)$. These two effects work in opposite directions. Fewer shares outstanding $\Rightarrow$ higher EPS. Higher interest expense $\Rightarrow$ lower EPS. Share repurchases occur when the first effect dominates. When the second effect dominates, the firm issues shares. The result is similar to the market-timing story in Baker and Wurgler (2000, 2002). The only difference is in why managers are trying to time the market. We are arguing that they do so because they are EPS maximizers.

Proposition 4.1 (Share Repurchases)**.** *Suppose a firm manager inherits an initial leverage level from the previous period, $\ell_0 \in [0, 1)$. She will undertake a debt-financed share-repurchase plan whenever*

$$\underbrace{EY(\ell_0)}_{\text{earnings yield}} \quad > \quad \underbrace{i(\ell_0) \cdot [1 + \delta(\ell_0)]}_{\text{adj. interest rate}} \tag{24}$$

The logic behind Proposition 4.1 is the same as in Proposition 3.3b. The only difference is that now we are talking about repurchasing existing shares rather than issuing new ones. The prevalence of share buybacks is only puzzling if you insist on modeling firm managers as NPV maximizers. When you model their actual objective, there is no puzzle at all.

If a firm manager's earnings yield becomes much higher than her adjusted interest rate, $EY(\ell_0) > i(\ell_0) \cdot [1 + \delta(\ell_0)]$, then she will view her shares as under valued by the stock market. She will do a debt-financed share repurchase because it is something that will boost her EPS.

It is common to hear firm managers talk about buying back shares because these shares are undervalued. For example, in a recent Bloomberg News article, an analyst wrote that "the stock buyback by Heineken sends a 'strong message that the board views the shares as undervalued.'"[2] These managers are aware that "the process of buying back shares, while increasing EPS, leaves the value of an investor's holdings unchanged. (Oded and Michel, 2008)" Nobody thinks a pizza gets bigger when you pay the chef to slice it differently. The point is not to boost the value of investors' holdings; it is to boost EPS. Buybacks do not happen because firm managers think their equity is undervalued in an absolute sense. They occur when managers think the cost of equity looks cheap compared to the cost of debt.

[2] Michael O'Boyle, Swetha Gopinath, and Sarah Jacob. "Heineken Seals $1 Billion Share Buyback as Femsa Exit Begins." *Bloomberg News.* February 15th, 2023.

4.2 M&A Payment

The next application looks at how a firm manager will decide to finance a costly new project. Imagine that, immediately after purchasing a company in year $t = 0$, the manager spots a new project she could implement. And, in this subsection, we will think about the project as acquiring another firm.

The timing in this subsection is a little bit different from the last one. We now think about the firm manager as having just completed the purchase of her target company. When she purchased the company, she did so using the leverage level that maximized her EPS, $\ell_\star$. Then, only after she completed the purchase, did she realize that there was this M&A deal on the table.

Acquiring the company will cost ϵ% of purchase price of firm. If the manager decides to finance the acquisition using debt, her leverage will increase by ϵ. If she decides to pay by giving the target firm's shareholders equity, she will need to issue $\epsilon \cdot \mathit{PurchasePrice}/\$1$ shares.

Either way, the cost needs to be paid immediately after purchasing the firm in year $t = 0$. By contrast, the benefit comes in future periods. From year $t = 1$ onward, the acquisition boosts expected NOIs by $(b \cdot \epsilon)$% where $b \in (0, \infty)$. Note that a $b > 1$ acquisition is not the same thing as a positive NPV acquisition. b determines how an acquisition will affect the acquirer's expected NOIs. It does not include any sort of risk adjustment.

The acquisition would alter the firm's future cash flows, so Modigliani and Miller (1958) capital-structure irrelevance no longer holds. Nevertheless, the principle of EPS maximization leads to a clear prediction about when and how the new acquisition will get financed.

First, imagine that the firm manager can only pay for the acquisition by issuing new equity to the target company's shareholders. In that case, she would have to issue $\epsilon \cdot \mathit{PurchasePrice}/\$1$ new shares, so her new EPS would be

$$\frac{(1 + b \cdot \epsilon) \cdot \mathrm{E}[\mathit{NOI}_1] - i(\ell_\star) \cdot \mathit{LoanAmt}(\ell_\star)}{\mathit{ValueOfEquity}(\ell_\star) + \epsilon \cdot \mathit{PurchasePrice}} \tag{25}$$

Her expected earnings would be higher, which would be good. But these earnings would be spread across a larger number of shares, which would be bad. The expression above assumes that, if the manager does not pull the trigger on the deal, her leverage would be optimal, $\ell_\star$.

Given this framing, we can characterize the manager's decision about whether to finance the M&A deal by issuing shares in the limit as $\epsilon \to 0$. She will invest if the derivative of Equation (25) with respect to ϵ is positive.

Lemma 4.2a (If Equity Is The Only Option)**.** *If a firm manager only has access to equity financing, then she will acquire the target company whenever*

$$b > b_{Equity} \overset{\text{def}}{=} \frac{EY(\ell_\star)}{r-g} \tag{26}$$

$EY(\ell_\star)$ is the earnings yield on the manager's company if she does not finance the acquisition. The manager thinks about this earnings yield as her cost of equity capital. So Equation (26) says that, as an EPS-maximizing manager, she will only issue equity to acquire the target company if the merger would boost her expected NOIs by a multiple of her cost of equity capital.

Next, consider the opposite scenario where the firm manager only has access to debt markets. If she decides to borrow money to pay for the acquisition, she would have to increase her leverage by ϵ. In that case, her new EPS would be

$$\frac{(1+b\cdot\epsilon)\cdot \mathrm{E}[NOI_1] - i(\ell_\star+\epsilon)\cdot LoanAmt(\ell_\star+\epsilon)}{\#Shares(\ell_\star)} \tag{27}$$

Her expected earnings may be higher or lower depending on how much the merger boosts her expected NOIs. The manager will now only invest if the derivative of Equation (27) is positive.

Lemma 4.2b (If Debt Is The Only Option)**.** *If a firm manager only has access to debt financing, then she will acquire the target company whenever*

$$b > b_{Debt} \overset{\text{def}}{=} \frac{i(\ell_\star)\cdot[1+\delta(\ell_\star)]}{r-g} \tag{28}$$

$i(\ell_\star)\cdot[1+\delta(\ell_\star)]$ is the adjusted interest rate that the firm manager would have to pay on a loan that is slightly larger than the one she already took out. This is her cost of debt capital. So, just like before, Equation (28) says that the manager will finance the acquisition by borrowing more money if it boosts her expected NOIs by a multiple of her cost of debt capital.

Under what conditions will the firm manager opt to acquire by giving the target firm's shareholders equity? When will she prefer to borrow? As in the previous section, the answer will hinge on whether the manager is in charge of a value firm or a growth firm. She will behave very differently in each case.

Proposition 4.2 (M&A Payment). *If a firm manager has access to both equity and debt markets, then she will acquire the target company whenever*

$$b > \begin{cases} 1 & \text{if } r - g < r_f \\ \frac{i(\ell_\star)\cdot[1+\delta(\ell_\star)]}{r-g} & \text{if } r - g > r_f \end{cases} \tag{29}$$

If $r - g < r_f$, she pays the target company's shareholders by issuing them new shares. If $r - g > r_f$, she pays them using a mix of debt and equity.

The firm manager has just finished purchasing her own firm using the EPS-maximizing amount of leverage, $\ell_\star$. If her firm is a growth firm where $r - g < r_f$, then $\ell_\star = 0$ and $EY(0) = r - g$. Hence, when in charge of a growth firm, the manager is willing to pay ϵ% of her firm's purchase price to acquire the target firm so long as the merger will boost her expected NOIs by at least ϵ%. And, whenever someone proposes such an M&A deal, she will pay for the target company by giving them equity since $EY(0) = r - g < r_f = i(0) \cdot [1 + \delta(0)]$.

By contrast, if the manager is running a value firm, $r - g > r_f$, then $\ell_\star \geq \ell_{\max r_f}$ and $EY(\ell_\star) = i(\ell_\star) \cdot [1 + \delta(\ell_\star)]$ since we are no longer at the zero-lower bound. As a result, the minimum required boost is

$$b_{Equity} = \frac{EY(\ell_\star)}{r - g} = \frac{i(\ell_\star) \cdot [1 + \delta(\ell_\star)]}{r - g} = b_{Debt} \tag{30}$$

And, whenever someone proposes an M&A deal that exceeds this threshold, the manager will pay the target company's shareholders using some combination of debt and equity. She may borrow money and deliver cash. Or the manager might pay target shareholders by issuing new shares. All this follows from taking firm managers at their word when they tell us that they are EPS maximizers.

Market commentators sometimes complain about profitable acquisitions not taking place because they would dilute the acquirer's EPS (Andrade, 1999). We now extend the logic behind Proposition 3.3a to better understand this phenomenon. The key observation is that EPS-maximizing managers do not do any risk adjustment when thinking about the future benefits of an acquisition. They only care about the effect on expected NOIs. As a result, if the boost comes disproportionately come from the future state of the world with the lower state price, it is possible to have an acquisition increase EPS while simultaneously reducing NPV. The opposite can also be true. There can exist positive-NPV acquisitions that lower the acquirer's EPS.

To formalize this reasoning, we allow an acquisition's boost to be different in each future state. Suppose an acquisition boosts future NOIs by b_u in the up state and b_d in the down state. If the manager's expected NOIs still go up by b on average, the associate up- and down-state boost profile (b_u, b_d) must satisfy

$$b = b_u \times p_u \cdot (1 + u) + b_d \times p_d \cdot (1 - d) \tag{31}$$

Note that there is an entire continuum of boost profiles, (b_u, b_d), associated with each average boost level, $b \in (0, \infty)$. Corollary 4.2 shows that this range of possibilities is large enough to allow for negative-NPV M&A deals which have $b > 1$ on average and positive-NPV M&A deals which have $b < 1$.

Corollary 4.2 (Accretion And Dilution)**.** *There are average boost levels $b > 1$ for which it is possible to construct negative-NPV boost profiles, (b_u, b_d). There are average boost levels $b < 1$ associated with positive-NPV boost profiles, (b_u, b_d).*

Corollary 4.2 points to where EPS dilution and accretion might create problems. A negative-NPV M&A deal with $b > 1$ is accretive. Proposition 4.2 tells us that an EPS-maximizing growth-firm manager will finance an acquisition whenever it has an average boost larger than one, $b > 1$. This manager would do an accretive deal even though they should not. Conversely, we say that a positive-NPV deal with $b < 1$ is dilutive. An EPS-maximizing manager would not do such a deal even though they should.

4.3 Cash Accumulation

Firms hold more cash than ever before. Bates, Kahle, and Stulz (2009) documents that "the average cash-to-assets ratio for US industrial firms more than [doubled] from 1980 to 2006." And this upward trend has continued in the decade since (Faulkender, Hankins, and Petersen, 2019). Rather than by drawing down on existing cash reserves, firm managers regularly choose to pay for a costly new project by issuing equity and/or levering up.

Why might firm managers do this? If there is cash burning a hole in their corporate pockets, why would they choose not to use it? How could this not be the cheapest payment option?

Textbook theory assumes that firm managers are NPV maximizers. In that framework, if you want to explain why managers do not always pay for a costly new project using cash on hand, then you must introduce some market imperfection such as a precautionary-savings motive or tax differential. We now show that, if firm managers are EPS maximizers rather than NPV maximizers, it is easy to understand why some firms hoard cash.

The setup and timing will be the same as in the previous subsection. The firm manager has just completed purchasing a company using the EPS-maximizing leverage, $\ell_{\star}$. Immediately after the paperwork is finalized, she spots a new project. Previously, this project was the acquisition of another firm. But now there is no reason to be so specific. Think about the project as building a new plant, starting a new product line, or enrolling in a new worker training program. Whatever it is, the project still costs ϵ% of the purchase price today and boosts future NOIs by $(b \cdot \epsilon)$% starting in year $t = 1$.

Besides lifting the restriction that the manager's project is an M&A deal, the only other new bit in this subsection has to do with the manager's financing options. In addition to equity and debt markets, we now assume the manager also has enough cash to pay for the project, $\mathit{Cash} \geq \epsilon \cdot \mathit{PurchasePrice}$. This cash was not involved in her purchase of the firm. Think about it as a windfall coming right after the ink dries on the first deal. At that very moment, she discovers a briefcase full of cash and spots a costly new project at the same time. We want to know when the manager will use the cash.

The firm earns the riskfree rate of return on any cash holdings. So, in the presence of cash, our formula for EPS in Equation (1) becomes

$$EPS \overset{\text{def}}{=} \frac{\mathrm{E}[NOI_1] + r_f \cdot Cash - i \cdot LoanAmt}{\#Shares} \tag{32}$$

So, if the manager pays for the new project with cash, her new EPS would be

$$\frac{(1 + b \cdot \epsilon) \cdot \mathrm{E}[NOI_1] + r_f \cdot (Cash - \epsilon \cdot PurchasePrice) - i \cdot LoanAmt}{\#Shares} \tag{33}$$

The logic behind when it is worthwhile to pay cash is the same as before.

Lemma 4.3 (If Cash Is The Only Option)**.** *If a firm manager only has access to cash holdings, then she will invest in a costly new project whenever*

$$b > b_{Cash} \overset{\text{def}}{=} \frac{r_f}{r - g} \tag{34}$$

There is a cost of capital associated with paying cash, r_f. So a firm manager will only choose to fund a new project by paying cash if it will boost her future earnings by a multiple of her cost of capital for cash. And when will this be?

Proposition 4.3 (Cash Accumulation)**.** *A growth firm with $r - g < r_f$ will never finance a costly new project out of her cash holdings. A value firm with $r - g > r_f$ will exhaust its cash holdings before using any other financing type.*

For growth firms, the cost of equity capital is lower than the riskfree rate, $EY(0) = r - g < r_f$. So they will finance any new project by issuing equity even when cash is present. Whereas, a value-firm manager exhausts her riskfree borrowing capacity when purchasing her own company, $\ell_\star \geq \ell_{\max r_f}$. So cash will always be the cheapest option for a new project, $r_f \leq EY(\ell_\star) = i(\ell_\star) \cdot [1 + \delta(\ell_\star)]$. Only after cash is gone will she turn to equity and debt markets.

Note that, while Section 4.2 talks about the acquisition of another firm, the costly new project could be anything. Thus, Sections 4.2 and 4.3 together describe how EPS-maximizing managers make capital-budgeting decisions more generally. Propositions 4.2 and 4.3 predict when an EPS-maximizing manager will undertake a costly new project as well as how they will pay it.

5 Empirical Evidence

How much leverage should I use? Should I repurchase shares? How should I pay for a new acquisition? And should I accumulate cash holdings? This section provides empirical evidence showing that firm managers in the real world answer these questions exactly as predicted by the principle of EPS maximization. It is not just that EPS maximization predicts the correct sign. An EPS-maximizing manager should behave differently depending on whether she is running a growth or value firm. And the value-vs-growth threshold should occur where the earnings yield is exactly equal to the riskfree rate. We find empirical evidence of this threshold effect in every application we look at.

5.1 Data Description

We start by describing our data. Throughout this section, we will use `teletype` to denote an empirical analog to some object in our theoretical model. For example, $\texttt{ValueOfAssets}_{n,t}$ represents the empirically observed value of the assets held by the nth firm's assets in year t.

We build our data around the CRSP-Compustat merged database. We take all firm-year observations for active public US companies from 1990 through 2022. Then we apply the following restrictions. We exclude the financial and utilities industries (GICS sectors: 40 and 55). We require the company to report its accounting data in US dollars (currency code: USD). We keep only those firms listed on either the NYSE, Amex, or Nasdaq (exchange codes: 11, 12, and 14). We also only keep firm-year observations that can be matched to previous year (match variables: `GVKEY` and `YEAR`). The CRSP-Compustat merged database gives us cash holdings (`Cash` = cash and short-term investments; CHE), total assets (`ValueOfAssets` = total assets; AT), and number of shares (`#Shares` = number of common shares outstanding; CSHO).

We then merge on data from the WRDS Financial Ratios Suite. This database gives us each firm's leverage (`Leverage` = total debt/ total assets; debt_assets), effective tax rate (`TaxRate` = effective tax rate; efftax), and book-to-market ratio (`BookToMarket` = book/market; bm). We merge these data onto our primary database by `GVKEY` and `YEAR`, keeping only successful matches.

Next, we add data from I/B/E/S on analysts' expected EPS for each firm. We use analysts' EPS forecasts for the upcoming quarter, and we restrict our sample to include only the final forecast made by each analyst. Let $\texttt{EPS}_{n,t,q}$ denote the average analyst EPS forecast for the nth firm in the qth quarter of year t. To compute the expected earnings yield, we divide this average by the firm's end-of-quarter stock price

$$\texttt{EY}_{n,t,q} \stackrel{\text{def}}{=} \frac{\texttt{EPS}_{n,t,q}}{\texttt{PricePerShare}_{n,t,q}} \tag{35}$$

Then, for each firm-year, we sum the quarterly earnings-yield estimates to create a single annual value, $\texttt{EY}_{n,t} = \sum_{q=1}^{4} \texttt{EY}_{n,t,q}$. We only keep firm-year observations that have at least one analyst forecast each quarter. We merge onto our primary database by PERMNO, CUSIP, and YEAR. Again, we keep only successful matches.

Our data on acquisitions come from the Thomson/Refinitiv SDC database. We start with all completed M&A deals from 1990 through 2020. We then restrict our sample to include deals where the acquirer is a public US company that sought 50%+ ownership of the target. We require the deal to be either a merger, a complete acquisition, or an acquisition of majority interest (form: "Merger", "Acquisition", "Acq. Maj. Int."). We exclude deals that are divestitures, recapitalizations, repurchases, restructuring, secondary buyouts, spin-offs, split-offs, and tender offers (including self-tenders and tender mergers). We aggregate the remaining data up to the acquirer-year level. Each row in the resulting database is a firm that completed at least one acquisition in a given calendar year. Let $\texttt{PaidForAcqWithEquity}_{n,t} \in \{0, 1\}$ denote an indicator variable for whether the nth acquirer use at least 50% equity to pay target shareholders in any acquisition during year t. We merge this data concerning acquirer payment choices onto our primary database by CUSIP and YEAR. We keep all observations in our primary database regardless of whether they match.

Our final data source is the CRSP US Treasury and Inflation Indexes database. This is where we get data on the annual riskfree rate, which corresponds to the annualized 30-day TBill rate ($\texttt{RiskfreeRate} = \text{T30}$). We report summary statistics in Appendix B.1.

5.2 Excess Earnings Yield

Proposition 3.3b tells us that an EPS-maximizing manager makes financing decisions by comparing her earnings yield to an adjusted interest rate, $EY \lesseqgtr i \cdot (1 + \delta)$. And Proposition 3.3d tells us that this comparison leads to different decisions depending on whether $r - g \lesseqgtr r_f$. In an ideal world, we would be able to create empirical analogs to all four terms involved in these two comparisons. Unfortunately, we only have data on one side of each comparison.

We observe $\texttt{EY} \sim EY$ but not $\texttt{CapRate} \sim r - g$. Given a consensus EPS forecast, we can compute expected earnings yield as shown in Equation (35). Analysts regularly forecast EPS, and if a firm happens to be unlevered, its earnings yield will equal its cap rate, $EY(0) = r - g$. But analysts do not separately forecast cap rates for levered firms. WRDS' web interface for I/B/E/S's "Detail History - Detail File with Actuals" database includes an alert, which states that all "non-EPS [measures] may be sparse[ly]" reported.

We observe $\texttt{RiskfreeRate} \sim r_f$ but not $\texttt{AdjInterestRate} \sim i \cdot (1 + \delta)$. We use the annualized 30-day TBill rate as the riskfree rate in our empirical analysis. This data is widely available. However, it is much harder to proxy for the adjusted interest rate faced by a firm manager. Even in our theoretical analysis, this cost of capital is firm-specific in the sense that it depends non-linearly on the manager's current leverage level. And, in practice, it will likely vary across firms for other reasons as well.

So, given that only half of each comparison is observable, we split the difference and construct a Frankenstein-variable out of the two observable halves

$$\texttt{ExcessEY}_{n,t} \overset{\text{def}}{=} \texttt{EY}_{n,t} - \texttt{RiskfreeRate}_t \tag{36}$$

We refer to ExcessEY as "excess earnings yield". If the nth firm is a value stock in year t, then the firm's excess earnings yield will be positive, $\texttt{ExcessEY}_{n,t} > 0$. By contrast, if the nth firm is a growth stock in year t, then the firm's excess earnings yield will be negative, $\texttt{ExcessEY}_{n,t} < 0$.

ExcessEY is a variable that is useful to researchers but not necessarily to managers. An EPS-maximizing manager will only directly compare her earnings

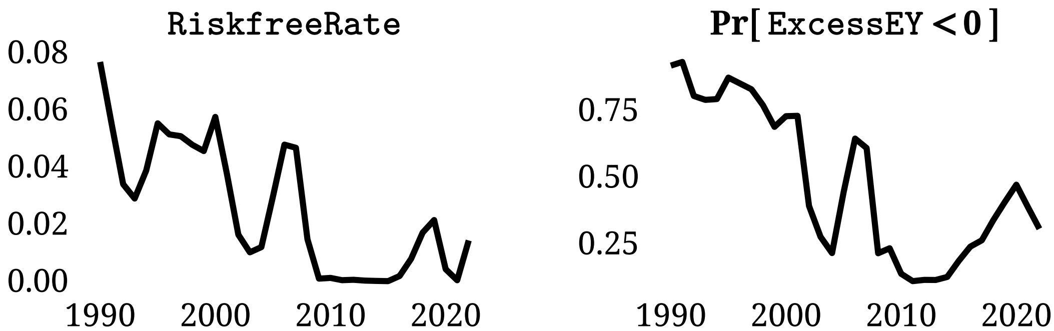


Figure 5. x-axis: time in years from 1990 through 2022. y-axis, left: annualized 30-day TBill rate. y-axis, right: fraction of growth firms where $\texttt{ExcessEY} < 0$.

yield to the riskfree rate when she is unlevered, $EY(0) = r - g \lessgtr r_f$. However, this is not the relevant comparison when running a levered firm, $\ell > 0$. In that case, she will compare her earnings yield to an adjusted interest rate strictly larger than the riskfree rate. Nevertheless, this levered value firm will still have $\texttt{ExcessEY} > 0$. This variable still separates value firms from growth firms.

We restrict our sample to firm-year observations with non-missing values for excess earnings yield. We should see a large qualitative difference between the corporate policies of firms with positive and negative `ExcessEY` values. However, because `ExcessEY` is not the same thing as $\texttt{ExcessCapRate} \sim (r - g) - r_f$ for a subset of firms, this difference is likely to be a little less sharp empirically than what is predicted by our theory.

Proposition 3.3d says that a growth stock with an earnings yield below the riskfree rate will make different financing decisions and thus be exposed to different risks than a value stock, which has an earnings yield above the riskfree rate. Note that this value/growth definition is only loosely related to existing definitions based on cross-sectional sorts (Fama and French, 1993).

In particular, our definition allows the fraction of growth stocks to vary over time. The cap rate of the typical firm can fluctuate from year to year. But, as shown in Figure 5, changes in the riskfree rate are also a major driver for the market's value/growth composition. In 2007 when the riskfree rate was 5% per year, 61% of all stocks were growth stocks with $\texttt{ExcessEY} < 0$. Five years later the riskfree rate was 5bps per year, and only 12% were growth stocks.

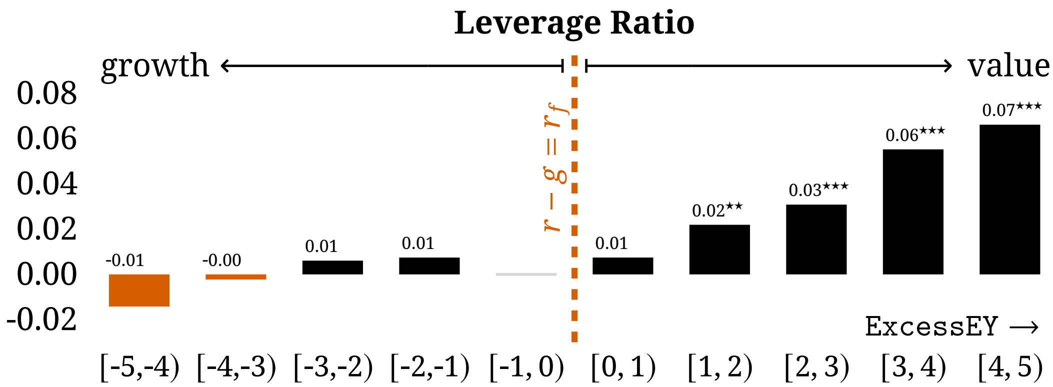


Figure 6. x-axis: excess earnings yield in 1% bins. y-axis: estimated slope coefficients $\hat{\beta}_{[c,c+1)}$ from Equation (37). Number above each bar is the estimated coefficient value. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.Reference group is [-1, 0) and is denoted by thin gray bar at zero. The vertical red dashed line denotes $\texttt{ExcessEY} = 0$. Growth firms are to the left.

5.3 Capital Structure

Proposition 3.3d says that value firms should use substantially more leverage than growth firms. Moreover, Proposition 3.3b implies that value-firm leverage level should be increasing in excess earnings yield. To test these predictions, we regress firm leverage on indicator variables whether a firm's excess earnings yield lies within a particular 1% bin

$$\texttt{Leverage}_{n,t} = \hat{\alpha} + \sum_{\substack{c=-5\% \\ c\neq-1\%}}^{+4\%} \hat{\beta}_{[c,c+1)} \cdot 1_{\{\, c\leq\texttt{ExcessEY}_{n,t}<(c+1)\,\}} + \hat{\varepsilon}_{n,t} \tag{37}$$

The $c \neq -1\%$ in the summation implies that [-1%, 0%) is the reference group. The nine other $\hat{\beta}_{[c,c+1)}$ coefficients are defined relative to the average leverage of firms in this omitted group.

Figure 6 shows that there is no measurable difference in leverage between the most extreme growth bin, [-5%, -4%), and the marginal value/growth bin, [-1%, 0%). However, a further increase in $\texttt{ExcessEY}$ to the most extreme value bin, [4%, 5%), is associated with a 7%pt increase in leverage. This is 1/7 of the sample-average leverage, 49%. See Appendix B for full regression results.

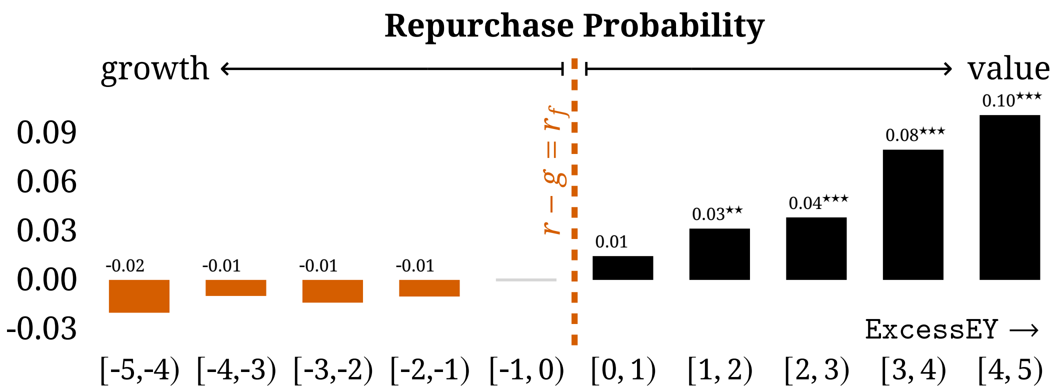


Figure 7. x-axis: excess earnings yield in 1% bins. y-axis: estimated slope coefficients $\hat{\beta}_{[c,c+1)}$ from Equation (40). Number above each bar is the estimated coefficient value. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. Reference group is [-1, 0) and is denoted by thin gray bar at zero. The vertical red dashed line denotes $\texttt{ExcessEY} = 0$. Growth firms are to the left.

5.4 Share Repurchases

To test the prediction that repurchases occur following increases in earnings yield (Proposition 4.1), we first compute the annual change in each firm's share count

$$\texttt{ShareGrowth}_{n,t} \overset{\text{def}}{=} \frac{\texttt{\#Shares}_{n,t} - \texttt{\#Shares}_{n,t-1}}{\texttt{\#Shares}_{n,t-1}} \tag{38}$$

Then, we look for firm-years where the share count dropped by at least 2%pt

$$\texttt{RepurchasedShares}_{n,t} \overset{\text{def}}{=} 1_{\{\texttt{ShareGrowth}_{n,t} < 2\%\}} \tag{39}$$

We regress this repurchase indicator on the 1% excess earnings yield bins

$$\texttt{RepurchasedShares}_{n,t} = \hat{\alpha} + \sum_{\substack{c=-5\% \\ c\neq -1\%}}^{+4\%} \hat{\beta}_{[c,c+1)} \cdot 1_{\{\, c \leq \texttt{ExcessEY}_{n,t} < (c+1) \,\}} + \hat{\varepsilon}_{n,t} \tag{40}$$

Consistent with the theory, Figure 7 shows that moving from the marginal value/growth bin, [-1%, 0%), to the most extreme value bin in our sample, [4%, 5%), is associated with a 10%pt increase in the probability of repurchasing shares. This is 2/3 of the sample-average repurchase rate, 15%.

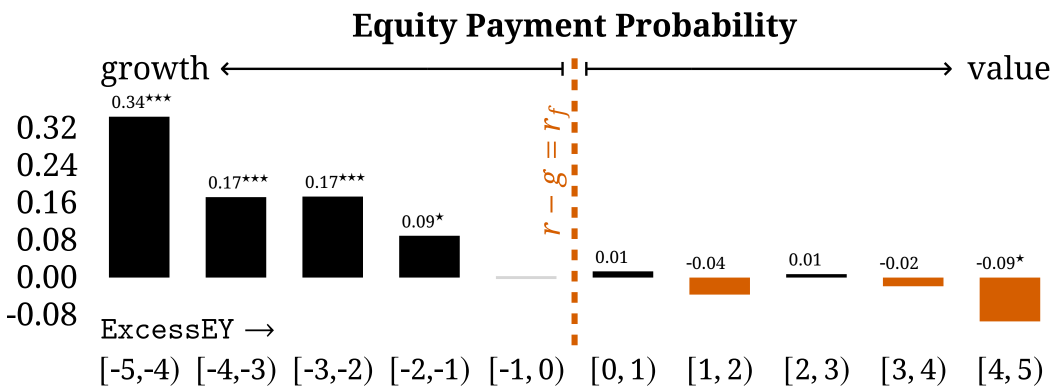


Figure 8. x-axis: excess earnings yield in 1% bins. y-axis: estimated slope coefficients $\hat{\beta}_{[c,c+1)}$ from Equation (41). Number above each bar is the estimated coefficient value. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. Reference group is [-1, 0) and is denoted by thin gray bar at zero. The vertical red dashed line denotes $\texttt{ExcessEY} = 0$. Growth firms are to the left.

5.5 M&A Payment

Proposition 4.2 says that when presented with the opportunity to acquire another firm, the manager of a growth firm should be much more likely to pay target shareholders with equity. To test this prediction, we restrict our sample to include only those firms which acquired another firm. Then we regress an equity-payment indicator on the 1% excess earnings yield bins

$$\texttt{PaidForAcqWithEquity}_{n,t} = \hat{\alpha} + \sum_{\substack{c=-5\% \\ c\neq-1\%}}^{+4\%} \hat{\beta}_{[c,c+1)} \cdot 1_{\{\, c \leq \texttt{ExcessEY}_{n,t} < (c+1) \,\}} + \hat{\varepsilon}_{n,t} \tag{41}$$

Recall that $\texttt{PaidForAcqWithEquity}_{n,t} = 1$ if the nth firm paid 50%+ equity for at least one acquisition in year t.

If growth firms are more likely to pay for acquisitions by issuing shares, we should see positive coefficient estimates when $\texttt{ExcessEY} < 0$. And that is what we find in Figure 8. A move from the marginal value/growth bin, $\texttt{ExcessEY} \in$ [-1%, 0%), to the most extreme growth bin in our sample, $\texttt{ExcessEY} \in$ [-5%, -4%), is associated with a 34%pt increase in the equity-payment probability. The average equity-payment probability is only 22%.

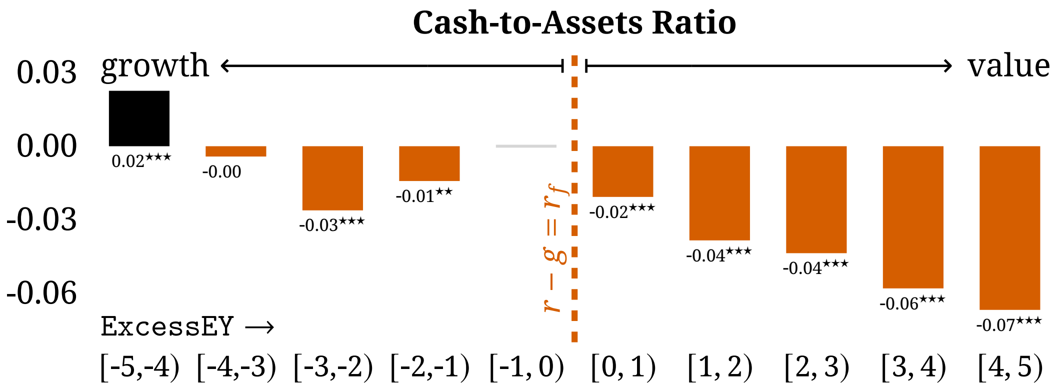


Figure 9. x-axis: excess earnings yield in 1% bins. y-axis: estimated slope coefficients $\hat{\beta}_{[c,c+1)}$ from Equation (43). Number below each bar is the estimated coefficient value. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. Reference group is [-1, 0) and is denoted by thin gray bar at zero. The vertical red dashed line denotes $\texttt{ExcessEY} = 0$. Growth firms are to the left.

5.6 Cash Accumulation

Finally, Proposition 4.3 says that, even when given the chance to use cash to pay for a costly new project, the manager of a growth firm will still opt to issue shares of equity. We normalize each firm's total cash holdings by its total assets

$$\texttt{CashToAssets}_{n,t} \stackrel{\text{def}}{=} \frac{\texttt{Cash}_{n,t}}{\texttt{ValueOfAssets}_{n,t}} \tag{42}$$

We then regress this cash-to-assets ratio on the 1% excess earnings yield bins

$$\texttt{CashToAssets}_{n,t} = \hat{\alpha} + \sum_{\substack{c=-5\% \\ c\neq -1\%}}^{+4\%} \hat{\beta}_{[c,c+1)} \cdot 1_{\{\, c \leq \texttt{ExcessEY}_{n,t} < (c+1)\,\}} + \hat{\varepsilon}_{n,t} \tag{43}$$

If value firms are more likely to finance new investments using existing cash holdings, we should see smaller coefficient estimates when $\texttt{ExcessEY} > 0$. And Figure 9 shows that value firms to the right of the dashed red line carry much less cash. A move from the marginal value/growth bin, $\texttt{ExcessEY} \in$ [-1%, 0%), to the most extreme value bin in our sample, $\texttt{ExcessEY} \in$ [4%, 5%), is associated with a 7%pt reduction in a firm's cash-to-assets ratio. This is nearly half of the sample-average cash-to-assets ratio, 16%.

6 Conclusion

Academic researchers have spent decades trying to convince firm managers to stop making decisions based on EPS. In his MBA corporate-finance textbook, Welch calls “EPS a meaningless measure”. Almeida (2019) argues that “it [is] time to get rid of EPS.” And Stewart Stern has even created an entire consulting company aimed at popularizing an alternative to EPS called “economic value added (EVA)” (Stern, Stewart, and Chew, 1995; Stern, Shiely, and Ross, 2002).

We are not arguing that firm managers should be EPS maximizers. There are clearly situations where it does produce suboptimal outcomes. Researchers have known this for decades (May, 1968; Pringle, 1973; Stern, 1974). In principle, EPS-maximizing managers could be leaving a lot of money on the table. From a normative perspective, it would be great if some silver-tongued scholar finally did talk firm managers into becoming NPV maximizers.

But things are different from a positive perspective. If you are trying to explain the decisions that real-world managers actually make, if you are trying to predict how they would actually behave in some counterfactual scenario, then you should not be modeling managers as NPV maximizers. For better or for worse, that is simply not the problem real-world managers are solving. The people in charge of large public companies are EPS maximizers.

How do we know? Easy. It is what firm managers tell us they are doing. Surveys of financial executives regularly find that “firms view earnings, especially EPS, as the key metric for an external audience, more so than cash flows. (Graham, Harvey, and Rajgopal, 2005)” Moreover, if you really think that most firm managers are not trying to maximize EPS, then why are academic researchers spending so much time trying to get them to stop?

This paper shows that, regardless of whether it is a good idea, the principle of EPS maximization gives a single unified explanation for a wide range of corporate decisions. Going forward, when researchers want to explain the choices that a firm manager will actually make, they should model her as an EPS maximizer. That should be the starting point. A model where the firm manager is an NPV maximizer will only be good at explaining the choices that academic researchers would like her to make.

A Proofs

Proof. **(Proposition 3.2)** *Equations (9) and (10) imply that, when a manager takes out a loan, her lender specifically chooses the interest rate $i(\ell)$ so that the present discounted value of her debt repayment in year $t = 1$ is equal to her initial loan amount*

$$\mathit{ValueOfDebt}(\ell) = \mathit{LoanAmt}(\ell) \tag{44}$$

The lender adjusts the fair interest rate so this remains true for every $\ell \in [0, 1)$.

After borrowing $\mathit{LoanAmt}(\ell)$, the firm manager finances the remainder of the purchase price by issuing equity. Thus, the firm's equity holders pay $\mathit{PriceOfEquity}(\ell)$ in year $t = 0$. In return, equity holders are entitled to any firm value left over in year $t = 1$ after repaying the lender. $\mathit{ValueOfEquity}(\ell)$ denotes the present discounted value of future payments to equity holders.

Leverage does not directly affect the firm's cash flows. There are also no frictions, information asymmetries, or taxes to create a wedge between the cash flows generated by the firm and those received by shareholders. So it must be that

$$\mathit{ValueOfEquity}(\ell) = \mathit{PurchasePrice} - \mathit{LoanAmt}(\ell) = \mathit{PriceOfEquity}(\ell) \tag{45}$$

since all future payments are priced correctly. □

Proof. **(Proposition 3.3a)** *The firm raises $\mathit{PriceOfEquity} = \mathit{PurchasePrice} - \mathit{LoanAmt}$ by issuing equity. $\mathit{ValueOfEquity}$ is the present discounted value of the future payouts to these equity holders. The ratio of these two is*

$$1 = \frac{\mathit{ValueOfEquity}}{\mathit{PriceOfEquity}} \tag{46a}$$

$$\begin{aligned} &= \frac{q_u \cdot \max\{(\mathit{NOI}_u + \mathit{ValueOfAssets}_u) - (1+i)\cdot \mathit{LoanAmt}, \$0\}}{\mathit{PriceOfEquity}} \\ &\quad + \frac{q_d \cdot \max\{(\mathit{NOI}_d + \mathit{ValueOfAssets}_d) - (1+i)\cdot \mathit{LoanAmt}, \$0\}}{\mathit{PriceOfEquity}} \end{aligned} \tag{46b}$$

Next, we write EPS into comparable terms

$$EPS = \frac{\mathrm{E}[NOI_1] - i \cdot LoanAmt}{\#Shares} \tag{47a}$$
$$= \frac{(p_u \cdot NOI_u + p_d \cdot NOI_d) - i \cdot LoanAmt}{\#Shares} \tag{47b}$$
$$= \frac{p_u \cdot (NOI_u - i \cdot LoanAmt) + p_d \cdot (NOI_d - i \cdot LoanAmt)}{\#Shares} \tag{47c}$$

Since $\#Shares \propto PriceOfEquity$, all differences between the NPV ratio and EPS occur in $ValueOfEquity - \mathrm{E}[Earnings_1]$. If the firm's debt is riskless, then

$$\begin{aligned} &ValueOfEquity - \mathrm{E}[Earnings_1] \\ &\quad = (q_u - p_u) \cdot (NOI_u - r_f \cdot LoanAmt) \\ &\qquad + (q_d - p_d) \cdot (NOI_d - r_f \cdot LoanAmt) \\ &\qquad + q_u \cdot (ValueOfAssets_u - LoanAmt) \\ &\qquad + q_d \cdot (ValueOfAssets_d - LoanAmt) \end{aligned} \tag{48a}$$
$$\begin{aligned} &= (\tilde{\mathrm{E}} - \mathrm{E})[NOI_1 - r_f \cdot LoanAmt] \\ &\quad + \tilde{\mathrm{E}}[ValueOfAssets_1 - LoanAmt] \end{aligned} \tag{48b}$$

However, if the debt is risky, then $i > r_f$ and there is an extra term to consider

$$\begin{aligned} &ValueOfEquity - \mathrm{E}[Earnings_1] \\ &\quad = (\tilde{\mathrm{E}} - \mathrm{E})[NOI_1 - i \cdot LoanAmt] \\ &\qquad + \tilde{\mathrm{E}}[ValueOfAssets_1 - LoanAmt] \\ &\qquad - q_d \cdot [(NOI_d + ValueOfAssets_d) - (1 + i) \cdot LoanAmt] \end{aligned} \tag{49a}$$

To complete the proof, observe that this extra term is the present discounted value of the manager's savings from being able to default in the down state

$$\begin{aligned} &\tilde{\mathrm{E}}[DefaultSavings_1] \\ &\quad = q_d \cdot \max\{(1 + i) \cdot LoanAmt - (NOI_d + ValueOfAssets_d), \$0\} \end{aligned} \tag{50}$$

□

Proof. **(Proposition 3.3b)** *The manager is initially planning on buying the company using leverage level, $\ell_0 \in [0,1)$. Then, she considers how her EPS would change if she made a small change to this initial leverage $\ell_0 \to \ell_\epsilon = (\ell_0 + \epsilon)$ and used the money to issue $\epsilon \cdot PurchasePrice$ fewer shares.*

This infinitesimal change would give her the new EPS value below

$$EPS(\ell_0 + \epsilon) = \frac{\mathrm{E}[NOI_1] - i(\ell_0 + \epsilon) \cdot LoanAmt(\ell_0 + \epsilon)}{\#Shares(\ell_0) - \epsilon \cdot PurchasePrice} \tag{51a}$$

$$= \frac{\mathrm{E}[NOI_1] - i(\ell_0 + \epsilon) \cdot [(\ell_0 + \epsilon) \cdot PurchasePrice]}{ValueOfEquity(\ell_0) - \epsilon \cdot PurchasePrice} \tag{51b}$$

The EPS-maximizing leverage will zero out $\frac{\mathrm{d}}{\mathrm{d}\epsilon}\big[EPS(\ell_0 + \epsilon)\big]_{\epsilon=0}$

$$= \frac{-[i'(\ell_0) \cdot \ell_0 + i(\ell_0)] \cdot PurchasePrice \cdot ValueOfEquity(\ell_0)}{ValueOfEquity(\ell_0)^2} + \frac{\mathrm{E}[Earnings_1(\ell_0)] \cdot PurchasePrice}{ValueOfEquity(\ell_0)^2} \tag{52a}$$

$$= \frac{1}{1-\ell_0} \cdot \left(\frac{\mathrm{E}[Earnings_1(\ell_0)] \cdot ValueOfEquity(\ell_0)}{ValueOfEquity(\ell_0)^2} - \frac{i(\ell_0) \cdot [1 + \delta(\ell_0)] \cdot ValueOfEquity(\ell_0)^2}{ValueOfEquity(\ell_0)^2} \right) \tag{52b}$$

$$= \frac{1}{1-\ell_0} \cdot \left(\frac{\mathrm{E}[Earnings_1(\ell_0)]}{ValueOfEquity(\ell_0)} - i(\ell_0) \cdot [1 + \delta(\ell_0)] \right) \tag{52c}$$

$$= \frac{1}{1-\ell_0} \cdot \big(EY(\ell_0) - i(\ell_0) \cdot [1 + \delta(\ell_0)] \big) \tag{52d}$$

where $\delta(\ell) = \ell \cdot [i'(\ell)/i(\ell)]$ is the elasticity of interest rates to leverage. □

Proof. **(Proposition 3.3c)**

(Case #1) *Suppose the manager is buying a company where $r - g < r_f$. In this case, the first-order condition in Equation (18) is always negative*

$$\frac{\mathrm{d}}{\mathrm{d}\epsilon}\big[EPS(\ell + \epsilon)\big]_{\epsilon=0} < 0 \qquad \textit{for all } \ell \in (0,1) \tag{53}$$

Meaning that EPS peaks at $\ell = 0$.

(Case #2) *Suppose the manager is buying a company where, $r - g > r_f$. Now, the first-order condition in Equation (18) will change sign exactly once. It will be positive when leverage is low and negative when leverage is high*

$$\tfrac{\mathrm{d}}{\mathrm{d}\epsilon}\big[EPS(\ell+\epsilon)\big]_{\epsilon=0} \begin{cases} >0 & \mathit{if}\ \ell < \frac{1}{1+r_f}\cdot\left(\frac{ValueOfFirm_d}{PurchasePrice}\right) \\ <0 & \mathit{if}\ \ell > \frac{1}{1+r_f}\cdot\left(\frac{ValueOfFirm_d}{PurchasePrice}\right) \end{cases} \tag{54}$$

There is now a single interior $\ell \in (0,1)$ that maximizes EPS. □

Proof. **(Lemma 3.3)** *We need to show two things.*

(a) *That $EY(0) = r - g$. Equation (1) tells us that unlevered earnings are the same as expected NOIs*

$$\mathrm{E}[Earnings_1(0)] = \mathrm{E}[NOI_1] - i(0)\cdot LoanAmt(0) \tag{55a}$$
$$= \mathrm{E}[NOI_1] - r_f \cdot \$0 \tag{55b}$$

So Gordon-growth logic implies that

$$EY(0) = \frac{\mathrm{E}[Earnings_1(0)]}{ValueOfEquity(0)} \tag{56a}$$
$$= \frac{\mathrm{E}[NOI_1]}{PurchasePrice} \tag{56b}$$
$$= r - g \tag{56c}$$

(b) *That $i(0)\cdot[1+\delta(0)] = r_f$. Equation (9) implies that, if $ValueOfFirm_d > \$1\cdot(1+r_f)$, the first \$1 borrowed will be riskless.* □

Proof. **(Proposition 3.3d)**

(Case #1) *Suppose the manager is buying a growth firm where $r - g < r_f$. In this case, the proof of Lemma 3.3 indicates says EPS is maximized at $\ell_\star = 0$.*

(Case #2) *Now Suppose the manager is buying a value firm where $r - g > r_f$. In this case, the proof of Lemma 3.3 says EPS is maximized at $\ell_\star = \frac{1}{1+r_f}\cdot(\frac{ValueOfFirm_d}{PurchasePrice})$.*

(Existence Of A Gap) *If you own the firm in year $t = 1$, you are entitled to its NOIs and the proceeds from selling its assets at market prices*

$$ValueOfFirm_d = NOI_d + ValueOfAssets_d \tag{57}$$

So if the firm is worth something in the down state, $ValueOfFirm_d > 0$, there will be a gap between the EPS-maximizing leverage of Case #1 and that of Case #2. □

Proof. **(Proposition 4.1)** *Suppose a firm manager's initial plan is to purchase a company using some leverage level $\ell_0 \in [0, 1)$. Proposition 3.3b says that she will scrap her initial plan in favor of a slightly higher leverage level whenever*

$$\tfrac{\mathrm{d}}{\mathrm{d}\epsilon}\big[EPS(\ell_0 + \epsilon)\big]_{\epsilon=0} = \frac{1}{1-\ell_0} \cdot \Big(EY(\ell_0) - i(\ell_0) \cdot [1 + \delta(\ell_0)] \Big) > 0 \tag{58}$$

When this derivative term is positive, the manager can increase her EPS by borrowing $\epsilon \cdot PurchasePrice$ and issuing $(\epsilon \cdot PurchasePrice)/\$1$ fewer shares. This same logic holds if the firm manager has been running her firm for some time and $\ell_0 \in [0, 1)$ is the leverage she chose in the previous period. □

Proof. **(Lemma 4.2a)** *In the limit as $\epsilon \to 0$, the difference between the manager's new EPS in Equation (25) and her original EPS is*

$$\begin{aligned}
\tfrac{\mathrm{d}}{\mathrm{d}\epsilon}[EPS_\epsilon]_{\epsilon=0} = {} & \frac{(b \cdot \mathrm{E}[NOI_1]) \times ValueOfEquity}{ValueOfEquity^2} \\
& - \frac{\mathrm{E}[Earnings_1] \times PurchasePrice}{ValueOfEquity^2} && \text{(59a)} \\
= {} & b \cdot \left(\frac{\mathrm{E}[NOI_1]}{ValueOfEquity} \right) - \frac{1}{1-\ell_0} \cdot \left(\frac{\mathrm{E}[Earnings_1]}{ValueOfEquity} \right) && \text{(59b)} \\
= {} & \frac{b}{1-\ell_0} \cdot \left(\frac{\mathrm{E}[NOI_1]}{PurchasePrice} \right) - \frac{1}{1-\ell_0} \cdot \left(\frac{\mathrm{E}[Earnings_1]}{ValueOfEquity} \right) && \text{(59c)}
\end{aligned}$$

If the manager can only pay for the acquisition by giving the target shareholders equity, the firm manager will execute the M&A deal whenever $\frac{\mathrm{d}}{\mathrm{d}\epsilon}[EPS_\epsilon]_{\epsilon=0} > 0$.

Setting this first-order condition equal to zero and solving for b gives

$$b_{Equity} = \frac{1}{r-g} \cdot \left(\frac{\mathrm{E}[Earnings_1]}{ValueOfEquity} \right) \tag{60a}$$

$$= \frac{EY}{r-g} \tag{60b}$$

The manager is willing to pay by issuing equity if the synergies exceed b_{Equity}. □

Proof. **(Lemma 4.2b)** *In the limit as $\epsilon \to 0$, the difference between the manager's new EPS in Equation (27) and her original EPS is*

$$\tfrac{\mathrm{d}}{\mathrm{d}\epsilon}[EPS_\epsilon(\ell_\star)]_{\epsilon=0} = \frac{b \cdot \mathrm{E}[NOI_1] - i(\ell_\star) \cdot [1 + \delta(\ell_\star)] \cdot PurchasePrice}{\#Shares(\ell_\star)} \tag{61}$$

where $\ell_\star$ is the EPS-maximizing leverage prior to the M&A deal.

If the manager can only pay for the acquisition by borrowing money and giving the target shareholders cash, she will do the M&A deal whenever $\tfrac{\mathrm{d}}{\mathrm{d}\epsilon}[EPS_\epsilon]_{\epsilon=0} > 0$. Setting this first-order condition equal to zero and solving for b gives

$$b_{Debt} = i(\ell_\star) \cdot [1 + \delta(\ell_\star)] \times \left(\frac{PurchasePrice}{\mathrm{E}[NOI_1]} \right) \tag{62a}$$

$$= \frac{i(\ell_\star) \cdot [1 + \delta(\ell_\star)]}{r-g} \tag{62b}$$

The manager is willing to pay by borrowing money if the synergies exceed b_{Debt}. □

Proof. **(Proposition 4.2)**

(Case #1) *Suppose the acquirer is a growth firm, $r - g < r_f$. In this case, the manager's EPS-maximizing leverage prior to acquisition is $\ell_\star = 0$. We know from the proof of Lemma 3.3 that*

$$EY(0) = r - g < r_f \tag{63a}$$

$$i(0) \cdot [1 + \delta(0)] = r_f \tag{63b}$$

So, for a growth firm, we can conclude that

$$b_{Equity} = \frac{EY(0)}{r-g} = \frac{r-g}{r-g} = 1 < \frac{r_f}{r-g} = \frac{i(0) \cdot [1+\delta(0)]}{r-g} = b_{Debt} \tag{64}$$

Moreover, since r_f is the lowest possible cost of debt financing, we can infer that whenever $b \geq b_{Equity}$ a growth firm will pay for the acquisition by issuing new shares to the target company's shareholders.

(Case #2) *Now suppose the acquirer is a value firm, $r - g > r_f$. In this case, the manager's EPS-maximizing leverage prior to acquisition will be $\ell_\star \geq \ell_{\max r_f}$. Proposition 3.3b tells us that, when not at the zero-lower bound, the firm manager will set*

$$EY(\ell_\star) = i(\ell_\star) \cdot [1 + \delta(\ell_\star)] \tag{65}$$

So, for a value firm, we can conclude that

$$b_{Equity} = \frac{EY(\ell_\star)}{r-g} = \frac{i(\ell_\star) \cdot [1+\delta(\ell_\star)]}{r-g} = b_{Debt} \tag{66}$$

Thus, we can infer that whenever $b \geq b_{Equity} = b_{Debt}$, a value firm likely to pay for an acquisition using some combination of borrowing and new share issuance. □

Proof. **(Corollary 4.2)** *The restriction linking an M&A deal's average boost level, $b \in (0, \infty)$, to the collection of viable up- and down-state boost profiles, (b_u, b_d), follows from noting that $NOI_u = (1+u) \cdot \mathrm{E}[NOI_1]$ and $NOI_d = (1-d) \cdot \mathrm{E}[NOI_1]$*

$$b \times \mathrm{E}[NOI_1] = b_u \times (p_u \cdot NOI_u) + b_d \times (p_d \cdot NOI_d) \tag{67a}$$

$$b \times \mathrm{E}[NOI_1] = b_u \times p_u \cdot (1+u) \cdot \mathrm{E}[NOI_1] + b_d \times p_d \cdot (1-d) \cdot \mathrm{E}[NOI_1] \tag{67b}$$

$$b = b_u \times p_u \cdot (1+u) + b_d \times p_d \cdot (1-d) \tag{67c}$$

So, if we fix the average boost associated with an acquisition, then we get an equation linking the up- and down-state boost levels

$$b_u = \left(\frac{1}{p_u} \cdot \frac{1}{1+u}\right) \cdot b - \left(\frac{p_d}{p_u} \cdot \frac{1-d}{1+u}\right) \cdot b_d \tag{68}$$

We now turn to the net present value of an acquisition. The acquisition costs

$$Cost/\epsilon = PurchasePrice \tag{69}$$

in year $t = 0$. The cost requires no risk adjustment. By contrast, the benefit of the acquisition comes in year $t = 1$ and does need to be risk adjusted. Furthermore, an increase in year $t = 1$ NOIs will also increase the sale price of the firm's assets in that state of the world as well. So, the present discounted value of the benefit is

$$\begin{aligned} Benefit/\epsilon &= q_u \times b_u \cdot ValueOfFirm_u + q_d \times b_d \cdot ValueOfFirm_d && \text{(70a)} \\ &= PurchasePrice \\ &\quad - q_u \times (1 - b_u) \cdot ValueOfFirm_u && \text{(70b)} \\ &\qquad - q_d \times (1 - b_d) \cdot ValueOfFirm_d \end{aligned}$$

Thus, an acquisition will have a positive net present value whenever

$$\begin{aligned} (Benefit - Cost)/\epsilon = q_u \times (b_u - 1) \cdot ValueOfFirm_u \\ + \, q_d \times (b_d - 1) \cdot ValueOfFirm_d > 0 \end{aligned} \tag{71}$$

Note that $(p_u, p_d) \neq (q_u, q_d)$ in our model since $r_f > 0$. So there will always be a wedge between state prices and physical probabilities.

Thus, there will exist a non-zero range of average boost values less than unity, $b < 1$, for which the risk-adjusted NPV of the acquisition is positive. There will also exist a non-zero range of average boost values less than unity, $b > 1$, for which the risk-adjusted NPV of the acquisition is negative.

Dilutive acquisitions have $\mathrm{Corr}[b_1, q_1] > 0$. Accretive acquisitions have $\mathrm{Corr}[b_1, q_1] < 0$. □

Proof. **(Lemma 4.3)** *In the limit as $\epsilon \to 0$, the difference between the manager's new EPS in Equation (33) and her original EPS is*

$$\tfrac{\mathrm{d}}{\mathrm{d}\epsilon}[EPS_\epsilon]_{\epsilon=0} = \frac{b \cdot \mathrm{E}[NOI_1] - r_f \cdot PurchasePrice}{\#Shares} \tag{72}$$

If the manager can only pay cash for the project, she will invest whenever $\frac{\mathrm{d}}{\mathrm{d}\epsilon}[EPS_\epsilon]_{\epsilon=0} > 0$*. Zeroing out this first-order condition and solving for b gives*

$$b_{Cash} = r_f \cdot \frac{PurchasePrice}{\mathrm{E}[NOI_1]} \tag{73a}$$

$$= \frac{r_f}{r-g} \tag{73b}$$

The manager is willing to pay cash if the project boost exceeds b_{Cash}*.* □

Proof. **(Proposition 4.3)**

(Case #1) *First consider a growth firm,* $r - g < r_f$*. In the absence of any cash holdings, Proposition 4.2 tells us that equity markets are the cheapest financing option for this firm*

$$b_{Equity} = \frac{EY(0)}{r-g} \tag{74a}$$

$$= \frac{r-g}{r-g} = 1 < \frac{r_f}{r-g} \tag{74b}$$

$$= \frac{i(0)\cdot[1+\delta(0)]}{r-g} = b_{Debt} \tag{74c}$$

However, Lemma 4.3 tells us that, for a growth firm, the cost of debt financing is the same as the cost of cash

$$b_{Cash} = \frac{r_f}{r-g} = \frac{i(0)\cdot[1+\delta(0)]}{r-g} = b_{Debt} \tag{75}$$

The manager can borrow the first \$1 *at the riskfree rate. And, if she uses* \$1 *of her cash, then she will no longer earn the riskfree rate on that money. Hence, for a growth-firm manager, equity financing remains the cheapest financing option.*

(Case #2) *Now consider a value firm,* $r - g > r_f$*. In this case, the manager's EPS-maximizing leverage prior to investing in the costly new project will be* $\ell_\star \geq \ell_{\max r_f}$*, and this leverage level will set*

$$EY(\ell_\star) = i(\ell_\star)\cdot[1+\delta(\ell_\star)] > r_f \tag{76}$$

Hence, Lemma 4.3 now tells us that, for a value firm, the cost of cash is now cheaper than either existing financing option

$$b_{Cash} = \frac{r_f}{r-g} < \underbrace{\frac{EY(\ell_\star)}{r-g}}_{b_{Equity}} = \underbrace{\frac{i(\ell_\star) \cdot [1 + \delta(\ell_\star)]}{r-g}}_{b_{Debt}} \tag{77}$$

If the manager uses \$1 *of her cash holdings, then she will no longer earn the riskfree rate on this dollar. But that is a small price to pay relative to issuing* \$1 *or new equity or borrowing* \$1 *from her lender. Hence, the manager of a value firm will pay cash whenever possible. Only once cash reserves are exhausted will she resort to capital markets.* □

B Empirics

As the title suggests, this paper is mainly about how researchers model the choices that firm managers make. It is primarily a theory paper. The empirical analysis plays a supporting role. For this reason, we report our regression results in Section 5 as Figures. This appendix contains the data work and background information underlying those figures.

B.1 Summary Statistics

Our primary dataset contains 15079 firm-year observations covering the period 1990 through 2022. We describe where these data come from and how we restrict our sample in the main text (Sections 5.1 and 5.2). Table B1 reports summary statistics for the firm-year observations in our sample.

B.2 Capital Structure

Table B2 reports the results of four different regressions of the form described in Equation (37). Column (1) reports the results of this exact regression specification. The coefficient estimates correspond to the ones found in Figure 6. Column (2) reports results of a similar specification, only now with year fixed effects. Column (3) adds three more control variables to the specification with year fixed effects. `BookToMarket` is the ratio of book-equity value to market cap, `ROA` is the return on assets (units: 1/yr), and `TaxRate` represents a firm's income tax liability as a fraction of its pretax income.

Columns (1), (2), and (3) all show the same basic pattern. A firm with a negative excess earnings yield, $\texttt{ExcessEY} < 0$, will tend to use the same amount of leverage no matter how negative its `ExcessEY` is. However, when a firm's excess earnings yield is positive, $\texttt{ExcessEY} > 0$, the firm will tend to lever up as `ExcessEY` increases.

This pattern is there in the baseline regression results. It is there when we control for year-specific effects. And it is there when we add additional controls. The point estimates are also really big, economically speaking. A very value-y firm-year observation where $\texttt{ExcessEY} \in [+4\%, +5\%)$ has a leverage that is 7%pt higher on average than an otherwise similar observation right at the value-growth boundary with $\texttt{ExcessEY} \in [-1\%, 0\%)$. This is 1/7 of the sample-average leverage across all firm-year observations, 49%. By contrast, there is no statistically measurable difference between the leverage of a very growth-y firm-year observation where $\texttt{ExcessEY} \in [-5\%, -4\%)$ and that of a marginal firm with $\texttt{ExcessEY} \in [-1\%, 0\%)$.

Column (4) even shows that the pattern persists when we restrict our sample to include only the 929 firm-year observations in our sample that face no tax burden, $\texttt{TaxRate} = 0$. As Strebulaev and Yang (2013) points out, the existence of such firms is hard to rationalize in a model with an interest tax shield where managers are NPV maximizers. Trade-off theory cannot explain why firm managers with no tax shield would take on debt. However, these firms are not puzzling when viewed through the principle of EPS maximization. They behave exactly like any other EPS-maximizing firm would behave.

B.3 Share Repurchases

Table B3 reports the results of three different regressions. The left-hand-side variable in all three regressions is RepurchasedShares, which is an indicator variable for whether a firm repurchased shares in a given year. Column (1) reports the results of the specification in Equation (40). The coefficient estimates correspond to the ones found in Figure 7. Column (2) adds year fixed effects to the specification, and column (3) adds three more control variables: BookToMarket, ROA, and TaxRate.

Again, all three columns show the same basic pattern. Firms with negative excess earnings yield, $\texttt{ExcessEY} < 0$, are less likely to repurchase shares, and it does not matter much how negative the excess earnings yield is. Firms with positive excess earnings yield, $\texttt{ExcessEY} > 0$, are much more likely to repurchase shares. Moreover, the effect is stronger the more positive is their excess earnings yield.

This pattern is there in the baseline regression results (column 1). It is there when we control for year-specific effects (column 2). And it is there when we add additional controls (column 3). In addition to being statistically significant, the pattern is also economically massive. A move from $\texttt{ExcessEY} \in [-1\%, 0\%)$ to

$\texttt{ExcessEY} \in [+4\%, +5\%)$ is associated with a 10%pt increase in the probability of repurchasing shares. This is 2/3 of the average repurchase probability across all firm-year observations, 15%. By contrast, there is no statistically measurable difference between the repurchase probability of a very growth-y firm-year observation where $\texttt{ExcessEY} \in [-5\%, -4\%)$ and that of a marginal firm-year observation with $\texttt{ExcessEY} \in [-1\%, 0\%)$.

B.4 M&A Payment

Table B4 reports the results of three different regressions. This table is different from the previous two in that it only includes the 1150 firm-year observations where a firm made at least one acquisition during that year. The left-hand-side variable is `PaidForAcqWithEquity`, which is an indicator variable for whether a firm paid $\geq$ 50% equity for at least one acquisition. Column (1) reports the results of the specification in Equation (41). The coefficient estimates correspond to the ones found in Figure 8. Column (2) adds year fixed effects to the specification, and column (3) adds three more control variables: `BookToMarket`, `ROA`, and `TaxRate`.

Just like before, all three columns in Table B4 display the same basic pattern. Firms with negative excess earnings yield, $\texttt{ExcessEY} < 0$, are growth firms. The EPS-maximizing managers of these firms view equity as cheap since their P/E ratios are so high. When one of these firms does an acquisition, they should be more likely to pay using equity. By contrast, firms with positive excess earnings yield, $\texttt{ExcessEY} > 0$, are value firms that are more likely to finance an acquisition using debt.

This pattern is there in the baseline regression results (column 1). It is there when we control for year-specific effects (column 2). And it is there when we add additional controls (column 3). What's more, the effect is also large. A move from being on the value/growth margin, $\texttt{ExcessEY} \in [-1\%, 0\%)$, to being an extreme growth firm, $\texttt{ExcessEY} \in [-5\%, -4\%)$, is associated with a 34%pt increase in the probability that an acquirer pays in equity. The average equity payment probability is only 22%.

B.5 Cash Accumulation

Table B5 reports the results of three different regressions. The left-hand-side variable is `CashToAssets`, which represents the ratio of a firm's cash and short-term investments to its total assets. Column (1) reports the results of the specification in Equation (43). The coefficient estimates correspond to the ones found in Figure 9. Column (2) adds year fixed effects to the specification, and column (3) adds `BookToMarket`, `ROA`, and `TaxRate` as controls.

Yet again, all three columns in Table B5 display the same basic pattern. Firms with negative excess earnings yield, $\texttt{ExcessEY} < 0$, are growth firms. Even when the manager of a growth firm has cash on hand, she will still view equity markets as the cheaper financing option since her P/E ratio is so high. Therefore, she will refrain from spending any cash holdings, leading to a high cash-to-assets ratio. By contrast, the manager of a value firm with a positive excess earnings yield, $\texttt{ExcessEY} > 0$, will view cash as the cheapest financing option. She will use any existing cash holdings before dipping into debt or equity markets. So a value-firm manager should maintain a low cash-to-assets ratio.

This pattern is there in the baseline regression results (column 1). It is there when we control for year-specific effects (column 2). And it is there when we add additional controls (column 3). Moreover, the effect is economically large. A move from being a firm-year observation on the value/growth margin, $\texttt{ExcessEY} \in [-1\%, 0\%)$, to being an extremely value-y firm-year observation, $\texttt{ExcessEY} \in [+4\%, +5\%)$, is associated with a 7%pt reduction in a firm's cash-to-assets ratio. This is nearly half of the average cash-to-assets ratio across our entire sample, 16%.

	#	Avg	Sd	Q10	Q50	Q90
	(1)	(2)	(3)	(4)	(5)	(6)
EY	15079	0.03	0.02	0.00	0.03	0.05
ExcessEY	15079	0.01	0.03	−0.03	0.01	0.04
Leverage	15079	0.49	0.25	0.20	0.49	0.76
$\log_2$(TotalAssets/\$1)	15076	9.74	2.28	6.81	9.70	12.72
BookToMarket	14830	0.49	0.39	0.13	0.41	0.93
ROA	15071	0.14	0.12	0.03	0.14	0.26
ROE	14703	0.14	1.37	−0.06	0.11	0.27
TaxRate	13477	0.31	0.17	0.06	0.34	0.42
TaxRate = 0	13477	0.07				
ShareGrowth	15076	0.08	0.32	−0.03	0.01	0.19
RepurchasedShares	15076	0.15				
IsAcquirer	15079	0.08				
PaidForAcqWithEquity	1150	0.22				
CashToAssets	15071	0.16	0.18	0.01	0.09	0.44

Table B1. Sample period: 1990-2022. EY: earnings yield (1/yr). ExcessEY: earnings yield in excess of 30-day TBill rate (1/yr). Leverage: total debt to total assets. $\log_2$(TotalAssets/\$1): log of total assets. BookToMarket: ratio of book equity to market cap. ROA: return on assets (1/yr). ROE: return on book equity (1/yr). TaxRate: income tax liability as a fraction of pretax income. TaxRate = 0: an indicator for firm-year observations with zero tax liability. ShareGrowth: percent change in shares outstanding relative to the previous year (1/yr). RepurchasedShares: indicator for ≥ 2%pt decrease in shares. IsAcquirer: indicator for firms-year observations with at least one acquisition. PaidForAcqWithEquity: an indicator for firm-years with at least one acquisition paid for using equity (missing when no acquisition). CashToAssets: ratio of cash plus short-term investments to total assets.

Dependent Variable:	Leverage			
	Full Sample			No Taxes
	(1)	(2)	(3)	(4)
Intercept	0.47*** (72.40)			
growth $-5\% \leq$ ExcessEY $< -4\%$	-0.01 (1.31)	$-0.02^{\star}$ (1.84)	0.00 (0.28)	-0.02 (0.62)
$-4\% \leq$ ExcessEY $< -3\%$	0.00 (0.23)	0.00 (0.37)	$0.02^{\star}$ (1.16)	0.00 (0.06)
$-3\% \leq$ ExcessEY $< -2\%$	0.01 (0.63)	0.01 (0.70)	$0.02^{\star}$ (1.72)	-0.01 (0.21)
$-2\% \leq$ ExcessEY $< -1\%$	0.01 (0.79)	0.01 (0.82)	$0.01^{\star}$ (1.65)	-0.02 (0.74)
$0\% \leq$ ExcessEY $< +1\%$	0.01 (0.85)	0.01 (1.16)	0.01 (1.30)	0.03 (0.95)
$+1\% \leq$ ExcessEY $< +2\%$	$0.02^{\star\star\star}$ (2.54)	$0.02^{\star\star\star}$ (2.92)	$0.02^{\star\star\star}$ (2.97)	0.01 (0.71)
$+2\% \leq$ ExcessEY $< +3\%$	$0.03^{\star\star\star}$ (3.62)	$0.03^{\star\star\star}$ (3.95)	$0.03^{\star\star\star}$ (3.68)	0.04 (1.47)
$+3\% \leq$ ExcessEY $< +4\%$	$0.06^{\star\star\star}$ (6.48)	$0.06^{\star\star\star}$ (6.60)	$0.05^{\star\star\star}$ (7.35)	$0.06^{\star\star}$ (2.17)
value $+4\% \leq$ ExcessEY $< +5\%$	$0.07^{\star\star\star}$ (7.76)	$0.07^{\star\star\star}$ (8.56)	$0.07^{\star\star\star}$ (10.02)	$0.08^{\star\star\star}$ (2.79)
BookToMarket			$-0.03^{\star\star\star}$ (5.33)	-0.01 (0.68)
ROA			$-0.24^{\star\star\star}$ (11.74)	0.14 (1.41)
TaxRate			$0.12^{\star\star\star}$ (11.41)	
Year FE	*N*	*Y*	*Y*	*Y*
# Obs	15079	15079	13276	929
Adj. R^2	1.0%	1.1%	3.0%	1.7%

Table B2. Leverage: total debt divided by total assets. $c\% \leq$ ExcessEY $< (c+1)\%$: indicator for whether excess earnings yield lies within 1% bin. Reference bin is [-1%, 0%). BookToMarket: ratio of book-equity value to market cap. ROA: return on assets (units: 1/yr). TaxRate: income tax liability as a fraction of pretax income. Column (1) gives coefficient estimates in Figure 6. Column (4) only includes firm-year observations where TaxRate = 0. Numbers in parentheses are t stats. *, **, and ***: statistical significance at 10%, 5%, and 1% levels.

Dependent Variable:	RepurchasedShares		
	(1)	(2)	(3)
Intercept	0.12*** (12.68)		
growth −5% ≤ ExcessEY < −4%	−0.02 (1.29)	−0.03** (1.96)	−0.03* (1.70)
−4% ≤ ExcessEY < −3%	−0.01 (0.68)	−0.02 (1.31)	−0.02 (1.28)
−3% ≤ ExcessEY < −2%	−0.01 (1.00)	−0.01 (1.04)	−0.02 (1.23)
−2% ≤ ExcessEY < −1%	−0.01 (0.75)	−0.02 (1.15)	−0.02 (1.22)
0% ≤ ExcessEY < +1%	0.01 (1.15)	0.01 (0.70)	0.01 (0.69)
+1% ≤ ExcessEY < +2%	0.03** (2.53)	0.03** (2.27)	0.02 (1.46)
+2% ≤ ExcessEY < +3%	0.04*** (3.13)	0.03*** (2.58)	0.02* (1.66)
+3% ≤ ExcessEY < +4%	0.08*** (6.51)	0.07*** (6.12)	0.06*** (4.64)
value +4% ≤ ExcessEY < +5%	0.10*** (8.23)	0.09*** (7.55)	0.08*** (6.01)
BookToMarket			0.03*** (3.59)
ROA			0.34*** (9.11)
TaxRate			0.05*** (2.60)
Year FE	*N*	*Y*	*Y*
# Obs	15076	15076	13273
Adj. R^2	1.2%	1.2%	1.5%

Table B3. RepurchasedShares: indicator for ≥ 2%pt year-over-year drop in shares outstanding. c% ≤ ExcessEY < (c + 1)%: indicator for whether excess earnings yield lies within 1% bin. Reference bin is [-1%, 0%). BookToMarket: ratio of book-equity value to market cap. ROA: return on assets (units: 1/yr). TaxRate: income tax liability as a fraction of pretax income. Column (1) gives coefficient estimates in Figure 7. Numbers in parentheses are t stats. ⋆, ⋆⋆, and ⋆⋆⋆ indicate statistical significance at the 10%, 5%, and 1% levels.

	Dependent Variable:	PaidForAcqWithEquity		
		(1)	(2)	(3)
	Intercept	0.18***		
		(4.79)		
growth	$-5\% \leq$ ExcessEY $< -4\%$	0.34***	0.20***	0.20***
		(5.72)	(3.36)	(3.16)
	$-4\% \leq$ ExcessEY $< -3\%$	0.17***	0.07	0.06
		(3.03)	(1.33)	(1.09)
	$-3\% \leq$ ExcessEY $< -2\%$	0.17***	0.11**	0.14**
		(3.18)	(2.09)	(2.42)
	$-2\% \leq$ ExcessEY $< -1\%$	0.09*	0.06	0.06
		(1.68)	(1.25)	(1.18)
	$0\% \leq$ ExcessEY $< +1\%$	0.01	0.04	0.04
		(0.26)	(0.80)	(0.86)
	$+1\% \leq$ ExcessEY $< +2\%$	-0.04	0.02	0.03
		(0.74)	(0.41)	(0.61)
	$+2\% \leq$ ExcessEY $< +3\%$	0.01	0.06	0.07
		(0.15)	(1.31)	(1.32)
	$+3\% \leq$ ExcessEY $< +4\%$	-0.02	0.05	0.05
		(0.37)	(0.98)	(1.04)
value	$+4\% \leq$ ExcessEY $< +5\%$	$-0.09^{\star}$	-0.03	-0.02
		(1.76)	(0.53)	(0.33)
	BookToMarket			-0.07
				(1.38)
	ROA			-0.07
				(0.43)
	TaxRate			-0.01
				(0.18)
	Year FE	*N*	*Y*	*Y*
	# Obs	1150	1150	1051
	Adj. R^2	0.9%	1.0%	0.9%

Table B4. Sample: firm-years with $\geq$ 1 acquisition. PaidForAcqWithEquity: indicator for firm-years that paid $\geq$ 50% equity for $\geq$ 1 target. $c\% \leq$ ExcessEY $<$ $(c{+}1)\%$: indicator for whether excess earnings yield lies in 1% bin. Reference bin is [-1%, 0%). BookToMarket: ratio of book equity to market cap. ROA: return on assets (units: 1/yr). TaxRate: income tax liability as a fraction of pretax income. Column (1) gives coefficient estimates in Figure 8. Numbers in parentheses are t stats. *, **, and ***: statistical significance at 10%, 5%, and 1% levels.

Dependent Variable:	CashToAssets		
	(1)	(2)	(3)
Intercept	$0.19^{\star\star\star}$ (40.84)		
growth $-5\% \leq$ ExcessEY $< -4\%$	$0.02^{\star\star\star}$ (2.84)	$0.05^{\star\star\star}$ (6.61)	$0.02^{\star\star}$ (2.43)
$-4\% \leq$ ExcessEY $< -3\%$	0.00 (0.57)	$0.02^{\star\star\star}$ (2.74)	0.00 (0.11)
$-3\% \leq$ ExcessEY $< -2\%$	$-0.03^{\star\star\star}$ (3.68)	0.00 (0.60)	-0.01 (1.07)
$-2\% \leq$ ExcessEY $< -1\%$	$-0.02^{\star\star}$ (2.04)	0.00 (0.09)	0.00 (0.10)
$0\% \leq$ ExcessEY $< +1\%$	$-0.02^{\star\star\star}$ (3.20)	$-0.03^{\star\star\star}$ (4.52)	$-0.02^{\star\star\star}$ (2.76)
$+1\% \leq$ ExcessEY $< +2\%$	$-0.04^{\star\star\star}$ (6.06)	$-0.05^{\star\star\star}$ (8.80)	$-0.04^{\star\star\star}$ (6.64)
$+2\% \leq$ ExcessEY $< +3\%$	$-0.04^{\star\star\star}$ (6.99)	$-0.06^{\star\star\star}$ (10.86)	$-0.05^{\star\star\star}$ (8.70)
$+3\% \leq$ ExcessEY $< +4\%$	$-0.06^{\star\star\star}$ (9.27)	$-0.08^{\star\star\star}$ (13.98)	$-0.07^{\star\star\star}$ (11.86)
value $+4\% \leq$ ExcessEY $< +5\%$	$-0.07^{\star\star\star}$ (10.66)	$-0.09^{\star\star\star}$ (15.69)	$-0.08^{\star\star\star}$ (13.27)
BookToMarket			$-0.08^{\star\star\star}$ (21.09)
ROA			0.00 (0.04)
TaxRate			$-0.07^{\star\star\star}$ (8.14)
Year FE	N	Y	Y
# Obs	15071	15071	13268
Adj. R^2	1.8%	5.6%	7.3%

Table B5. CashToAssets: cash and short-term investments divided by total assets. $c\% \leq$ ExcessEY $< (c+1)\%$: indicator for whether excess earnings yield lies within 1% bin. Reference bin is [-1%, 0%). BookToMarket: ratio of book-equity value to market cap. ROA: return on assets (units: 1/yr). TaxRate: income tax liability as a fraction of pretax income. Column (1) gives coefficient estimates in Figure 9. Numbers in parentheses are t stats. *, **, and ***: statistical significance at the 10%, 5%, and 1% levels.

C Stock Splits

When a company does a stock split (or a reverse split), it has to retroactively update all of its EPS numbers to reflect its new share count. So there is no effective change in the company's EPS. Suppose a firm has $\mathrm{E}[Earnings_1] = \$100$ and $\#Shares = 100$ to begin with, giving it an $EPS = \$1$. Then the firm decides to do a 1-for-2 reverse split. After the split, the company will have $\#Shares = 50$ and an $EPS = \$2$. But this new EPS will not look higher to investors because the manager is required to revise her previous $1 per share EPS up to $2 per share.

When GE did a 1-for-8 reverse stock split on July 30, 2021, it posted answers to shareholder FAQs (General Electric Co, 2021). One of these questions was: "How did the reverse stock split affect the FY'20, 1Q'21, and 2Q'21 EPS and the FY'21 Outlook and how will it impact the future calculation of net earnings or loss per share?" Here is how the company answered

> "We have adjusted our net earnings or loss per share for FY'20, 1Q'21, and 2Q'21 to reflect the reverse stock split. We have also updated our EPS from March '21 Outlook to reflect the change in share count. This adjustment simply reflects the reduced share count from the reverse stock split and does not otherwise change our previous Outlook.
>
> Additionally, in financial statements issued after the reverse stock split becomes effective, per share net earnings or loss and other per share of common stock amounts for periods ending before the effective date of the reverse stock split will be adjusted to give retroactive effect to the reverse stock split."

In short, a firm manager cannot artificially inflate her EPS by repeatedly engaging in reverse stock splits. This is why EPS-maximizing managers are not in charge of companies with a single share of equity worth the company's entire market cap. EPS is not a manipulation-proof measure of firm performance. But reverse stock splits are not one of the ways to manipulate it.

References

Acharya, V. and G. Plantin (2019). Monetary easing, leveraged payouts, and lack of investment. Working paper, New York University. [5]

Almeida, H. (2019). Is it time to get rid of earnings-per-share (EPS)? *Review of Corporate Finance Studies 8*(1), 174–206. [2, 41]

Almeida, H., V. Fos, and M. Kronlund (2016). The real effects of share repurchases. *Journal of Financial Economics 119*(1), 168–185. [5]

Amel-Zadeh, A. and G. Meeks (2019). Bidder earnings forecasts in mergers and acquisitions. *Journal of Corporate Finance 58*, 373–392. [9]

Andrade, G. (1999). Do appearances matter? the impact of EPS accretion and dilution on stock prices. Working paper, Harvard Business School. [30]

Asness, C., T. Hazelkorn, and S. Richardson (2018). Buyback derangement syndrome. *Journal of Portfolio Management 44*(5), 50–57. [5]

Axelson, U., T. Jenkinson, P. Strömberg, and M. Weisbach (2013). Borrow cheap, buy high? The determinants of leverage and pricing in buyouts. *Journal of Finance 68*(6), 2223–2267. [5]

Baker, K., P. Gallagher, and K. Morgan (1981). Management's view of stock repurchase programs. *Journal of Financial Research 4*(3), 233–247. [4, 7]

Baker, K., C. Singleton, and T. Veit (2011). *Survey research in corporate finance: Bridging the gap between theory and practice*. Oxford University Press. [4, 7]

Baker, M. and J. Wurgler (2000). The equity share in new issues and aggregate stock returns. *Journal of Finance 55*(5), 2219–2257. [26]

Baker, M. and J. Wurgler (2002). Market timing and capital structure. *Journal of Finance 57*(1), 1–32. [26]

Baker, M. and J. Wurgler (2013). Behavioral corporate finance: An updated survey. In G. Constantinides, M. Harris, and R. Stulz (Eds.), *Handbook of the Economics of Finance*, Volume 2, pp. 357–424. North Holland. [3]

Bancel, F. and U. Mittoo (2004). Cross-country determinants of capital structure choice: A survey of European firms. *Financial Management 33*(4), 103–132. [4, 7]

Bates, T., K. Kahle, and R. Stulz (2009). Why do US firms hold so much more cash than they used to? *Journal of Finance 64*(5), 1985–2021. [31]

Bennett, B., C. Bettis, R. Gopalan, and T. Milbourn (2017). Compensation goals and firm performance. *Journal of Financial Economics 124*(2), 307–330. [5]

Bens, D., V. Nagar, D. Skinner, and F. Wong (2003). Employee stock options, EPS dilution, and stock repurchases. *Journal of Accounting and Economics 36*(1-3), 51–90. [5]

Berle, A. and G. Means (1933). *The modern corporation and private property*. MacMillan Company, New York. [5]

Bettis, C., J. Bizjak, J. Coles, and S. Kalpathy (2010). Stock and option grants with performance-based vesting provisions. *Review of Financial Studies 23*(10), 3849–3888. [1]

Block, S. (1999). A study of financial analysts: Practice and theory. *Financial Analysts Journal 55*(4), 86–95. [4]

Brav, A., J. Graham, C. Harvey, and R. Michaely (2005). Payout policy in the 21st century. *Journal of Financial Economics 77*(3), 483–527. [7, 8]

Brounen, D., A. De Jong, and K. Koedijk (2006). Capital structure policies in europe: Survey evidence. *Journal of Banking & Finance 30*(5), 1409–1442. [4, 7]

Chinco, A., S. Hartzmark, and A. Sussman (2022). A new test of risk factor relevance. *Journal of Finance 77*(4), 2183–2238. [5]

Dasgupta, S., J. Harford, and F. Ma (2023). EPS-sensitivity and mergers. *Journal of Financial and Quantitative Analysis*, forthcoming. [5]

De Angelis, D. and Y. Grinstein (2015). Performance terms in CEO compensation contracts. *Review of Finance 19*(2), 619–651. [5]

DeAngelo, H. (2022). The capital-structure puzzle: what are we missing? *Journal of Financial and Quantitative Analysis 57*(2), 413–454. [1, 5]

Dichev, I., J. Graham, C. Harvey, and S. Rajgopal (2013). Earnings quality: Evidence from the field. *Journal of Accounting and Economics 56*(2–3), 1–33. [4, 6, 7]

D'Mello, R. and P. Shroff (2000). Equity undervaluation and decisions related to repurchase tender offers: An empirical investigation. *Journal of Finance 55*(5), 2399–2424. [5]

Ellis, C. (1965). Repurchase stock to revitalize equity. *Harvard Business Review 43*(4), 119. [5]

Fama, E. and K. French (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics 33*(1), 3–56. [36]

Faulkender, M., K. Hankins, and M. Petersen (2019). Understanding the rise in corporate cash: precautionary savings or foreign taxes. *Review of Financial Studies 32*(9), 3299–3334. [31]

Frank, M. and V. Goyal (2009). Capital structure decisions: which factors are reliably important? *Financial Management 38*(1), 1–37. [5]

Frank, W. and J. Weygandt (1970). Convertible debt and earnings per share: pragmatism vs. good theory. *The Accounting Review 45*(2), 280–289. [5]

Garvey, G., T. Milbourn, and K. Xie (2013). What will it do for my EPS? A straightforward but powerful motive for mergers. Working paper, Washington University in St. Louis. [5]

Gebhardt, W., C. Lee, and B. Swaminathan (2001). Toward an implied cost of capital. *Journal of Accounting Research 39*(1), 135–176. [5]

General Electric Co (2021). GE reverse stock split frequently asked questions. Technical report. https://www.ge.com/sites/default/files/GE_Reverse_Stock_Split_FAQs.pdf. [61]

Gitman, L. and C. Maxwell (1987). A longitudinal comparison of capital budgeting techniques used by major US firms: 1986 versus 1976. *Journal of Applied Business Research 3*(3), 41–50. [4, 7]

Gordon, M. (1962). *The investment, financing, and valuation of the corporation*. RD Irwin. [5]

Gormsen, N. and K. Huber (2022). Corporate discount rates. Working paper, University of Chicago. [5]

Graham, B. (1947). A questionnaire on stockholder-management relationship. *The Analysts Journal 3*(4), 57–62. [4]

Graham, B. and D. Dodd (1934). *Security analysis: Principles and technique*. McGraw-Hill. [5]

Graham, J. (2022). Presidential address: Corporate finance and reality. *Journal of Finance 77*(4), 1975–2049. [1]

Graham, J. and C. Harvey (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics 60*(2–3), 187–243. [4, 7, 19, 25]

Graham, J. and C. Harvey (2002). How do CFOs make capital budgeting and capital structure decisions? *Journal of Applied Corporate Finance 15*(1), 8–23. [2, 8]

Graham, J., C. Harvey, and S. Rajgopal (2005). The economic implications of corporate financial reporting. *Journal of Accounting and Economics 40*(1–3), 3–73. [1, 4, 6, 7, 41]

Graham, J. and M. Leary (2011). A review of empirical capital-structure research and directions for the future. *Annual Review of Financial Economics 3*(1), 309–345. [1]

Grullon, G. and R. Michaely (2004). The information content of share repurchase programs. *Journal of Finance 59*(2), 651–680. [5]

Gutierrez, G. and T. Philippon (2017). Investmentless growth: An empirical investigation. *Brookings Papers on Economic Activity Fall 2017*, 89–170. [25]

Hertzel, M. and P. Jain (1991). Earnings and risk changes around stock repurchase tender offers. *Journal of Accounting and Economics 14*(3), 253–274. [5]

Hommel, N., A. Landier, and D. Thesmar (2023). Corporate valuation: An empirical comparison of discounting methods. Working paper, Massachusetts Institute of Technology. [5]

Houston, J., B. Lev, and J. W. Tucker (2010). To guide or not to guide? Causes and consequences of stopping quarterly earnings guidance. *Contemporary Accounting Research 27*(1), 143–185. [1]

Hovakimian, A., T. Opler, and S. Titman (2001). The debt-equity choice. *Journal of Financial and Quantitative Analysis 36*(1), 1–24. [5]

Hribar, P., N. Jenkins, and B. Johnson (2006). Stock repurchases as an earnings management device. *Journal of Accounting and Economics 41*(1-2), 3–27. [5]

Huang, R., C. Marquardt, and B. Zhang (2014). Why do managers avoid EPS dilution? Evidence from debt-equity choice. *Review of Accounting Studies 19*, 877–912. [5]

Humana Inc (2023). Form 8-K. Technical Report 001-5975, U.S. Securities and Exchange Commission. https://humana.gcs-web.com/static-files/e8b5e74a-b2de-450c-89f4-d82f66d50ec4. [10]

Jensen, M. and W. Meckling (1976). Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics 3*(4), 305–360. [1]

Kahle, K. and R. Stulz (2021). Why are corporate payouts so high in the 2000s? *Journal of Financial Economics 142*(3), 1359–1380. [25]

Kim, D. and J. Yang (2010). Beating the target: A closer look at annual incentive plans. Working paper, Indiana University. [5]

Lemmon, M., M. Roberts, and J. Zender (2008). Back to the beginning: Persistence and the cross-section of corporate capital structure. *Journal of Finance 63*(4), 1575–1608. [5]

Lettau, M., S. Ludvigson, and P. Manoel (2018). Characteristics of mutual-fund portfolios: Where are the value funds? Working paper, University of California at Berkeley. [22]

Lins, K., H. Servaes, and P. Tufano (2010). What drives corporate liquidity? An international survey of cash holdings and lines of credit. *Journal of Financial Economics 98*(1), 160–176. [7]

Lintner, J. (1956). Distribution of incomes of corporations among dividends, retained earnings, and taxes. *American Economic Review 46*(2), 97–113. [6]

Lintner, J. (1963). The cost of capital and optimal financing of corporate growth. *Journal of Finance 18*(2), 292–310. [5]

Malenko, N., J. Grundfest, and Y. Shen (2023). Quadrophobia: Strategic rounding of EPS data. *Journal of Financial and Quantitative Analysis*, forthcoming. [5]

Matsumoto, D., M. Pronk, and E. Roelofsen (2011). What makes conference calls useful? The information content of managers' presentations and analysts' discussion sessions. *Accounting Review 86*(4), 1383–1414. [1]

May, M. (1968). The earnings per share trap. *Financial Analysts Journal 24*(3), 113–117. [2, 41]

Modigliani, F. and M. Miller (1958). The cost of capital, corporation finance, and the theory of investment. *American Economic Review 48*(3), 261–297. [1, 3, 5, 12, 15, 20, 27]

Modigliani, F. and M. Miller (1963). Corporate income taxes and the cost of capital. *American Economic Review 53*(3), 433–443. [1]

Mukhlynina, L. and K. Nyborg (2020). The choice of valuation techniques in practice: Education versus profession. *Critical Finance Review 9*, 201–265. [2, 4, 6]

Myers, S. (2001). Capital structure. *Journal of Economic Perspectives 15*(2), 81–102. [1]

Myers, S. and N. Majluf (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics 13*(2), 187–221. [1]

O'brien, P. (1988). Analysts' forecasts as earnings expectations. *Journal of Accounting and Economics 10*(1), 53–83. [1]

Oded, J. and A. Michel (2008). Stock repurchases and the EPS enhancement fallacy. *Financial Analysts Journal 64*(4), 62–75. [5, 26]

Pennacchi, G. and J. Santos (2021). Why do banks target ROE? *Journal of Financial Stability 54*, 100856. [5]

Petty, W., D. Scott, and M. Bird (1975). The capital expenditure decision-making process of large corporations. *The Engineering Economist 20*(3), 159–172. [4]

Pinegar, M. and L. Wilbricht (1989). What managers think of capital structure theory: A survey. *Financial Management 18*(4), 82–91. [7]

Pinto, J., T. Robinson, and J. Stowe (2019). Equity valuation: A survey of professional practice. *Review of Financial Economics 37*(2), 219–233. [4]

Pringle, J. (1973). Price earnings ratios, earnings-per-share, and financial management. *Financial Management 2*(1), 34–40. [2, 41]

Ronen, J. (2008). *Earnings management*. Springer. [5]

Schall, L., G. Sundem, and W. Geijsbeek (1978). Survey and analysis of capital budgeting methods. *Journal of Finance 33*(1), 281–287. [7]

Schwarz, N. (1999). Self-reports: How the questions shape the answers. *American Psychologist 54*(2), 93. [8]

Shleifer, A. and R. Vishny (1997). The limits of arbitrage. *Journal of Finance 52*(1), 35–55. [15]

Shleifer, A. and R. Vishny (2003). Stock market driven acquisitions. *Journal of Financial Economics 70*(3), 295–311. [5]

Solomon, E. (1963). *The theory of financial management*. Columbia University Press, New York. [5]

Stern, J. (1974). Earnings per share don't count. *Financial Analysts Journal 30*(4), 39–43. [2, 41]

Stern, J., J. Shiely, and I. Ross (2002). *The EVA challenge: Implementing value-added change in an organization*. John Wiley & Sons. [10, 41]

Stern, J., B. Stewart, and D. Chew (1995). The EVA financial management system. *Journal of Applied Corporate Finance 8*(2), 32–46. [10, 41]

Strebulaev, I. and B. Yang (2013). The mystery of zero-leverage firms. *Journal of Financial Economics 109*(1), 1–23. [53]

Taggart, R. (1977). A model of corporate financing decisions. *Journal of Finance 32*(5), 1467–1484. [15]

Taub, A. (1975). Determinants of the firm's capital structure. *Review of Economics and Statistics 57*(4), 410–416. [5]

Tirole, J. (2010). *The theory of corporate finance*. Princeton University Press. [5]

Tsetsekos, G., D. Kaufman, and L. Gitman (1991). A survey of stock repurchase motivations and practices of major US corporations. *Journal of Applied Business Research 7*(3), 15–21. [7]

Welch, I. (2011). *Corporate finance*. Prentice-Hall. [41]