Performance Pay Plans, Power and Product Prices*

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Abstract

Using a high-granularity dataset containing retail prices for ∼300,000 products spanning ∼1,000 narrowly-defined product categories, I examine how product prices relate to the performance metrics used in CEO pay plans. Firms with large market shares reduce their product prices when the CEO is compensated on the basis of: (1) accounting-based relative performance evaluation ("RPE") and/or (2) performance metrics that shield the CEO from expenses (e.g., sales or EBITDA). Price reductions occur sharply around the adoption of accounting-based RPE, but occur slowly around the adoption of sales-based pay. Price reductions with accounting-based RPE are most pronounced in product categories where firms compete directly against their RPE peers. The high granularity of the dataset allows for a tight empirical design that rules out many non-causal explanations. Collectively, this evidence is consistent with a large body of theoretical work which shows that RPE and cost shielding encourage competitive aggression, and thereby suggests that the performance metrics used in CEO pay plans can have important implications for customers, competitors, supply-chain partners and potentially antitrust authorities.

Keywords: Executive Compensation; Product Market Competition; Pricing; Relative Performance Evaluation; Cost Shielding

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1 Introduction

How do executive incentives affect firms' product market strategies? A large body of existing theory assumes that executive compensation plans can affect micro-level aspects of firm strategy, such as product pricing, however this premise has yet to be directly tested. I bridge this gap by using using a highly granular dataset containing the selling prices of roughly 300,000 retail products, and examining the empirical association between CEO performance metrics and product selling prices.

I focus on two salient features of CEO pay plan design: relative performance evaluation ("RPE") and "cost shielding," both of which have become commonplace in CEO pay plans. RPE is an approach to performance measurement in which a CEO's performance is evaluated based on how their firm's performance compares to that of a reference group of peers. Cost shielding pay plans include income statement performance metrics that exclude some or all expenses (e.g., revenue or EBITDA), thus shielding CEOs from those costs, at least partially, vis-á-vis their compensation (Bloomfield, Gipper, Kepler, and Tsui, 2021). Theory suggests that such incentives push firms with substantial market power to increase their competitive aggression. Absent countervailing frictions, rewarding a manager for outperforming their product market rivals, and/or shielding a manager from production costs, encourages aggression, leading to lower product prices (e.g., Fershtman, 1985; Vickers, 1985; Sklivas, 1987; Fershtman and Judd, 1987; Aggarwal and Samwick, 1999).

With respect to RPE, I document that firms with considerable market power reduce their product prices when their CEO pay plans include accounting-based RPE. This effect is sharp, and occurs immediately following the adoption of accounting-based RPE. The price reductions are more substantial in product categories where products are more substitutable, and/or more of the RPE peers act as competitors. In product categories where the firm has a negligible market share, no similar price reductions occur. This evidence is all consistent with the theory of RPE-motivated costly sabotage (Dye, 1984; Lazear, 1989; Gibbons and Murphy, 1990), whereby firms increase their competitive aggression to harm their peers' profits (more than they hurt their own).

Unlike accounting-based RPE, stock price-based RPE has little, if any, observable relation to selling prices. This finding stands to reason, as product market aggression is unlikely to be the preferred tactic for sabotaging stock price-based RPE peers; product market aggression has a very indirect effect on stock prices; more direct and lower cost alternative approaches are available, such as peer-harming voluntary disclosure policies (Bloomfield, Heinle, and Timmermans, 2023).

With respect to cost shielding, I document that firms with considerable market power reduce their product prices when their CEO pay plans include cost shielding performance metrics. This effect is strongest for sales-based pay, which provides the greatest degree of cost shielding. Effects are qualitatively similar, but somewhat weaker, for EBITDA-based pay, which provides an intermediate degree of cost shielding. I find very weak effects for EBIT-based pay (which provides very little cost shielding), and an opposite-signed effect for bottom-line earnings, which offers no cost shielding at all, instead holding managers entirely accounting for all expenses. This evidence is all consistent with theory; cost shielding appears to encourage heightened aggression, while cost accountability (e.g., from bottom-line earnings-based pay) appears to discipline competitive aggression.

In contrast to accounting-based RPE, the relation between cost shielding and product prices does not appear to be sharp—price changes are not detectable within a short window around the adoption of sales-based pay. One possible explanation for this difference is the following. It is conceivable that RPE has an immediate effect on firms' incentives to behave aggressively, because the CEO immediately values the harm competitive aggression inflicts upon peers, while cost shielding has a slower effect by encouraging costly investments in capacity, which will not map into product prices until further in the future.

Collectively, the evidence in this study is aligned in suggesting that the metrics used for evaluating and compensating CEO performance can and do affect product prices in the manner presumed by extant theory. Specifically, accounting-based RPE (which encourages CEOs to outperform their product market competitors) and cost shielding (which downweights expenses in the CEO's incentive pay plan) appear to motivate powerful firms to reduce the prices of their product offerings. Firms without the requisite power to engage strategically in the product market (i.e., firms with small market shares) do not behave this way.

Prior to this study, direct evidence regarding the link between CEO incentives and competitive aggression has remained elusive. Closest to addressing this, a recent paper by Feichter, Moers, and Timmermans (2022) uses a structured content analysis to examine the link between RPE peer group overlap and text-based measures of competitive aggression. Specifically, Feichter et al. (2022) document that, when RPE peer groups are more overlapping (i.e., peer relations are more mutually symmetric), news events about those firms in the press suggest a more aggressively competitive relationship, with a greater focus on new product launches, pricing decisions, market strategy, acquisitions, strategic partnerships, and the like. No existing work yet provides direct evidence of a link between CEO incentives and product market selling prices.

Prior work on the topic has been impeded by two primary obstacles. First, product prices are usually difficult to observe in broad samples. Standard data sources, like Compustat, provide aggregated revenue numbers, but these figures aggregate across numerous product lines, and comingle product prices with sales volumes. Second, product prices and CEO incentives are both highly endogenous; changes in CEO incentives may be associated with firm-level pricing decisions for any number of reasons that do not require a causal effect of one on the other.

This study addresses the gap in the literature by using highly granular scanner data on retail store product prices. I examine monthly average selling prices for close to 300,000 products, partitioned into over 1,000 distinct product categories (called "modules"), produced by over one hundred of the largest consumer packaged goods ("CPG") manufacturers in the United States (e.g., Coca Cola, PepsiCo, Kellogg's, General Mills, Procter and Gamble, Colgate-Palmolive, etc.).

These data help mitigate many of the problems impeding earlier work on the topic. First and foremost, the data provide retail selling prices for a broad range of products. In the accounting and finance literatures, prior research on product prices has typically used very loose proxies for pricing (e.g., gross margins or other ratios of accounting numbers) or focused on very niche product categories for which data are more easily available, (e.g., airline ticket prices, as in Azar, Schmalz, and

Tecu, 2018). My data do not cover the entire American economy, but capture a broad swath of retail products, ranging from electronics/appliances to food and beverage products, to OTC medication and cosmetics, and toiletries, along with a wide variety of miscellaneous merchandise. Essentially, any type of product that can be purchased from a supermarket, grocery store, convenience store, liquor store or drug store can be found in my sample.

Second, the highly granular, disaggregated nature of the data makes it more feasible to address endogeneity concerns related to product market supply and demand shocks, and CEO incentive design. In particular, the high-granularity of the data allows me to carefully filter out many extraneous (and potentially problematic) sources of variation through a tight fixed effect structure. For example, with module-year-month fixed effects, which I use throughout my analysis, I subsume any arbitrary timeseries of supply and demand shocks, at the module level. The modules in my data are highly precise (much more so than a typical industry definition), for example distinguishing napkins from paper towels from facial tissues from toilet paper. With such precise product categories, shocks are likely to be reasonably homogeneous within each product category.

Moreover, the disaggregated nature of the data allows a firm to act as its own control, *within* each point in time. Almost every firm in the sample operates simultaneously across multiple different product categories (often hundreds of them), and commands very different levels of power across product categories, at the same point in time. Most firms act as major players in some product categories while simultaneously being nearly atomistic price-takers in other product categories. As such, the data provide within-firm-time variation in market power and product pricing. For example, Colgate-Palmolive may have a commanding 35% market share in the tooth brush market, while simultaneously having a modest single-digit percentage market share in the dish detergent market. For a given firm at a given point in time, the performance metrics in the CEO pay plan—and their determinants—are held constant across all product categories in which the firm operates. But the pricing implications of the performance metrics in the CEO pay plan can vary widely across product categories, depending on the firm's market share in one market versus another.

So while CEO incentives remain an endogenous firm choice, the disaggregated nature of the data allows me to filter any firm-level point-in-time effects (e.g., CEO incentives and their determinants, governance policies, firm-wide supply and demand shocks), and still retain the variation necessary to estimate the heterogeneous effects of CEO incentives on product prices, as a function of market share. Ultimately, I cannot possibly rule out all conceivable endogeneity concerns, but the data allow me to address many potentially confounding factors by accommodating arbitrary module-wide and/or firm-wide time trends.

This study makes several contributions. First and foremost, this is the first study to provide direct, broad sample evidence regarding the link between the performance metrics in the CEO pay plan and product retail prices. Many theoretical models *assume* the existence of such a relation, and rely on this presumption to generate predictions about compensation practices (e.g., Fershtman, 1985; Vickers, 1985; Fershtman and Judd, 1987; Sklivas, 1987; Aggarwal and Samwick, 1999; Bloomfield, Friedman, and Kim, 2023; Bloomfield, Marvao, and Spagnolo, 2023). Moreover, predictions from many of these models have found empirical support, vis-á-vis observed pay practices. For example, Vrettos (2013) and Bloomfield (2021) find that firms' use of RPE and sales-based pay align with predictions from strategic delegation, regarding the use of CEO pay as a form of observable commitment to product market aggression. Coming at it from a slightly different perspective, Bloomfield et al. (2023) documents that firms are more likely to rely on RPE– and use it more effectively for risk-sharing– when the concern of RPE-induced cost sabotage via product market aggression is mitigated by cartel membership.

The prior evidence regarding pay plan design supports the notion that the underlying premise– that pay practices materially influence product market strategy– is empirically descriptive. However, this prior evidence does not constitute an explicit test of the assumption itself, only its resultant predictions. This study bridges the gap by explicitly examining the underlying link between pay plans and product prices. Most closely related to this study is a recent paper by Feichter et al. (2022), which examines the link between RPE peer group overlap and text-based measures of competitive aggression, using a structured content analysis. This study complements Feichter et al. (2022) by explicitly documenting the product price changes, themselves. In so doing, this study also adds to the growing literature which directly examines the link between accounting/finance topics and product selling prices. Related work in this area examines how product prices relate to common ownership (e.g., Antón, Ederer, Giné, and Schmalz, 2018; Backus, Conlon, and Sinkinson, 2021) and M&A activity (Kepler, Naiker, and Stewart, 2021).

This paper further contributes to the large literature on CEO compensation, and its effects on firm behavior. A long stream of literature has examined the influence of CEO compensation on firms' investment and risk-taking activities (e.g. Ai and Li, 2015; Coles, Daniel, and Naveen, 2006; Tsao, Lin, and Chen, 2015; Sheikh, 2012; Bizjak, Brickley, and Coles, 1993; Cheng, 2004). This paper provides evidence to suggest that CEO incentives affect another important aspect of firm strategy: product pricing decisions. Related to this literature, a great deal of prior work in this area has questioned the importance/relevance of CEO performance pay plans as drivers of firm behavior, in light of their small stature in comparison to CEOs' large equity stakes (e.g., Core, Guay, and Verrecchia, 2003; Core, Guay, and Larcker, 2003). Other studies have pushed back against this perspective arguing that CEO performance pay plans can play a vital role in communicating strategic priorities in incentivizing their achievement (e.g. Murphy and Jensen, 2011; Bloomfield et al., 2021; Bushman, 2021). This study provides further evidence of the importance of CEO pay plans by documenting that CEO incentive plans appear to affect a fundamental component of firm strategy: product selling prices.

Lastly, this study contributes to the literature on accounting policy (e.g., disclosure, reporting and performance measurement), and its relation to product market competition. A large body of existing literature examines the interplay between product market considerations and accounting policy. Most well-known is the role of "proprietary costs" in curbing firms' disclosure practices.[1] More recently, an emerging body of work examines how firms use their reporting and/or disclo-

[1] See: (e.g., Ellis, Fee, and Thomas, 2012; Lang and Sul, 2014; Li, Lin, and Zhang, 2018; Bernard, Burgstahler, and Kaya, 2018; Berger and Hann, 2007; Heinle, 2020; Verrecchia, 1990, 1983; Berger, Choi, and Tomar, 2023; Glaeser, 2018; Verrecchia and Weber, 2006; Boone, Floros, and Johnson, 2016).

sure policies to improve their product market position via entry deterrence, strategic commitment or strategic coordination.[2] This study contributes to this established literature by documenting one concrete channel through which accounting policy affects product market competition: the performance metrics in CEO pay plans influence product pricing.

The remainder of this paper is organized as follows. Section 2 provides institutional and theoretical background and lays out my predictions; Section 3 describes the data sources, sample and key variables used in my analysis; Section 4 explains my empirical strategy; Section 5 discusses and empirical results; and Section 6 concludes. Appendix A provides a stylized model demonstrating how RPE might affect product selling prices and Appendix B discusses the relation between my empirical design and a hedonic pricing regression. Appendix C illustrates the empirical design within the context of a real-world example involving Colgate-Palmolive's adoption of RPE.

2 Background and Hypothesis Development

In most neoclassical models of corporate decision-making, the sole function of the firm is to maximize its profits (e.g., Hicks, 1939, 1946; Marshall, 1890). Under this paradigm, product market strategies (e.g., product prices) are simply those that equate marginal revenues and marginal costs.

More modern conceptions of the "theory of the firm" appreciate the more nuanced nature of the firm as a legal entity, comprised of a "nexus of contracts" linking together a myriad of other entities/individuals, all with their own goals and motivations (e.g. Jensen and Meckling, 1976). Firms, and their behaviors, can thus be better understood by examining the incentives of the key decision-makers that comprise the firm.

Decision-makers in these firms often have explicit performance goals that diverge from sheer profit or stock price maximization. For example, many incentive pay plans shield CEOs from costs (e.g., performance pay based on revenue or EBITDA), and/or reward managers for *relative* prof-

[2] See: (e.g., Li, 2010; Bertomeu and Liang, 2015; Burks, Cuny, Gerakos, and Granja, 2018; Tomy, 2019; Bloomfield and Tuijn, 2019; Bourveau, She, and Žaldokas, 2020; Bertomeu, Evans III, Feng, and Tseng, 2021; Kepler, 2021; Glaeser and Landsman, 2021).

itability, compared to a peer group. In theory, these incentives can create a sharp divide between the product market strategy that maximizes firm profits (i.e., equates marginal revenues and marginal costs), and the strategy that maximizes the decision-maker's personal objective function. In what follows, I discuss two particularly salient forms of executive incentives– RPE and cost shielding– and offer testable predictions as to their likely impacts on product pricing.

2.1 Relative Performance Evaluation

RPE has become a staple in many firm's CEO pay plans. Since 2006, explicit reliance on peer-based RPE has grown by over two-and-a-half times, from ∼11% in 2006 to ∼29% in 2019 (Bloomfield, Guay, and Timmermans, 2022).[3] Much of this growth can likely be attributed to external pressure from proxy advisors and compensation consultants who consistently tout RPE as an integral part of their compensation design 'best practices' (e.g., Meridian Compensation Partners LLC, 2016; 2019; Institutional Shareholder Services Inc., 2020; Glass Lewis, 2020).

The primary justification for RPE is that it helps shareholders share risk with their CEOs (e.g., Holmström, 1982; Lazear and Rosen, 1981) In particular, RPE helps filter out common performance shocks—those that economically related firms are similarly exposed to—and thereby allows firms to better monitor/ascertain the CEO's contribution to value creation (or destruction). Existing work supports the notion that firms use RPE, and implement it quite effectively, for this purpose. For example, Bloomfield et al. (2022) shows that firms are more likely to use RPE when the potential risk-sharing benefits are greater, and moreover RPE-using firms typically construct peer groups that are about as effective as possible at filtering common risk.

In addition to risk-sharing, RPE also has another theoretical effect: it incentivizes "costly sabotage" (e.g., Dye, 1984; Lazear, 1989; Gibbons and Murphy, 1990; Chowdhury and Gürtler, 2015). When agents are evaluated and compensated on the basis of relative performance, they are rewarded for taking actions that harm the performance of the benchmark, even if doing so comes

[3]The recent growth in RPE usage is even larger when index-based RPE is considered; I focus exclusively on peer-based RPE in this study.

at the expense of their own absolute performance. To improve relative performance, agents need only ensure that the damage done to the benchmark outstrips the cost to their own performance.

Depending on the context, costly sabotage can take many different forms. In electoral politics, it may look like "negative campaigning" (e.g., White, 1994; Lau and Pomper, 2002, 2004, 2001a,b; Lau and Rovner, 2009). In higher education, it may manifest as destroying classmates' work product (Royal and Guskey, 2014). In an intra-firm corporate promotion context, sabotage may play out as lackluster cooperation with coworkers, or spreading rumors (e.g., Gibbons and Murphy, 1990).

In the context of CEO compensation, the RPE peers are not co-workers, but rather other firms—often product market competitors. As such, one of the most direct ways to engage in costly sabotage is likely through product market strategy. In most oligopolistic games, excessive competitive aggression (e.g., profit-reducing overproduction and/or price cutting) is a viable tactic for boosting relative performance, at the expense of absolute performance. For a firm with considerable market power, these tactics reduce profits for the firm employing them a little, while reducing rival profits by much more.

In theory, there are contexts in which this side effect can be wielded, strategically, as a tool for gaining product market advantage. Through the lens of "strategic delegation," Aggarwal and Samwick (1999) show that Cournot rivals can use RPE as a strategic commitment device, credibly signaling their commitment to aggressive overproduction. In Cournot oligopolies, rival firms' strategic actions are substitutes, meaning that one firms' aggressive commitment encourages other firms to cut back production, as a best response, which softens competition for the RPE-using firm. Suggestive empirical evidence by Vrettos (2013) supports the notion that (at least some) firms use RPE for this purpose.

Whether the intended purpose or not, RPE is likely to encourage excess aggression, resulting in lower product selling prices. However, this effect is not likely to be homogeneous across contexts. The link between RPE and competitive aggression hinges crucially on product market power. A price-taking firm in a competitive market has very limited scope for effectively sabotaging competitors- any deviation away from profit maximization is almost sure to hurt the deviating firm more than its rivals. In contrast, a major player with considerable market power likely has ample ability to engage in strategies that are somewhat profit-reducing for themselves, but considerably more damaging to their rivals. As such, my first prediction is:

P1: For firms with large market shares, RPE is negatively related to prices.

Not all RPE grants evaluate relative performance on the same basis. In particular, the link between RPE and product market aggression likely depends on the performance metric used for the relative performance comparison. RPE-motivated product market aggression is likely more prevalent when the basis for comparison comes from accounting-based performance metrics (e.g., earnings). Most accounting measures of performance, like sales or earnings, are directly tied to product market outcomes, and are difficult to influence through other channels.

Another common basis for comparison is stock price performance. Unlike accounting-based performance metrics, relative stock performance is only affected indirectly by product market outcomes. Product market outcomes flow into accounting numbers, which are then reported and disseminated to shareholders who process the information to form expectations about future cash flows and risks, which they then use to value the firm's stock. While there is still a straight line connecting product market sabotage to relative stock performance, the path is much less direct, likely rendering the sabotage tactic less effective. Moreover, there are alternative (presumably preferable) strategies for engaging in sabotage when the basis for comparison is stock performance. For example, Bloomfield et al. (2023) provide evidence that firms with stock price RPE enact peer-harming voluntary disclosure policies to depress peers' stock prices, and boost relative performance. Such a strategy is far more direct, and probably also less costly to the firm, since it does not require deviating from value-maximizing operations.

2.2 Cost Shielding

RPE can encourage price cuts by rewarding the CEO for the harm this choice inflicts upon product market rivals—specifically those in their RPE peer groups. However, RPE is not the only pay plan design feature that is likely to encourage price cuts. Another common feature of executive pay plans that is likely to have a similar impact is "cost shielding" (Bloomfield et al., 2021).

Cost shielding pay plans rely on performance metrics that exclude particular expenses, and thereby (partially) inoculate managers from these expenses, vis-á-vis their compensation. For example, sales-based pay shields the CEO against all expenses, while milder forms of cost shielding such as EBIT- or EBITDA-based pay provide more targeted approaches, shielding CEOs against specific categories of expenses, like interest and depreciation expenses.

There are many reasons why cost shielding may be a useful pay plan design feature. From a risk-sharing perspective, expenses may be volatile and largely outside of the manager's control (e.g., input price shocks), in which case cost shielding can protect managers' from undue outcome risk (Holmström, 1979). Cost shielding can also be used to address more specific agency frictions related to managerial myopia and/or inefficient internalization of sunk cost (Bloomfield et al., 2021).

Much like RPE, cost shielding can also be used as a strategic tool for softening competition from product market rivals. In a similar spirit to Aggarwal and Samwick (1999), a number of papers show, analytically, how sales-based pay can function as a strategic commitment to aggressive product market behavior (e.g, Fershtman, 1985; Vickers, 1985; Sklivas, 1987; Fershtman and Judd, 1987). Moreover, Bloomfield (2021) provides supporting empirical evidence, showing that firms are more likely to start using revenue-based pay as a form of cost-shielding when: (1) they can credibly disclose doing so to their rivals; and (2) an observable commitment to aggressive product market behavior is most likely to elicit softer competition from rivals.

Regardless of the reasons for cost shielding, the incentive effect vis-á-vis product pricing is likely to be similar. Firms with pricing power are likely to lower their selling prices when CEOs are held less accountable for production expenses. As such, my second prediction is:

P2: For firms with large market shares, cost shielding is negatively related to prices.

This effect is likely most pronounced for sales-based pay, which shields the CEO from *all* expenses. EBITDA-based pay is also likely to have an effect, since depreciation is a substantial portion of the product cost for many firms' operations.[4] In contrast, EBIT-based pay is unlikely to have a major impact on selling prices. Interest and tax expense likely do not vary much with product market strategy, though could perhaps facilitate investment and thereby indirectly spur production. Bottom-line earnings-based pay (which fully exposes managers to expenses, offering no cost shielding) is likely to act in the opposite direction, disciplining product market aggression.

2.3 Credibility of the Null

There are many reasons why CEO incentives might *not* be associated with product selling prices. First, it has been argued that performance pay plans are effectively irrelevant in altering CEO incentives, given the sheer magnitude of a typical CEO's equity holdings (e.g., Core et al., 2003)—equity incentives tend to be much larger than other components of pay, in pure financial terms. However, ample evidence suggest that aspects of the incentive pay plan, beyond sheer stock price incentives, are important to firms and their managers (e.g. Bushman, Indjejikian, and Smith, 1996; Murphy and Jensen, 2011; Guay, Kepler, and Tsui, 2019; Bushman, 2021; Gipper, 2021; Bloomfield, 2021; Bloomfield et al., 2021).

Second, CEOs are typically not directly involved with day-to-day operational decisions related to the particulars of product market strategy (e.g., pricing, issuance of sales promotions, production schedules, etc.). Most large organization are highly decentralized with those sorts of operational decision-making rights and responsibilities being spread across dozens or hundreds (potentially thousands) of managers through a lengthy chain of delegation. However, incentives from the top do typically percolate down through the organization, ultimately influencing incentives further

[4]While depreciation is typically thought of as an economically fixed and sunk cost (i.e., the purchase price of a machine or factory or warehouse does not change based on how it is used), accounting systems often treat these costs as if they are variable. Depreciation on any manufacturing PP&E is considered 'product cost' which is allocated to products and expensed as part of costs of goods sold ("COGS") when those products are sold.

down the chain, where more direct influence over day-to-day operations lies (Mookherjee, 2006).

Third, product selling prices are not solely under the control of the manufacturers (the focus of my study). The prices customers experience in the storefront (what I observe in my data) are the end result of a supply-chain transaction, involving manufacturers and retailers, and potentially intermediary wholesalers, all of whom bring their own incentives and motivations into the negotiation process (Bonnet and Dubois, 2010; Wang, Wang, and Wang, 2013; Olbrich, Jansen, and Hundt, 2017). As such, it is conceivable that variation in manufacturers' pricing incentives might have very little impact on the final selling prices observed in retail outlets.

Fourth, it is possible that CEO incentives do indeed have a major impact on firms' product market strategies, but do so in a way that does not clearly manifest through product prices. For example, cost shielding via sales-based pay might encourage price cuts, because managers are less responsible for the product costs incurred (as predicted). Alternatively, selling prices might *increase* because managers spend more on higher quality inputs and/or on R&D and advertising– also shielded expenses– spurring greater demand for their products. It is possible (or even likely) that both forces are simultaneously present in the data, and the two effects countervail.

Fifth, it is possible that CEO pay plan metrics influence product selling prices, as predicted, but are endogenously adjusted to balance out countervailing frictions, to keep prices as close to profit-maximizing as possible. For example, if omitted frictions encourage overpricing, and cost shielding and/or RPE are continuously calibrated to counterbalance these frictions, then the empirical analysis will document a null association between pay plan metrics on product prices, despite a causal effect of pay plans on product prices.

In sum, there are many reasons to expect CEO pay plans to be related to product selling prices, but also many reasons to be skeptical of such a relation. Ultimately, it is an empirical question whether, and to what extent, the performance metrics use for CEO compensation, on the manufacturing side, relate to products' retail selling prices. In what follows, I document the empirical relations between various performance metrics product prices.

3 Data, Sample and Key Variables

In this section, I describe the data sources and sample construction procedures, and define the key variables used in my analyses.

3.1 Data and Sample

My sample comes from the intersection of Incentive Lab (provided by Institutional Shareholder Services) and the NielsenIQ Retail Measurement Services dataset (provided by the Kilts Center). Incentive Lab provides details on executive pay plan design (e.g., the metrics used for evaluating and compensating CEO performance). NielsenIQ's Retail Measurement Services dataset provides highly granular data on product selling prices in retail stores all around the United States of America. These data reflect product prices at the UPC-store-week level, where UPC stands for "universal product code" (the 12-digit barcode found on any product sold in a retail outlet).

For this study, I aggregate these data to the product-month level, and then match these products, by hand, to the publicly-listed parent company that owns the UPC (usually the manufacturer, but sometimes a holding company that owns the manufacturer). This procedure results in a final sample consisting of 10,662,283 observations over a 12-year period (from 2007 to 2018) comprised of 116 publicly-listed firms– primarily major CPG manufacturers– selling 294,300 products across hundreds of product groups, further partitioned into 1,052 distinct (and highly precise) product categories known as "modules." Figure 1 presents an example of the organizational hierarchy.

Table 1 provides tabulated descriptives on the sample composition. Panel A presents a breakdown of the sample, by retail department. The largest department is "Dry Grocery" (e.g., cereals, breads, crackers, chips, nuts, etc...) accounting for a little over 30% of the sample. "General Merchandise" and "Health & Beauty Care" are next most prevalent, contributing about 20% each. Panel B lists the 20 largest companies in the sample (by number of observations) and tabulates the number of observations attributable to each one. The largest twenty companies account for roughly 70% of the sample, with the remaining ~100 companies combining to account for the other 30%.

3.2 Key Variables

In this subsection, I describe the construction of the variables used in my analyses. Summary statistics can be found in Table 2.

3.2.1 Product Prices

The primary dependent variable across all specifications is the price of a product, measured at the product-year-month level. In my regressions, I use $log(Price_{i,j,p,t})$, equal to the natural logarithm of the average price at which firm i sells product p in product module j during year-month t. I use the natural logarithm to mitigate skewness, and also because this allows the regression results to better reflect proportional changes in price—a $1 change in price can be an enormous change or a negligible change, depending on the initial price level, and the log transform takes this into account.

3.2.2 Performance Metrics

The primary independent variables across all specifications are indicators reflecting the presence of a particular performance metric in the CEO pay plan. In total, I examine six different metrics: *Acct RPE*, equal to one if the CEO has incentive pay tied to accounting-based RPE (*performancetype*="Rel" & *metrictype* = "Accounting"); *Stock RPE*, equal to one if the CEO has incentive pay tied to stock price-based RPE (*performancetype*="Rel" & *metrictype* = "Stock Price"); *Sales Pay*, equal to one if the CEO has incentive pay tied to absolute sales objectives (*performancetype*="Abs" & *metrictype*="Sales" or "Gross Revenue"); *EBITDA Pay*, equal to one if the CEO has incentive pay tied to absolute EBITDA objectives (*performancetype*="Abs" & *metrictype*="EBITDA"); *EBIT Pay*, equal to one if the CEO has incentive pay tied to absolute EBIT objectives (*performancetype*="Abs" & *metrictype*="EBIT" or "Operating Income"); and *Earnings Pay* equal to one if the CEO has incentive pay tied to absolute bottom-line earnings objectives (*performancetype*="Abs" & *metrictype*="EPS" or "Earnings"). All incentive measures are defined at the firm-year-month level (indexed only by i and t); for a given firm at any given time, the metrics in the CEO pay plan are identical across all the product modules in which the firm operates.

3.2.3 Product Market Power

The primary moderating construct across all specifications is product market power. I measure product market power using market shares, at the firm-module-level, lagged by 12 months.[5] That is, for firm i operating in product module j at time t, I define the variable $Share_{i,j,t-12}$ equal to the firm i's revenue from product module j twelve months before time t (i.e., at time $t-12$) divided by total revenue in product module j (across all firms in the market) at time $t-12$. In my main analyses, I use $log(Share)$ equal to the natural logarithm of the lagged market share. In robustness analyses, I also use $sqrt(Share)$ equal to the square root of the lagged market share; and $Share$ equal to the raw, untransformed lagged market share.

4 Empirical Strategy

While theoretical work has long provided clear predictions regarding the link between pay plan performance metrics and product pricing, empirical work has been slow to test these implications. This is likely due, in large part, to two major obstacles: data limitations and endogeneity concerns.

First, conventional data sources do not provide clear information about product market strategy. For example, Compustat provides summary data about revenue, but this information cannot be reliably attributed to specific product lines—it is either at the firm-level or, at best, a fairly aggregate segment level. Most large firms operate in several distinct product markets, and may employ different tactics/strategies across them based on their share of a particular market. For example, a firm may be a major strategic player in some product markets, while being a fairly atomistic price taker in others. Moreover, even if revenues can be tied to specific product lines/markets, revenue commingles both selling prices and sales volumes, and the two cannot be disentangled without

[5] I use lagged market shares to avoid the possibility of reverse causality, whereby the market share is endogenous to the current incentive plan.

major assumptions or additional information.

Second, product pricing and CEO pay plan design are both highly endogenous, and thus may be associated with each other for a number of reasons beyond the causal effect of one on the other. For example, selling prices are sensitive to supply and demand shocks, and CEO incentive plans are likely designed with these potential shocks in mind (e.g., using RPE or cost shielding to protect risk-averse managers from systematic input price shocks).

To mitigate both of these issues, I rely on the NielsenIQ RMS data set. This data source partitions products into over 1,000 different highly granular "modules," and provides UPC-level product prices. These modules are far more detailed than any conventional industry classification. For an example of the level of granularity, the data has separate modules for toothbrushes versus toothpaste versus mouthwash versus dental floss, as well as napkins versus paper towels versus facial tissues. The high-precision product modules allow for tight fixed effects (module-year-month) to strip out arbitrary supply/demand shocks at the module-year-month level. Given how tightly these modules are defined (i.e., how similar products must be to reside within the same module), any module-year-month shocks are likely to be fairly homogeneous across products.

With respect to CEO incentives, the disaggregate nature of the data are helpful in that they allow for identification from within-firm-time variation in market shares and product prices. Typically, within-firm variation comes exclusively from the timeseries (e.g., changes over time in the dependent and independent variables). While this timeseries variation is important for this study, there is also an additional dimension of within-firm variation coming from the cross-section of product markets in which a firm simultaneously operates. Below, I detail how I exploit this rich variation.

The granularity of the data allows for an empirical strategy that would not ordinarily be feasible: a firm can act as its own control, at each point in time. The design of the CEO pay plan, and any change to it, applies simultaneously throughout a firm. However, the implications of the CEO pay plan for product pricing vary across product categories, based on the firm's market power in each category. A given firm will often be a powerful strategic player in some product markets while simultaneously being an atomistic price-taker in other product markets. With this in mind, I can use tight fixed effects (firm-year-month) to control for an arbitrary timeseries of firm-wide factors– including executive incentives– while still retaining the variation needed to test my predictions. While CEO incentives remain an endogenous firm choice, this design substantially alleviates endogeneity concerns by allowing for the main effects of CEO incentives– along with any other firm-wide point-in-time effects, such as the determinants of CEO incentives– to be entirely controlled for in the analysis.

The general estimating equation is of the form:

$$\begin{aligned} log(Price_{i,j,p,t}) &= \sum_{m \in M} \beta_m Metric_{m,i,t} \times log(Share_{i,j,t-12}) \\ &+ \gamma log(Share_{i,j,t-12}) + \sum_{m \in M} \lambda_m Metric_{m,i,t} + \phi_{i,t} + \mu_{j,t} + \varepsilon_{i,j,p,t}, \end{aligned} \tag{1}$$

where M is the set of performance metrics examined, with m indexing each metric, i indexing each firm, j indexing each product category (i.e., module), p indexing each unique product (i.e. UPC), and t indexing each year-month. Firm(-year-month) fixed effects are reflected by $\phi_{i,t}$, and module-year-month fixed effects are reflected by $\mu_{j,t}$.[6]

In these specifications, the parameters of interest are the β's, which reflect the moderating role of market share in the relation between performance metrics and product selling prices. In concept, the regression is akin to a generalized difference-in-differences design. The $Metric$ indicator variables turn 'on' and 'off' analogously to a $Post$ variable, indicating whether or not the metric is included in the pay plan. The $log(Share)$ variable reflects a continuum of treatment intensity; greater market share is predicted to heighten the sensitivity of product prices to CEO incentives.

In my main analyses, I use three different fixed effect structures: (1) module-year-month; (2) firm + module-year-month; and (3) firm-year-month + module-year-month.[7] These various fixed

[6]This design has some superficial similarities to "hedonic pricing regression." See Appendix B for a discussion of this relation, and explanation of why the typical concerns are unlikely to be present in my context.

[7]Note that with the inclusion of firm-year-month fixed effects, the main effects of $Metric_{m,i,t}$ are subsumed.

effect structures allow for the coefficients of interest to be identified from different sources of variation. All specifications include module-year-month fixed effects, which strip out any arbitrary timeseries of module-level supply and/or demand shocks. The portion of product prices not explained by these fixed effects can be thought of as "abnormal" price—i.e., the difference between a product's price and the average price of all other very similar products at the same point in time.

With no other fixed effects included, identifying variation comes primarily from cross-sectional heterogeneity in firms' pay plans, market shares and abnormal product prices. With the addition of firm fixed effects, identifying variation comes primarily from within-firm cross-sectional variation in market power, and within-firm timeseries variation in pay plans and abnormal product prices (e.g., price changes in response to adding a new metric to the CEO pay plan). With interacted firm-year-month fixed effects, identifying variation comes exclusively from within-firm-time variation in market share and abnormal product prices. For example, a firm may be a big player in one product category, and a small player in another product category, at the same point in time. The CEO pay plan metrics are equivalent across the two categories, but the metrics may relate to abnormal prices differentially across the two categories, as a function of the firm's market share in each category.[8]

This design is not impervious to identification threats; without exogenous variation in CEO incentives, I cannot conclusively establish that CEO pay plan metrics play any causal role in affecting product prices. However, the depth and granularity of the data allow this design to rule out a litany of potential alternative explanations. For example, the results in this study *cannot* be attributed to: cross-firm differences in pay plans and product pricing; sample-wide, module-wide and/or firm-wide time trends in CEO compensation and product pricing; or changes in CEO compensation in response to (or anticipation of) firm-wide and/or module-wide shocks.

Any threat to the validity of my inferences would have to explain why CEO pay plan metrics associate with product selling prices *differentially*, as a function of the firm's market share in a specific product category. In my view, the most credible alternative interpretation is that CEO

[8]See Appendix C for a real-world example, involving Colgate-Palmolive's adoption of RPE, which illustrates how within-firm-time variation in market shares can be used to identify the effects of interest.

incentives are adjusted as one component of a larger strategic shift, intended to influence the product markets in which the firm is more dominant. In this case, the estimated coefficients may not be unbiased estimates of the causal effect of CEO pay plans on product prices. Instead, they would reflect the effect of the overall strategic shift, as proxied for in my regressions by the change in pay plan metrics. Even under this alternative interpretation, pay plan design choices would still be an integral component of– and credible signal for– strategic intention and competitive aggression.

5 Empirical Results

In this section, I present and discuss the results of my empirical analysis.

5.1 Descriptives

I begin my empirical analysis by describing the data, and the variation contained within it. The most important sources of variation relate to pay plans and market share. I discuss both below.

5.1.1 Pay Plans

The two most common performance metrics are bottom line earnings (72.7% of observations) and sales (61.7% of observations), followed far behind by EBIT (36.0% of observations) and stock price RPE (15.3% of observations). The two least common performance metrics I examine are EBITDA (13.2% of observations) and accounting-based RPE (2.5% of observations).[9]

Similar to Bloomfield et al. (2021), I find that earnings metrics seem to act as substitutes; reliance on EBITDA- EBIT- and bottom-line earnings-based pay are all negatively correlated with each other. The use of sales-based pay is negatively correlated with EBITDA-based pay (which provides the most similar level of cost shielding), but positively correlated with the use of EBIT- and bottom-line earnings-based pay.

[9]Note that even less common metrics, like accounting-based RPE, are still present in hundreds of thousands of observations and can be found represented in the majority of product categories. Twelve percent of the firms in my sample use accounting RPE at some point during the sample window, peaking in popularity in 2009 with a 7.7% usage rate.

5.1.2 Market Share

Firms tend to operate across a large number of product categories, and exhibit a great deal of heterogeneity in market share across the markets in which they they operate. The average (median) firm in the sample operates in 185.2 (184) product categories, and commands an average (median) market share of 21.3% (15.3%) in each product category in which they operate. Most product markets have at least one major player; over one-third (one-half) of all modules have at least one firm with a 30% (27%) market share. Almost all modules have small players—in over 95% (90%) of modules, there are firms with shares of less than 5% (1%). That is, most modules have both large players and small players, at the same time.

At any point in time, the within-firm variation in market power is also substantial. Almost 95% of the firms in the sample operate in at least one product category in which they have a share of less than 1% (i.e., virtually no market power at all). Seemingly at odds with this fact, the average firm in my sample operates in at least one product category in which they command a >35% market share (i.e., considerable market power). That is, most of the firms in my sample are atomistic price-takers in some markets, and powerful strategic players in other markets, at the same time.

5.2 RPE and Product Prices

I first examine the link between RPE and product prices, using the estimating equation described by eq. (1). The two metrics of focus are *Acct RPE* and *Stock RPE*. Specifications differ with respect to fixed effect structure. All specifications include module-year-month fixed effects, which strip out any arbitrary timeseries of module-level supply and/or demand shocks. Specification (1) includes no additional fixed effects. Specification (2) adds firm fixed effects. Specification (3) replaces the firm effects with firm-year-month fixed effects. The results are presented in Table 3.

The results demonstrate that market share significantly moderates the relation between accounting-based RPE and product prices. Large-share firms appear to reduce their prices when their CEOs have accounting-based RPE in their pay plans. On average, for firms using accounting-based RPE, a one percent increase in market share is associated with a roughly 0.03 to 0.04 percent decrease in product prices. To put this economic effect size in perspective, the results in specification (1) suggest that the use of accounting-based RPE is associated with an ∼11% price reduction, for a firms with a 50% market share, but only a ∼1.5% price reduction for a firm with a 5% market share.[10]

The results in Table 3 provide no evidence of a link between stock price-based RPE and product prices. The estimated coefficients on $log(Share) \times Stock\ RPE$ are all statistically insignificant and economically minuscule. The divergent results between accounting-based and stock-based RPE are consistent with the notion that accounting-based RPE is much more likely to elicit product market aggression as a form of costly sabotage. This finding is not surprising. As discussed in Section 2.1, product market aggression can have a direct impact on peers' accounting performance outcomes (e.g., sales and/or profits), but the connection to stock performance outcomes is much more tenuous. As such, product market aggression is likely not a go-to tactic for engaging in sabotage against stock price-based RPE peers. A much more natural strategy might be to use strategic peer-harming voluntary disclosures to depress peers' stock prices. Bloomfield et al. (2023) provides evidence to suggest that firms use such tactics against their stock price RPE peers.

The disparate results across accounting-based and stock price-based RPE may (partially) explain why stock price-based RPE is more popular. To the extent that excess competitive aggression is an undesirable form of costly sabotage, boards may prefer to forgo giving CEOs pay plan incentives that are likely to encourage it (e.g., Bloomfield et al., 2023). If stock price-based RPE is a less costly risk sharing tool, firms may opt to use that instead of accounting-based RPE. Accounting-based RPE may be used when firms are actively trying to commit to excess aggression (á la Aggarwal and Samwick, 1999) to soften the competition they face from their rivals.

[10] Calculated as $0.137 - 0.041 * log(Share)$: $0.137 - 0.041 * log(0.5) = 0.109$; $0.137 - 0.041 * log(0.05) = 0.014$.

5.3 Cost Shielding and Product Prices

I now replicate the analysis in Table 3, but focus on cost shielding performance metrics, as opposed to RPE. Cost shielding performance metrics are income-statement performance metrics which differ from each other based on the extent to which they include or exclude expenses.

At the most extreme end of the cost shielding spectrum is sales-based pay, which excludes *all* expenses. Intermediate forms a cost shielding often manifest as more targeted expense exclusions, such as EBIT (a.k.a., operating income) which excludes interest and tax expenses, or EBITDA which further excludes depreciation and amortization expenses. Unlike sales metrics, EBIT and EBITDA hold managers fully accountable for direct costs, like direct material and direct labor, as well as any period expenses like R&D or advertising. At the other end of the cost shielding spectrum is bottom-line earnings, which provides no cost shielding at all.

In Table 4, I examine sales-, EBITDA-, EBIT- and bottom-line earnings-based pay, jointly. The analysis yields a consistent pattern of results, vis-á-vis cost shielding and product prices—market power significantly moderates the relation between cost shielding and product prices. This pattern is most striking for sales-based pay, and somewhat more muted for softer forms of cost shielding (i.e., EBITDA- and, to a lesser extent, EBIT-based pay).

Across all specifications, market share significantly moderates the association between sales-based pay and product prices. The economic significance is substantial. On average, for firms using sales-based pay, a one percent increase in market share is associated with a roughly 0.02 percent decrease in product prices. For perspective, the results suggest that for firms with 50% market shares, sales-based pay is associated with a 5 to 6 percent price reduction; for firms with 5% market shares, sales-based pay is associated with no price change at all. While the estimated effects are somewhat weaker than those of accounting RPE (roughly 50% to 65% as strong, depending on specification), the economic importance is likely quite a bit greater than that of accounting-based RPE, because sales-based pay is far more prevalent in the sample.

EBITDA-based pay also appears to interact with market share in explaining product prices, however these inferences are not as robust. The coefficient on $EBITDA\ Pay \times log(Share)$ is statistically significant in two out of three specifications, and has an economic magnitude of about half that of sales-based pay. EBIT-based pay seems to have (almost) no bearing on prices with the coefficient on $EBIT\ Pay \times log(Share)$ being statistically significant in only one out of three specifications. It is not surprising that EBIT would play a weak (or non-existent) role in this context, since EBIT only provides shielding against interest and tax expenses, which are unlikely to have much influence on product market strategy.

Bottom-line earnings-based pay, which provides full cost exposure/accountability (i.e., no cost shielding) appears to have the opposite effect—$Earnings\ Pay \times log(Share)$ has a significantly *positive* coefficient in two out of three specifications. The economic magnitude is on par with that of EBITDA-based pay, but with a countervailing positive sign.

In sum, it seems that firms with market power tend to lower their prices when their CEOs are incentivized with sales- and/or (to a lesser extent) EBITDA-based pay, and raise their prices when their CEOs are incentivized with bottom-line earnings-based pay. These results all comport cleanly with the spectrum of cost shielding. Cost-shielding in CEO pay plans appears to encourage powerful firms (i.e., those with ample price-setting power) to lower their product prices, while cost accountability (via bottom-line earnings-based pay) appears to discipline firms' product market strategies, and encourage firms to raise their prices.

5.4 RPE and Cost Shielding, Jointly

Pay plan design choices are not made in isolation from each other. The entire pay plan is designed, jointly, considering how all the various components will mesh together. With this in mind, I replicate the RPE and cost shielding analyses from Tables 3 and 4, jointly, to ensure that inferences remain consistent. As shown in Table 5, I find that considering RPE metrics and cost shielding metrics, jointly, does not alter my inferences. If anything, including all of the metrics together seems to sharper the inferences, somewhat strengthening the statistical significance for both EBITDA- and EBIT-based pay.

Among firms with major market shares, accounting-based RPE and sales-based pay continue to show strong negative pricing effects, across all specifications. EBITDA- and bottom-line earnings-based pay continue to show a moderate countervailing pricing effect, though these effects remain somewhat sensitive to empirical specification. The economic magnitudes of these effects are not substantially different from those shown in Tables 3 and 4.

5.5 Supplemental and Robustness Tests

5.5.1 Mechanism Tests: RPE and Costly Sabotage

Tables 3 and 5 show that powerful firms' use of accounting RPE is negatively related to product selling prices. This evidence is consistent with the theory of costly sabotage (e.g., Gibbons and Murphy, 1990), whereby powerful firms engage in competitive aggression to harm their rivals' profitability. To further establish this mechanism, I look to peer identities and cross elasticities as sources of variation in the viability of underpricing as an RPE-improving sabotage tactic.

With respect to peer identities, competitive aggression is only a viable tactic for sabotaging RPE peers if the peers are product market competitors. As such, the link between accounting-based RPE and product pricing should depend not only on the focal firms' market share, but also on the presence of RPE peers in the product category. If a product category contains no RPE peers, then there is no clear sabotage-related reason to lower prices in that market. In contrast, if the product category is heavily populated with RPE peers, then there are strong sabotage-related reasons to lower prices in that market.

To examine this, I use a modified version of eq. (1), as shown below.

$$
\begin{aligned}
log(Price_{i,j,p,t}) &= \beta Prop.\ of\ Peers_{i,j,t} \times log(Share_{i,j,t-12}) \\
&+ \gamma log(Share_{i,j,t-12}) + \lambda Prop.\ of\ Peers_{i,j,t} + \phi_{i,t} + \mu_{j,t} + \varepsilon_{i,j,p,t}, \qquad (2)
\end{aligned}
$$

where $Prop.\ of\ Peers_{i,j,t}$ is the proportion of firm i's RPE peers that are present as competitors in product module j at time t. $Prop.\ of\ Peers$ takes a value of zero if there are no RPE peers operating in the module, and one if all of the RPE peers operate in the module. If some RPE peers compete in the module, while others do not, $Prop.\ of\ Peers$ takes a value between zero and one. Since $Prop.\ of\ Peers$ is undefined for any firm that does not use accounting-based RPE, I focus on the subset of firms that do use accounting-based RPE for this analysis. Results are presented in Table 6.

I observe that the firms with large market shares reduce their prices significantly more in product categories where their RPE peers are more prevalent. In product categories where no peers are present, I observe no evidence of a price reduction in response to accounting-based RPE, regardless of the firm's market power. In product categories where RPE peers are prevalent, firms with major market shares appear to cut prices substantially. This evidence is all consistent with the costly sabotage theory of RPE, whereby firms value the harm that their competitive aggression inflicts upon rivals' profits, and behave more aggressively (e.g., by cutting product prices) as a consequences of their incentives to damage rivals' profits.

The efficacy of underpricing as a form of costly sabotage also depends on the cross elasticity of demand—if goods are highly substitutable, then the cross elasticity of demand is likely to be large, and a change in price by one firm substantially lowers the quantity demanded from the other firm. In contrast, if goods are not particularly substitutable, then the cross elasticity of demand is likely to be small, and a change in price by one firm has little impact on the quantity demanded from the other firm.

With this in mind, I examine whether the documented patterns between RPE and product prices vary with cross elasticities. For each module, j, I estimate the degree of product substitutability using the following regression:

$$log(Quantity\ Sold_{i,j,p,t}) = \xi_j log(Price_{i,j,p,t}) + \sigma_j log(Avg.\ Price_{j,t}) + \tau_{j,t} + phi_{i,j} + \epsilon_{i,j,p,t}, \qquad (3)$$

where $Avg.\ Price_{j,t}$ is the average selling price of all products in product module j at time t.[11]

[11] In these regressions, τ's represent year fixed effects, and not year-month fixed effects; the latter would subsume $log(Avg.\ Price)$.

In this analysis, ξ_j reflects the average own-price elasticity in module j, and σ_j reflects the average cross-price elasticity in module j. I then use the estimates of σ_j as module-level measures of product substitutability, and evaluate whether the evidence of RPE-motivated underpricing is more pronounced in modules with more substitutable products. To do so, I augment the main regression specification by adding the full interaction $log(Share)$, $Acct\ RPE$ and σ. Results are tabulated in Table 7. Consistent with the theory of costly sabotage, the negative association between $log(Share) \times Acct\ RPE$ and product prices is significantly stronger (i.e., even more negative) in modules where goods are more substitutable. That is, firms appear to underprice more in response to RPE when their underpricing has a more negative impact on rivals' profits—exactly as theory predicts.

5.5.2 Price Change Sharpness

I next examine how 'sharp' the price changes are around changes in pay plan design. To do so, I estimate the regression from eq. (1) using short windows around the addition of accounting-based RPE and/or sales metrics. I examine three symmetric windows: (1) a twelve-month, with six months before and after metric adoption; (2) an eight-month window, with four months before and after metric adoption; and (3) a six-month window, with three months before and after adoption. I present results in Table 8. Panel A presents results for accounting-based RPE. Panel B presents results for sales-based pay.

In Panel A, I document that price changes appear to occur sharply around the adoption of accounting-based RPE. Significant results are observable in all three windows examined, with the strongest results manifesting in the shortest window. Figure 2 presents a graphical depiction of the price changes around accounting-based RPE adoption events. Prices appear to be fairly stable in the three months before, and the three months after adopting accounting-based RPE, but there is a sharp transition from pre- to post-adoption. Firms with large market shares (over 30%) drop their prices sharply when the new fiscal year begins, and accounting-based RPE is adopted into the CEO pay plan. Prices remain approximately flat for firms with smaller market shares.

In Panel B, I document no sudden price changes around the adoption of sales-based pay. This is somewhat surprising given the robust evidence from Tables 4 and 5. While market power does significantly moderate the relation between sales-based pay and product prices, it does not seem to do so in a sharp manner around the adoption of sales-based pay. Perhaps cost shielding results in slower changes in pricing policy, because CEOs react to cost shielding through increased capacity investment, which has a more delayed impact on product pricing.

In untabulated results, I find that the patterns in Table 8 are robust to the inclusion of firm fixed effects; accounting-based RPE continues to show a significant sharp effect, while sales-based pay continues to show no effect. However, given the short window nature of these tests, the specifications become somewhat "brittle," with so many fixed effects. This can lead to unreliable inferences. For this reason, I only tabulate results using module-year-month fixed effects.

5.6 Alternative Measures of Power

In my main analyses, I use $log(Share)$ to measure firms' product market power. To evaluate whether my inferences are sensitive to the choice to use the log transform, I replicate the analysis in Table 5 using two alternative measures: $sqrt(Share)$ and $Share$. These results are tabulated in Table 9. I find that the results are largely unaffected by these alterations. Results for accounting RPE and sales-based pay are qualitatively unchanged, both being highly statistically and economically significant. Results for EBITDA-based pay are significant when using $sqrt(Share)$, but fall short of conventional inferences thresholds when using $Share$, but the estimated magnitudes remain substantial. All alternative results for EBIT-based pay are statistically insignificant, and economically small. The results for $Earnings\ Pay$ seem to be qualitatively stable across approaches.

5.6.1 Market Share versus Market Importance

The preceding evidence shows that market share moderates the relation between CEO incentives and product prices. While the tight design using module-year-month and firm-year-month fixed effects holds CEO incentives constant across product categories, the results can still be biased if

CEO incentives were designed taking some categories into account more than others.

For example, suppose that (for unspecified reasons) firms add accounting-based RPE and/or cost shielding into their CEO pay plans, in anticipation of negative firm-specific demand shocks (which depress prices). By itself, this behavior is well-accommodated by my design, and would not lead to spurious inferences. However, further suppose that firms care more about some modules than others, and make these anticipatory changes only when they anticipate negative demand shocks in the markets that are most important to the firm's operations. If more important markets tend to be those in which the firm has a greater market share (which seems highly plausible) then the design is likely to produce biased coefficient estimates.

To assess this issue, I construct a measure of market importance based on the proportion of firm sales attributable to the module. I call this variable Mix. Unsurprisingly Mix and $Share$ are highly correlated (ρ=0.225, p$<$0.01), lending credence to the concern that pay plans may be designed with high market share modules in mind. However, across a battery of robustness analyses, I find no evidence to support this concern, and considerable evidence to dispel this concern.

First, I conduct sub-sample analyses, focusing only on observations in which the module is a small (below-median) portion of the firms' operations. These modules ostensibly represent product categories that are below-median in importance/priority to the firm, and thus unlikely to have been major considerations during the pay plan design phase. On this subsample, I find that my prior results continue to hold; accounting-based RPE, sales-based pay and EBITDA-based pay all interact negatively and significantly with market share to explain product prices. These results are tabulated in Table 10.

Second, I conduct placebo analyses, replacing measures of market power with analogous measures of market importance. In these analyses, I do not find any evidence of an interactive effect between Mix and accounting-based RPE, sales-based pay or EBITDA-based pay in explaining product prices. Third, I replicate the main analyses, and include Mix and its interactions with each performance metric variable as controls. I find that doing so does not alter my inferences.

These results are left untabulated.

In sum, the results documented in this study do not appear to be attributable to product markets that are especially central to firms' operations. Even in product modules that are a very small component of firm operations (e.g., accounting for only 1%-2% of firm revenue), I continue to observe the predicted effects. Given their small stature, it seems unlikely that CEO pay plan design choices would be substantially endogenous to any factors related specifically to these markets.

5.6.2 Jack-Knife Tests

The sample composition descriptives in Table 1, combined with the rarity of certain performance metrics (e.g., accounting-based RPE) shown in Table 2 may give readers cause to be concerned that the documented patterns are driven by individual large firms, with undue influence over the results. To assess this concern, I conduct a battery of jack-knifed "leave-one-out" tests, in which I drop each of the twenty largest firms, one at a time. I then replicate the analysis in Table 5, twenty times, on these subsamples. In untabulated results, I find that my inference remain stable across all subsamples; no individual firm seems to explain the patterns I document. Similarly, I drop each department, one and a time, and replicate the analysis in Table 5. In untabulated analyses, I find that no single department is responsible for the patterns I document.

6 Conclusion

In this study, I examine the empirical link between CEO pay plan metrics and product selling prices. Consistent with theory, product prices are lower when CEOs have RPE and/or cost shielding metrics in their pay plans. These results are pronounced specifically in settings where the firm has considerable market power. Changes in product prices occur quickly around the adoption of accounting-based RPE, but occur slowly around the adoption of sales-based pay.

The empirical evidence is consistent with the notion that the metrics used in CEO incentive plans influence firm operations, in a manner that affects product market strategy in a fundamental way. The granular nature of my data allows for a tight design that rules out many non-causal explanations. That said, CEO incentives and product prices are highly endogenous, and the results in this study cannot definitively rule out *all* plausible alternative, non-causal explanations for the observed relations.

The most likely validity threat is the possibility that CEO incentives are designed in response to factors that are specifically related to the product markets in which they have large market shares. For example, if firms add RPE or cost shielding components in response to firms-specific negative demand shocks in their high market-share product categories, but not in their low market-share product categories. While I cannot definitively rule this out, I examine this possibility, and find no evidence to support it.

Appendix A: Analytical Model of RPE-Motivated Underpricing

In this appendix, I present a simple analytical model to highlight the intuition for RPE-motivated underpricing. The model is in the spirit of Aggarwal and Samwick (1999), but allows for an arbitrary numbers of firms. Unlike Aggarwal and Samwick (1999), my focus is on the product prices themselves, rather than the equilibrium incentives. I do not derive optimal contracts, but instead take contracts as exogenous and demonstrate the effect of a focal firm's reliance on RPE on the equilibrium product prices.

I assume that N firms produce and sell differentiated goods at a constant marginal cost of c, and a market price characterized by the following inverse demand function:

$$p_i = A - \left(q_i + \frac{1}{2} \sum_{j \neq i} q_j \right), \tag{4}$$

where p_i is the market price of good i, q_i and q_j's are the available quantities of goods i and j, for $i, j \in \{1, ..., N\}$.[12] The $\frac{1}{2}$ term in front of $\sum_{j \neq i} q_j$ reflects the imperfect degree of substitutability

[12]This inverse demand function corresponds to the demand function: $q_i = \frac{2}{N+1} \left(A - Np_i + \sum_{j \neq i} p_j \right)$.

across products.[13] Profits for each firm are thus:

$$\begin{aligned}\Pi_i &= q_i \cdot (p_i - c) \\ &= q_i \cdot \left(A - \left(q_i + \frac{1}{2} \sum_{j \neq i} q_j \right) - c \right). \end{aligned} \tag{5}$$

In what follows, I derive equilibrium pricing under two scenarios: (1) all firm maximize profits; and (2) one firm places a weight of γ on *relative* profits, while all others maximize profits. I show that RPE motivates the firm to lower its prices, especially when it controls a larger share of the market. I focus on the case of differentiated Bertrand competition, however the relevant insights vis-á-vis RPE and product prices would be qualitatively similar under differentiated Cournot competition.[14]

A.1 Profit Maximization Equilibrium

As a benchmark, I first assume that each firm chooses p_i to maximize their own profit, yielding the following system of first order conditions known as "best response functions":

$$p_i^* = \frac{1}{2N} \left(A + \sum_{j \neq i} p_j \right) + \frac{c}{2}. \tag{6}$$

The equilibrium is such that all N first order conditions are simultaneously satisfied, which occurs when all firms charge a price of:

$$\begin{aligned} p_i^{**} &= \frac{1}{N+1} A + \frac{N}{N+1} c \\ &= \frac{A + Nc}{N+1}. \end{aligned} \tag{7}$$

The equilibrium price is a convex combination of the level of demand, A, and the marginal cost, c, with the weights on each being driven by competition. The more firms, the lower the weight on

[13] The intuition is qualitatively unchanged if the $\frac{1}{2}$ is replaced by any coefficient $\sigma \in (0, 1)$.

[14] Under both modes of competition, increase reliance on RPE leads to strictly greater levels of underpricing, with the primary conceptual distinction being whether prices are an explicit firm choice (as in Bertrand competition) or a product market equilibrium outcome (as in Cournot competition).

demand and the greater the weight on cost. For $N = 1$, pricing decisions comport to the monopoly pricing rule, $\frac{A+c}{2}$. In the limit, as $N \to \infty$, prices converge to marginal cost.

A.2 Relative Performance Evaluation

I next consider the possibility that firms may depart from profit-maximizing behavior. In particular, I allow for a weight of γ on *relative profits*, defined as the difference between the focal firm's profits, and the average profits of all $N-1$ other firms in the market. With a weight of γ_i on relative profits, firm i's objective function is $\Pi_i - \gamma_i \frac{1}{N-1} \sum_{j \neq i} \Pi_j$, yielding the first order condition:

$$p_i^* = \frac{1}{2N}\left(A + \sum_{j\neq i} p_j\right) + \frac{c}{2} - \frac{\gamma_i}{2N}\left(\frac{1}{N-1}\sum_{j\neq i} p_j - c\right). \tag{8}$$

The first order condition is identical to that of the profit-maximization case, shown in eq. (6), but includes an additional term, $-\frac{\gamma_i}{2N}\left(\frac{1}{N-1}\sum_{j\neq i} p_j - c\right)$, to reflect the relative performance incentives.

The equilibrium prices are those which simultaneously satisfy all first order conditions, jointly. To streamline the analysis, I make the simplifying assumption that only a single firm (indexed by i) has a potentially non-zero $\gamma_i \equiv \gamma$, while all others (indexed by $-i$) maximize profits, without any regard for relative profits.[15] The equilibrium occurs at the following prices:

$$p_i^{**}(\gamma) = \overbrace{\frac{A+Nc}{N+1}}^{p_i^{**}(\gamma=0)} - \overbrace{\gamma\frac{1}{N+1}\left(\frac{(A-c)(N+2)}{\gamma+(N+1)(2N+1)}\right)}^{\text{eqm. price cut from firm } i\text{'s use of RPE}}, \tag{9}$$

$$p_{-i}^{**}(\gamma) = \underbrace{\frac{A+Nc}{N+1}}_{p_{-i}^{**}(\gamma=0)} - \underbrace{\gamma\frac{1}{N+1}\left(\frac{(A-c)}{\gamma+(N+1)(2N+1)}\right)}_{\text{eqm. price cut from firm } i\text{'s use of RPE}}. \tag{10}$$

As shown above, the RPE-using firm, i, charges a price that is equal to the profit-maximization equilibrium price of $\frac{A+Nc}{N+1}$, minus an RPE-motivated price reduction equal to $\gamma \times \frac{1}{N+1}\left(\frac{(A-c)(N+2)}{\gamma+(N+1)(2N+1)}\right)$.

Under reasonable assumptions (i.e., $\gamma \in (0,1]$, $N \geq 2$, and $A > c$),[16] it can easily be verified that

[15] This assumption is not essential, but simplifies the analysis considerably. The main intuition is unaffected if this assumption is removed.

[16] The assumption that $\gamma \in (0,1]$ ensures that firms place a weakly positive weight on their own profit and a strictly

this RPE-motivated price reduction has the following three properties: (1) it is strictly positive; (2) it is strictly increasing in γ; and (3) the effect of γ shrinks as N grows. In other words, RPE induces firms to lower their product prices, especially if they control a larger share of the market.

Of note, firm i's use of RPE doesn't only affect firm i's prices. In equilibrium, rivals react to firm i's use of RPE, changing their prices as well. As shown in the equations above, $p^{**}_{-i}(\gamma)$ is also equal to the profit-maximization equilibrium price of $\frac{A+Nc}{N+1}$, minus an RPE-motivated price reduction. However, the RPE-motivated price reduction is smaller, since it does not contain the $(N+2)$ term in the numerator.

As an empirical matter, it is difficult to identify firm i's RPE-motivated price reduction, on its own, since prices change over time for a variety of reasons (e.g., demand shocks, cost shocks, etc...). If these shocks occur at the product-market level, then they can be stripped away by comparing a firm's prices to the those of its rivals. For example, by calculating:

$$\begin{aligned}\delta(\gamma) &\equiv p^{**}_{-i}(\gamma) - p^{**}_{i}(\gamma) \\ &= \gamma\frac{A-c}{\gamma+(N+1)(2N+1)}.\end{aligned} \tag{11}$$

This expression reflects the extent to which an RPE-using firm underprices its products, compared to its rivals. It is easy to verify that this expression has all the same properties as $p^{**}_{i}(\gamma)$: (1) it is strictly positive; (2) it is strictly increasing in γ; and (3) the effect of γ shrinks as N grows. That is, RPE-using firms underprice relative to their rivals, especially if they control a larger share of the market.

Figure A1 offers a graphical presentation of the underpricing expression, as a function of γ, for various values of N. As can be seen in the figure, underpricing increases with γ, especially for lower values of N. At larger values of N, the upward slope becomes negligible.

positive weight on relative profits; the assumption that $N \geq 2$ ensures that there is an oligopoly with at least one rival—the first order condition is undefined otherwise; the assumption that $A > c$ ensures that it is optimal for firms to operate.

Appendix B: Relation to Hedonic Pricing Regressions

Readers may note some econometric similarities between my methodological approach and "hedonic pricing regression," which has been oft-criticized in the literature. The key similarity between the two is that price is the dependent variable of the regression, however my methodology is conceptually entirely dissimilar from hedonic pricing regression, in its purpose, and the standard criticisms do not apply.

A hedonic pricing regression is a technique intended to estimate customers' preferences over various product features. Product prices are regressed on a vector of product features, and the loadings on each feature ostensibly reflects a representative customer's demand each feature. For example, the prices of laptop computers might be regressed on their screen sizes, pixel densities, battery lives, CPU clockspeeds, gigabytes of RAM, SSD storage sizes, and webcam resolutions. The coefficients thus ostensibly reflect customers' preferences over various product attributes (e.g., average willingness to pay for an extra hour of battery life).

The standard critique of this approach is that it presumes demand-centric variation in prices. If larger screens, longer-lasting batteries and faster CPUs are also more expensive to produce (which they surely are), then the coefficients are not unbiased estimates of the parameters of customer demand; they jointly reflect supply and demand considerations. More generally, the problem with this approach is that the features of interest are usually relevant to both parties (producers and consumers) and thus their relation to prices do not clearly reflect either side's preferences, in isolation. There are cases where this problem can be addressed, structurally, using simultaneous equations to estimate both supply- and demand-side preferences, but these systems are not always well-identified (Rosen, 1974).

While my approach also involves product prices as the dependent variable, the similarity ends there. I am not trying to estimate consumer's implicit preferences over various product features. Instead, I am trying to estimate the effect of CEO incentives on the firm's willingness to supply their products to the market. The above concern only applies insofar as CEO incentives are also relevant to customers' purchase decisions. If customers are willing to pay more or less for a product because of the metrics used in the CEO pay plan, then my methodology is invalid. In my setting, there is no clear reason to expect customers to care– or even know– about the metrics used in the CEO pay plan. As such, customer indifference appears to be a reasonable assumption, in which case the methodology valid.

Appendix C: Illustration of research design using Colgate-Palmolive example

As an emblematic example of RPE-motivated underpricing, I present the case of Colgate-Palmolive. During my sample period, Colgate-Palmolive added accounting-based RPE to their CEO's pay plan. Theory suggests that such an adjustment is likely to encourage price cuts, especially in product categories where Colgate-Palmolive is a major player with a large market share (see Appendix A).

As en empirical matter, assessing the effect of a change in CEO incentives on product prices is difficult because the incentives are determined endogenously; any observed changes in product prices may be responses to whatever underlying factor drove the change in incentives, and not necessarily caused by the change in CEO incentives. However, in this context, the empirical estimation is aided by the fact that CEO incentives are a firm-level choice that has differential theoretical implications for product pricing across the various different product markets in which the firm competes.

In the case of Colgate-Palmolive, they were selling goods in dozens of distinct markets with highly varied market shares. For example, Colgate-Palmolive was a major player with a market share of ∼36% in the "Tooth Cleaners" product module, while simultaneously being a much small player in markets like "Specialty Soaps" and "Bar Soaps," with market shares hovering around 10%. While the CEO pay plan (and all its determinants) are held constant across these various markets, the predict impact of the CEO pay plan is quite different across them, with the CEO incentives having stronger implications for product pricing in markets where the firm is a more influential strategic player. See Figure C1 for a graphical depiction.

My empirical strategy is to examine whether changing executive incentives differentially associated with changes in product prices, based on within-firm variation in market share. For example, when Colgate-Palmolive adopted accounting-based RPE, this change occurred simultaneously across all product markets in which Colgate-Palmolive competes. However, I find that product price reductions do not occur homogenously across all product markets; Colgate-Palmolive appears to lower it's prices dramatically in the Tooth Cleaners product market (where they have a commanding 36% market share), but makes no noticeable price changes in the "Specialty Soaps," "Bar Soaps" or "Non-Disinfectant Cleaners" product markets (in which they have roughly 10% market share). Figure C2 presents a graphical depiction of these price changes in a 6-month window around Colgate-Palmolive's adoption of accounting-based RPE.

I observe that product prices across all markets are fairly stable over the 3 months prior to the adoption of accounting-based RPE. In the markets where Colgate-Palmolive had modest market shares of around 10% (i.e., "Specialty Soaps," "Bar Soaps" and "Non-Disinfectant Cleaners"), the price continue to be fairly stable, with slight fluctuations over the 6-month window, and no noteworthy changes. In contrast, prices in the "Tooth Cleaner" market drop by almost 10% immediately upon the adoption of accounting-based RPE, and remain low afterwards. It appears to be a sharp level change from one fairly stable price level prior to adoption to a new (lower) price level following adoption.

While the fact patterns of this particular case closely align with my theoretical predictions, this case in isolation should not be interpreted as a strong evidence in favor of the theory. There are any number of reasons for the price drop in tooth cleaner market that may have nothing to do with RPE. This example is simply meant to provide a real-world anecdote that illuminates the identifying variation I exploit in my analysis. A compelling test of the theory requires examining whether the documented associations among CEO incentives, market shares and product prices manifest in broad samples, spanning many firms and product categories. This study offers exactly this broad sample test: across over 100 major CPG firms and 1,000 product categories, I find that the broad sample associations among CEO incentives, market shares and product prices qualitatively align those of the Colgate-Palmolive example, described here.

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Figure A1: Underpricing as a Function of RPE

This figure presents a plot of product underpricing, $\gamma\frac{A-c}{\gamma+(N+1)(2N+1)}$, as a function of γ and N. The x-axis is γ, from 0 to 1. The y-axis is the focal firms' underpricing, relative to its rivals. Several curves are shown, depicting the relation between γ and underpricing for various values of N: $N = 2$ in red; $N = 3$ in orange; $N = 4$ in yellow; $N = 5$ in green; $N = 10$ in blue; and $N = 20$ in purple.

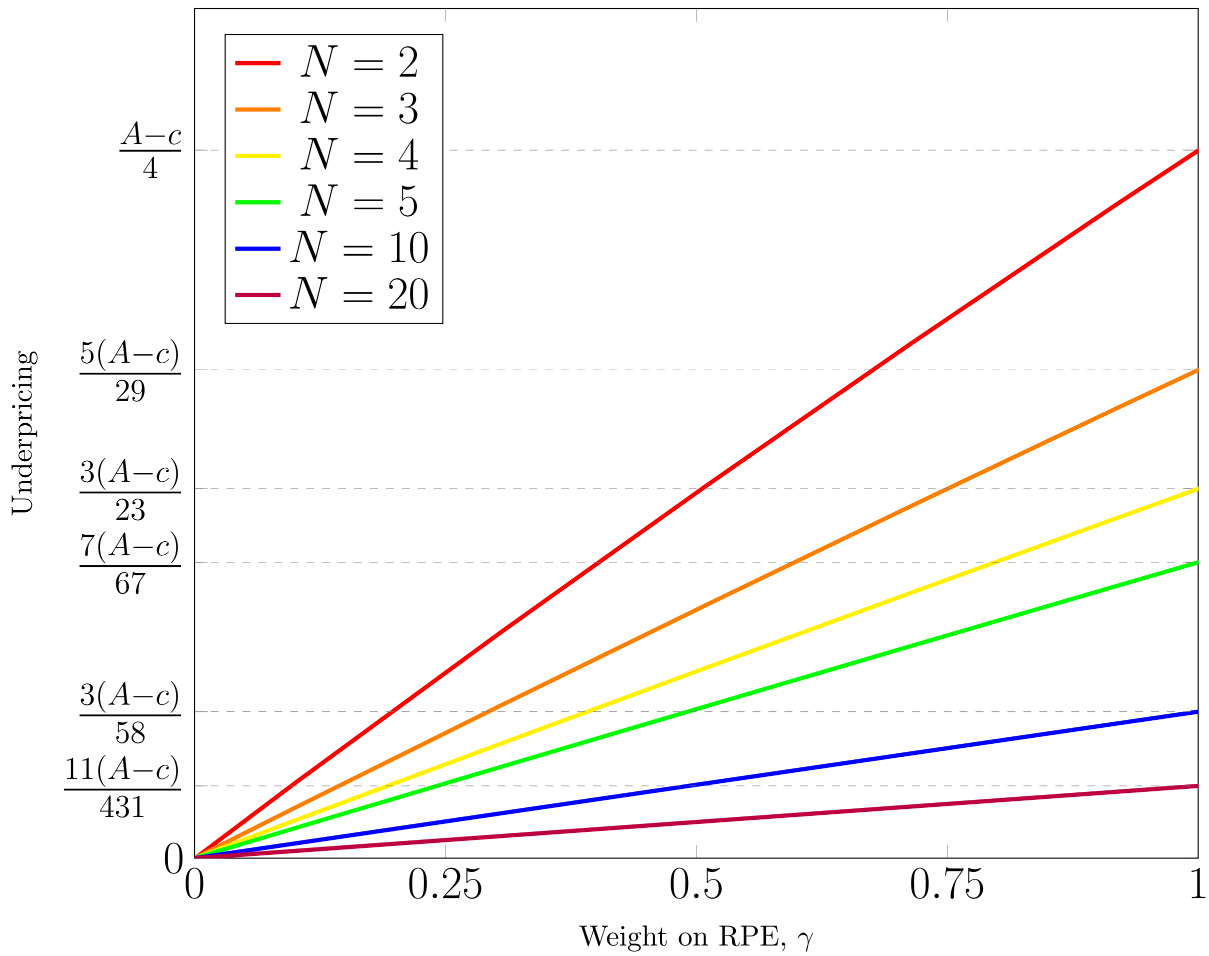

Figure C1: Colgate-Palmolive Market Shares

This figure presents a graphical illustration of the within-firm-time variation in market share on which my empirical strategy relies. A single parent company (e.g., Colgate-Palmolive) likely competes across multiple different markets at the same point in time (e.g., "Specialty Soap" and "Tooth Cleaners") and hold substantially different degrees of product market power across markets. The CEO's pay plan incentives are constant across all markets, but their predicted impact on each product market (depicted by arrows of varying thickness) vary across markets, as a function of market share.

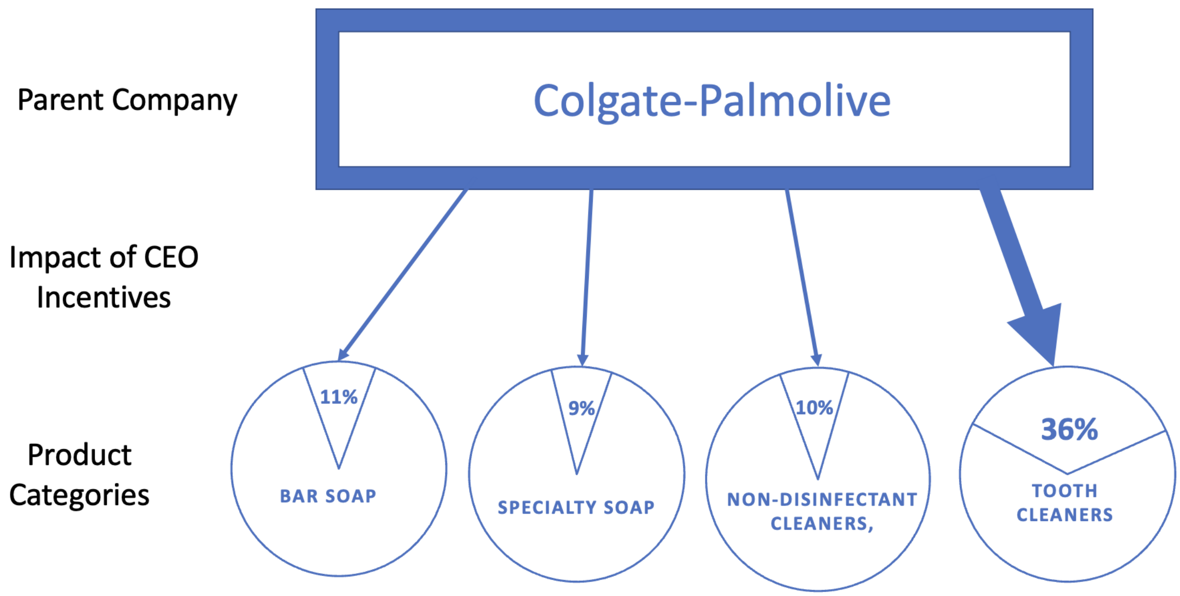

Figure C2: Colgate-Palmolive Price Changes around RPE Adoption

This figure presents a timeseries plot of abnormal prices in the six months surrounding Colgate-Palmolive's adoption of accounting-based RPE. Fiscal months 10, 11 and 12 are the three months immediately preceding the adoption of accounting-based RPE; Fiscal months 1, 2 and 3 are the three months immediately following the adoption of accounting-based RPE. The vertical red line mark the transition from one fiscal year to the next. The vertical axis is the residual from a regression of product prices on firm and module-year-month fixed effects. These price residuals were then adjusted by subtracting out the average value for fiscal month 12, ensuring that all lines cross at zero, the month prior to treatment. The solid blue line represents the "Tooth Cleaners" market (in which Colgate-Palmolive had a 36% market share); the other lines represent "Bar Soap," "Specialty Soap" and "Non-Disinfectant Cleaner" markets (in which Colgate-Palmolive had roughly 10% market shares).

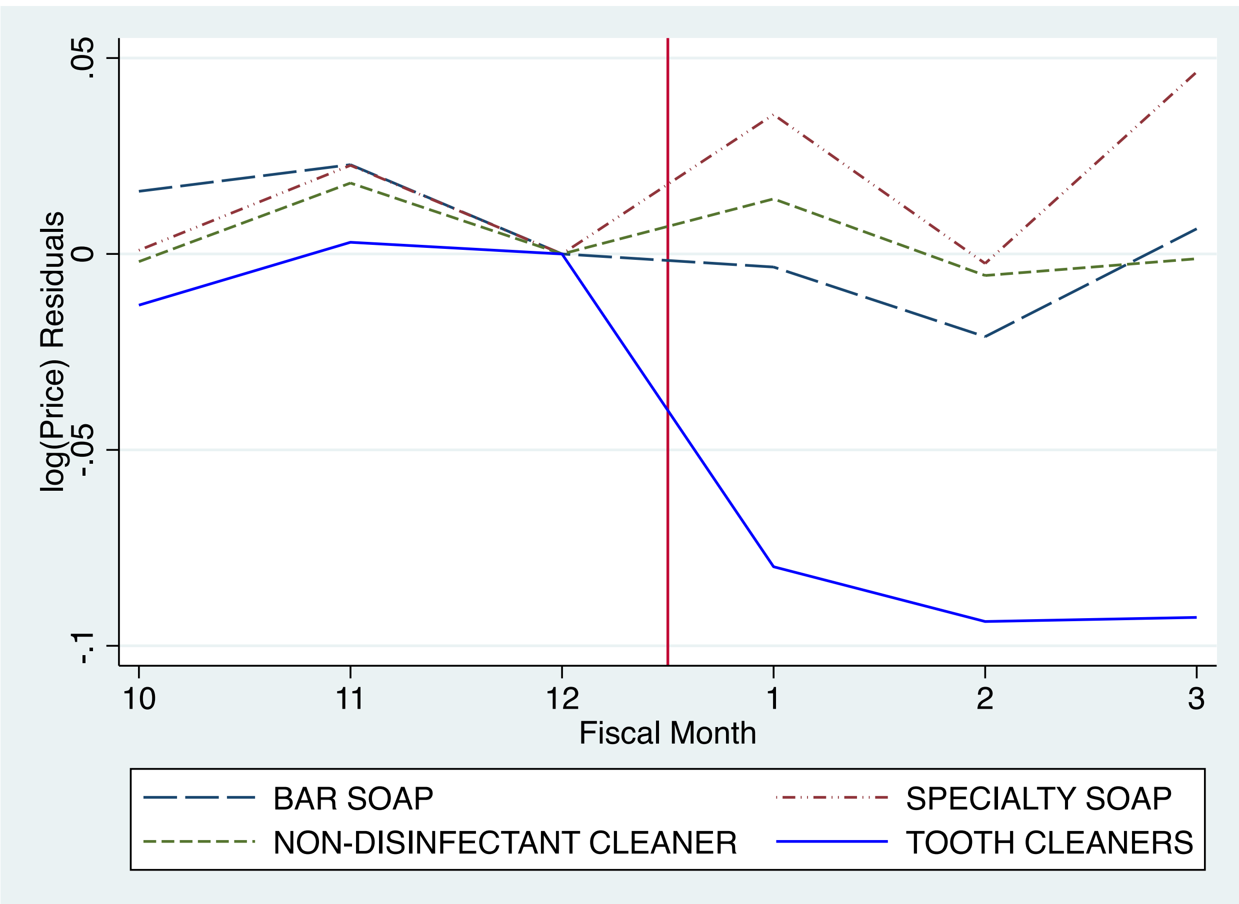

Figure 1: Organizational Heirarchy

This figure presents an illustrative example of the organizational heirarchy. Ten “departments” are partitioned into “product groups,” with each product group further partitioned into highly granular “product modules.”

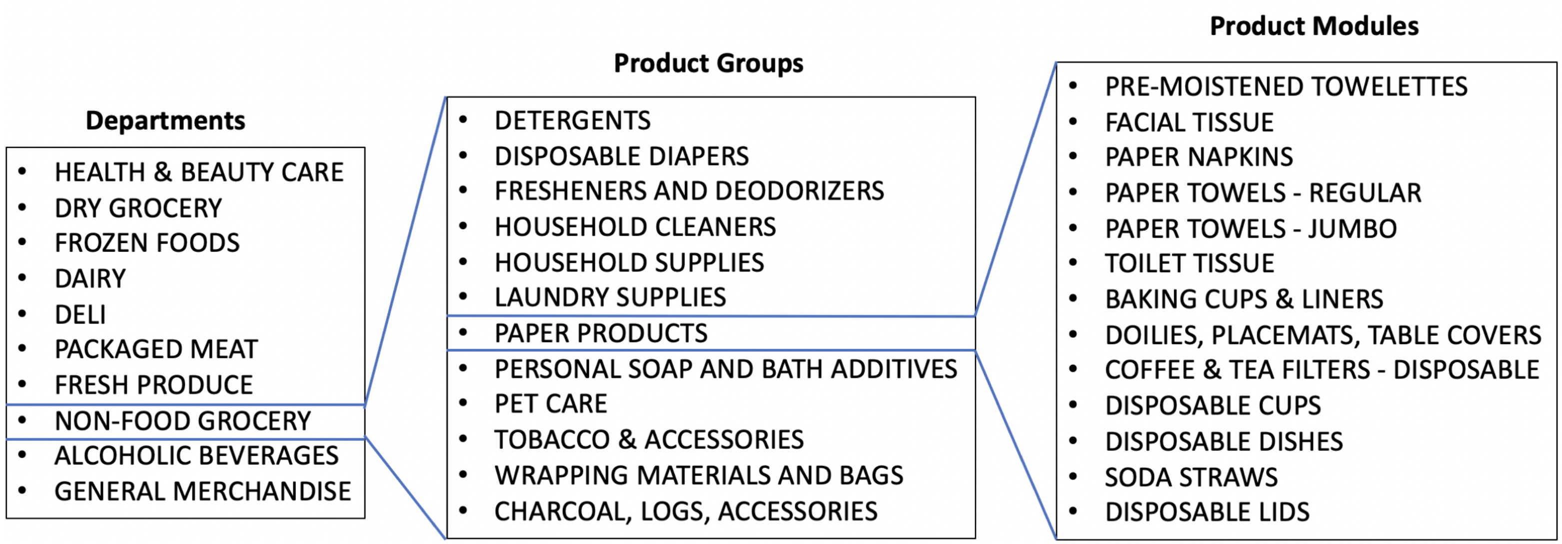

Figure 2: Price Changes around Accounting-Based RPE Additions

This figure presents pricing residuals, in event time, around the addition of accounting-based RPE grants. Fiscal months 10, 11 and 12 are the three months immediately preceding the adoption of accounting-based RPE; Fiscal months 1, 2 and 3 are the three months immediately following the adoption of accounting-based RPE. The vertical red line mark the transition from one fiscal year to the next. The vertical axis is the residual from a regression of product prices on firm and module-year-month fixed effects. These price residuals were then adjusted by subtracting out the average value for fiscal month 12, ensuring that the two lines cross at zero, the month prior to treatment. The long-dashed red line corresponds to firms with shares of 30% or more in a given product category; the dotted-and-dashed blue line corresponds to firms with shares of less than 30% in a given product category.

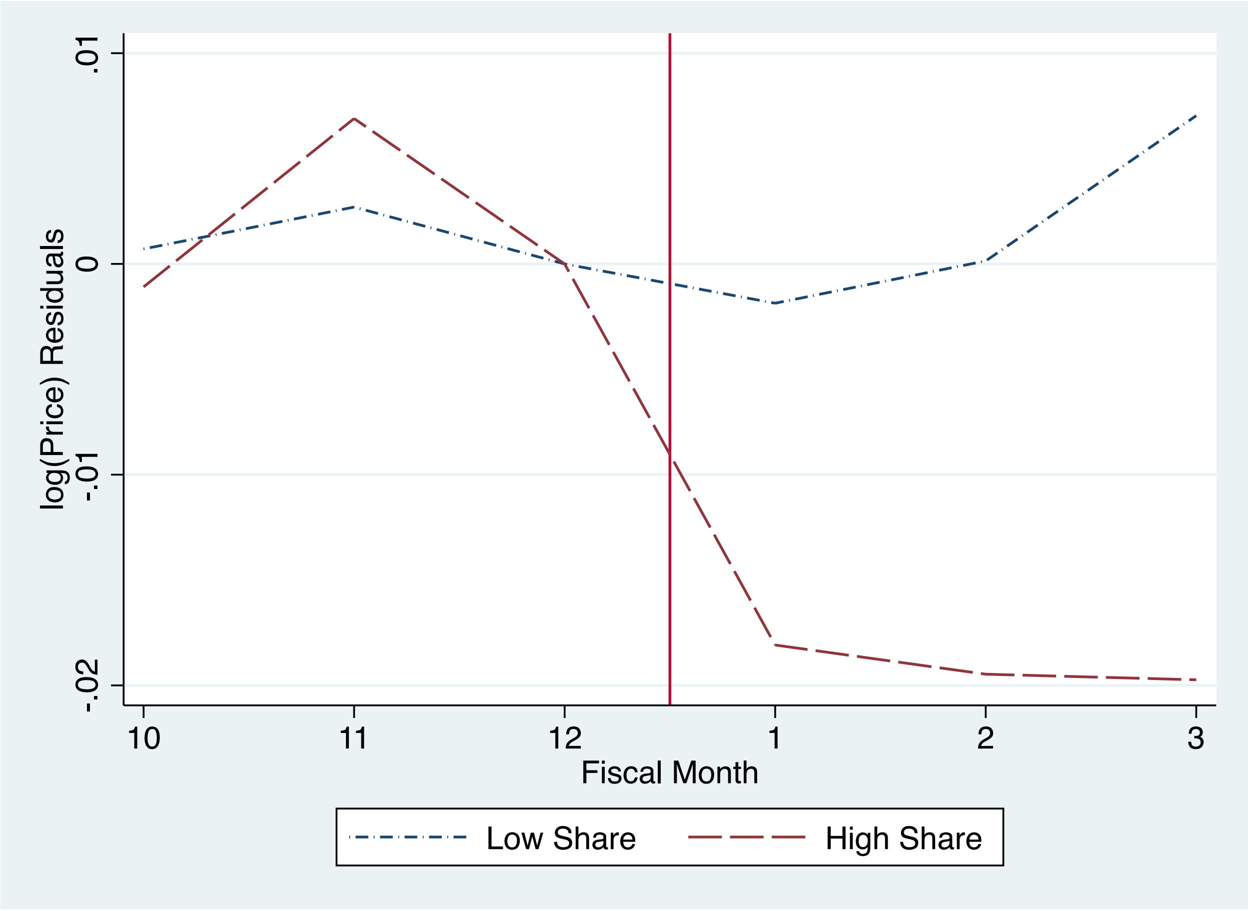

Table 1: Sample Descriptives

This table presents a description of the sample. Panel B presents a breakdown of the sample by department. Panel A lists the 20 largest companies in the sample, by number of observations.

Panel A: Department Breakdown

Department	Num Obs.	Prop. of Sample
DRY GROCERY	3,394,126	0.318
GENERAL MERCHANDISE	2,303,758	0.216
HEALTH & BEAUTY CARE	2,132,838	0.200
NON-FOOD GROCERY	1,521,640	0.143
FROZEN FOODS	377,141	0.035
DAIRY	299,873	0.028
ALCOHOLIC BEVERAGES	277,904	0.026
PACKAGED MEAT	224,109	0.021
DELI	92,251	0.009
FRESH PRODUCE	38,643	0.004
Total	10,662,283	1.000

Panel B: Top 20 Companies

Company	Num Obs.	Prop. of Sample
NEWELL BRANDS INC	1,415,708	0.133
PROCTER & GAMBLE COMPANY, THE	1,006,856	0.094
THE KRAFT HEINZ COMPANY	415,258	0.039
PEPSICO INC	413,729	0.039
CONAGRA INC	407,301	0.038
GENERAL MILLS	398,609	0.037
JOHNSON & JOHNSON	390,613	0.037
TYSON FOODS INC	324,854	0.030
3M COMPANY	301,865	0.028
J. M. SMUCKER COMPANY, THE	296,447	0.028
HAIN CELESTIAL GROUP	261,049	0.024
ALTRIA GROUP INC	247,469	0.023
COCA-COLA COMPANY	237,367	0.022
THE HERSHEY CO	225,734	0.021
THE CLOROX COMPANY	218,414	0.020
KELLOGG COMPANY	216,358	0.020
GENERAL ELECTRIC COMPANY	198,743	0.019
HORMEL FOODS CORPORATION	196,991	0.018
COLGATE-PALMOLIVE COMPANY	193,474	0.018
CAMPBELL SOUP CO	182,364	0.017
Top 20 Combined	7,549,203	0.708

Table 2: Summary Statistics

This table presents descriptive statistics. Panel A presents summary statistics for the variables used in the analyses. Panel B Presents the correlation matrix.

Panel A: Summary Statistics

Variable	Num Obs.	Mean	SD	Q1	Median	Q3
Product Prices						
log(Price)	10,662,283	1.428	1.052	0.826	1.387	2.068
Perf. Metrics						
Acct RPE	10,662,283	0.025	0.156	0.000	0.000	0.000
Stock RPE	10,662,283	0.153	0.360	0.000	0.000	0.000
Sales Pay	10,662,283	0.617	0.486	0.000	1.000	1.000
EBITDA Pay	10,662,283	0.132	0.338	0.000	0.000	0.000
EBIT Pay	10,662,283	0.360	0.480	0.000	0.000	1.000
Earnings Pay	10,662,283	0.727	0.446	0.000	1.000	1.000
Product Market Power						
log(Share)	10,662,283	-2.836	2.578	-3.749	-1.875	-1.081
sqrt(Share)	10,662,283	0.385	0.255	0.153	0.392	0.583
Share	10,662,283	0.213	0.215	0.024	0.153	0.339

Panel B: Pearson Correlations

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	*log(Price)*	1.000								
(2)	*Acct RPE*	0.015	1.000							
(3)	*Stock RPE*	0.034	0.153	1.000						
(4)	*Sales Pay*	-0.038	-0.087	0.021	1.000					
(5)	*EBITDA Pay*	-0.035	0.012	0.154	-0.179	1.000				
(6)	*EBIT Pay*	-0.005	-0.106	-0.065	0.139	-0.109	1.000			
(7)	*Earnings Pay*	0.032	-0.130	-0.086	0.301	-0.317	-0.070	1.000		
(8)	*log(Share)*	0.068	0.047	0.020	0.103	-0.106	-0.040	0.073	1.000	
(9)	*sqrt(Share)*	0.047	0.038	-0.029	0.117	-0.130	-0.066	0.111	0.844	1.000
(10)	*Share*	0.028	0.021	-0.056	0.116	-0.118	-0.070	0.104	0.698	0.958

Table 3: RPE and Product Prices

This table presents evidence on the relation between product selling prices and the use of accounting-based and/or stock-based RPE in CEO pay plans. Specifications differ with respect to fixed effect structure. In Specification (1), I use module-year-month fixed effects; In Specification (2), I add firm fixed effects; In Specification (3), I replace the firm fixed effects with firm-year-month fixed effects. In all specifications, the dependent variable is $log(Price)$. Below each coefficient, I report t-statistics, based on standard errors clustered by firm.

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Acct\ RPE_{i,t} \times log(Share_{i,j,t-12})$	−0.041***	−0.031***	−0.041***
	(−3.632)	(−3.007)	(−4.039)
$Stock\ RPE_{i,t} \times log(Share_{i,j,t-12})$	0.001	0.002	−0.001
	(0.123)	(0.145)	(−0.051)
$log(Share_{i,j,t-12})$	0.014*	0.022***	0.023***
	(1.709)	(3.597)	(3.605)
$Acct\ RPE_{i,t}$	−0.137***	−0.084**	
	(−3.166)	(−2.109)	
$Stock\ RPE_{i,t}$	0.004	0.018	
	(0.083)	(0.383)	
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	Yes	No
Firm-Year-Month FEs	No	No	Yes
Observations	10,662,283	10,662,283	10,662,283
R-squared	0.417	0.439	0.442

Table 4: Cost Shielding and Product Prices

This table presents evidence on the relation between product selling prices and the use of various different income-statement metrics (sales, EBITDA, EBIT and bottom-line earnings) in CEO pay plans. Specifications differ with respect to fixed effect structure. In Specification (1), I use module-year-month fixed effects; In Specification (2), I add firm fixed effects; In Specification (3), I replace the firm fixed effects with firm-year-month fixed effects. In all specifications, the dependent variable is $log(Price)$. Below each coefficient, I report t-statistics, based on standard errors clustered by firm.

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Sales\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.027***	−0.017**	−0.021**
	(−2.649)	(−2.329)	(−2.557)
$EBITDA\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.017*	−0.011	−0.015*
	(−1.840)	(−1.642)	(−1.833)
$EBIT\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.015*	−0.011	−0.011
	(−1.847)	(−1.538)	(−1.360)
$Earnings\ Pay_{i,t} \times log(Share_{i,j,t-12})$	0.002	0.018**	0.018**
	(0.214)	(2.218)	(2.162)
$log(Share_{i,j,t-12})$	0.034***	0.025***	0.027***
	(3.230)	(3.077)	(3.210)
$Sales\ Pay_{i,t}$	−0.051*	−0.071***	
	(−1.665)	(−2.730)	
$EBITDA\ Pay_{i,t}$	−0.070	−0.027	
	(−1.274)	(−0.803)	
$EBIT\ Pay_{i,t}$	−0.039	−0.028	
	(−0.985)	(−1.006)	
$Earnings\ Pay_{i,t}$	0.043	0.048	
	(1.309)	(1.540)	
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	Yes	No
Firm-Year-Month FEs	No	No	Yes
Observations	10,662,283	10,662,283	10,662,283
R-squared	0.418	0.439	0.441

Table 5: RPE, Cost Shielding and Product Prices, jointly

This table presents evidence on the relation between product selling prices and the use of accounting- and stock-price based RPE as well as various different income-statement metrics (sales, EBITDA, EBIT and bottom-line earnings) in CEO pay plans. Specifications differ with respect to fixed effect structure. In Specification (1), I use module-year-month fixed effects; In Specification (2), I add firm fixed effects; In Specification (3), I replace the firm fixed effects with firm-year-month fixed effects. In all specifications, the dependent variable is $log(Price)$. Below each coefficient, I report t-statistics, based on standard errors clustered by firm.

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Acct\ RPE_{i,t} \times log(Share_{i,j,t-12})$	−0.044***	−0.036***	−0.046***
	(−3.998)	(−3.267)	(−4.271)
$Stock\ RPE_{i,t} \times log(Share_{i,j,t-12})$	0.004	0.003	0.001
	(0.369)	(0.258)	(0.099)
$Sales\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.026***	−0.017**	−0.020**
	(−2.682)	(−2.350)	(−2.588)
$EBITDA\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.019*	−0.013*	−0.016**
	(−1.950)	(−1.832)	(−2.031)
$EBIT\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.016**	−0.012*	−0.012
	(−1.993)	(−1.700)	(−1.563)
$Earnings\ Pay_{i,t} \times log(Share_{i,j,t-12})$	0.002	0.017**	0.017**
	(0.147)	(2.181)	(2.120)
$log(Share_{i,j,t-12})$	0.035***	0.026***	0.029***
	(3.319)	(3.125)	(3.344)
$Acct\ RPE_{i,t}$	−0.145***	−0.103**	
	(−3.018)	(−2.296)	
$Stock\ RPE_{i,t}$	0.008	0.022	
	(0.159)	(0.448)	
$Sales\ Pay_{i,t}$	−0.050	−0.071***	
	(−1.653)	(−2.666)	
$EBITDA\ Pay_{i,t}$	−0.075	−0.033	
	(−1.378)	(−0.990)	
$EBIT\ Pay_{i,t}$	−0.045	−0.032	
	(−1.122)	(−1.142)	
$Earnings\ Pay_{i,t}$	0.039	0.046	
	(1.194)	(1.492)	
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	Yes	No
Firm-Year-Month FEs	No	No	Yes
Observations	10,662,283	10,662,283	10,662,283
R-squared	0.419	0.440	0.442

Table 6: Accounting-Based RPE, Peer Competiton, and Product Prices

This table presents evidence on the relation between product selling prices and competition against accounting-based RPE peers. In all specifications, the dependent variable is $log(Price)$. The sample is only those firms that use accounting-based RPE. The primary treatment variable is $Prop.\ of Peers$ which is equal to the proportion of a firm's accounting-based RPE peers that sell products in a given module. Specifications differ with respect to fixed effect structure. In Specification (1), I use module-year-month fixed effects; In Specification (2), I add firm fixed effects; In Specification (3), I replace the firm fixed effects with firm-year-month fixed effects. In all specifications, the dependent variable is $log(Price)$. Below each coefficient, I report t-statistics, based on standard errors clustered by firm.

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Prop.\ of\ Peers_{i,j,t} \times log(Share_{i,j,t-12})$	$-0.251***$	$-0.309***$	$-0.314***$
	(-3.432)	(-5.742)	(-5.522)
$log(Share_{i,j,t-12})$	0.052	0.071*	0.072*
	(1.352)	(2.100)	(2.076)
$Prop.\ of\ Peers_{i,j,t}$	-0.288	$-0.345***$	$-0.310***$
	(-1.482)	(-5.343)	(-7.907)
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	Yes	No
Firm-Year-Month FEs	No	No	Yes
Observations	266,564	266,564	266,564
R-squared	0.465	0.465	0.465

Table 7: RPE, Sabotage and Cross-Price Elasticities

This table presents evidence on the moderating role of cross-price demand elasticities. The cross-price elasticity, σ is estimated at the module-level according to eq. 3. The tabulated regression is the full interaction of $log(Share_{i,j,t-12})$, $log(Acct\ RPE_{i,t})$, and σ_j. Specifications differ with respect to fixed effect structure. In Specification (1), I use module-year-month fixed effects; In Specification (2), I add firm fixed effects; In Specification (3), I replace the firm fixed effects with firm-year-month fixed effects. In all specifications, the dependent variable is $log(Price)$. Below each coefficient, I report t-statistics, based on standard errors clustered by firm.

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Acct\ RPE_{i,t} \times log(Share_{i,j,t-12}) \times \sigma_j$	−0.003	−0.011***	−0.010**
	(−0.845)	(−2.689)	(−2.251)
$Acct\ RPE_{i,t} \times log(Share_{i,j,t-12})$	−0.045***	−0.036***	−0.046***
	(−3.759)	(−3.533)	(−4.448)
$log(Share_{i,j,t-12}) \times \sigma_j$	−0.002	−0.001	−0.001
	(−0.983)	(−0.353)	(−0.411)
$Acct\ RPE_{i,t} \times \sigma_j$	−0.050**	−0.067***	−0.070***
	(−2.504)	(−3.751)	(−3.738)
$log(Share_{i,j,t-12})$	0.014*	0.022***	0.023***
	(1.756)	(3.598)	(3.573)
$Acct\ RPE_{i,t}$	−0.162***	−0.112***	
	(−3.706)	(−3.099)	
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	Yes	No
Firm-Year-Month FEs	No	No	Yes
Observations	10,662,283	10,662,283	10,662,283
R-squared	0.417	0.440	0.442

Table 8: Prices Changes around Metric Adoption Events

This table presents evidence on the timeliness of product price changes around the adoption of accounting-based RPE and sales-based pay in CEO pay plans. Panels differ with respect to the performance metric. In Panel A, I examine the adoption of accounting-based RPE; in Panel B, I examine the adoption of sales-based pay; Within each panel, specifications differ with respect to sample window. In Specification (1), I use a 12-month window around metric adoption (six months before and after); In Specification (1), I use an 8-month window around metric adoption (four months before and after); In Specification (1), I use a 6-month window around metric adoption (three months before and after); In all specifications, I use module-year-month fixed effects. In all specifications, the dependent variable is $log(Price)$. Below each coefficient, I report t-statistics, based on standard errors clustered by firm.

Panel A: Adoption of Accounting-Based RPE

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Acct\ RPE_{i,t} \times log(Share_{i,j,t-12})$	−0.021***	−0.025***	−0.059***
	(−4.351)	(−6.464)	(−15.324)
$log(Share_{i,j,t-12})$	−0.073***	−0.058***	−0.034***
	(−9.588)	(−22.569)	(−26.272)
$AcctRPE_{i,t}$	0.660***	0.636***	0.416***
	(20.716)	(24.719)	(16.373)
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	No	No
Firm-Year-Month FEs	No	No	No
Sample Window	12 months	8 months	6 months
Observations	101,623	68,013	51,236
R-squared	0.401	0.404	0.403

Panel B: Adoption of Sales-Based Pay

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Sales\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.006	0.002	−0.004
	(−0.721)	(0.219)	(−0.253)
$log(Share_{i,j,t-12})$	0.006	0.004	0.001
	(0.730)	(0.428)	(0.171)
$Sales\ Pay_{i,t}$	−0.102	−0.015	−0.036
	(−1.518)	(−0.209)	(−0.414)
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	No	No
Firm-Year-Month FEs	No	No	No
Sample Window	12 months	8 months	6 months
Observations	577,367	385,709	287,798
R-squared	0.464	0.465	0.465

Table 9: RPE, Cost Shielding and Product Prices using Alternative Measures of Power

This table presents a replication of Table 5 using two alternative measures of product market power. In Panel A, I use *sqrt*(*Share*); In Panel B, I use raw *Share*. Within each panel, specifications differ with respect to fixed effect structure. In Specification (1), I use module-year-month fixed effects; In Specification (2), I add firm fixed effects; In Specification (3), I replace the firm fixed effects with firm-year-month fixed effects. In all specifications, the dependent variable is *log*(*Price*). Below each coefficient, I report t-statistics, based on standard errors clustered by firm.

Panel A: *sqrt*(*Share*) Measure of Power

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Acct\ RPE_{i,t} \times sqrt(Share_{i,j,t-12})$	−0.421∗∗∗	−0.265∗∗	−0.349∗∗∗
	(−3.103)	(−2.442)	(−2.880)
$Stock\ RPE_{i,t} \times sqrt(Share_{i,j,t-12})$	−0.050	−0.077	−0.101
	(−0.479)	(−0.642)	(−0.791)
$Sales\ Pay_{i,t} \times sqrt(Share_{i,j,t-12})$	−0.337∗∗∗	−0.230∗∗∗	−0.288∗∗∗
	(−3.051)	(−2.810)	(−3.133)
$EBITDA\ Pay_{i,t} \times sqrt(Share_{i,j,t-12})$	−0.250∗	−0.177∗	−0.218∗∗
	(−1.885)	(−1.917)	(−2.207)
$EBIT\ Pay_{i,t} \times sqrt(Share_{i,j,t-12})$	−0.100	−0.060	−0.061
	(−1.033)	(−0.841)	(−0.756)
$Earnings\ Pay_{i,t} \times sqrt(Share_{i,j,t-12})$	0.001	0.172∗	0.178∗
	(0.008)	(1.935)	(1.944)
$sqrt(Share_{i,j,t-12})$	0.381∗∗∗	0.261∗∗∗	0.298∗∗∗
	(3.062)	(2.645)	(2.797)
$Acct\ RPE_{i,t}$	0.147∗∗∗	0.105∗∗∗	
	(2.944)	(2.935)	
$Stock\ RPE_{i,t}$	0.010	0.028	
	(0.223)	(1.001)	
$Sales\ Pay_{i,t}$	0.150∗∗	0.055∗	
	(2.045)	(1.845)	
$EBITDA\ pay_{i,t}$	0.056	0.065∗∗∗	
	(0.897)	(3.447)	
$EBIT\ pay_{i,t}$	0.043	0.033	
	(1.110)	(1.547)	
$Earnings\ Pay_{i,t}$	0.029	−0.066∗∗	
	(0.419)	(−2.485)	
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	Yes	No
Firm-Year-Month FEs	No	No	Yes
Observations	10,662,283	10,662,283	10,662,283
R-squared	0.418	0.439	0.441

Panel B: *Share* Measure of Power

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Acct\ RPE_{i,t} \times Share_{i,j,t-12}$	−0.411∗∗∗	−0.230∗∗	−0.304∗∗
	(−2.833)	(−2.134)	(−2.446)
$Stock\ RPE_{i,t} \times Share_{i,j,t-12}$	−0.153	−0.195	−0.218∗
	(−1.293)	(−1.608)	(−1.714)
$Sales\ Pay_{i,t} \times Share_{i,j,t-12}$	−0.422∗∗∗	−0.277∗∗∗	−0.342∗∗∗
	(−3.347)	(−3.135)	(−3.502)
$EBITDA\ Pay_{i,t} \times Share_{i,j,t-12}$	−0.254	−0.176	−0.207
	(−1.392)	(−1.426)	(−1.591)
$EBIT\ Pay_{i,t} \times Share_{i,j,t-12}$	−0.021	0.007	0.011
	(−0.179)	(0.090)	(0.127)
$Earnings\ Pay_{i,t} \times Share_{i,j,t-12}$	−0.007	0.193∗∗	0.199∗∗
	(−0.045)	(2.082)	(2.071)
$Share_{i,j,t-12}$	0.444∗∗∗	0.270∗∗	0.307∗∗
	(3.100)	(2.500)	(2.576)
$Acct\ RPE_{i,t}$	0.079∗∗	0.055∗∗∗	
	(2.087)	(2.635)	
$Stock\ RPE_{i,t}$	0.015	0.029∗∗	
	(0.373)	(2.046)	
$Sales\ Pay_{i,t}$	0.114∗	0.023	
	(1.851)	(1.117)	
$EBITDA\ Pay_{i,t}$	0.027	0.040∗∗∗	
	(0.487)	(3.582)	
$EBIT\ Pay_{i,t}$	0.019	0.016	
	(0.579)	(1.121)	
$Earnings\ Pay_{i,t}$	0.031	−0.042∗∗	
	(0.583)	(−2.575)	
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	Yes	No
Firm-Year-Month FEs	No	No	Yes
Observations	10,662,283	10,662,283	10,662,283
R-squared	0.418	0.439	0.441

Table 10: RPE, Cost Shielding and Product Prices, Low Mix Modules

This table presents evidence on the relation between product selling prices and the use of accounting- and stock-price based RPE as well as various different income-statement metrics (sales, EBITDA, EBIT and bottom-line earnings) in CEO pay plans. The sample is restricted to observations in which the module accounts for a below-median proportion of the firm's revenue. Specifications differ with respect to fixed effect structure. In Specification (1), I use module-year-month fixed effects; In Specification (2), I add firm fixed effects; In Specification (3), I replace the firm fixed effects with firm-year-month fixed effects. In all specifications, the dependent variable is $log(Price)$. Below each coefficient, I report t-statistics, based on standard errors clustered by firm.

	Outcome = $log(Price_{i,j,p,t})$		
	(1)	(2)	(3)
$Acct\ RPE_{i,t} \times log(Share_{i,j,t-12})$	−0.045∗∗∗	−0.046∗∗∗	−0.058∗∗∗
	(−3.948)	(−3.494)	(−4.113)
$Stock\ RPE_{i,t} \times log(Share_{i,j,t-12})$	0.014	0.013	0.012
	(1.152)	(0.987)	(0.853)
$Sales\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.016∗	−0.014∗	−0.014∗
	(−1.840)	(−1.848)	(−1.732)
$EBITDA\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.023∗∗	−0.020∗∗∗	−0.023∗∗∗
	(−2.376)	(−2.742)	(−2.705)
$EBIT\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.023∗∗∗	−0.014∗	−0.014
	(−2.974)	(−1.875)	(−1.602)
$Earnings\ Pay_{i,t} \times log(Share_{i,j,t-12})$	−0.000	0.018∗∗	0.018∗∗
	(−0.033)	(2.544)	(2.448)
$log(Share_{i,j,t-12})$	0.036∗∗∗	0.025∗∗∗	0.026∗∗∗
	(3.568)	(3.537)	(3.487)
$Acct\ RPE_{i,t}$	−0.180∗∗∗	−0.142∗∗	
	(−2.732)	(−2.542)	
$Stock\ RPE_{i,t}$	0.115	0.088	
	(1.401)	(1.194)	
$Sales\ Pay_{i,t}$	0.031	−0.080∗∗	
	(0.565)	(−2.126)	
$EBITDA\ Pay_{i,t}$	−0.096	−0.091∗∗	
	(−1.547)	(−2.288)	
$EBIT\ Pay_{i,t}$	−0.118∗∗	−0.059	
	(−2.494)	(−1.472)	
$Earnings\ Pay_{i,t}$	−0.011	0.064∗	
	(−0.265)	(1.714)	
Module-Year-Month FEs	Yes	Yes	Yes
Firm FEs	No	Yes	No
Firm-Year-Month FEs	No	No	Yes
Observations	5,335,501	5,335,501	5,335,501
R-squared	0.408	0.433	0.437