Barbarians at the Store?
Private Equity, Products, and Consumers[*]

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Abstract

We investigate the effects of private equity on product markets using price and sales data for an extensive number of consumer products. In the years following a buyout, target firms increase sales by 50% compared to matched control firms. Price increases—roughly 1% on existing products—do not drive this growth. The launch of new products and geographic expansion do. Competitors lose shelf space and marginally raise prices themselves. These growth results hold in particular for private firms and during the late-2000s financial crisis, suggesting private equity eases financial constraints and provides expertise to navigate tough times and manage growth. Our findings question the common view that private equity firms weaken their targets and substantially increase prices, harming consumers.

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I. Introduction

Private equity firms have raised more than $3 trillion in capital over the last five years, exercising a growing influence on the day-to-day purchases of millions of consumers.[1] Private equity (PE) firms have a simple goal: acquire businesses, and exit with gains. How they achieve gains, however, is an open question. Do PE firms simply transfer wealth using financial engineering strategies,[2] or do they create wealth by improving firm operations? Consistent with the wealth creation channel, studies show that PE firms improve total factor productivity (Davis et al., 2014) and managerial practices (Bloom et al., 2015, Bernstein and Sheen, 2016), focus patenting activity (Lerner et al., 2011), increase employee safety (Cohn et al., 2016), and reduce agency problems (Edgerton, 2012).

Firms, however, exist to sell products and services. Despite this, the effects of private equity on target firm outputs has received little academic attention. Thus in this paper, we use micro-level retail scanner data to study private equity's strategies in the consumer product market. We answer the following basic questions: What happens to prices? Does the product mix change? And does product availability expand or contract? Answering these questions helps reveal whether and how PE firms attempt to create wealth. It also provides insight into how private equity impacts consumers, a topic under constant scrutiny by policy makers and the media.

We compile monthly store-level prices and unit sales for nearly two million unique consumer products sold in over 41,000 locations in the United States between 2006 and 2016.

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[1]Bain and Company (2018) reports that private equity firms have raised $701 billion globally in 2017, reaching a total level of over $3 trillion in the 2012-2017 period. A series of articles published by the New York Times, titled "This is Your Life, Brought to You by Private Equity" 12/24/16, highlights the extensive influence of private equity on consumers.

[2]Exploiting tax rules, extracting dividends, or repackaging assets are among the most common financial engineering strategies used by private equity firms.

This sample covers over 50% of grocery and drug store sales and over 30% of mass merchandiser sales in the United States. The data is remarkably detailed. For example, we can see that in the first week of August 2008, twenty-four cans of Del Monte French style green beans were sold in a particular store in Chicago at an average price of $1.15 per can. We link each product to its parent company. Private equity firms acquired 236 of these companies over our sample period.

We test for changes in product prices and sales, innovation, and availability after a PE buyout. Specifically, we first match each private equity target with a similar counterfactual at the time of the private equity event. We go beyond the firm-level match commonly used in the literature; the granularity of our data allows us to compare product lines and even products within the same store. Each of these different treatment-control pairs represents a cohort. We stack cohort-level observations and run a generalized difference-in-differences estimation.

We begin by documenting that in the five years post-buyout private equity targets increase revenues by 50% on average compared to matched control firms. Price increases do not drive this growth. The average price of the products in a firm's product line increases by only about 5% relative to competitors. Further, this increase is primarily a composition effect from either the introduction of new products or expansion into richer areas, as the price of an existing product in a particular store increases by only about 1% relative to its direct competitors sharing shelf space.

Volume growth, therefore, drives revenue growth. How do firms increase units sold? First, PE targets increase the variety of products offered by 11% more than matched untreated firms. This is the net result of a shorter product cycle; new varieties are both introduced and discontinued more rapidly. New goods sell without cannibalizing existing lineups, which

maintain pre-PE sales rates. Second, PE firms also innovate more into new consumer categories, such as a green bean seller branching to cauliflower. Finally, PE product availability expands to new stores (+25%), new retail chains (+10%), and new zip codes (+14%).

Firms that compete with PE targets are affected by the deals. They increase prices, but also only marginally following the buyout—less than half of one percent. This evidence is consistent with typical oligopoly models of rivals' behavior when one firm raises prices. Competing firms' product variety falls slightly, likely crowded out by the new offerings from PE firms.

How do private equity firms enable this growth? Put another way, why weren't target firms undertaking these actions on their own? To address this question, we look where PE has a larger impact cross-sectionally and try to infer from that what they bring to the table. We split our sample by target firm type, time period, and industry structure. The data have equal visibility into public and private firms, and this is our first split. PE firms achieve growth only in private targets. In contrast, there is some evidence public targets raise prices and see reduced sales for existing products. This is consistent with PE firms providing access to capital or managerial expertise (more dear for private firms– (Boucly et al., 2011, Bloom et al., 2015)) and taming agency costs (for public firms– (Jensen, 1986)). We examine private equity separately during and after the late-2000s financial crisis. PE targets outperformed matched controls in particular during the crisis, consistent with Bernstein et al. (2019). Again, access to capital and managerial guidance are arguably more valuable at this time, and thus we infer these may be a source of PE advantage. Lastly, we find PE buyout targets are more successful in more fragmented markets, possibly because of lower barriers to entry.

A caveat in interpreting our results is that we cannot unambiguously conclude that private equity firms cause target firms to increase sales, product innovation, and geographic

expansion, as "private equity treatment" is not randomly assigned. The standard approach commonly used in the literature to deal with this endogeneity concern is to match treated firms with similar in the pre-buyout period untreated firms. A problem with this approach is that firms might differ across a multitude of observable and unobservable characteristics, leading to poor matches. Industry codes are coarse; firms in the same broad industry are unlikely to have the same product lineup. The granularity of the data helps mitigate this concern: we match not only across similar firms, but also across similar product categories and products themselves. In other words, we can use store shelf neighbors as counterfactuals. For example, we compare a can of green beans sold by a target firm with a can of green beans sold by an untreated firm in the same store. This specificity curtails—though does not eliminate—the role that unobservables could play in explaining our results.

Our work contributes to the empirical literature on the effects of private equity on corporate performance and behavior. Chevalier (1995) documents that supermarket LBOs have incentives to raise prices, but the overall market impact depends on competitive structure: local market grocery price indices rise when rivals have high leverage but fall when rivals are concentrated and in stronger financial positions. Our analysis differs along several dimensions. We do not study retail chains themselves; instead, our buyouts are of firms that sell to and within supermarkets, drug stores, and mass merchandisers. Our price and sales data are thus at the individual product level, not overall store level. We also investigate product market outcomes such as innovation and geographic availability. Moreover, we provide evidence on PE deals completed in the 2000s in contrast to the supermarket deals of the 1980s, an important comparison given the evidence that PE strategies have evolved significantly over the past few decades (see, e.g Guo et al., 2011). Our results that PE firms spur growth complement the evidence in Boucly et al. (2011) that French target firms increase

profitability, sales, debt issuance, and capital expenditures compared to control firms. Our evidence that PE deals do not seem to harm consumers also dovetails with findings that private equity could benefit firm stakeholders by, for example, promoting a more efficient reallocation of the workforce (Davis et al., 2014), reducing work-related injuries (Cohn et al., 2016), increasing employee technological human capital (Agrawal and Tambe, 2016), and improving sanitation and food-safety (Bernstein and Sheen, 2016).

II.   Hypotheses Development

What happens in the product market after private equity buyouts? A popular view in the media is that businesses suffer under PE ownership. To generate cash flows, "you can expand the company, but more likely you slash costs, close divisions, cut staff, curtail marketing, eliminate research and development and more. In other words, cutting to the bone."[3] If PE firms follow such a strategy, target companies could trim product offerings and raise prices to boost short term cash flow.[4] Scaling back investment could also be optimal for some target firms. Agency theory (e.g., Jensen, 1986) predicts that managers might engage in empire building. The added leverage and incentive alignment typical in PE buyouts might, therefore, impose discipline. If lower prices stem from an overinvestment in market share, then private equity firms could raise prices. Analogously, if firms are selling too many products in too many places, private equity could prune product offerings and distribution. Last, liquidity constraints imposed by increased leverage could also lead to higher prices (Chevalier and Scharfstein, 1996).

An alternative and more recent stance on the role of private equity would predict, in-

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[3]*Wall Street Journal*, 3/29/15.
[4]Kosman (2009) devotes an entire chapter to "Lifting Prices" in his book "The Buyout of America."

stead, post-buyout product market expansion. Surveying PE firms, Gompers et al. (2016) find that in target firms revenue growth is pursued more aggressively than cost cutting, acknowledging that PE firms may have incentives to overstate the former and understate the latter. Analyzing data from 839 French PE deals, Boucly et al. (2011) indeed find that buyouts appear to infuse capital and relax credit constraints, as target firms grow faster and become more profitable than their peers, particularly when capital might be most dear ex ante. Bloom et al. (2015) find that private equity may bring better management practices to target firms. If these mechanisms are at play, we expect to see expansion in product offerings and geographic penetration. Implications for pricing, however, are unclear. New or better products might be more expensive. On the contrary, leaner manufacturing or more skillful bargaining with retailers could lead to lower prices.

These contrasting predictions can co-exist in the cross-section of target firms. For example, agency theories might better describe dynamics in more mature industries and for publicly traded firms (Jensen, 1986). Capital constraints may be more relevant for private or small firms (Farre-Mensa and Ljungqvist, 2016). Bloom et al. (2015) find that private firms are more in need of managerial expertise than public firms. Davis et al. (2014) document employment growth following private firm buyouts but contraction after public deals. Boucly et al. (2011) find stronger growth results for private-to-private buyouts. We also take into account the level of competition in product markets (low vs. high concentration in product categories). Chevalier (1995) reports that local market prices fall when rivals are concentrated and stronger financially and rise when competitors are weaker.

III.   Data Description

A.   Nielsen Retail Scanner Data

We combine private equity buyouts and retail store scanner data in our analyses. Product market data comes from the Nielsen Retail Scanner database from the Kilts Center for Marketing. This database tracks all purchases made in the United States from January 2006 to December 2016 at over 41,000 stores from 91 U.S. retail chains (see Table II). Almost all major chains are present in our data, but their identities are anonymized. The largest chain in the sample has 9,273 stores. The sample covers roughly 50% of total U.S. grocery and drug store sales and 30% of U.S. mass merchandiser sales. The stores are spread across the United States, covering 98% of media Designated Market Areas (DMAs). Nielsen tracks weekly average prices and units sold at each store for close to two million unique consumer products.

The Nielsen data identifies products by name and Universal Product Code (UPC). The data are very specific. For example, Table I lists all products available under the category "Canned Green Beans" in a specific grocery store in Austin, Texas, in December 2007. Seventeen green bean products are sold in the store differing in brand (e.g. Del Monte, General Mills), type (e.g. organic, French style), and size (e.g. 8oz, 14.5oz). We exclude UPCs that do not identify unique products (e.g., private label products, products temporarily sold in different size). For each product, each week, in each store, we know the average price, units sold, and total revenue. Table II provides summary statistics. The average product is sold in 571 stores and an average store carries about 19,000 products. Nielsen groups items into mutually exclusive groups such as "Vegetables-Beans-Green-Canned," "Fabric Softeners-Liquid," or "Vacuum and Carpet Cleaner Appliance." These are called "product categories"

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and should be thought of as highly-specific industry definitions. Panel B of Table II shows that there are 1,127 different product categories with an average of 21 items sold nationally by roughly 4.4 firms per category per store.

We match each UPC to its parent firm. The GS1 organization oversees the management of UPCs. Manufacturers buy from GS1 the usage right to a UPC company prefix that corresponds to the first six to nine digits of the UPCs of its products. Firms are required to disclose their name and address when buying a company prefix. Using the GS1 Data Hub, we exactly match 82% of the UPCs in the data to a GS1 company prefix. We map the remaining UPCs to companies by assuming that UPCs in the same firm share the first eight digits. In Panel C of Table II, we present the characteristics of the sample's over 52,000 firms. The average firm sells 10.2 products from 2.9 product categories in 1,346 stores through nine retail chains.

The data allows us to precisely define competitors, market structure, and plausible counterfactuals. We aggregate the data at the monthly level to shrink the dataset to a manageable size.[5] The monthly frequency allows us to accurately capture when firms introduce new products, discontinue products, and expand into new markets. Notwithstanding the richness of the data, we miss two important pieces of information. First, we observe the prices paid by consumers–the sum of the wholesale price and retailer markup. We cannot say with certainty which of these two price components drives our results. That said, whether PE firms are changing wholesale prices or influencing retailers to change margins, the ultimate effect on the consumer is the same. Second, we do not observe manufacturing costs and markups and, thus, we cannot draw direct conclusions about the profitability or optimality of firms'

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[5]The Nielsen data records weekly sales from Sunday morning to Saturday night. If the beginning or the end of the month is not on a Sunday, we assign a pro-rata of the weekly units sold and sales to each corresponding month.

decisions before or after the private equity deal.

B.   Private Equity data

We obtain data on private equity deals from Capital IQ and Preqin. From Capital IQ, we select all "closed," North American, majority stake transactions classified as "Leveraged Buyout", "Management Buyout", "Secondary Buyout", or "Going Private Transaction". From Preqin, we collect all North American private equity portfolio companies. We keep only deals closed between 2007 and 2015 as we require at least one year of product market data before and after each deal, and the Nielsen data spans 2006-2016. To link PE targets with firms in the Nielsen/GS1 database, we begin with fuzzy match algorithms and then manually check each deal to make sure the firms are correctly identified. We also buttress this process with a "top-down" approach, collecting the largest PE deals from Capital IQ and manually checking if any belong in the sample. This makes sure we do not miss any large, obvious deals[6]. We end up with 236 private equity deals, of which 222 are buyouts of private firms and 14 are public.

Figure 1 shows the number of buyouts over time. Deals are more frequent during the private equity boom of the mid-2000s to 2007 and less frequent during the financial crisis starting in 2008. Appendix Table A5 lists the private equity targets with the highest average sales in our sample. The three largest are Del Monte, The Nature's Bounty, and the Pabst Brewing Company. These are not necessarily the targets with the greatest deal value, just those with greatest presence in the consumer product categories we analyze. Table A4 in the online appendix lists the most common private equity buyers in our sample.

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[6]Expanded details on how the sample is formed are in the online appendix.

IV. Empirical Methodology

A. Research Design

Private equity firms do not randomly select companies. As shown in Table A2 in the online appendix, they are more likely to target product categories that are less concentrated, firms that are smaller, and products that are cheaper than competitors. While a comprehensive study of the characteristics of firms and products taken over by private equity is beyond the scope of this study, we can adopt an identification strategy that controls for these observable trends. An advantage of our setting is that our detailed data allows us to match each treated unit with a very similar counterfactual.

While the matching strategy approaches the ideal randomized control experiment, it does not completely solve endogeneity problems. There are two outstanding concerns. First, while we control for pre-deal observable characteristics, there could be unobserved characteristics that explain differences in post-event outcomes. Second, even if we could match on all pre-deal characteristics, a firm could still be targeted because it is expected to change in the future. We find evidence that alleviates the first concern: after the match, treated and control groups are similar also on the observable variables that we do not use in the matching procedure. The granularity of the data helps with the second concern. We are able to compare, for example, two cans of green beans on the same store shelf. While it is possible that one brand has a different trajectory than another (e.g., buzz from an advertising campaign), matching with such specificity certainly reduces the scope of variation (e.g., we control for a sudden increase in green bean popularity).

B. Matching Procedure

We match each private equity acquired firm, firm-product line, or product with a close competitor chosen based on observable characteristics at the time of the private equity deal. We define each resulting treated-control pair as a cohort and then stack all cohorts. Finally, we run a difference-in-differences regression specification on this stack of cohorts.

We match each of the 236 treated firms and 1,039 treated firm-categories with a similar counterfactual based on four variables measured at the time of the private equity deal: the number and growth rate of products sold, and the level and growth rate of the average price of products sold. We match with replacement each treated unit with the closest control using the Abadie and Imbens (2006) distance metric that weights each dimension by its standard deviation. Both treated and control units must be in the sample for at least one year before and one year after the buyout event.

We also perform analyses at the individual product level. For each product-store—e.g., Del Monte 14.5 oz. French Style Green Beans sold in a particular store in Austin, Texas—we select a matched product in that same store, in the same product category at the time of the private equity deal. Again, we choose the particular green bean item that has the most similar level and growth trajectory in both units sold and price.

C. Econometric Specification

Our main empirical analysis employs a stacked cohort generalized difference-in-differences strategy. Essentially, we take the difference in outcome for each treated unit i (firm, product-category, or product) after the private equity deal relative to before and compare it with the difference in outcome of its matched control unit within the same cohort c.

$$y_{i,c,t} = \beta(d_{i,c} \times p_{t,c}) + \alpha_{i,c} + \delta_{t,c} + u_{i,c,t} \tag{1}$$

All regressions are estimated from 24 months before the event to 60 months afterwards. We choose the pre-window to have enough periods to test the parallel pre-trend assumption. We selected the post-window to cover the average duration of a private equity deal. The unit-cohort fixed effect $\alpha_{i,c}$ ensures that we compare the outcome within the same unit after versus before the private equity deal. The time-cohort fixed effect $\delta_{t,c}$ ensures that the treatment unit is compared only with the matched control at each point in time. $d_{i,c}$ is a dummy variable identifying treated units. $p_{t,c}$ is a dummy variable equal to one if the time period is after the private equity buyout. The coefficient β represents the diff-in-diff effect of the private equity deal on the outcome variable relative to a matched counterfactual. The standard errors are double-clustered at the firm and month level to adjust for heteroskedasticity and serial and cross-sectional correlations in the error term (Bertrand et al., 2004).

The high-frequency data allows us to test if the parallel pre-trend assumption holds. We can also learn how quickly private equity firms implement change. We estimate the impact of private equity month-by-month, using the equation below:

$$y_{i,c,t} = \sum_{k=-24}^{60} \beta_k(d_{i,c} \times \lambda_{t,k,c}) + \alpha_{i,c} + \delta_{t,c} + u_{i,c,t} \tag{2}$$

$\lambda_{t,k,c}$ is a dummy equal to one if time t is equal to k and zero otherwise. Standard errors are also double clustered at the firm and month level. Given the large number of fixed effects and observations, all regressions in the paper are estimated using the fixed point iteration procedure implemented by Correia (2014).

V. The Effect of Private Equity on Target Firms

A. Sales and Prices

What happens to the sales and pricing of goods sold by consumer products firms acquired by private equity? We start by analyzing sales, average product prices, and units sold at the firm level. Each target firm is matched to an untreated firm as described in section IV.B. Panel A of Table III shows estimated coefficients of regressions of each firm's log sales, weighted average log price, and log units sold on *After*, a dummy variable that equals one for firm-month observations after the private equity deal close date for target firms. We find that revenues relative to a matched firm increase dramatically. The coefficient on *After* is 0.406, translating to a 50% increase in sales in the years following the deal[7]. This result is consistent with papers that document growth following PE buyouts (e.g. Boucly et al., 2011). This growth is primarily driven by A 43% increase in units sold. The average price per firm increases by 5%. We compute average product prices by dividing total revenues by units sold for each firm in each month. This is a very rough measure of prices—it blends all categories, products, and stores into a single number for each firm. This measure will thus be influenced heavily by compositional changes. While it could capture well overall trends in pricing for single category firms, the average price per firm is not likely informative for firms that sell both cheap and expensive items.

To better understand price dynamics and what ultimately drives changes in sales and units, we begin "peeling the onion". We break the unit of analysis down from the firm to the firm-category. In other words, now instead of treating Del Monte as a single entity, we analyze separately their green bean, canned peach, and spaghetti sauce businesses. This

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[7]Throughout the text, we exponentiate the coefficients for regressions with logged dependent variables when reporting magnitudes.

sharpens the analysis in three ways. First, it increases the quality of the control firm match. Rather than comparing prices and sales of Del Monte and General Mills overall, we can now isolate and compare only their green beans. Second, it allows us to separate changes in existing product categories from changes in the category mix. Last, it permits controls for categories having different players, competitive dynamics, and trends. The 236 private equity treated firms in our sample range from operating in a single Nielsen-defined product category (e.g., Noosa Yoghurt, LLC only sells products in the "Yogurt-Refrigerated" category in our sample) up to 101 categories for American Roland Food Corp. We match each treated firm-category with the same category of an untreated firm with similar number and growth of products, and level and growth in prices.

In Panel B of Table III, we regress the logs of revenues, units sold, and average nationwide prices for a firm in a particular product category on the *After* variable. This breakdown at the product category level mimics the firm-level results. With the added precision of only comparing products within their categories, we find that average prices of private equity-owned firms increase by 3% relative to matched firms. Sales increase by 23% and units sold increase by 18%. All are significantly significant at 1%. These point estimates for units and revenues at the category level are a little smaller than at the firm level. This could be a sign that either PE firm targets' larger categories are growing the most, or that they are expanding to new categories. We explore this in the next section.

Figure 2 plots the trend in log sales and average log prices over time with a 90% confidence interval. The graphs show no obvious pre-trend in sales or price before the private equity buyout. This provides comfort that we are comparing similar firms and firm-categories. After the event, at the product-category level, there is a gradual increase in both sales and prices over the next 3-5 years; PE firms take time to implement change.

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After a PE buyout, we find small price increases and large unit sales increases at the category level for targets. Multiple paths can generate these results; distinguishing between them is important for understanding both PE growth strategies and their effects on consumers. The relative increase in average nationwide category-level prices could be because existing products have been marked up. Alternatively, the composition of goods sold within a category might have shifted towards more expensive varieties (e.g., the PE target sells more premium organic products), or the firm might be growing share in markets or retailers that simply charge more (e.g., New York City). Consumers dislike higher prices on goods they already buy but could welcome greater access or choice of new varieties, even if more expensive. Similarly, there are different paths to the increase in firm-category units sold; PE targets could be gaining share within a store or expanding to new stores.

To peel the onion further, we drill down to the individual product and store level. Instead of comparing a PE target and control firm's green bean sales nationally, we now compare a PE target's 16 ounce can of fancy Italian green beans in a particular supermarket in Austin, Texas with a non-PE treated can of green beans in the same store. In other words, we use literal store shelf neighbors as counterfactuals. This allows us to tease apart changes to existing products from composition and location effects.

The unit of observation is a specific UPC in a specific store in a month. A cohort is defined as a treated-untreated pair of products within the same store and category. We regress the logs of sales, average price, and units on *After*, product-cohort fixed effects, and cohort-time fixed effects.

In Panel C of Table III, we find only a 1% increase in the price post-PE for a given treated product relative to a competing product in the same store. Though potentially meaningful for the target firm's profitability, this magnitude is likely marginal for consumers. This 1%

increase for existing products also implies that the average category price increase of 3% shown in Panel B is likely due to a composition effect: adding or shifting consumer tastes to products that are more expensive or expanding to locations with higher prevailing prices or cost of living. Results on revenues and units sold differ substantially from our the results in Panels B and C; both *After* coefficients are zero. This means that existing products are not gaining share within their current stores. Some combination of selling new products or selling in new places must, therefore, drive unit and revenue increases at the firm and category level. We explore innovation and geographic availability next.

B.   New Product Development

Do private equity firms change the pace of new product introduction? Do they expand into new industries? Lerner et al. (2011) and Amess et al. (2015) find that after a leveraged buyout, firms increase their patenting activity and produce more influential patents, suggesting either a relaxation of financial constraints or reduced agency problems. While patents capture the early stages of innovation, our data allows us to study the end result with the release of new products.

Mimicking the price and sales analyses, we first answer these questions at the overall firm level. We match each of the 236 firms acquired by private equity with a non-private equity-owned firm with the closest number and growth of products, and level and growth in prices. The unit of analysis is a firm-month. Table IV illustrates the effect of private equity on product innovation. *Number of Products* is the log of the number of unique UPCs a firm sells nationwide in month t. *New products* is the number of products introduced by the firm in month t. A new product is a UPC that appears for the first time in the Nielsen database. *Discontinued Products* is the number of products dropped by the firm in month t, meaning

the UPC never reappears again in the sample. We drop the first and last six months of the sample for this analysis to allow enough time to ensure that new UPCs really are new and discontinued UPCs do not reappear. We cannot see if a product dropped near the end of the sample might only be gone temporarily. Finally, *Number of Categories* is the log of the number of product categories, out of a total of 1,127 defined by Nielsen, in which a firm sells at time t.

In Panel A of Table IV we compare the product portfolios of PE and non-PE firms. Column 1 shows that firms run by private equity expand their product selection (distinct UPCs) by 11% after their acquisition, relative to matched firms. These firms can grow their product line by introducing new products or dropping fewer products. Columns 2 and 3 show that private equity-run firms engage in greater churn– they both introduce and discontinue products more frequently. More than twice as many new products are created each month than dropped, however, driving the net increase in product variety. We also examine whether targeted firms are more likely to expand into new product categories. In column 4, the coefficient on *After* is 5% and significant. There is thus evidence that PE targets both create new varieties of green beans and move into previously untapped vegetables or other products.

To confirm this interpretation, in Panel B we run analyses at the national firm-category level. We compare each treated firm-category with the same category of an untreated competitor. Within a category, private equity controlled firms do indeed increase their unique product portfolio by 2.5% relative to their pre-private equity ownership days. Both new product introductions and discontinuations increase at a faster rate. Recalling that Table III showed that existing products did not decline in sales, these new products appear not to cannibalize existing goods. Figure 3 shows that product innovation happens gradually over

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the years following the private equity buyout.

Overall, private equity firms appear to engage in increased creative destruction within their product lines, with the boost to the number of new products outpacing replacement, resulting in greater product variety. There is also evidence of expansion into new industries. Closing the loop, since average category-level prices rise for these private equity treated firms, the new products must be slightly higher priced. And since there are more products for sale, this partially explains why overall units sold for treated firms grow despite no change to existing product growth at the store level.

C. Product Availability

Firms bought by private equity increase their units sold and revenues at a faster rate than competitors. The previous section shows that introduction of new products helps drive this result. In addition, private equity may facilitate geographic expansion.

We employ the firm-level sample in Table V, panel A, and the firm-category level sample in panel B. *After*, once again, is a dummy variable indicating a post-buyout firm-month or firm-category-month for target firms. Column 1 shows that firms increase the number of physical stores in which they sell their products by 25% after they are acquired by private equity, relative to a matched untreated firm. This can happen by selling to more stores within the same retail chain or by breaking into new retail chains. Column 2 shows indeed that private equity firms increase the number of retail chains by 10% after the private equity event. How widespread geographically is this expansion? Column 3 shows that private equity firms expand to 14% more 3-digit ZIP codes[8]. The results in panel B, where the unit of analysis is a firm-category, are similar. Figure 4 shows that this expansion occurs steadily

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[8]Counties, Designated Market Areas, and states all give similar results.

over the years subsequent to the deal close date.

VI.   Competitor Response

The results thus far show what happens to private equity treated goods relative to a matched competitor. Competitors, however, do not necessarily stand still. In this section, we investigate how competition responds to PE entry. Added to relative changes, these results reveal absolute changes to product characteristics and the ultimate impact felt by consumers.

A.   Competitor Response: Prices

Prices on existing products taken over by PE increase by about 1% relative to matched products (Table III, Panel C). This could be the result of private equity firms keeping prices constant while competitors lower prices in an attempt to run highly leveraged targets out of business. Alternatively, the price effects could be bigger than the small ones we have previously estimated if competitors also increase prices. Whether rivals match PE price increase behavior, as typical oligopoly models would predict, or seize an opportunity for predation is an empirical question.

To identify the pricing response of competitors to private equity entry, we exploit geographic variation in a given competitor's exposure to a PE buyout. As an example, assume that Del Monte, a private equity takeover target, sells green beans in store A but not in store B. General Mills, who is not private equity owned, sells green beans in both stores. We compare the price response of General Mills in store A, which faces PE competition, to its response in store B, which does not. We attribute a differential price response in the months

following the buyout to the PE deal. The identifying assumption is that the price of this particular green bean product of General Mills would otherwise move similarly wherever it is sold.

The control firms from earlier regressions switch roles to now become the object of interest. We first extract the same non-PE products and store locations that face a PE competitor from the same-store analysis of Table III. We then identify the stores where these non-PE products are sold absent the PE competitor. Given that each product is sold in thousands of stores, we select ten random stores, and among these we select the closest match in terms of price level and growth to the non-PE product which does face a PE rival. These two product-stores form a cohort.

In Table VI, *After* is a dummy variable which equals one for non-PE products after private equity deals for their competitors, in stores where that newly private equity-owned product is also sold. As with the same-store product analysis, we include product-cohort fixed effects and time-cohort fixed effects. In Panel A, Column 1, the coefficient on *After* is 0.3% and significant, suggesting that private equity leads direct store competitors to raise prices, but only marginally. A threat to our identifying assumption would be if pricing trends in the store in which the non-PE product faces PE competition are systematically different from trends in stores absent PE. To address this concern, we first control for the retail chain in case PE products tend to be sold in chains that are raising prices generally. In Column 2, we require that all eleven stores (ten which sell only the non-PE product, one which also sells the PE entrant) from which the product-store cohorts are drawn are part of the same retail chain. Alternatively, perhaps stores that sells both the PE product and non-PE competitor are located in geographic areas experiencing differential price changes. Thus in Column 3 we require that all stores used to define the cohorts are in the same Designated Market Area.

The coefficients on *After* in these regressions are 0.4% and 0.3% and still significant. Private equity entry thus leads competitors to raise prices in stores where they compete directly, but the magnitudes are small.

Figure 5 plots the price response (from Column 1) over time. Interestingly, the change to pricing is immediate. This evidence suggests that the response is an actual price increase to existing products as opposed to a gradual increase due to introduction of new, more expensive varieties. Added to the relative price increase for a given product of approximately 1% for PE-owned goods, the results in panel A suggest the absolute PE price increase is 1.3 to 1.4%.

B. Competitor Response: Product Mix and Availability

Private equity targets boost product introduction and thus increase variety. How do competitors respond along this dimension? To address this question we analyze if, after the buyout, there is a change in the number of unique products these competitors stock on shelves in stores where they compete with the PE firms vs. stores where they do not. As an illustrative example, General Mills, which is not PE-owned, sells 10 varieties of green beans in stores A and B prior to the PE buyout of its competitor, Del Monte. Del Monte sells green beans in store A but not store B. What happens to General Mills' unique green bean count in store A vs. store B after the PE rival emerges? The unit of analysis is now a firm's entire category within a store, not a specific product, since we want to count the number of products in the category. For each store in which a non-PE firm competes with a PE in a given category, we select ten random stores where the non-PE firm does not compete with PE. We form cohorts using all eleven firm-category stores, one treated by a PE entrant and ten untreated.

We present these results in Table VI, Panel B. In Column 1, we find that a private equity

buyout of a competitor does not change a firm's variety of product offerings. Column 2 makes sure all 11 stores in each cohort are from the same retail chain, and Column 3 requires all cohort members to be in the same Designated Market Area. Sharpening the cohorts better isolates the PE versus no PE competitor split. Unlike with prices, where competitors respond (marginally) in the same direction as their PE shelfmates, product variety responds in the opposite direction. The number of unique UPCs offered in a category declines by roughly 2% in both specifications. A reasonable explanation for this finding is that shelf space is finite; more aggressive PE product introduction appears to crowd out competitors.

VII.   Mechanisms

Private equity deals result in marginally higher prices but significantly higher sales, primarily through aggressive introduction of new products in new locations. How do private equity firms achieve these results in practice? Why is private equity needed? In this section we try to uncover the mechanisms at play by examining cross-sectional variation in PE impact. Knowing when and where private equity is particularly effective can shed light on their approach. We examine public versus private targets, the financial crisis, industry structure, and firms' share of their markets. Variation along these dimensions will suggest various and overlapping channels through which PE firms act.

A.   Private Equity Deal Press Releases

A straightforward starting point for understanding how private equity firms achieve results is their stated plans and strategies. This is in the spirit of Gompers et al. (2016) who survey PE firms, asking them how they hope to create value. For every deal in our sam-

ple, we search for the press release announcement and read and categorize reasons given for the deal. Of course, what firms say is not necessarily their true intention, and even if it is, there is no guarantee they will achieve success. Announcements are likely to overstate positive outcomes (e.g. growth) and downplay negative outcomes (e.g. layoffs). That said, announcements can offer insight into the range of strategies employed.

We are able to locate press releases for 237 deals[9]. The results are tallied in Table VII. The classification of reasons is not mutually exclusive. Some press releases mention growth generically; some specifically detail new product development, acquisitions, or distribution. Overall, expansion and growth broadly are mentioned for a strong majority of deals. Capital infusion and human capital are additional, related, factors. Cost cutting and financial engineering are hardly present. Overall, the stated strategies are consistent with the growth results we find and suggest a variety of levers to pull to achieve them.

B. *Public versus Private Targets*

Public and private firms may reside at different points in their life cycles. They could also require different types of assistance or face different challenges. Private firms are more likely constrained financially (Farre-Mensa and Ljungqvist, 2016), while public firms are usually more mature and could be more subject to agency problems and overinvestment (Jensen, 1986). In Table VIII, we rerun our sales, price, product innovation, and product availability tests separately on public and private PE firm targets. Of the 236 treated firms, 222 are private and 14 are public. We find the impact of private equity is not the same for public and private targets.

In Panel A, the results for private targets match those for the pooled sample at the firm

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[9]We include here deals that do not have enough data points to survive in the final sample.

level (Table III): post-PE prices increase by 5% while units and revenues increase dramatically by 45% and 52%. For public firms, however, although the coefficients have the same sign, the magnitudes on sales and units increases are much smaller and not significant. At the firm-category level, the results for private firms again agree with the full sample results–significant growth in sales and units and a 4% increase in prices– and again public firms are different. Directionally, public firm nationwide sales and units within a product category fall post-buyout relative to a control. Public firm buyouts thus do not appear to have the same implications for growth.

Panel A of Table VIII concludes by re-examining the PE impact on individual products in a particular store, relative to competitors on the same shelf. The full sample results from Table III showed no relative change to existing product sales and a marginal 1% increase to prices. This result masks differences between public and private firms. Existing products sold by private firms actually increase their revenues by 6%, significant at the 1% level, in a given store post-buyout. This is driven by an increase in units sold, not price. Public firms, instead, raise prices significantly by 2% and see a 6% decline in revenues. Overall, the results suggest that PE firms increase sales and units only in private companies. We find mixed results for public targets.

Table IV showed that in the full sample, product offerings expand within existing categories and into new ones after a private equity takeover. In Table VIII, Panel B, we split these innovation results by public and private status. Private firm post-buyout behavior mimics the full sample findings: the number of unique UPCs for sale grows by 11%, sold in 6% more product categories. There is scant evidence, however, that public firm targets create more new varieties or enter more new product lines relative to controls post-buyout. The signs of the coefficients are mixed and none are significant.

In Panel C, we revisit location expansion. Private firms drive the strong growth in market penetration in the overall sample (see Table V). Private firms post-buyout register higher growth rates across stores, ZIP codes, and chains relative to matched firms. The results hold both at the firm and firm-category level. Public firms again show mixed results with none significant.

This divergence in results between public and private firms suggests the existence of both growth and agency motives for private equity deals. Access to financing, managerial expertise, or business connections can help younger, private firms take the next step to expand their product lines. *The New York Times* notes that "business owners with a product to sell often dream of winning shelf space in the Wal-Marts and Targets of the world. But... it is a challenge to get shelf space in any store."[10] Public firms, in contrast, may be overinvesting in market share by charging prices that are too low. Our results of growth for private but not public targets, plus higher prices for the latter, are consistent with other studies. For example, Davis et al. (2014) document that employment grows following private firm buyouts, while it declines after public deals. Boucly et al. (2011) find stronger growth for private target firms. This variation in deal outcomes can also perhaps explain the negative portrayal of private equity in the media: layoffs and contraction are associated with the most visible, well-known targets.

C. Financial Crisis

The financial crisis of the late-2000's provides an interesting shock to the availability of capital. How do PE firm targets compete in an environment where growth is low and competitors may be struggling? In Table IX, we split the PE deals into those that close

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[10]"Getting Your Product Onto Retail Shelves" *The New York Times* 10/20/2010

between 2007 and 2010 and those that close between 2011 and 2016. We ask whether PE target behavior relative to control firms is different during versus after the crisis. Panel A shows that at the firm and firm-category level, prices, units, and sales increase similarly for PE firm targets in both time periods, consistent with the full sample results. Results for existing products in a given store, however, diverge. During the crisis, PE target products sell 7% more units and generate 10% higher revenue than controls. In Panel B, there is more experimentation and churn by PE firms during the crisis, as the coefficients on firm-category new product introductions and discontinuations are larger here and significant. The product availability results in Panel C show that expansion is generally similar during the two periods, though firms during the crisis appear to expand to more new stores, chains, and zip codes based on the coefficient magnitudes and significance levels.

Overall, this is suggestive evidence that PE-backed firms performed better than matched controls during the financial crisis in particular, and thus private equity provides a financing advantage or management expertise to navigate tough times. This is consistent with Bernstein et al. (2019), who study the interaction of private equity and the financial crisis in the United Kingdom. They focus on firms that were backed by PE before the crisis, i.e., PE-owned in 2007. They find using accounting statement data that PE-backed companies decreased investments less than non-PE backed companies. PE-backed companies also increased their market share during the crisis. They attribute this to the ability of PE sponsors to raise capital, assist with operating problems, and provide strategic guidance.

D. Industry Structure

In which industries are PE firms most successful? We examine both an industry's overall competitive environment as well as a PE target's particular standing within it. For each of

the 1,127 product categories, each month, we calculate the nationwide Hirfindahl-Hirschman Index value (HHI). Specifically, we compute the revenue market share by firm and then square and sum these shares, resulting in a value between zero and one. Lower HHI values correspond to lower industry concentration. We split categories into those above and below the median HHI each month. In Panel A of Table X we run the product innovation tests separately for each group. Relative to a matched control, PE targets increase their unique UPC count by 8% more in less concentrated industries, while there is no difference where HHI is high.

Orthogonal to overall industry structure, how does a PE target's share within its industry impact its growth? For each firm, each month, we calculate its market share in each product category. For example, if in April 2009 there are 30 firms nationwide that sell green beans, we divide each firm's green bean sales by total green bean sales that month. We then categorize these 30 firms into those that are above or below the median green bean market share. PE buyout targets are particularly likely to expand product offerings in industries where they are in a stronger position. When their market share is above median, unique UPCs increase by 11% more than matched firms. There is no relative increase in new product development when PE firms are small players. Panel B looks at product discontinuations in high versus low HHI and market share industries and finds suggestive evidence that PE targets are more active in replacing UPCs, again, when market share is high.

Low HHI industries are traditionally considered more competitive, but they are also less likely to be dominated by a small number of firms. Is it better to try to expand where there are many small sellers, or where Coke and Pepsi have the lion's share of the market and may erect high entry barriers? Our results on HHI and market share combined show PE makes the most aggressive push when they hold a strong position in a fragmented market.

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VIII. Conclusion

Buyout deals often elicit strong negative reactions: a common view is that private equity firms try to increase corporate profitability by laying-off workers and increasing prices, hurting stakeholders such as workers and consumers. Investment in firms is reduced in order to harvest dividends. Private equity is undoubtedly exercising a growing influence on the purchases of millions of people. Therefore, to move beyond anecdotes, we investigate the effects of private equity on consumer products in a large-scale study using price and sales data for nearly two million unique UPCs sold in over 41,000 stores. Retail scanner data has several nice features. First, we are able to study the evolution of pricing strategies, product innovation, and geographic availability following a buyout. Second, we can more precisely identify counterfactuals in our empirical analyses. In our difference-in-differences estimations, we analyze as treated and control units not only firms, but also product categories and products sold within the same store. This specificity mitigates somewhat concerns that selection, not actions of private equity firms, drive results. Third, the geographic richness of the data permits the study of competitors' response by comparing price changes in locations with and without a PE brand.

Contrary to the critics' view, we find that target firms raise prices only marginally. Compared to similar products sold in the same store, target firms raise price by about 1.0%. Competitors respond to private equity deals by raising prices, but only in those stores where they face PE competition, and the response is limited–roughly 0.3%. An overall price increase of 1.3% in the five years following a buyout for target firms does not seem to support the view that private equity firms harm consumers on this dimension. Despite the marginal increase in the price of existing products, target firms experience a significant increase in their overall sales of about 50% in the years post-buyout. Compared to matched firms,

target firms launch more products and expand more aggressively geographically and among retailers. This increase in product variety and availability can benefit consumers (Kahn and Lehmann, 1991 and Lancaster, 1990). Overall, our evidence is consistent with the private equity asset class as an avenue of wealth creation and not simply wealth transfer.

What does private equity bring to the table to spur growth? We explore different buyout target types, economic environments, and industry characteristics for clues. Growth is stronger for private firm targets and during the late-2000s financial crisis. These are firms and times that likely demand more access to capital and management expertise. Armed with funds and know-how, where do firms find positive NPV growth opportunities? Private equity targets are most aggressive when they have a strong position in a fragmented market.

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Table I. Example of Product Category: Canned Green Beans

List of canned green bean products available in a specific grocery store in Austin, TX, for the month of December 2007.

UPC	Product Details	Firm Name	Size (Oz.)	Units Sold	Sales	Av. Price
2400016286	Cut Green Beans	Del Monte Foods Inc.	14.5	109.43	101.88	0.92
2400016287	Cut Green Beans (No Salt)	Del Monte Foods Inc.	14.5	86.14	81.68	0.92
2400016289	French Style Green Beans	Del Monte Foods Inc.	14.5	51.00	49.89	0.94
2400016293	Whole Green Beans	Del Monte Foods Inc.	14.5	37.29	39.15	1.05
2000011197	Cut Green Beans	General Mills, Inc.	14.5	30.43	30.12	0.99
2400001546	French Style Green Beans	Del Monte Foods Inc.	28.0	16.71	21.90	1.31
3470001219	Cut Italian Green Beans	Sager Creek Vegetable Co.	28.0	11.29	18.96	1.68
3470001211	Cut Italian Green Beans	Sager Creek Vegetable Co.	16.0	21.57	18.34	0.85
3470001211	Cut Italian Green Beans	Sager Creek Vegetable Co.	14.5	21.57	18.34	0.85
2400039364	Pickled Green Beans with Dill Flavor	Del Monte Foods Inc.	14.5	15.29	18.05	1.13
2000011196	French Style Green Beans	General Mills, Inc.	14.5	17.29	17.11	0.99
2400001830	Cut Green Beans	Del Monte Foods Inc.	28.0	5.57	7.30	1.31
2400016290	French Style Green Beans (No Salt)	Del Monte Foods Inc.	14.5	7.14	7.04	0.95
2400001393	Cut Green Beans	Del Monte Foods Inc.	8.0	8.14	5.94	0.73
2400000087	Cut Green Beans (No Salt)	Del Monte Foods Inc.	8.0	3.71	2.71	0.73
2400016292	French Style Green Beans with Onions	Del Monte Foods Inc.	14.5	1.00	1.05	1.05
2400039201	Organic Cut Green Beans	Del Monte Foods Inc.	14.5	0.29	0.49	1.73

Table II. Summary Statistics

This table presents summary statistics for all variables and data used in the paper. Panel A introduces an overview of the number of products, stores, firms, and private equity deals in the overall Nielsen data. Panel B shows the characteristics of the product categories in Nielsen data. We calculate the Hirfindahl-Hirschman Index (HHI) for each of the 1,123 product categories, each month. Panel C presents firm characteristics in the overall sample. Panels D focuses on product characteristics used in our analyses and split by treatment status.

PANEL A: Overall Sample

	N.			N.
Products	1,977,481		Stores	41,309
Stores per Product	571		Chains	91
Products per Store	18,909		3-Digit ZIP	877
Firms	52,205		Counties	251
PE Deals	236		Designated Market Areas	206
Private Target Deals	222		States	49
Public Target Deals	14			

PANEL B - Product Category Characteristics

	Mean	Median	S.D.
N. Categories	1,127	-	-
N. Products per Category	20.80	8.07	38.04
N. Stores per Category	30,123	36,762	12,821
N. Firms per Category-Store	4.43	2.00	5.94
Herfindahl-Hirschman Index (HHI)	0.60	0.57	0.34

PANEL C - Firm Characteristics

	Mean	Median	S.D.
N. Products per Firm	10.22	3.00	41.22
N. Stores per Firm	1,345.82	62.00	4,177.03
N. Chains per Firm	8.83	3.00	14.78
N. Categories per Firm	2.87	1.00	6.42

PANEL D - Product Characteristics by Treatment

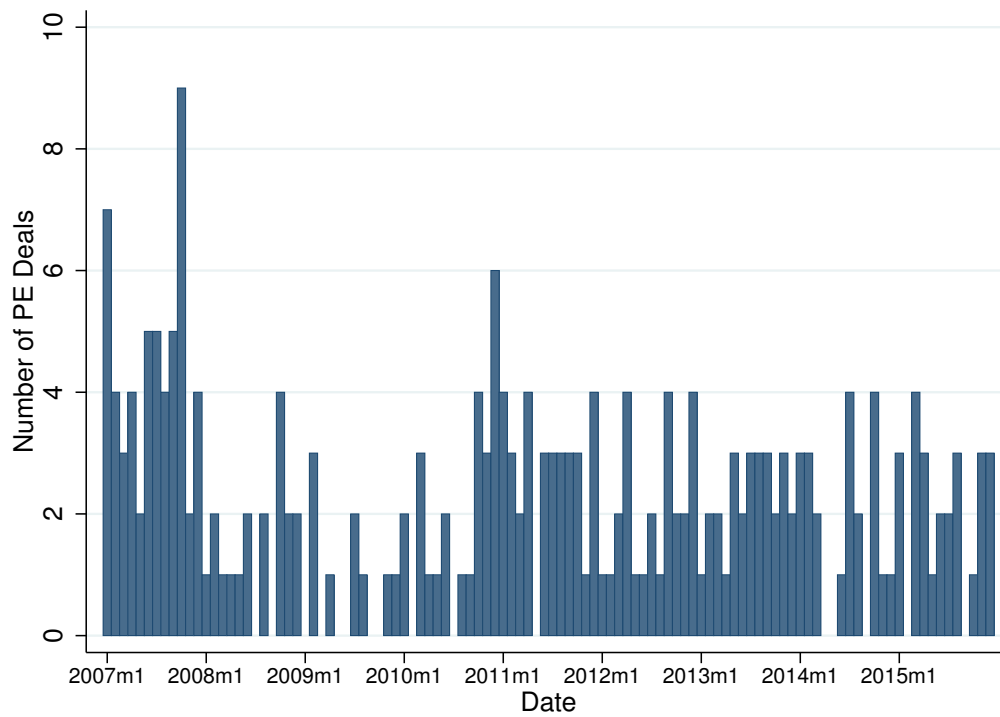|	Control Group				Treated Group		
	Mean	Median	S.D.		Mean	Median	S.D.
Price	5.32	3.99	5.16		5.19	3.76	5.34
Monthly Units Sold per Store	8.51	1.00	42.25		8.62	1.00	39.40
Monthly Sales per Store	20.42	4.96	106.36		19.64	4.99	81.67

Figure 1. Private Equity Deals over Time

This figure shows the monthly number of private equity deals in our sample from January 2007 to December 2015.

Table III. Private Equity, Sales, and Prices

This table presents OLS coefficient estimates from regressing log of sales (Column 1), log of average monthly prices (Column 2), and log of units sold (Column 3) on *After*, a dummy equal to one for the post-buyout months for firms (Panel A), firm-categories (Panel B), or product-stores (Panel C) that underwent a buyout during our sample period. Each cohort is a pair of treated-untreated firms (panel A), firm-categories (panel B), or product-store (Panel C) where the treated unit is matched to the untreated unit with the closest distance at the time of the private equity deal in the level and growth in price, and number and growth in number of products using the Abadie and Imbens (2006) distance metric. The unit of analysis is unique at the firm-month level in panel A, at the firm-product category-month level in panel B, and at the product-store-month level in panel C. The estimation period goes from -24 months to +60 months around the date of the closing of the private equity deal. The regressions are estimated using the fixed point iteration procedure implemented by Correia (2014). Standard errors are in parentheses and are double-clustered by firm and month. *$p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A: Within Firm

	Sales	Average Prices	Number of Units Sold
After	0.406***	0.053***	0.355***
	(3.59)	(2.86)	(3.43)
N. Obs.	31,596	31,596	31,596
Firm-Cohort FE	Yes	Yes	Yes
Date-Cohort FE	Yes	Yes	Yes

Panel B: Within Firm-Category

	Sales	Average Prices	Number of Units Sold
After	0.211***	0.032***	0.169***
	(3.58)	(3.76)	(3.14)
N. Obs.	224,454	224,454	224,454
Firm-Cat.-Cohort FE	Yes	Yes	Yes
Date-Cat.-Cohort FE	Yes	Yes	Yes

Panel C: Within Product-Store

	Sales	Price	Number of Units Sold
After	0.00213	0.01084**	0.01332
	(0.15)	(2.35)	(0.76)
N. Obs.	880,331,932	880,331,932	880,331,932
UPC-Store-Cohort FE	Yes	Yes	Yes
Date-Store-Cohort FE	Yes	Yes	Yes
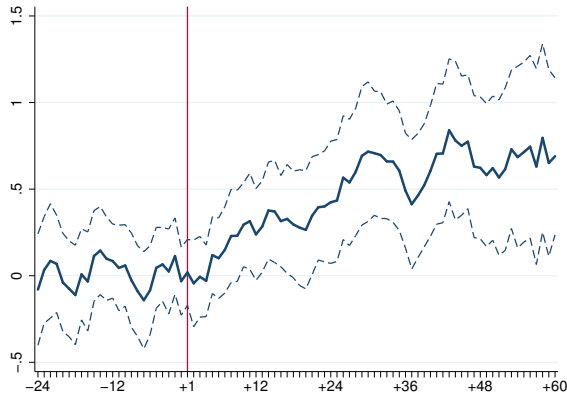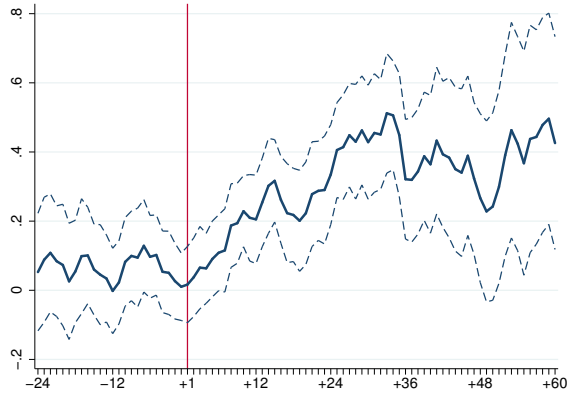
Figure 2. Time Trend of Total Sales and Average Price

These figures plot the coefficient estimates of regressions following equation 2, where the dependent variables are total sales for panels (a) and (c) and average price for panels (b) and (d). The unit of analysis is a firm-month for panels (a) and (b) and a firm-category-month for panels (c) and (d). The coefficient estimate at time t represents the difference in the outcome variables between private equity firms/firm-categories and matched non-private equity firms/firm categories t months away from the date of closing of the private equity deal. The estimation period goes from -24 months to +60 months around the date of the closing of the private equity deal, indicated by the vertical line. The dotted lines show the 90% confidence interval.

## Table IV. Private Equity and Product Innovation

This table presents OLS coefficient estimates from regressing the log of number of products (Column 1), a new product dummy (Column 2), a discontinued product dummy (Column 3), and the log of number of product categories (Column 4) on *After*, a dummy equal to one for the post-buyout months for firms (Panel A) or firm-categories (Panel B) that underwent a buyout during our sample period. We measure the number of products by counting products that a firm or firm-category has on the shelves in at least one store in that month. The New Products variable is the number of products introduced by the firm or firm-category in that month. The Discontinued Products variable is the number of discontinued products by the firm or firm-category in that month. We measure number of categories by counting the categories in which a firm has at least one product on store shelves in that month. Each cohort is a pair of treated-untreated firms (panel A) or firm-categories (panel B) where the treated unit is matched to the untreated unit with the closest distance at the time of the private equity deal in the level and growth in price, and number and growth in number of products using the Abadie and Imbens (2006) distance metric. The unit of analysis is unique at the firm-month level in panel A and at the firm-product category-month level in panel B. The estimation period goes from -24 months to +60 months around the closing date of the private equity deal. The regressions are estimated using the fixed point iteration procedure implemented by Correia (2014). Standard errors are in parentheses and double-clustered by firm and month. *$p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A: Within Firm

	Number of Products	New Products	Discont. Products	Number of Categories
After	0.104***	0.393**	0.159	0.051**
	(3.12)	(2.06)	(1.11)	(2.22)
N. Obs.	31,596	31,596	31,596	31,596
Firm-Cohort FE	Yes	Yes	Yes	Yes
Date-Cohort FE	Yes	Yes	Yes	Yes

Panel B: Within Firm-Category

	Number of Products	New Products	Discont. Products
After	0.025**	0.048**	0.034*
	(2.13)	(2.41)	(1.77)
N. Obs.	224,454	224,454	224,454
Firm-Cat.-Cohort FE	Yes	Yes	Yes
Date-Cat.Cohort FE	Yes	Yes	Yes
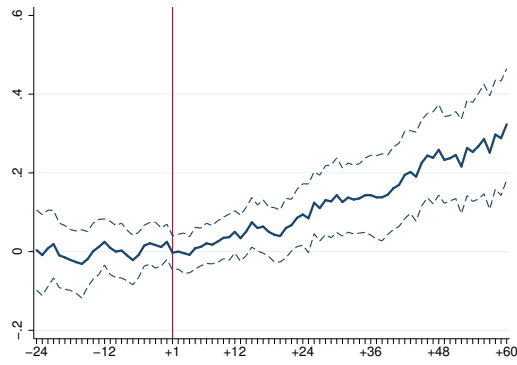
(a) Number of Products - Within Firm

(b) Number of Products - Within Firm-Category
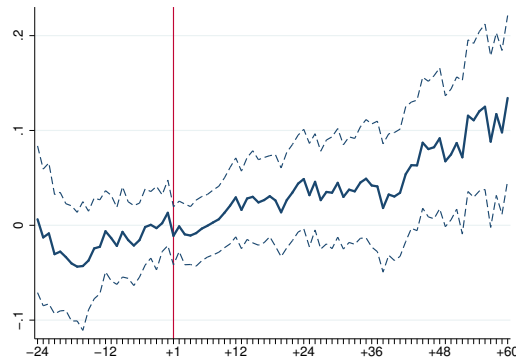
(c) Number of Product Categories - Within Firm

Figure 3. Time Trend of Product Innovation

These figures plot the coefficient estimates of regressions following equation 2, where the dependent variables are number of products for panels (a) and (b) and number of product categories for panel (c). The unit of analysis is a firm-month for panels (a) and (c), and a firm-category-month for panel (b). The coefficient estimate at time t represents the difference in the outcome variables between private equity firms/firm-categories and matched non-PE firms/firm categories t months away from the date of closing of the private equity deal. The estimation period goes from -24 months to +60 months around the closing date of the private equity deal, indicated by the vertical line. The dotted lines show the 90% confidence interval.

Table V. Private Equity and Product Availability

This table presents OLS coefficient estimates from regressing the logs of number of stores (Column 1), number of retail chains(Column 2), and number of 3-digit ZIP codes (Column 3) where a firm or firm-category is present on *After*, a dummy equal to one for the post-buyout months for firms (Panel A) or firm-categories (Panel B) that underwent a buyout during our sample period. Each cohort is a pair of treated-untreated firms (Panel A) or firm-categories (Panel B) where the treated unit is matched to the untreated unit with the closest distance at the time of the private equity deal in the level and growth in price, and number and growth in number of products using the Abadie and Imbens (2006) distance metric. The unit of analysis is unique at the firm-month level in panel A and the firm-product category-month level in panel B. The estimation period goes from -24 months to +60 months around the closing date of the private equity deal. The regressions are estimated using the fixed point iteration procedure implemented by Correia (2014). Standard errors are in parentheses and double-clustered by firm and month. $^*p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Panel A. Within Firm

	N. Stores	N. Chains	N. ZIP Codes
After	0.223***	0.098***	0.129**
	(3.07)	(3.28)	(2.47)
N. Obs.	31,596	31,596	31,596
Firm-Cohort FE	Yes	Yes	Yes
Date-Cohort FE	Yes	Yes	Yes

Panel B. Within Firm-Category

	N. Stores	N. Chains	N. ZIP Codes
After	0.130***	0.052***	0.095***
	(2.93)	(2.92)	(2.89)
N. Obs.	224,454	224,454	224,454
Firm-Category-Cohort FE	Yes	Yes	Yes
Date-Category-Cohort FE	Yes	Yes	Yes
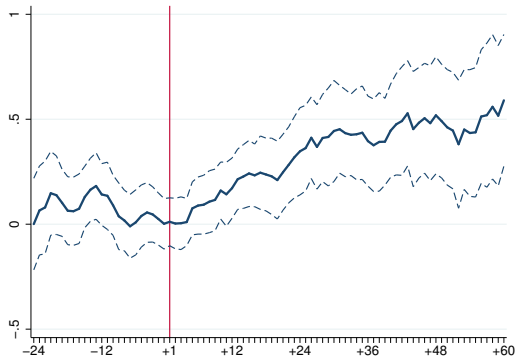
(a) N. Stores - Within Firm
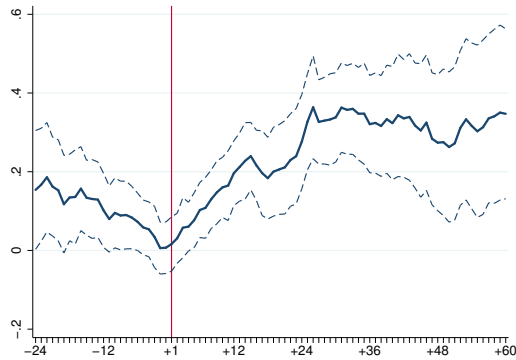
(b) N. Stores - Within Firm-Category
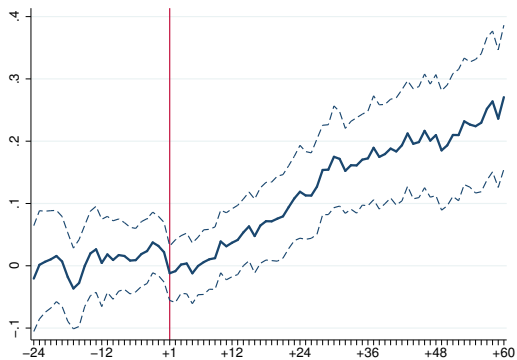
(c) N. Retail Chains - Within Firm
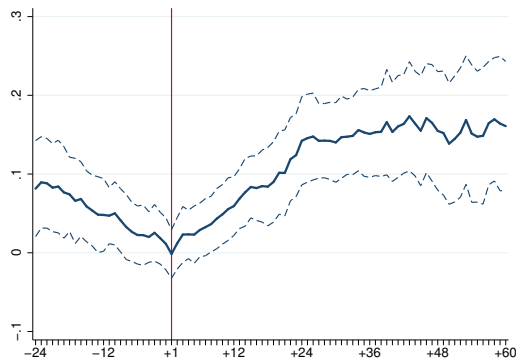
(d) N. Retail Chains - Within Firm-Category

(e) N. 3-digit ZIPs - Within Firm
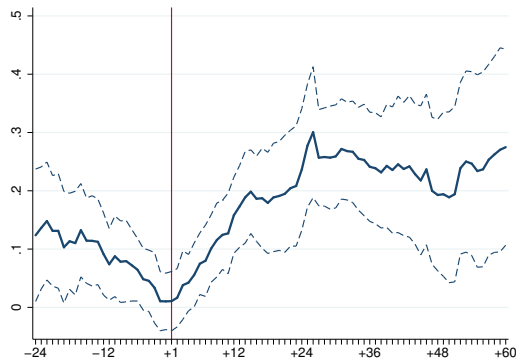
(f) N. 3-digit ZIPs - Within Firm-Category

Figure 4. Time Trend of Product Availability

These figures plot the coefficient estimates of regressions following equation 2, where the dependent variables are number of stores for panels (a) and (b), the number of retail chains for panels (c) and (d), and the number of 3-digit ZIPs for panels (e) and (f). The unit of analysis is a firm-month for panels (a), (c), and (e), and a firm-category-month for panels (b), (d), and (f). The coefficient estimate at time t represents the difference in the outcome variables between PE firms/firm-categories and matched non-PE firms/firm categories t months away from the closing date of the private equity deal. The estimation period goes from -24 months to +60 months around the date of the closing of the private equity deal, indicated by the vertical line. The dotted lines show the 90% confidence interval.

Table VI. Competitor Response

This table presents evidence from product-stores (Panel A) or firm-categories (Panel B) whose firms did not go through a private equity deal. In Panel A, we present OLS coefficient estimates from regressing the log of average monthly prices on *After*, a dummy variable equal to one in the post-buyout months if the treated product was competing in the same store-category with at least one product that underwent a buyout during our sample period. Each cohort is thus made of a treated product sold in a store with PE competition and a matched control product—with the same UPC—sold in different stores without private equity competition. In practice, for each treated product we randomly select ten of these stores without PE competition. Among these ten stores, we then choose the closest match based on the level and growth in the product-store price before the deal, using the Abadie and Imbens (2006) distance metric. In Column 1, we randomly choose ten among all the stores in the US to select the match. In Column 2, we choose the ten stores within the same retail chain of the treated product. In Column 3, the ten stores are from within the same Designated Market Area of the treated product. In Panel B, we present OLS estimates from regressing the log of number of products on *After*, a dummy variable equal to one if in the treated firm-category was competing with at least one product in the same category that underwent a buyout during our sample period. Each cohort is thus made of a treated firm-category sold in a store with PE competition and the same firm-category from ten different stores without private equity competition. In Column 1, we randomly choose the ten store among all the stores in the US. In Column 2, we choose the ten stores within the same retail chain of the treated firm-category. In Column 3, the ten stores are from within the same Designated Market Area of the treated firm-category. The unit of analysis is unique at the product-store-month level in Panel A and the firm-product category-month level in Panel B. The estimation period goes from -24 months to +60 months around the closing date of the private equity deal. The regressions are estimated using the fixed point iteration procedure implemented by Correia (2014). Standard errors are in parentheses and double-clustered by firm and month. $*p < 0.1$, $** p < 0.05$, $*** p < 0.01$

Panel A. Prices - Within Product-Store

	Full Sample	Same Chain	Same DMA
After	0.003***	0.004***	0.003***
	(6.49)	(8.13)	(5.50)
N. Obs.	8,086,245	6,841,427	6,272,768
Product-Cohort FE	Yes	Yes	Yes
Date-Cohort FE	Yes	Yes	Yes

Panel B. Number of Products - Within Firm-Category

	Full Sample	Same Chain	Same DMA
after	-0.001	-0.015***	-0.018***
	(-0.78)	(-7.61)	(-9.17)
N. Obs.	31,086,844	13,238,814	12,845,822
Product-Cohort FE	Yes	Yes	Yes
Date-Cohort FE	Yes	Yes	Yes
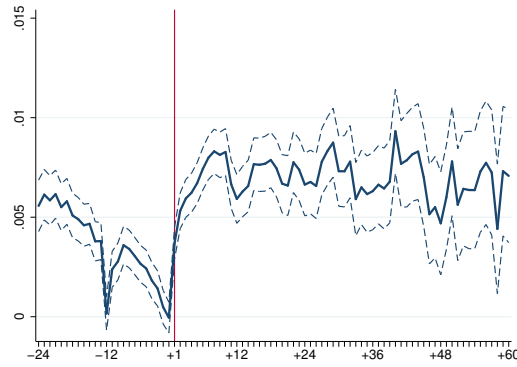
(a) Competitor price response
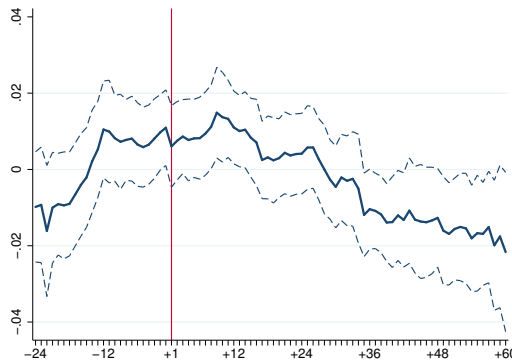
(b) Competitor product mix response

Figure 5. Trend in Competitor Response

These figures plot the coefficient estimates of regressions following equation 2, where the dependent variables are average monthly prices for panel (a) and number of products for panel (b). The coefficient estimate at time t represents the difference in the outcome variables between treated product-stores/firm-categories and matched controls t months away from the date of closing of the private equity deal. This sample only includes product-stores/ firm-categories whose firms did not go through a private equity deal. In panel (a), each cohort is made of a treated product that is sold in a store-category where a private equity deal occurred, and the best match (with the same UPC) but selected from ten random stores across the US where there is no private equity competitor. In panel (b), each cohort is made by a firm-category where the PE deal occurred, and the average of the same firm-category from ten random stores across the US where there is no private equity competitor. The estimation period goes from -24 months to +60 months around the date of the closing of the private equity deal, indicated by the vertical line. The dotted lines show the 90% confidence interval. Regressions are estimated using the fixed point iteration procedure implemented by Correia (2014).

Table VII. Mechanism: Press Releases

This table shows the number (and percentage) of press releases that mention a reason for the private equity deal. Out of 297 deals, we were able to find 237 press releases, of which 44 did not include any reason for the deal. 297 deals is higher than the 236 used in this paper's regressions because the sample here includes deals that did not have enough data for inclusion.

Reason	N. Deals	(%)
Expansion Plans/General Growth	163	(69%)
Financial Capital for Growth	63	(27%)
Industry Experience/Expertise	58	(25%)
New Products	49	(21%)
Acquisitions	29	(12%)
Distribution	26	(11%)
New Management/CEO	24	(10%)
Cost Efficiencies	9	(4%)
Access To Talent	2	(1%)

Table VIII. Mechanism: Public vs. Private Targets

This table presents OLS coefficient estimates from regressing, in Panel A, logs of sales, average monthly prices, and units sold on *After*, a dummy equal to one in the post-buyout months if the firm, firm-category, or product-store underwent a buyout during our sample period. In Panel B we focus on product innovation, in Panel C product availability. All the outcome variables are either indicator variables or in logs. Public targets are those deals where the target was a public company before the private equity acquisition. Each cohort is a pair of treated-untreated firms, firm-categories, or product-stores where the treated unit is matched to the untreated unit using the same methodologies followed in the previous tables. The unit of analysis is unique at the firm-month, firm-product category-month, or product-store-month. The estimation period goes from -24 months to +60 months around the closing date of the private equity deal. The regressions are estimated using the fixed point iteration procedure implemented by Correia (2014). Standard errors are in parentheses and double-clustered by firm and month. $*p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A: Sales, Pricing, and Units

		Public Target				Private Target		
		After	T-stat	N. Obs.		After	T-stat	N. Obs.
Within	Sales	0.214	(0.53)	2,088		0.420***	(3.54)	29,508
Firm	Average Prices	0.046	(0.94)	2,088		0.053***	(2.73)	29,508
	Units Sold	0.119	(0.36)	2,088		0.372***	(3.41)	29,508
Within	Sales	-0.074	(-0.43)	24,820		0.247***	(4.09)	199,634
Firm-Category	Average Prices	-0.014	(-0.72)	24,820		0.038***	(4.16)	199,634
	Units Sold	-0.059	(-0.40)	24,820		0.198***	(3.55)	199,634
Within	Sales	-0.063*	(-1.95)	307,133,126		0.055***	(5.01)	554,415,032
Product-Store	Prices	0.020**	(2.27)	307,133,126		0.007	(1.39)	554,415,032
	Units Sold	-0.059**	(-2.09)	307,133,126		0.035***	(4.67)	554,415,032

Panel B: Product Innovation

		Public Target				Private Target		
		After	T-stat	N. Obs.		After	T-stat	N. Obs.
Within	N. of Products	0.060	(0.47)	2,088		0.107***	(3.09)	29,508
Firm	New Products	1.766	(1.12)	2,088		0.296*	(1.78)	29,508
	Discontinued Products	-0.424	(-0.43)	2,088		0.201	(1.48)	29,508
	Number of Categories	-0.078	(-0.90)	2,088		0.060**	(2.53)	29,508
Within	N. of Products	-0.008	(-0.22)	24,820		0.029**	(2.36)	199,634
Firm-Category	New Products	0.181	(1.51)	24,820		0.032**	(1.98)	199,634
	Discontinued Products	0.043	(0.65)	24,820		0.032*	(1.69)	199,634

Panel C: Product Availability

		Public Target				Private Target		
		After	T-stat	N. Obs.		After	T-stat	N. Obs.
Within	N. Stores	0.205	(0.98)	2,088		0.224***	(2.93)	29,508
Firm	N. Chains	-0.080	(-1.43)	2,088		0.110***	(3.49)	29,508
	N. Zip	0.057	(0.37)	2,088		0.134***	(2.44)	29,508
Within	N. Stores	-0.116	(-0.97)	24,820		0.161***	(3.52)	199,634
Firm-Category	N. Chains	-0.086	(-1.61)	24,820		0.069***	(3.96)	199,634
	N. Zip	-0.096	(-1.11)	24,820		0.119***	(3.50)	199,634

Table IX. Mechanism: During (2007-2010) vs. After (2011-2015) Financial Crisis

This table presents OLS coefficient estimates from regressing, in Panel A, logs of sales, average monthly prices, and units sold on *After*, a dummy equal to one in the post-buyout months if the firm, firm-category, or product-store underwent a buyout during our sample period. In Panel B we focus on product innovation, in Panel C product availability. All the outcome variables are either indicator variables or in logs. The group 2007-2010 includes private equity deals that closed in that range. Each cohort is a pair of treated-untreated firms, firm-categories, or product-stores where the treated unit is matched to the untreated unit using the same methodologies followed in the previous tables. The unit of analysis is unique at the firm-month, firm-product category-month, or product-store-month. The estimation period goes from -24 months to +60 months around the closing date of the private equity deal. The regressions are estimated using the fixed point iteration procedure implemented by Correia (2014). Standard errors are in parentheses and double-clustered by firm and month. *$p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A: Pricing Strategy

		2007-2010			2011-2015		
		After	T-stat	N. Obs.	After	T-stat	N. Obs.
Within	Sales	0.589***	(2.98)	15,390	0.255**	(2.01)	16,206
Firm	Average Prices	0.057*	(1.84)	15,390	0.049**	(2.23)	16,206
	Units Sold	0.514***	(2.88)	15,390	0.223*	(1.89)	16,206
Within	Sales	0.206*	(1.98)	99,864	0.215***	(3.20)	124,590
Firm-Category	Average Prices	0.035**	(2.25)	99,864	0.030***	(3.11)	124,590
	Units Sold	0.177*	(1.95)	99,864	0.163**	(2.54)	124,590
Within	Sales	0.096***	(6.56)	62,340,132	0.007	(0.37)	817,991,800
Product-Store	Prices	-0.001	(-0.08)	62,340,132	0.012**	(2.45)	817,991,800
	Units Sold	0.068***	(6.80)	62,340,132	-0.003	(-0.21)	817,991,800

Panel B: Product Innovation

		2007-2010			2011-2015		
		After	T-stat	N. Obs.	After	T-stat	N. Obs.
Within	N. of Products	0.106*	(1.90)	15,390	0.102**	(2.57)	16,206
Firm	New Products	0.603	(1.59)	15,390	0.220	(1.40)	16,206
	Discontinued Products	0.347	(1.43)	15,390	0.004	(0.02)	16,206
	Number of Categories	0.048	(1.25)	15,390	0.054*	(1.94)	16,206
Within	N. of Products	0.026	(1.35)	99,864	0.024	(1.66)	124,590
Firm-Category	New Products	0.082**	(1.99)	99,864	0.024	(1.34)	124,590
	Discontinued Products	0.087**	(2.14)	99,864	-0.004	(-0.31)	124,590

Panel C: Product Availability

		2007-2010				2011-2015		
		After	T-stat	N. Obs.		After	T-stat	N. Obs.
Within	N. Stores	0.308**	(2.50)	15,390		0.153*	(1.82)	16,206
Firm	N. Chains	0.125**	(2.44)	15,390		0.075**	(2.17)	16,206
	N. Zip	0.206**	(2.24)	15,390		0.064	(1.15)	16,206
Within	N. Stores	0.102	(1.43)	99,864		0.150***	(2.73)	124,590
Firm-Category	N. Chains	0.050**	(2.20)	99,864		0.053**	(2.11)	124,590
	N. Zip	0.079	(1.64)	99,864		0.107**	(2.45)	124,590

Table X. Mechanism: Category Concentration and Firm Market Share

This table presents OLS coefficient estimates from regressing outcome variables of interest on *After*, a dummy equal to one in the post-buyout months if the firm-category underwent a private equity buyout during our sample period. In Panel A, the outcome variable New Products is the number of products introduced by the firm-category in that month. Discontinued Products is the number of products permanently dropped from the product lineup by the firm in a category that month. *HHI* is the Herfindahl-Hirschman Index of each product category, each month, calculated by squaring and summing the national market shares of each firm in a given category. *High* values of *HHI* are those categories whose *HHI* is above the median that month. *Market Share* for each firm is its sales divided by total sales, each month, in a particular category. *High* values of *Market Share* are firms above the median in a category-month. Each cohort is a pair of treated-untreated firm-categories where the treated unit is matched to the untreated unit with the closest distance at the time of the private equity deal in the level and growth in price, and number and growth in number of products, using the Abadie and Imbens (2006) distance metric. The unit of analysis is unique at the firm-product category-month level. The estimation period goes from -24 months to +60 months around the date of the closing of the private equity deal. The regressions are estimated using the fixed point iteration procedure implemented by Correia (2014). Standard errors are in parentheses and double-clustered by firm and month. *$p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A: New Products

	HHI		Market Share	
	High	Low	High	Low
After	0.013	0.075**	0.107**	0.005
	(0.69)	(2.52)	(2.53)	(0.43)
N. Obs.	109,800	114,490	92,712	98,920
Firm-Cat.-Cohort FE	Yes	Yes	Yes	Yes
Date-Cat.-Cohort FE	Yes	Yes	Yes	Yes

Panel B: Discontinued Products

	HHI		Market Share	
	High	Low	High	Low
After	0.041	0.020	0.076*	0.002
	(1.42)	(1.11)	(1.80)	(0.26)
N. Obs.	109,800	114,490	92,712	98,920
Firm-Cat.-Cohort FE	Yes	Yes	Yes	Yes
Date-Cat.-Cohort FE	Yes	Yes	Yes	Yes