

The Competitive Price Effects of Lidl's Entry in the US Grocery Market

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Katrijn Gielens¹

¹ Katrijn Gielens is Associate Professor of Marketing at the University of North Carolina Kenan-Flagler Business School. This report was commissioned by Lidl. The terms of the agreement granted “full discretion over the content of the report” to the author.

Key Takeaways

- **Competing retailers set their prices for individual products, including staples, substantially lower in Lidl markets compared to markets where Lidl is not present. (See Figure 2 A.)** We observed the following price reactions across the product aisles:
 - For a half-gallon of milk, retailers in markets where Lidl is present set prices about 55% lower than in markets where Lidl is not present.
 - Price reductions of more than 30% can be found in categories such as avocados and bread-related products.
 - For some frequently purchased goods, such as ice cream, bananas and cheese, these price reductions amount to more than 15%.
- On average, competing retailers near Lidl stores set their prices approximately 9.3% lower than in markets where Lidl is not present, which is more than three times as much as was typically reported in other academic work on Walmart's entry in a new market.
- **Prices set by retailers in markets where Lidl operates vary considerably among the different supermarket chains. (See Table 3.)**
 - Aldi sets their prices up to 19% lower in markets where Lidl operates compared to where it is not present;
 - Food Lion and Kroger set their prices up to 15% and up to 13% lower, respectively, compared to where it is not present.
- **This price reaction results, on average, in substantial dollar savings for customers. (See Figure 2B.)** For a broad grocery basket of 48 products, including dairy products, meats, produce, canned and frozen goods, \$17 and \$22 can be saved at Food Lion and Kroger, respectively, and \$14 can be saved at Aldi.
- **Overall, significant cost savings can be obtained for consumers in markets where Lidl operates, especially when taking into account that prices at Lidl stores are even lower.**

INTRODUCTION

On June 15th, Lidl opened ten stores in Virginia, North Carolina, and South Carolina, with further plans of opening of up to 90 more stores across the US within a year, thereby putting big-name companies like Walmart, Kroger, and others on high alert.

Unlike conventional supermarkets, which usually carry up to 40,000 mostly branded products, a typical Lidl store offers a carefully managed assortment of mainly private label products, perhaps representing a tenth as many items but providing a quick and easy shopping opportunity (Paglia 2017). Lidl's US stores are positioned as "low-priced grocery" pledging to 'rethink grocery' through a combination of quality, convenience, and value. Or, as Lidl US CEO Brendan Proctor states it, Lidl offers a model for consumers wanting a good quality product, at a good price who do not want to spend all day in a store and essentially "want to get back to living" (Planet Retail 2017).

In an industry marked by cut-throat competition and mounting markdowns, Lidl promises that prices at its new US stores will be up to 50% lower than those of comparable products at other grocers (Bhattarai 2017). So far, Lidl has made good on its pricing strategy. According to the food research firm Hartman Group, prices in a basket of selected goods at new Lidl stores were as much as 39% lower than at stores of competitors, such as North Carolina-based Food Lion, as well as Walmarts in Virginia and North Carolina. In addition, Kantar Retail reports that, on a basket of 15 private-label goods, Lidl is priced up to 23% below Walmart (Paglia 2017).

In addition to this direct price difference between Lidl and its competitors, there has also been much speculation about the indirect competitive price effects of Lidl's entry in the US; that is, will retailers change their prices if they have to compete head-on with Lidl? Anecdotal evidence gathered in the first few months after Lidl's entry suggests that a period of fierce price

competition followed Lidl's entry in the market. Scott Mushkin, analyst at Wolfe Research, reported that Walmart cut its prices by more than 20% in areas where Lidl recently opened stores, such as Virginia Beach and North Carolina. In other regions where Lidl has not yet entered the market, he had not seen price-cutting from Walmart. However, Mushkin expects it to be likely as Lidl continues to expand, forcing Kroger, Target, and others to also cut prices (Watkins 2017).

The result is significant price pressure on store brands and private labels. According to Mushkin, "Our store visits and analysis highlighted significant price compression in private-label pricing, aggressive prices in the all-important customer traffic-driving fresh food areas and even lower branded prices, too." In a similar vein, *Business Insider* reported that grocers near the new Lidl stores dropped prices to better compete. For example, the Dollar General store in Roebuck, South Carolina dropped prices by 10% to 30% in response to Lidl entering the market, and Food Lion also cut prices in markets where it competes directly with Lidl (Peterson 2017).

Price competition is widely believed to further intensify in the coming years as Lidl expands. Retailers do indeed compete with each other on price. That is, they carefully monitor prices charged by competitors and will make changes accordingly. However, it is not yet clear who the retail winners will be as the grocery price wars evolve, but there is little doubt that consumers will benefit as retailers are forced to continue dropping prices and offer more convenient shopping services in order to stay competitive.

Less consensus, however, can be found as to the extent of these price cuts. In studies looking into the effect of Walmart Super Center entries, competitive price reductions in the range of 1% (Basker and Noel 2009) and 2.5% (Hausman and Leibtag 2007), and 5% at most (Ailawadi et al. 2010) are typically reported. These estimates mainly cover Walmart's ongoing

expansion across the US market. Lidl's store openings, however, are part of an entire new launch into the US market, thereby adding a new powerful and global player to a retail industry already in turmoil. Stronger competitive price reactions may therefore have materialized in Lidl's case.

So far, no research has studied the impact of such international entries on retail prices and, therefore, few benchmarks exist. Whereas some press reports covering Lidl's entry hinted at reductions in the 10 to 20% ballpark, these types of anecdotal reports do not really manage to carefully tweak out the price effect that can be uniquely attributed to the actual entry and many confounding events and situations are not adequately filtered out.

In this paper, I will present empirical evidence that retailers do indeed systematically compete with each other on price, and that they drop their prices if necessary to remain price competitive following Lidl's entry. Moreover, this paper attempts to demonstrate the *causal* role that Lidl plays in regard to its competitors' prices. To do this, we combine a unique store-category level panel data set, detailing competitors' prices in both markets in which Lidl operates and markets where Lidl is not present. The price data pertain to rival retailers' private label products. All selected products are part of a typical household's grocery basket and cover 48 specific grocery products from several categories, including dairy products, meats, produce, canned and frozen goods, and miscellaneous items.

We find that the competitive price effect due to Lidl's entry amounts to approximately 9.3%, meaning that competing supermarkets in vicinity of a Lidl store set their prices lower by 9.3% compared to markets where Lidl is not active. This competitive price effect is substantively stronger than what is reported in academic studies following Walmart entries.

The strength of the competitive price reaction varies considerably by retailer. Close competitor Aldi sets prices up to 19% lower in markets where Lidl is present compared to

markets where Lidl is not present. Food Lion and Kroger, the national supermarket leader, set prices up to 15% and up to 13% lower, respectively, in Lidl markets compared to markets where Lidl is absent. These price reactions imply substantial dollar savings for consumers on a wide basket of 48 typical grocery products of \$17 and \$22 in the case of Food Lion and Kroger, respectively, and \$14 for Aldi.

Also, substantial differences in price reactions can be observed across the product aisles. For staples such as a half-gallon of milk, retailers close to Lidl set prices lower by about 55% compared to markets where Lidl is not present. For some frequently purchased goods, such as ice cream, these price differences amount to more than 15%, and for avocados and bread products prices differences of over 30% can be found. Overall, significant cost savings can be obtained for consumers in markets where Lidl is present.

BACKGROUND²

Before elaborating on its price effects on competing retailers, it may be worthwhile to reflect on the nature of Lidl's business model and why this can alter price competition (see Steenkamp 2017 for a more substantive discussion).

The model, which is also embraced by other retailers such as Aldi, Trader Joe's, and even wholesale clubs like Costco, in many ways is aimed at offering basic goods of daily need at the lowest possible prices – up to 30 to 50% below traditional retailers' prices – while maintaining high-quality standards. The concept is not to be confused with discounters like Walmart. Lidl stores in the US are about 20,000 square feet, about the size of many Trader Joe's. The stores

² This discussion is mainly taken from Steenkamp (2017) and Steenkamp and Kumar (2009).

offer a limited assortment of consumer packaged goods and perishables – typically less than 2,000 SKUs. In contrast, a typical U.S. supermarket sells 40,000 items, on average, and a WalMart supercenter sells 100,000.

Lidl stores consist of six aisles, with general merchandise likely featured through the center of the store. The entire layout is designed to streamline the shopping experience and reduce search time (Bhattarai 2017). Offering a limited assortment of products enables hard discounters to provide a high volume of basic goods and helps to streamline efficient operations. To further reduce costs, hard discounters often display produce in the shelf-ready packaging they were shipped in rather than stacking them in some intricate formation. This allows staff to easily and efficiently rearrange boxes as soon as the product sells out while keeping the freshest produce on top.

As such, costs typically add 13% or 14% to the procurement price – 2% each for logistics, rental, over-head, and marketing, plus about 5% for staff. In contrast, traditional supermarkets are twice as costly on each of the cost components, and, therefore, need to add double that amount (28-30%) to their procurement prices.

Private labels feature prominently in the assortment. Around 90% of Lidl's SKUs are private label. The relative emphasis of private labels is the key differentiator between the Lidl-like discounters and dollar stores, such as Dollar General and Dollar Tree. The former have deep expertise on how their products are produced, who can produce them, and what trade-offs they need to make. The large revenues combined with their small number of SKUs mean that the volume per SKU is very large. Aldi and Lidl, for example, are the biggest sellers of private-label grocery products worldwide. As a result, they are able to drive out every fractional cent of cost without compromising on quality and can outcompete other retailers on price. Indeed, most

international comparisons of prices across retail stores have designated retailers adhering to this concept the price winner.

STUDY DESIGN

To attribute any competitive price effects to Lidl and not to other confounding events, we compare prices at competing retail stores in markets where Lidl operates, i.e. treatment stores, with prices set by the same retailers in markets in which Lidl is not present, i.e. control stores. By matching markets and stores and comparing the price levels (while accounting for other confounding effects), inference can be drawn about Lidl's causal impact on rival supermarkets' price levels. Using a control-group study design enables us to rigorously quantify reactions, separating them from other chain-specific regional factors, as well as alleviating potential bias due to the endogeneity of Lidl's entry.

Selection markets and stores. So far, Lidl is present in 23 markets along the US East Coast. From those 23 markets, we selected markets (1) where both Walmart and Aldi were already present in close vicinity and (2) for which a matching market could be found that resembles the focal market in all but the actual presence of Lidl.

By considering markets in which Aldi and Walmart are present, we can establish that any price effect can be attributed to Lidl, per se, and not to the more generic entry of a hard discounter or power player. Moreover, we have to make sure that we compare markets in which, without the presence of Lidl, similar prices would have been set. To do so, the experimental market, i.e. the market in which Lidl entered, and the control market, i.e. the market in which Lidl is not yet present, should resemble each other closely with respect to the socio-economic

profile and the presence of competing chains. In addition, stores in the control market could not have a Lidl within a 15-miles radius.

Using Census data on 22 socio-economic characteristics at the ZIP-code level, including population, income, and household size as well as data on the competitive structure in the different markets, we could identify six Lidl markets that lived up to these criteria. We subsequently identified all incumbent stores in the vicinity of the entries. This resulted in 20 "experimental" stores from five chains: Aldi, Food Lion, Kroger, Publix, and Walmart. All treatment stores are, on average, within a 1.7 miles radius or 4.5 minutes driving time of the focal Lidl.

We also identified 20 stores belonging to the same retail chains and market areas that are not exposed to the entry. These control stores were, on average, 41.2 miles or 49.7 minutes driving distance away from the nearest Lidl store. This data set represents a natural experiment and enables us to perform treatment-versus-control-group analyses. Table 1 summarizes the key characteristics of the markets.

The direct price differences between Lidl and its competitors differ notably across the different markets. Whereas in Henrico, where premium retailers such as Publix are present, prices at competitors were on average 32% higher than Lidl prices; price differences in Orangeburg and Shelby, where mostly price fighters are present, were less pronounced.

---Please see TABLE 1 on pages 22 and 23---

The five retailers covered in the analysis differ widely in market positioning. Walmart is by far the largest national retailer and can be described as a general merchandiser carrying a wide

assortment at low prices following a strict Every Day Low Pricing (EDLP) strategy. Kroger and Publix are full range supermarkets offering full service using a HiLo strategy, meaning that they resort to more extensive price promotion tactics to attract consumers to the store. Whereas Kroger is the largest national supermarket player in the US, Publix is an upcoming player in the Southeast. Food Lion is also a supermarket owned by Ahold-Delhaize but with a narrower assortment and a more pronounced EDLP price image than Kroger and Publix. Like Lidl and Trader Joe's, Aldi could also be considered a hard discounter, with a narrow assortment mainly concentrating on private-label products.

Products. When retailers compete with prices, they typically do so to safeguard their overall price image. As consumers' overall price image typically reflects their assessment of the overall level of prices throughout a store, we select a broad basket of 48 grocery products that cover all different aisles and offer a fair representation of the store. In Appendices A and B, the products are listed alongside their average shelf prices and the observed direct price differences between Lidl and its competitors.

They include dairy products (milk, eggs), meats (beef, pork), produce (bananas, peppers), canned and frozen goods (canned vegetables, frozen pizza), and miscellaneous items (sugar, dishwashing detergents). The products differ widely in both price levels and price differences between Lidl and its competitors. For example, products like white bread, potato chips, and macaroni and cheese are priced significantly higher at competitor stores than at Lidl, whereas prices for orange juice and smoked ham are more or less on par. In contrast, for some (six out of 48) products such as salsa and avocados, higher prices can be observed at Lidl.

Products were selected that are part of the Lidl assortment. As the Lidl products are mostly private-label products, only private labels at the rival stores were included in this study.

For each Lidl item, the closest resembling private-label item was identified at the five competitors. The retailers covered in our dataset differed substantially with respect to the total price paid for the recorded items in the basket.

Across all markets surveyed, the cheapest overall baskets were found consistently at Lidl. Next were Aldi and Walmart, followed by Food Lion. Markedly more had to be paid at Kroger and Publix. On average, in markets surveyed where Lidl is present, retailers set prices 25% above Lidl prices. More specifically, prices are about 100% higher at Publix, 50% higher at Kroger, 36% higher at Food Lion, 9% higher at Walmart, and 5% higher at Aldi.

Prices. Data collectors were dispatched to the 12 markets covered in the study. For all products, prices were collected through store visits on October 30, 2017. In each store, the price recorded is the lowest price available to all shoppers arriving at the store. So, for example, discounts that require obtaining coupons in advance are never factored in to prices. Promotions that do not require coupons or for which coupons are available in the store, and are redeemable on the spot, are factored in. All prices of products in the same product category were expressed in the same volume price to allow direct comparison. For example, all ice cream prices refer to 48 fl. ounces.

Using the data we thus collected, we estimate the following model

$$(1) \ln(\text{PRICE}_{p,r,m}) = \beta + \gamma \text{LIDL}_m + \sum_r^R \omega_r \text{Retailer}_r + \sum_p^P \theta_p \text{Product}_p + \sum_m^M \mu_m \text{Market}_m + \zeta_{p,r,m}$$

Whereby *PRICE* captures the price of product *p* set by retailer *r* in market *m*. *LIDL* is a dummy variable that equals one in markets in which Lidl is present and zero otherwise. The parameter γ expresses the average percentage difference between prices in markets in which Lidl is present versus where it is not present. This parameter thus allows us to single out the effect of Lidl's

presence on competing retailers. To control for potential sources of unobserved heterogeneity we further include product, retailer, and market-pair fixed effects. To account for correlations in the error term across products within cities, standard errors are clustered by city.

RESULTS

Table 2 summarizes the estimation results.

---Please see TABLE 2 on page 24---

The focal parameter γ is -0.093 and is significantly different from zero at the 1% level. This means that, on average, prices set by rival retailers in markets where Lidl operates are approximately 9.3% below prices encountered at similar stores in markets where Lidl is not present. To translate this effect to a monetary value, we apply the 9.3% price difference on the prices for the total basket of goods in markets in which Lidl is not present. As such, we find that consumers save an average of \$13 per basket because they are shopping in a market in which Lidl is present.

Compared to the estimates found in relation to entries in a new local market by established US retailers, which typically range between 1% and 2.5% in case of a Walmart Supercenter (see, e.g., Hausman and Leibtag 2007, Basker and Noel 2009, and Ailawadi et al. 2010), the competitive effect of Lidl's entry in the US market is thus vastly more substantial, leading to more substantive consumer savings.

While the average price reduction in response to Lidl's entry is 9.3%, the impact is likely to be heterogeneous across (1) competitors of different sizes and types, (2) cities, and (3) products.

In general, we expect supermarkets whose consumers are most similar to Lidl's to make the largest price reductions; competitors that are differentiated in selection and other amenities (service, location, etc.) should react the least (Basker and Noel 2009). Relatedly, we expect the overall competitive environment in each market to affect the price response: markets in which prices are already highly competitive should see the smallest additional price reductions in response to Lidl.

Differences across retailers

Not all retailers necessarily react by changing their prices when faced with a new entry, and marked differences can be found for different types of retailers. In general, a retailer that is affected more by the entry should be more motivated to retaliate (Leeflang and Wittink 1996). Retailers resembling Lidl, in terms of format, assortment, and positioning overlap, should be more affected (Cleeren et al. 2010; Gielens et al. 2008). In general, a retailer can follow two possible approaches. It may attempt to reduce prices, either by lowering costs (for example by increasing efficiency, cutting back on service levels, or reducing the quality of the groceries sold) or by lowering profit margins, to compete on prices head-on. This may be the only option for a chain that has firmly positioned itself in the marketplace as a low-end low-price chain targeting price-sensitive consumers. The other option available to a full-service supermarket is to shift its focus, at least in part, away from the most price-sensitive consumers (whose "defection" to Lidl can be assumed to be a lost cause) and position itself more firmly in the higher-end market that caters to less price-elastic consumers (Ailawadi et al. 2010).

To capture differences in retailers' responses we alter Eq. (1) as follows:

$$(2) \quad \ln(\text{PRICE}_{p,r,m}) = \beta + \sum_r^R \gamma_r \text{LIDL}_m * \text{Retailer}_r + \sum_r^R \omega_r \text{Retailer}_r + \sum_p^P \theta_p \text{Product}_p + \sum_m^M \mu_m \text{Market}_m + \zeta_{p,r,m}$$

Whereby γ_r represents the price difference set by a specific retailer r between markets where Lidl is present compared to where Lidl is not present.

As can be seen in Table 2, and as graphically depicted in Figure 1, the competitive reactions vary significantly by retailer. For example, whereas the γ_r parameter for Aldi amounts to -0.14 ($p < 0.01$), the parameter for Walmart only amounts to -0.03 ($p < 0.05$).

---Please see FIGURE 1 on page 28---

Translating these parameters to percentage price differences between markets where Lidl is present and where Lidl is not active, we find the following. When Lidl is present in their markets, three retailers set their prices at even lower levels than is observed on average. More specifically, compared to markets where Lidl is not active, Food Lion and Aldi set their prices on average 13.6% and 13.9%, respectively, lower in Lidl markets. Kroger sets its prices, on average, 10.1% lower. On the other hand, Publix (4%), and Walmart (3%), have markedly smaller price differences between Lidl and non-Lidl markets. Taking into account the prices paid for a total basket at the six retailers, these differences would imply \$22, \$17, and \$14 savings at Kroger, Food Lion, and Aldi in markets where Lidl is present.

Interestingly, the most substantial price reactions do not necessarily follow the dividing lines of similarity in market positioning and overlap. As expected from a close competitor, Aldi reacts substantially. Comparing the two HiLo supermarkets we find a stark contrast between Kroger and Publix. Whereas Kroger has been drifting more to a mixed-EDLP strategy, thereby

emphasizing prices more, it may have no other option but to set lower prices. Publix, in contrast, by explicitly emphasizing its service and assortment strengths, may be less susceptible to losing its core customers to Lidl and may not have a vast interest in competing up front with the price fighter. Comparing the two EDLP players, we see that Food Lion's reaction is markedly more pronounced than Walmart's. Food Lion, being a smaller player, may have no other choice than to follow the new entrants' price pressure whereas the large scale player may have more power to withstand price pressure.

Differences across markets

Incumbents are more motivated to protect their position in markets that are attractive and of strategic importance to them (Shankar 1999). Differences in competitive price reactions may therefore be expected to vary across different markets. Also, because different markets may be of different strategic importance to different retailers, the effects may differ along two dimensions: retailers and markets. To test for these differences, we adapt Eq. (1) as follows:

$$(3a) \quad \ln(\text{PRICE}_{p,r,m}) = \beta + \sum_m^M \gamma_r \text{LIDL}_m * \text{Market}_m + \sum_r^R \omega_r \text{Retailer}_r + \sum_p^P \theta_p \text{Product}_p + \sum_m^M \mu_m \text{Market}_m + \zeta_{p,r,m}$$

and

$$(3b) \quad \ln(\text{PRICE}_{p,r,m}) = \beta + \sum_m^M \sum_r^{R_m} \gamma_{m,r} \text{LIDL}_m * \text{Market}_m * \text{Retailer}_r + \sum_r^R \omega_r \text{Retailer}_r + \sum_p^P \theta_p \text{Product}_p + \sum_m^M \mu_m \text{Market}_m + \zeta_{p,r,m}$$

In Eq. (3a) we only allow for differences in reactions across markets, whereas Eq. (3b) allows for heterogeneity across both markets and retailers.

At first glance we do not find statistical differences across markets, despite the fact that price differences between competitors and Lidl varied significantly between markets. This means that the market specific price differences between Lidl and non-Lidl stores are all on average close to 9 to 10%. However, when we allow for retailer-market specific effects, some interesting insights can be gained (see last columns of Table 2). More specifically, for both Aldi and Kroger the $\gamma_{m,r}$ parameters differ significantly. In Table 3, we use the estimates obtained with Eq. (3b) and translate them to percentage price differences between Lidl and non-Lidl markets, and dollar savings in Lidl markets.

---Please see Table 3 on page 25---

For two retailers we find significant differences across markets, i.e. Aldi and Kroger, although they tend to react quite differently. In Henrico and Shelby, Aldi reacts significantly less strong (9% and 10% price difference between Lidl and non-Lidl markets versus 14% on average), whereas in Orangeburg, the market where the lowest price difference between competitor and Lidl prices were recorded, Aldi sets its prices up to 19% lower when Lidl is present compared to when Lidl is not present. Interestingly, the markets in which Aldi reacts stronger seem to have a less affluent consumer profile and thus may represent more of Aldi's core markets. Kroger, on the other hand, reacts far stronger in Henrico, the more affluent market with the highest average price difference relative to Lidl. Once again, this type of market may represent the more strategically important markets to Kroger, which are deemed more important to defend through price reactions.

Differences across products

Finally, retailers will most likely not react equally strong in all product categories they carry in their assortment. Most grocery retailers carry a large number of product categories with varying degrees of vulnerability to Lidl, but little is known about how reactions might vary across these products. Overall, large, high-growth, and profitable product categories may be more important to retailers (Ailawadi et al. 2010). It is also likely that incumbents will view staple and traffic-building categories as more important to defend (Dhar, Hoch, and Kumar 2001). Staple and/or traffic-building categories are more likely to be emphasized because these categories can drive where the consumer chooses to purchase his or her entire shopping basket, making incumbents more vulnerable in these categories. Moreover, because Lidl's value proposition is EDLP, price-sensitive categories are more likely to be affected. In addition, incumbents may have more cushioning in large, growing, and profitable categories, so it is not clear if they are more or less vulnerable. To test for these differences we adapt Eq. (1) as follows.

$$\ln(\text{PRICE}_{p,r,m}) = \beta + \sum_p \gamma_p \text{LIDL}_m * \text{Product}_p + \sum_r \omega_r \text{Retailer}_r + \sum_p \theta_p \text{Product}_p + \sum_m \mu_m \text{Market}_m + \zeta_{p,r,m}$$

Whereby γ_p represents the price difference for product p between markets where Lidl is present or not.

Table 4 summarizes the estimation results, and in Figure 2 we graphically illustrate the effect sizes for those products for which we find a statistically significant effect. Overall we find significant effects for 21 out of 48 products.

---Please see TABLE 4 on pages 26 and 27; FIGURE 2 on pages 29-30---

Using the parameter estimates reported in Table 4, we find that price differences between Lidl and non-Lidl markets of over 50% can be found for an important staple such as milk, which

vastly exceeds the average difference of 9.3%. Likewise, for items bought on almost all trips, such as ice cream and cheese, price differences between Lidl and non-Lidl markets of more than 15 and 20% can be observed. For avocados and bread-related products, price differences even amount to more than 30%. Substantial savings can thus be realized for consumers. More specifically, assuming that a household buys half a gallon of milk every two weeks, these numbers imply an annual saving of \$24 on the household's milk expenditures.

CONCLUSIONS

Over the last couple of months, the business press has reported at great length about Lidl's entry in the US market. Various illustrations are given about the substantial price gaps observed between Lidl's products and its competitors'. Also, the potential for further price reductions by these rivals is pointed out, leading to substantial cost savings for consumers, even outside Lidl stores. Still, very little evidence is around to support such sustained rival price reactions, and even less is known about whether the observed price effects can truly be attributed to Lidl. In this study, I aim at identifying the competitive price effect caused by Lidl. To that extent a quasi-natural experiment was used whereby data for markets in which Lidl is present were compared with prices observed in similar markets where Lidl is not yet present.

Filtering out all potentially confounding effects, we find that, on average, competitor retailers set their prices approximately 9.3% lower in markets where Lidl is present compared to where Lidl is not present. To benchmark the magnitude of this effect, we compare it with similar competitive price effects following a Walmart entry and find that the competitive price effect due to Lidl is substantively higher.

The magnitude of the competitive price effect varies considerably by retailer: both close competitor Aldi and Food Lion set prices up to 19 to 15% lower, respectively, in markets where Lidl is present compared to where Lidl is not present; national supermarket leader Kroger sets its prices up to 13% lower. In Lidl markets, this price reaction results in substantial dollar savings on a basket of about 50 products of up to \$17 and \$22 in the case of Food Lion and Kroger, respectively, and \$14 for Aldi.

Also, substantial differences in competitive reactions can be observed across product aisles. For a half-gallon of milk, differences between Lidl and non-Lidl markets of about 55% are found. Price reductions of more than 30% can be found in categories such as avocados and bread related products. For some frequently purchased goods, such as cheese and ice cream, these price reductions amount to more than 15%. Overall, combined with the overall lower basket prices at Lidl, significant cost savings can be obtained for consumers following Lidl's entry in their local markets.

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Table 1 A

Socio-economic characteristics of treatment and control markets

Market Pair	1		2		3		4		5		6	
	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>
Zip Code	23233	27513	27804	28303	29118	29061	29615	29063	28152	27203	28083	28504
State	VA	NC	NC	NC	SC	SC	SC	SC	NC	NC	NC	NC
City	Henrico	Cary	Rocky Mount	Fayetteville	Orangeburg	Hopkins	Greenville	Irmo	Shelby	Asheboro	Kinston	Kannapolis
Population	30131	42637	29381	29197	16027	14802	35642	36266	24361	21602	21538	24270
Median age	38.7	38.2	39.9	36.8	42.2	38.8	40.9	35.5	38.4	35.9	43.8	37.3
% Bachelor's degree	40%	38%	18%	17%	19%	16%	32%	28%	13%	9%	11%	10%
% White	77%	72%	48%	51%	33%	25%	80%	69%	75%	74%	68%	72%
% African American	7%	9%	44%	39%	60%	69%	12%	24%	22%	17%	27%	21%
% Asian	13%	13%	2%	4%	2%	0%	5%	3%	1%	0%	1%	1%
% Non U.S. citizen	9%	9%	3%	2%	2%	3%	7%	2%	2%	10%	4%	6%
% Married	57.5	59.1	41.3	44.9	44.9	45.3	49.8	56.6	49.2	43.5	49.1	47.2
% Unemployed	3.3	4.6	11.5	9.3	10.8	8.6	6.1	5.2	13.9	12.1	9.1	12.1
% Senior Citizen	11%	8%	16%	16%	15%	13%	20%	10%	16%	14%	18%	16%
Household size	2.58	2.55	2.42	2.25	2.49	2.74	2.21	2.87	2.58	2.48	2.47	2.63
% 1-unit structures	74.2	68.9	70.9	69.4	72.1	76.7	56.7	91.1	76.4	64.8	68.3	83.3
% English speaking	94.6	93.7	96.8	96.5	97.5	96.5	95.6	97.8	97.9	89.7	95.2	93.8
% Speak only English	82.7	79.1	92.9	87.3	93.9	93.6	87.9	93.3	94.9	78.7	92.4	86.8
% Food stamps	2%	2%	16%	16%	14%	13%	6%	6%	19%	22%	16%	15%
% children under 18	34%	37%	28%	24%	29%	33%	24%	42%	31%	32%	30%	34%
% Below poverty level	3.4	5.4	14	13.9	14.7	10.2	9.6	7.8	19.3	23.3	12.5	14.1
% Driving to work	93%	88%	93%	92%	98%	94%	92%	92%	95%	96%	95%	94%
% Public Transport	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%	1%	0%
% Availability of car	99%	99%	97%	96%	99%	99%	97%	99%	98%	95%	98%	97%
Mean income	119860	104101	57767	59969	63264	64831	79632	85220	51621	39943	62867	50411
% Owner-occ. houses	66.8	62.3	59	50.4	74.2	78.8	53.9	83.3	67.6	48.1	68.4	63.9

Table 1 B

Presence of retailers in treatment and control markets

Pair	1		2		3		4		5		6	
	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>	<i>Treatment</i>	<i>Control</i>
City	Henrico	Cary	Rocky Mount	Fayetteville	Orangeburg	Hopkins	Greenville	Irmo	Shelby	Asheboro	Kinston	Kannapolis
Presence of Lidl	Y ^a		Y		Y		Y		Y		Y	
Presence of Aldi	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Presence of Food Lion	Y	Y	Y	Y					Y	Y	Y	Y
Presence of Kroger	Y	Y	Y	Y								
Presence of Publix	Y	Y					Y	Y				
Presence of WM	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Average direct price difference between competitors and Lidl	32% ^b		26%		1%		35%		9%		12%	

^a: Y indicates the presence of a retailer in a specific city.

^b: The number should be read as follows. On average, prices for the basket of goods surveyed in the study are set 32% above Lidl prices by the competitors in the treatment market.

Table 2: Estimation results

Homogenous Model			Heterogonous retailer effects			Heterogonous retailer-Market Effects		
Parameter	Estimate	t value	Parameter	Estimate	t value	Parameter	Estimate	t value
Intercept	0.52	10.30	Intercept	0.49	9.00	Intercept	0.49	9.24
Lidl	-0.09	-11.05	Lidl*ALDI	-0.14	-8.70	Lidl*market 1*ALDI	-0.09	-7.84
						Lidl*market 2*ALDI	-0.14	-6.73
						Lidl*market 3*ALDI	-0.19	-21.96
						Lidl*market 4*ALDI	-0.16	-6.93
						Lidl*market 5*ALDI	-0.10	-11.98
						Lidl*market 6*ALDI	-0.16	-9.12
			Lidl*FOOD LION	-0.13	-14.63	Lidl*market 1*FOOD LION	-0.15	-12.61
						Lidl*market 2*FOOD LION	-0.13	-9.87
						Lidl*market 5*FOOD LION	-0.12	-12.98
						Lidl*market 6*FOOD LION	-0.14	-7.61
			Lidl*Kroger	-0.10	-4.54	Lidl*market 1*Kroger	-0.13	-11.34
						Lidl*market 2* Kroger	-0.07	-5.08
			Lidl*PUBLIX	-0.04	-1.78	Lidl*market 1* PUBLIX	-0.04	-1.83
						Lidl*market 4* PUBLIX	-0.04	-1.83
			Lidl*WM	-0.03	-2.36	Lidl*market 1* WM	-0.03	-3.25
						Lidl*market 2* WM	-0.01	-0.66
						Lidl*market 3* WM	-0.02	-2.63
						Lidl*market 4* WM	-0.03	-1.53
						Lidl*market 5* WM	-0.02	-1.81
						Lidl*market 6* WM	-0.04	-3.02
Product FE	Y			Y			Y	
Retailer FE	Y			Y			Y	
Market-pair FE	Y			Y			Y	
Observations	1,717			1,717			1,717	

Table 3
Price reductions per retailer and treatment market

		<i>Henrico</i>	<i>Rocky Mount</i>	<i>Orangeburg</i>	<i>Greenville</i>	<i>Shelby</i>	<i>Kinston</i>
Aldi	% price reduction	9% ^a	14%	19%	16%	10%	16%
	\$ saved	7.3 ^b	13.5	17.3	15.0	9.2	14.1
Food Lion	% price reduction	15%	13%			12%	14%
	\$ saved	17.9	16.1			12.3	16.1
Kroger	% price reduction	13%	7%				
	\$ saved	21.0	9.4				
Publix	% price reduction	4%			4%		
	\$ saved	5.9			6.2		
WM	% price reduction	3%	1%	2%	3%	2%	4%
	\$ saved	1.9	1.1	2.0	3.0	1.1	3.6

^a: The number should be read as follows: In Henrico, where Lidl is present, Aldi sets its prices, on average, 9% lower than in control market, Cary.

^b: The number should be read as follows: In Henrico, consumers at Aldi spend \$7.3 less on the basket of products surveyed than in the control Aldi store in Cary.

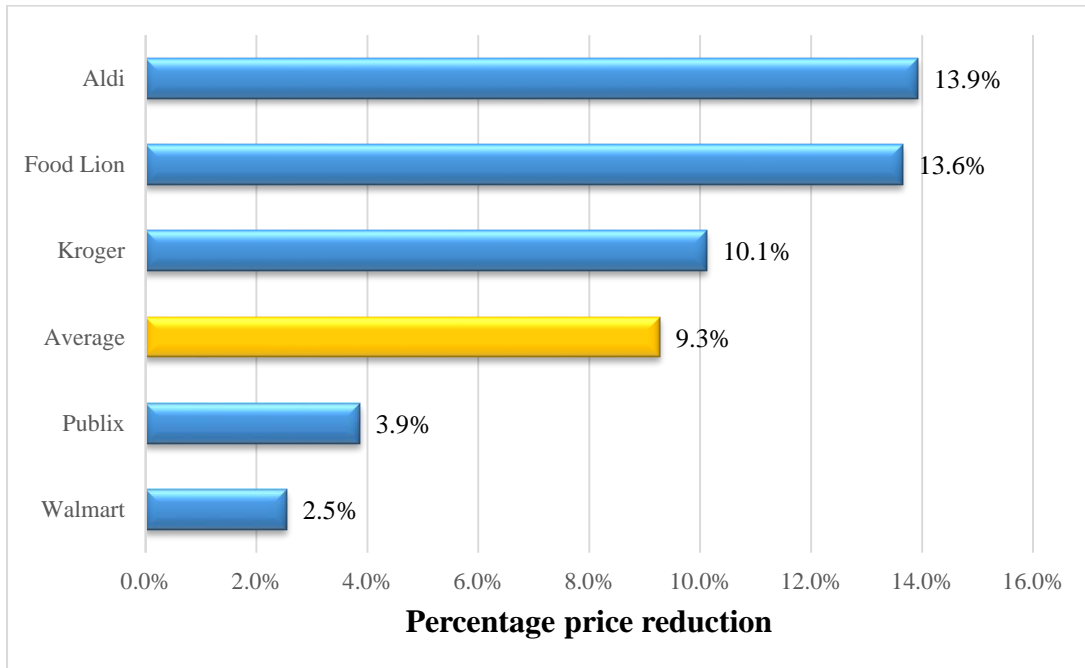
Table 4
Product specific price effect estimates

Parameter	Estimate	t-Value
Intercept	0.63	21.37
Ice Cream	-0.15	-3.90
Pizza	-0.08	-1.14
Tilapia Fillets	0.07	0.67
Shrimps	0.00	-0.06
Smoked Bacon	-0.06	-0.33
Smoked Ham	-0.16	-2.72
Sliced Cheese	-0.22	-3.57
Salsa A	-0.03	-0.33
Orange Juice	-0.08	-3.10
Butter	-0.10	-2.73
Whole Milk (1 gallon)	-0.09	-0.88
Whole Milk (.5 gallon)	-0.56	-7.37
Eggs	-0.04	-0.17
Tomato Ketchup	-0.08	-1.58
Mayonnaise	-0.11	-4.31
Pasta Sauce	-0.11	-4.28
Olive Oil	0.04	1.03
Ground Coffee	-0.10	-1.71
Flour	-0.14	-3.38
Granulated Sugar	-0.06	-1.35
Oats	-0.06	-1.42
Spaghetti	-0.04	-0.62
Jelly	-0.13	-5.91
Peanut Butter	-0.07	-3.18
Macaroni and Cheese	-0.10	-1.23
Chunk Light Tuna in Water	-0.21	-1.64
Chicken Soup	-0.13	-1.99
Pinto Beans	0.01	0.26
Water	0.06	0.35
Cola	-0.04	-1.08
Chocolate Chip Cookies	-0.05	-1.29
Potato Chips	-0.11	-2.24
Tortilla Chips	-0.18	-4.46
White Bread	-0.05	-0.74
Buns	-0.33	-6.25
Laundry Detergent	-0.05	-0.70
Dishwashing Liquid	-0.08	-1.95

Diapers	-0.02	-1.41
Chicken tenderloin	-0.01	-0.08
Pork Chops	0.00	-0.07
Ground Beef	-0.09	-1.06
Trash Bags	-0.04	-0.55
Bananas	-0.18	-3.84
Avocados	-0.47	-6.25
Pineapples	0.23	4.76
Asparagus	0.01	0.19
Peppers	-0.04	-1.49
Tomatoes	-0.10	-1.10
<hr/>		
Product FE	Y	
Retailer FE	Y	
Market-pair FE	Y	
Observations	1,717	
<hr/>		

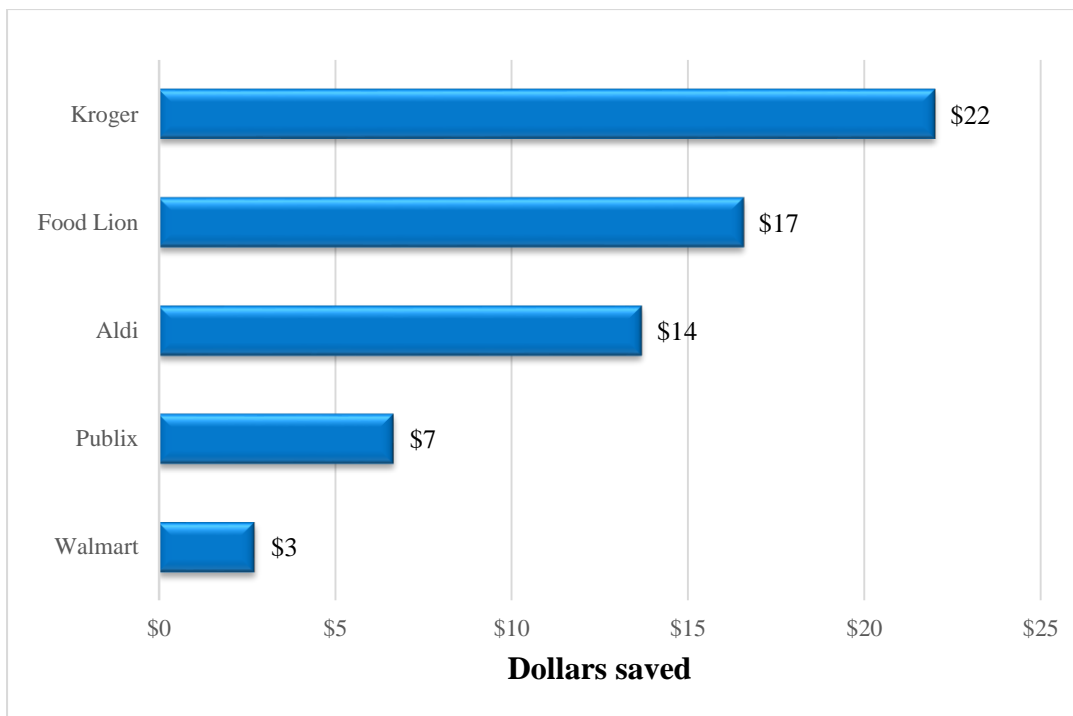
Figure 1: Retailer Specific Effects

Panel A: Average Price Difference between Treatment (Lidl) market and Control Market



The numbers should be read as follows: For example, on average, Aldi stores near Lidl stores set their prices approximately 13.9% lower than in markets where Lidl is not present.

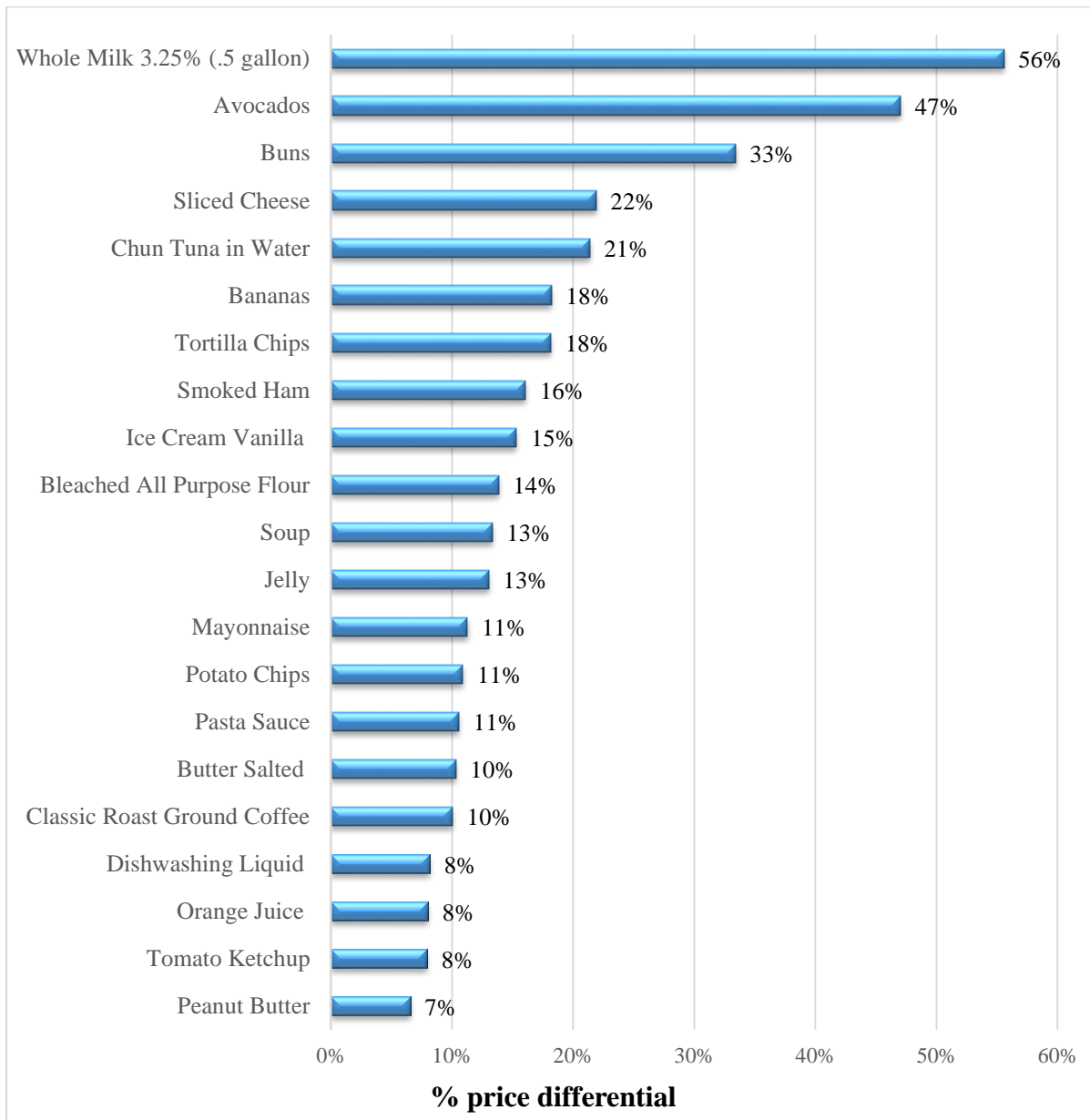
Panel B: Dollar Savings on Total Product Basket per Competitor



The numbers should be read as follows: For example, in Kroger stores near Lidl stores consumers save \$22 on the total product basket than in markets where Lidl is not present.

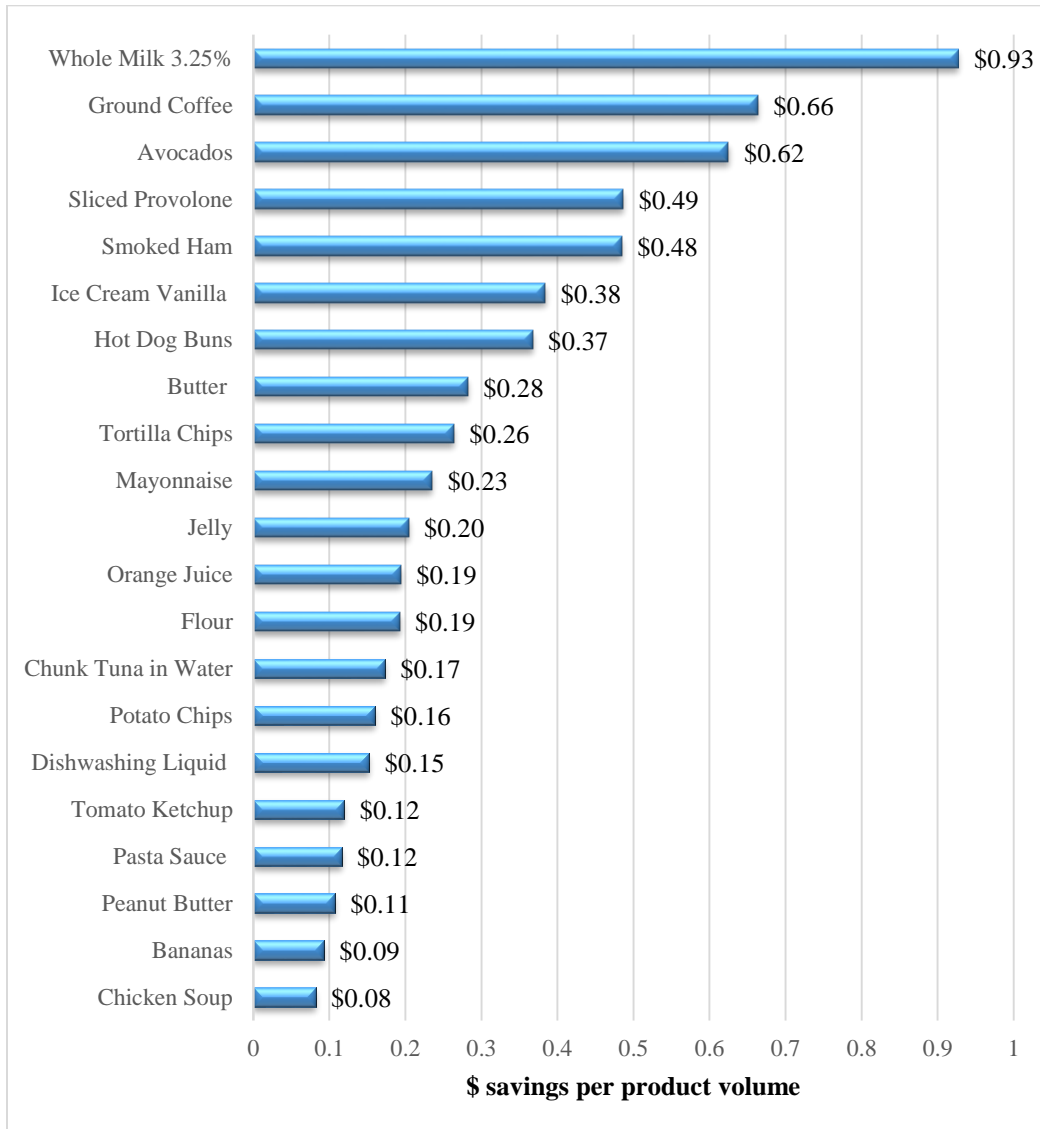
Figure 2: Products Specific Price Reactions

Panel A: Average % Price Difference between Treatment (Lidl) Markets and Control markets



The numbers should be read as follows: For a half-gallon milk, competitors near Lidl stores, on average, set their prices 56% lower than in markets where Lidl is not present.

Panel B: Average Dollar Savings per Product



The numbers should be read as follows: On a half-gallon of milk, consumers in stores near Lidl stores save \$.93 compared to stores in markets where Lidl is not present.

Appendix A

List of products and their average shelf prices across competing retailers in markets where Lidl is not present

Product	Shelf price
Asparagus	3.13
Avocados	1.33
Bananas	0.51
Buns	1.10
Butter	1.63
Butter	2.74
Chicken Soup	0.61
Chicken tenderloin	3.43
Chocolate Chip Cookies	1.76
Chunk Tuna in Water	0.81
Cola	2.36
Diapers	7.51
Dishwashing Liquid	1.87
Eggs	1.96
Flour	1.39
Ground Beef	3.28
Ground Coffee	6.61
Ice Cream Vanilla	2.51
Jelly	1.57
Laundry Detergent	5.04
Macaroni and Cheese	0.50
Mayonnaise	2.09
Milk (.5 gallon)	1.67
Milk (1 gallon)	2.70
Oats	1.61
Olive Oil	3.18
Orange Juice	2.42
Pasta Sauce	1.10
Peppers	3.68
Pineapples	2.37
Pinto Beans	1.10
Pizza	4.29
Pork Chops	3.37
Potato Chips	1.47
Purified Water	2.28
Salsa	2.35
Shrimps	6.38
Sliced Cheese	2.22
Smoked Bacon	4.56
Smoked Ham	3.02
Spaghetti	1.39

Sugar	1.85
Tilapia Fillets	8.04
Tomato Ketchup	1.50
Tomatoes	1.45
Tortilla Chips	1.45
Trash Bags	5.74
White Bread	1.05

Appendix B

The average direct price differences

The numbers below have to be interpreted as follows. The price of bananas, for example, at competing retailers is 21% more expensive than at a Lidl store in a treatment market.

Product	Average % direct price difference between competitors and Lidl
Asparagus	2%
Avocados	-15%
Bananas	21%
Buns	28%
Butter	31%
Chicken Soup	7%
Chicken tenderloin	33%
Chocolate Chip Cookies	10%
Chunk Tuna in Water	39%
Cola	17%
Diapers	24%
Dishwashing Liquid	19%
Eggs	-4%
Flour	32%
Ground Beef	6%
Ground Coffee	20%
Ice Cream	25%
Jelly	11%
Laundry Detergent	-4%
Macaroni and Cheese	87%
Mayonnaise	36%
Milk (.5 gallon)	32%
Milk (1 gallon)	17%
Oats	5%
Olive Oil	4%
Orange Juice	2%
Pasta Sauce	-17%
Peanut Butter	30%
Peppers	9%
Pineapples	-6%
Pinto Beans	7%
Pizza	38%
Pork Chops	12%
Potato Chips	58%
Purified Water	33%
Salsa	-7%
Shrimps	2%
Sliced Cheese	44%
Smoked Bacon	57%

Smoked Ham	3%
Spaghetti	27%
Sugar	50%
Tilapia Fillets	52%
Tomato Ketchup	30%
Tomatoes	10%
Tortilla Chips	32%
Trash Bags	24%
White Bread	56%
