What Happens when More Starbucks Cafés come to Town?

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Abstract

This study first uses a theoretical model to illustrate that the increasing market presence of Starbucks cafés has two opposing effects on the demand for packaged ground coffee products sold via grocery stores, i.e., "*demand-increasing*" and "*business-stealing*" effects, the relative strengths of which determine the ultimate market outcomes. We then empirically examine how these effects influence the equilibrium market outcomes. The empirical findings reveal that market presence of an additional Starbucks café increases the prices and quantities sold of Starbucks and non-Starbucks packaged ground coffee products in grocery stores and suggest a relatively dominant "*demand-increasing*" effect. Furthermore, we find evidence of net welfare gains associated with Starbucks café entry in local markets.

Keywords: Starbucks Cafés, Grocery Stores, Retail Packaged Ground Coffee, Business-stealing Effect, Demand-increasing Effect

JEL Classification Codes: L13, D12, L66, M30

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1. Introduction

The increasing number of consumer goods and services in recent years is a consequence of the diligent efforts that firms have been putting on proliferating their product lines to meet consumers' ever-changing needs and preferences. When a firm extends its product line, it needs not only to decide which type of new products to launch, but also to carefully coordinate the relationship between the new products with the existing products. On the one hand, if two products are positioned too "closely" with each other in the product line, for example, having similar quality or functionality, a business-stealing effect can easily occur. This may shift the existing consumers between products resulting in gains for one product and losses for the other. On the other hand, a multi-product firm wants to leverage the strong favorable reputation of established products and brands to promote the sales of new products. This idea is well expressed by Michael Conway, a Starbucks Corp. executive vice president, when he explained the company's strategy of launching packaged ground coffee in grocery stores: "Because of the impression we make every day in the cafés, we don't have to work as hard when we launch new products".[1]

The coexistence of business cannibalization/stealing and demand-increasing effects complicates the interrelationship between products as well as the business decisions of a firm because a strategy which is meant to be applied to one product category can have an ambiguous impact on the profit of another product category of the firm, and sometimes the impact can even spill over to related products of competing firms. This calls for firms and researchers to consider these two types of effects across products and across firms when evaluating strategies for changes in product lines. Our empirical focus in this study is to analyze the interrelationships between Starbucks café outlet line and its retail packaged ground coffee products line in the grocery chains.

Starbucks, the Seattle-based coffee chain, since it opened its first coffee store in 1971, has aggressively expanded its café brand by locating thousands of café shops across the world. In contrast to the rapid growth of café shops, it took Starbucks a long time to launch and grow its business of packaged coffee products retailed in grocery stores. In 1989, 18 years after it was founded, the company began providing private-label coffee in Costco, a wholesale grocery chain, under the Kirkland Signature Brand. In 1998, Starbucks partnered with Kraft, a food

[1] "Starbucks' grocery gambit" by Beth Kowitt, Fortune, December 5, 2013. http://fortune.com/2013/12/05/starbucks-grocery-gambit/

manufacturing firm with favorable brand recognition in grocery stores, to distribute its packaged coffee in grocery stores, but this partnership was terminated by Starbucks in late 2010 as Starbucks alleged that Kraft failed to market its brands in grocery stores satisfactorily.[2] Subsequently, Starbucks decided to own and control its packaged ground coffee products by itself. "Shouldn't our shareholders benefit from our ability to build a brand inside Starbucks?" the company's CEO Howard Schultz said, "as opposed to selling a category or product that is something that we don't own or have equity in?" [1]

To explore the consumer brand awareness accumulated by its café shops, Starbucks placed so-called "Signature Aisles" in grocery stores to "feature bags of coffee under a sign with Starbucks' distinctive mermaid logo".[2] Moreover, Starbucks extended its loyalty program from café shops to grocery store aisles. In particular, the loyalty program members who buy Starbucks ground coffee products in grocery stores can earn rewards points that can be redeemed for coffee, food and merchandise in Starbucks cafés. Those who redeem rewards points in Starbucks cafés can receive coupons for their future purchases of Starbucks ground coffee products in grocery stores. The fact that Starbucks diligently strives to leverage the strong reputation and value created by its café shops when promoting its packaged ground coffee products in grocery stores makes it interesting to investigate the interactions of these two streams of product lines.

The key objective of this study is to examine the market effects associated with the increasing presence of Starbucks café shops on the U.S. retail packaged ground coffee products in the grocery channel. Specifically, the study addresses the following questions: (*i*) How does Starbucks business strategy of establishing café shops in local markets influences the prices and quantities of its own and its competitors' retail packaged ground coffee products sold in grocery stores located in these markets? (*ii*) Considering the countervailing impacts of the "*demand-increasing*" and "*business-stealing*" effects on retail packaged coffee products induced by the market entry of a new Starbucks café shop, which of the two effects dominate in determining equilibrium market outcomes? and (*iii*) What is the welfare effect associated with entry of a Starbucks café shop in a local market?

The analyses begin by using a theoretical model to illustrate the "*business-stealing*" and "*demand-increasing*" effects of Starbucks café shops on consumers' quantity demand for

[2] "Starbucks Aims For Grocery Store Supremacy With New Signature Aisle" by Rachel Tepper, Huffton Post, April 26, 2013. https://www.huffingtonpost.com/2013/04/26/starbucks-grocery-store-aisle_n_3157075.html

packaged ground coffee of Starbucks and its competitors. Specifically, on a purchase occasion, a potential consumer has the option to either purchase packaged ground coffee from grocery stores and make a drink by themselves, visit a Starbucks café shop to purchase and enjoy barista-prepared coffee, or choose neither of these options. The model assumes the proportion of grocery coffee shoppers decreases with the number of Starbucks café shops: when there are more Starbucks café shops in a market, consumers more easily patronize a café to grab a cup of barista-brewed coffee and therefore become less likely to buy packaged coffee from supermarkets. This is referred to as a *"business-stealing"* effect.

Meanwhile, for those consumers who continue to buy ground coffee in grocery stores, the increasing presence of Starbucks café shops also shifts their relative preference for Starbucks and competing brands, e.g., Folgers, of packaged ground coffee in two distinct ways. First, Starbucks café shops offer consumers opportunities to try a variety of coffee drinks and explore their preferences over different types or flavors of coffee. Consumers then can use the packaged ground coffee purchased from grocery stores to make their ideal coffee drink. This *"demand-increasing"* effect may boost consumers' demand for packaged ground coffee products of both Starbucks and Folgers if the two brands do not fully cover the market of grocery coffee shoppers. Second, the presence of Starbucks café shops may increase consumers' perceived utility of Starbucks packaged ground coffee in a magnitude higher than that of Folgers packaged ground coffee, driven by increased consumer awareness of the Starbucks brand as well as the benefits associated with the Starbucks loyalty program. Such a *"demand-increasing"* effect may enhance the demand for Starbucks branded products disproportionately more than Folgers branded products.

Depending on the relative magnitudes of the above two opposing effects, a new Starbucks café shop available in the market likely has either a net positive or a net negative effect on the demand of retail packaged coffee products, Starbucks brand and competing non-Starbucks brands, in the grocery channel. Our theoretical analysis shows that due to countervailing forces of the "*business-stealing*" and "*demand-increasing*" effects, an increase in the number of available Starbucks café shops in the market has an ambiguous impact on the equilibrium quantities sold of retail packaged ground coffee for both Starbucks brand products and competing non-Starbucks brand products. The theoretical ambiguity, therefore, makes it necessary to examine the impacts in real-world settings. A similar countervailing tension between "*demand-increasing*" versus "*business-stealing*" effects is empirically examined by Berry and Waldfogel (1999) in the context of the provision of various public radio programming. Accordingly, we specify a structural econometric model to empirically examine the market demand and supply of Starbucks and non-Starbucks packaged ground coffee products sold in grocery stores. The estimated model is subsequently used to simulate new market equilibrium outcomes based on an assumed counterfactual change in the number of Starbucks café shops present in the relevant market.

For the empirical analyses we use a standard discrete-choice demand model, and assume that competing firms set prices according to a static Bertrand-Nash price-setting game. The demand model is specified to allow the number of Starbucks café shops in the relevant market to influence consumers' mean utility obtained from consuming package ground coffee products sold in grocery stores, as well as influence consumers' mean utility obtained from choosing the outside option. The outside option of our demand model includes consumers' choosing to consume freshly-brewed coffee from a local café shop. The estimated demand model and supply-side equations implied by the assumed price-setting behavior of firms are used jointly to simulate the new market equilibrium that would result from the counterfactual entry of an additional Starbucks café shop in the relevant market. A comparison of actual market outcomes with model-predicted market outcomes resulting from the counterfactual entry of an additional Starbucks café shop reveals the extent to which an additional Starbucks café shop influences prices and quantities sold of Starbucks' and non-Starbucks brand packaged ground coffee products sold in local grocery stores, as well as the impact on consumers' welfare.

The demand estimates suggest that each additional Starbucks café shop in the local market increases consumer demand for both Starbucks and competing non-Starbucks packaged ground coffee products in the grocery chains. The counterfactual experiments reveal that the entry of an additional Starbucks café shop increases both prices and quantities sold of Starbucks and competing non-Starbucks packaged ground coffee products. The findings provide empirical evidence that the increasing market presence of Starbucks cafés exhibits a "*demand-increasing*" effect that dominates the "*business-stealing*" effect on the sales of retail packaged coffee products, which ultimately expand the retail packaged coffee market segment. Furthermore, the size of the market-expansionary effect attenuates as the market becomes increasingly saturated with Starbucks café shops. Last, based on the predicted changes in money-metric consumer surplus, we find net welfare gains associated with market entry of a new Starbucks café.

The remainder of the paper proceeds as follows. In the next section, we briefly review the relevant literature. In section 3 we discuss key empirically testable insights from a simple theoretical model that we specify and analyze. Section 4 discusses the data used in the empirical analysis. Section 5 describes the empirical model, as well as estimation and identification of parameters in the empirical model. Section 6 presents and discusses the empirical results. Section 7 concludes the paper.

2. Related Literature

This paper joins the literature of "umbrella branding" and "brand extension". Brand is one of the most important assets of firms. It is very common for a multi-product firm to label several products under the same brand name, a practice which is termed "umbrella branding" or "brand extension" [Aaker and Keller (1990), Pepall and Richards (2002)]. Umbrella branding is a justifiable firm strategy posited by two distinct theories in the literature. First, it has been shown that umbrella branding is a rational strategy within the theoretical framework of adverse selection models. Specifically, using an adverse selection model it can be shown that firms, under some conditions, will find it optimal to leverage the reputations created by existing products and brands to signal the high quality of new products [Wernerfelt (1988); Choi (1998); Cabral (2000); Miklos-Thal (2012); Moorthy (2012)]. Second, it has also been shown that umbrella branding is a rational strategy within the theoretical framework of moral hazard models. In particular, it has been assumed within a moral hazard model framework that firms' product quality choice is endogenous, and scholars use this theoretical framework to demonstrate that umbrella branding may lead to a larger scope of high-quality investment when a firm simultaneously chooses the qualities of multiple products [Andersson (2002); Cai and Obara (2006); Hakenes and Peitz (2008); Cabral (2009); Rasmusen (2016)].

There also exists a rich body of empirical work which documents the spillover of brand image among products under the same brand name [see Keller and Lehmann (2006) for an overview]. For instance, Sullivan (1990) finds the Audi 5000's alleged sudden-acceleration defect has a significant negative impact on the demand for Audi 4000 and Quattro, whereas the launching of Jaguar's new model leads to an increase in demand for its old model as a result of advertising used to promote the new model. Erdem (1998) proposes a model in which consumers' quality perceptions regarding a brand in one product category are affected by their experiences with the same brand in another category. The model is estimated on panel data for toothpaste and toothbrushes and the results show that the correlation coefficient of consumers' prior beliefs about the qualities of two umbrella products is 0.882, which is taken as an empirical support to the signalling theory of umbrella branding.

Our paper investigates spillover effects of Starbucks café shops on the demand and pricing of its umbrella branding products, Starbucks and its competing brands packaged ground coffee products sold via the grocery chains. This research is different from previous empirical work of umbrella branding. Specifically, we allow the co-existence of both positive and negative spillover effects associated with a firm's action in a given product category. A positive spillover effect increases the demand of related products, while a negative spillover effect decreases the demand of related products. Furthermore, we allow the relative magnitudes of these opposing effects to vary by the number of Starbucks café shops in a given market. Before performing empirical analyses, we propose a theoretical framework that demonstrates how the number of Starbucks café shops may influence equilibrium prices and quantities of Starbucks and non-Starbucks packaged ground coffee products. This theoretical analysis sheds light on the empirical results we later find.

Spillover effect has also received a lot of attention in the advertising literature. Our paper, thus, is also related to that strand of literature. For instance, Garthwaite (2014) studies the economic effect of celebrity endorsements in the publishing sector. The study finds that celebrity endorsements increase consumers' purchases of endorsed books and generate spillover benefits for the non-endorsed titles written by an endorsed author. However, the aggregate adult fiction sales fall with endorsements, which suggests endorsements are more of a "*business-stealing*" effect type of advertising in this case. Chae et. al. (2016) investigate the spillover effects of seeded marketing campaigns (SMCs) on the generation of "word of mouth" (WOM) at the brand and category levels. Using data on cosmetics brands, they find brand- and category-level WOM spillover effects. We focus on another important dimension of firms' strategies, the location choices of company-branded retail stores, and its spillover effects on the "umbrella branding" products sold through grocery channels.

There is a rich literature in empirical industrial organization in which researchers explicitly model the market entry decision/strategy of firms. Models in this literature are typically built on the assumption that a firm will optimally choose to enter a market if its expected variable profits are sufficient to cover its sunk market entry cost. Seminal papers in this literature include Berry

(1992) and Bresnahan and Reiss (1990, 1991). Even though in this paper we examine the impact that market entry of a Starbucks café has on packaged ground coffee products sold in grocery stores, it is beyond the scope of the analysis to explicitly model the market entry decision/strategy of Starbucks cafés. Accordingly, unlike the local market competition analysis associated with the market entry of Wal-Mart stores studied in Jia (2008), our study does not measure sunk entry cost in comparison to the variable profits associated with establishing a Starbucks café, nor do we attempt to measure the potential net benefits (chain effects) to Starbucks' café line of business associated with establishing multiple cafés across neighboring markets.

3. Theoretical Framework and Insights

Suppose there are two coffee manufacturing firms that correspond to two brands, Folgers (F) and Starbucks (S), respectively, each of which produces a packaged ground coffee product and sells through grocery stores. Starbucks also serves consumers fresh-made coffee beverage through its company-operated or franchised café shops. On a given purchase occasion, a potential consumer has the option to either purchase packaged ground coffee from a grocery store and make a drink themself, visit a Starbucks café shop to enjoy barista-prepared coffee, or choose neither of these options. We normalize the number of potential consumers in a market to a measure of 1, with a proportion $m \in (0,1)$ of them choosing to purchase packaged ground coffee from a grocery store on a given purchase occasion. Therefore, $1-m$ of the consumers choose not to purchase packaged ground coffee from a grocery store on the given purchase occasion. The proportion of consumers choosing not to purchase packaged ground coffee from a grocery store on the given purchase occasion may have chosen to visit a Starbucks café shop to purchase barista-prepared coffee, visit some other café shop to purchase barista-prepared coffee, or not purchase coffee of any type.

Business-stealing effect: First, we capture the *"business stealing"* effect by assuming the number of consumers that buy ground coffee products from grocery stores is determined by the following function:

$$m(N_S) \tag{1}$$

where $m(\cdot)$ is a decreasing function of the number of Starbucks café shops N_S, i.e., $m'(N_S) < 0$. The idea is that when additional Starbucks café shops enter a market, consumers can more easily stop by one café to grab a cup of coffee and thus reduce the purchases of packaged ground coffee from grocery stores. This "*business-stealing*" effect likely decreases demand for both Starbucks and Folgers packaged coffee products in grocery stores.

Demand-increasing effect: We then model the *"demand-increasing"* effect by allowing the number of Starbucks café shops to shift a consumer's utility of purchasing the two brands of packaged ground coffee in grocery stores:

$$U_S = v_0 + (1 + \theta)v(N_S) - t_k x - p_S \tag{2}$$

$$U_F = v_0 + v(N_S) - t_k(1 - x) - p_F \tag{3}$$

where v_0 denotes the intrinsic value of ground coffee. $(1 + \theta)v(N_S)$ and $v(N_S)$ are the incremental value a consumer attaches to the packaged ground coffee of Starbucks and Folger respectively, both of which increase with the number of Starbucks café shops, N_s , but at different rates: $(1 + \theta)v'(N_S) > v'(N_S) > 0$. The parameter $\theta \geq 0$ measures the extent to which Starbucks become more favorable for consumers than Folgers as N_s increases. The motivating idea is that the presence of Starbucks café shops may enhance consumers' valuations for packaged coffee products. A reason is that Starbucks café shops offer coffee drinkers opportunities to try a variety of coffee drinks and explore their preferences over different types/flavors of coffee. Coffee drinkers can then use the packaged coffee purchased from the grocery stores to make their ideal coffee drinks.

We assume that consumers have heterogeneous preferences with respect to the products of Starbucks and Folgers. Specifically, Starbucks and Folgers are respectively located on the endpoints 0 and 1 of a Hotelling line of length one. The consumers who may purchase packaged ground coffee from grocery stores are uniformly distributed along the line and each has a location indexed by $x \sim U[0,1]$: the smaller x is, the more the consumer prefers Starbucks' products. The unit "transportation cost" is denoted as $t_{k\in\{H,L\}}$, which takes two values $t_H > t_L > 0$, depending on how consumers perceive the two brands. Type-H consumers are loyal consumers who strongly prefer one brand and are reluctant to switch to the other brand, while type-L consumers are "switchers" who have a lower "transportation cost" to reach both brands. We assume type-H consumers take a proportion of α among all the $m(N_S)$ consumers who buy packaged ground coffee. To simplify the analysis, we also assume that each brand charges a uniform price to different types of consumers, and denote the price of Starbucks as p_S and the price of Folgers as p_F, respectively.

The specification in equation (2) and equation (3) above capture the idea that the *"demand-increasing"* effect benefits both the sales of Starbucks and Folgers retail packaged coffee. This effect is likely to be more pronounced for Starbucks products than Folgers' for at least two reasons. First, the presence of Starbucks cafés increases consumers' awareness of Starbucks brand name, incentivizing them to choose Starbucks' packaged ground coffee from among the packaged coffee products offered in grocery stores. Second, Starbucks loyalty program rewards its member consumers who purchase Starbucks products from groceries bonus points, which can be redeemed for free coffee/food/merchandise in local Starbucks café shops. Consumers who redeem rewards points can further get coupons for their future purchases of Starbucks packaged coffee. A larger number of Starbucks café shops facilitates consumers to redeem Starbucks rewards points and increases the benefits associated with the purchases of Starbucks packaged coffee.

The technical details of the equilibrium analysis and comparative statics generated from the theoretical framework are described in the Appendix. The comparative statics analysis shows that as the number of Starbucks café shops increases, the coexistence of the two countervailing effects on consumer demand leads to an indeterminate overall change in the equilibrium quantity sold for Starbucks packaged coffee products. The sign of the total effect depends on the relative dominance between the negative "*business-stealing*" effect and the positive "*demand-increasing*" effect.

As for the competing brand, Folgers, our theory predicts that an increasing number of Starbucks café shops also has a mixed effect on its equilibrium quantity sold. The sign of the overall demand impact depends on the relative sizes of the two consumer segments. The *"business-stealing"* effect negatively affects Folger's sales for sure, while the *"demand-increasing"* effect can either positively or negatively affect sales depending on whether the proportion of type-H consumers exceed a certain threshold, α^*.

On the one hand, when the proportion of type-H consumers exceeds this threshold (i.e., the local market is relatively dominated by type-H consumers), the *"demand-increasing"* effect is positive, weakening the negative *"business-stealing"* demand impact. This is intuitive, as in the market segment for type-H consumers, Starbucks and Folgers each act as local monopolist to their respective loyal consumers. The "*demand-increasing*" effect stimulates the demand of the loyal consumers for each brand. Therefore, the overall effect on the competing brand of an increase in the number of Starbucks café shops in markets dominated with type-H consumers will depend on the relative strength of the above two countervailing effects.

On the other hand, when the proportion of type-H consumers is instead smaller than the threshold (i.e., market is relatively dominated by type-L consumers), the *"demand-increasing"* effect is negative, reinforcing instead of countering the negative *"business-stealing"* demand impact. For type-L consumers, the increasing presence of Starbucks cafés, although enhances these consumers' utility for each brand, has a larger positive impact on Starbucks packaged coffee. This in fact disadvantages Folgers during its competition with Starbucks for type-L consumers, some of whom may switch to consume Starbucks packaged ground coffee, resulting in a negative *"demand-increasing"* effect. Therefore, the overall effect on the competing brand demand of an increase in the number of Starbucks café shops in markets dominated with type-L consumers is negative.

Given the ambiguous effect on equilibrium quantities of packaged ground coffee products sold in grocery stores induced by the increased market presence of Starbucks café shops, the theoretical results call for an empirical study which investigates the signs of the impacts in real-world markets. We undertake such an empirical study throughout subsequent sections of the paper.

4. Data and descriptive analysis

4.1 The data

We focus our empirical analysis on U.S. retail packaged ground coffee sold in grocery stores during the sample periods from 2008 through 2012.[3] According to the store opening information reported in the annual reports provided by Starbucks Corp., we calculate the annual growth rates of Starbucks café presence in U.S. domestic and international markets, respectively, and plot these growth rates in Figure 1. The plots reveal that Starbucks café shop count slowly picked up in 2010, from the massive café shop closures between 2008 and 2009 (The New York Times[4]). Specifically, both the domestic and global growth rates of Starbucks cafés experienced a vast rebound of 3.16% in the U.S. and 6.25% worldwide from 2011 to 2012; and since then,

[3] Retailers of the packaged ground coffee products in our main dataset include supermarkets and drug stores. We generically refer to these retailers as "grocery stores" throughout the paper.
[4] Starbucks Corp. announced more than 600 store closures and a significant financial loss resulted from the global economic crisis of 2007-2008. See the relevant article which was retrieved from the New York Times in the following URL:https://www.nytimes.com/2008/07/02/business/02sbux.html

Starbucks Corp. continues to sustain a moderate growth in terms of café shop expansions nationwide.

Figure 1: Growth Rates of Starbucks Café Shops in the U.S. and worldwide

Source: Authors' calculation based on Starbucks annual reports.

We obtain the location data of Starbucks cafés in the U.S. during the sample periods from AggData, a marketing firm which collects business locational data. The dataset contain information about the complete café addresses including zip codes and states, business hours, and in-store wireless status. We define a market as the combination of period (year-month) and grocery store where various brand packaged ground coffee products are sold. Using the location data, we create a variable, *Nshop*, that measures the extent of Starbucks café presence in the local market. *Nshop* is the number of Starbucks cafés (either corporate-owned or franchised) located within the zip code area where the relevant grocery store is located.

Information about packaged ground coffee products sold in grocery stores is sourced from the Information Resources Inc. (IRI) academic database [Bronnenberg et al. (2008)], a weekly scanner dataset available for years 2008 through 2012. The working sample contains consumer purchases of ground coffee products that are packed in bulk in bags or canisters. Detailed information for each weekly observation includes: weekly unit sales (in ounces); revenue from these unit sales; and various attributes that are used to delineate a product in this analysis, such as brand name,[5] package net weight (in ounces), organic feature, caffeine level, and packaging material. Details of the sample construction and various product attribute definitions are presented in Appendix B.

A product within a defined market is considered as the unique combination of the various product attributes listed above. The weekly observations are then aggregated to monthly frequency according to the product and market definition. The "quantity" variable for a defined product is the sum of weekly unit sales in a month; and the "price" variable for a defined product is the mean of the weekly average unit price which is obtained by dividing the revenue from weekly unit sales by the weekly unit sales. The monthly aggregation reduces the data sample to have 402,330 records.

Our computation of potential market size for each defined market is inspired by the "potential market factor" method in Ivaldi and Verboven (2005). According to the 2016 coffee consumption survey provided by the National Coffee Association (NCA), 56% to 64% of the surveyed population (with an average of 59% over the sample periods) reported they consume home-brew coffee daily. We assume the retail packaged coffee quantity sales in the data reflect 59% of total quantity that could be potentially purchased by the entire population in a defined market. Consequently, a market's potential size is simply the total quantity sales across all products in the market multiplied by the "potential market factor". The "potential market factor" in our case is the reciprocal of 59%. As such, the observed product shares are obtained by dividing the relevant product's quantity by this measure of potential market size.

Summary statistics of the data are reported in Table 1. The retail packaged ground coffee products in the data sample are sold across 113 grocery stores located in 96 zip code areas. The average price is about 50 cents per ounce, and 324 ounces of a typical product are sold per month. The summary statistic for the zero-one dummy variable, *Starbucks*, implies that about 10% of the packaged ground coffee products in the sample belong to the Starbucks brand.

[5] Among all the coffee brands in the subsample, Folgers (23.6% of total dollar sales), Starbucks (15.3%), Private Label (12%), Maxwell House (7%), and Dunkin Donuts (6.3%) are the top five brands with the largest dollar sales over the sample periods.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Price ($/ounce)	0.522	0.242	0.029	2.31
Product Quantity Sold (ounces)	323.847	658.652	7	97,803.8
Starbucks dummy (1 if products belong to Starbucks brand)	0.105	0.307	0	1
Nshop (number of Starbucks café shops in a local market)	4.313	3.436	0	22
Caffeine (grams per ounce of dry coffee grounds)	1.468	0.724	0	2.232
Package Weight (total ounces of dry coffee grounds in a package)	17.777	9.755	6	80
Organic dummy (1 if products are organic)	0.058	0.234	0	1
Product market shares (all inside goods)	0.01	0.017	0.000023	0.43
No. of zip code areas	96			
No. of grocery stores	113			
No. of manufacturers	130			
No. of brands	165			
No. of defined markets	6,780			
No. of observations	402,330			

* Prices are adjusted to 2012 dollars.

Nshop is the count of Starbucks café shops in a defined market. *Nshop* in our data varies both over time in a given local market and across markets at a given time. These time series and cross-sectional variations identify the impact of *Nshop* on demand for the retail packaged coffee products in grocery stores. The larger is the value of *Nshop* for a given market, the greater the penetration of Starbucks café shops in the local retail packaged coffee market. The data summary shows that an average of 4 Starbucks café shops locate within the zip code neighborhood of a typical grocery store where packaged ground coffee products are sold.

Caffeine measures the caffeine content in grams per ounce of dry coffee grounds. *Package Weight* measures the net weight in ounces of coffee grounds in the package, a variable that captures the impact on demand of consumers' product package size preferences. *Organic* is a zero-one dummy variable capturing heterogeneity in consumers' preference for organic versus non-organic coffee products.

4.2 Descriptive analysis

Before turning to the structural empirical model, we first present some descriptive evidence regarding the demand impacts on retail packaged coffee product sales associated with the market presence of Starbucks café shops. In Table 2, we show the regression results that describe correlations between retail packaged ground coffee product quantities sold and various factors influencing the quantities sold. In these regressions, we control for local demographics, including the mean home values, median personal income for adult population (male and female), adult population at the county-level, adult population at the zip code-level, the fraction of the zip code population aged 15-64, and the fraction older than 64 years.[6]

The positive and statistically significant coefficient estimate on *Nshop* reveals that quantities sold of non-Starbucks packaged coffee products in grocery stores increase with the number of local Starbucks café shops. Furthermore, the number of Starbucks café shops has a greater positive impact on quantities sold of Starbucks packaged coffee products relative to non-Starbucks packaged coffee products in local grocery stores, as evidenced by the positive and statistically significant coefficient estimates on variables *Nshop* and *Starbucks* × *Nshop*, respectively.

The positive and statistically significant coefficient estimates on variables *Caffeine* and *Packaged Weight* suggest that sales of packaged coffee increase with caffeine content and package size, respectively. However, the negative and statistically significant coefficient estimate on the *Organic* dummy variable reveals that organic coffee products have lower sales relative to non-organic coffee products. The negative sign of the coefficient estimate on the competition variable measured by the number of competing products offered in the market comply with economic intuition. Specifically, the quantity sold of an individual product tends to decline on average as the market becomes more competitive.

Results from the "reduced-form" regressions in Table 2 provide some preliminary evidence on the potential impacts of the market presence of additional Starbucks café shops on unit sales of Starbucks and competing non-Starbucks brands of packaged coffee sold in grocery stores. However, the "reduced-form" regressions in Table 2 are not able to disentangle key driving forces, "*demand-increasing*" versus "*business-stealing*" effects, of the net impact on unit sales of packaged ground coffee sold in grocery stores caused by the increasing market presence of Starbucks café shops. Accordingly, we now turn to specifying a structural empirical demand model designed to separately identify these key driving forces.

[6] Mean home values are measured by zip code-level typical home values obtained from Zillows.com research data page. We use the mean home values to approximate market average wealth level. Guler (2018) finds a significant positive effect of consumer wealth level on the number of visits to Starbucks cafés. County-level population and median income as well as zip code-level population are obtained from the U.S. Census Bureau database.

Table 2: Descriptive Regressions

Variable	Dependent Variable: Log (Quantity Sold) (1)	(2)	(3)	(4)
Nshop	0.0066***	0.0057***	0.0065***	0.0057***
	(0.0017)	(0.0017)	(0.0017)	(0.0017)
*Starbucks*Nshop*	0.038***	0.0379***	0.038***	0.038***
	(0.0017)	(0.0017)	(0.0017)	(0.0017)
Caffeine	0.399***	0.399***	0.399***	0.399***
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Package Weight	0.0488***	0.0488***	0.0488***	0.0488***
	(2.09E-04)	(2.09E-04)	(2.09E-04)	(2.09E-04)
Organic	-1.057***	-1.057***	-1.057***	-1.057***
	(0.0087)	(0.0087)	(0.0087)	(0.0087)
Number of competing products	-0.0038***	-0.0036***	-0.0037***	-0.0036***
	(2.10E-04)	(2.12E-04)	(2.10E-04)	(2.12E-04)
Mean home value	0.0034	0.0053	0.0048	0.0053
	(0.0055)	(0.0055)	(0.0055)	(0.0055)
County population age>=16	0.0104			
	(0.0074)			
Median income for age>=16	0.0331		0.165	
	(0.273)		(0.275)	
Fraction county male population age>=16		-1.253**	-1.396**	-1.154**
		(0.564)	(0.568)	(0.567)
Median income for male age>=16		-0.721***		-0.723***
		(0.217)		(0.217)
Median income for female age>=16		0.829***		0.828***
		(0.287)		(0.288)
Fraction zip code population age 15 to 64			0.0057	0.0063*
			(0.0037)	(0.0037)
Fraction zip code population age>=65			0.0094*	0.0091*
			(0.0051)	(0.0051)
Constant	3.649***	4.564***	4.009***	3.948***
	(0.173)	(0.330)	(0.474)	(0.477)
Number of Observations	402,330	402,330	402,330	402,330
R-squared	0.403	0.403	0.403	0.403
F	904.3	901.4	898.3	895.4

Notes: ***p<0.01; **p<0.05; and *p<0.1 indicate statistical significance at 1%, 5% and 10% levels, respectively. Standard errors are in parentheses. All regressions include year, month, grocery store, and brand fixed effects.

5. The Structural Empirical Model

The empirical analysis includes two steps. First, we estimate the structural parameters in a random-coefficients logit demand model [see for example, Berry (1994); Berry, Levinsohn and Pakes (1995, "BLP" hereafter); and Nevo (2000a, b, 2001)] of packaged ground coffee products sold in grocery stores. We are most interested in the parameter estimates that capture the impact of the presence of Starbucks café shops on demand for the packaged ground coffee products.

Second, we use the estimated structural demand parameters along with an assumed oligopolistic model of supply to simulate new market equilibrium outcomes resulting from the counterfactual market presence of an additional Starbucks café shop. A comparison of simulated market equilibrium outcomes with actual outcomes in the data reveals how equilibrium prices, consumer demand and welfare are predicted to change with the market presence of an additional Starbucks café shop.

5.1 Demand

In each market m and period t, consumer i is assumed to face $J_{mt} + 1$ product purchase alternatives indexed by $j = 0, 1, \ldots, J_{mt}$, where alternatives $j = 1, \ldots, J_{mt}$ are the various packaged ground coffee products available for purchase in grocery stores located in market m during period t, i.e., the "inside" goods of the demand model [See Gayle and Lin (2022) for similar modelling of retail packaged ground coffee demand], while $j = 0$ represents consumers' "outside" option/good in market m during period t.[7] The indirect utility consumer i obtains from choosing product j is a function of observed and unobserved (to the researchers) non-price product attributes, price, and individual consumer characteristics that influence individual preferences. We follow a similar specification of the conditional indirect utility function in Nevo (2000a, b):

$$U_{ijmt} = x_{jmt}\beta_i + \alpha_i p_{jmt} + \phi_{i,1} Nshop_{mt} + \phi_{i,2} Nshop_{mt} \times Starbucks_{jmt} + \xi_{jmt} + \epsilon_{ijmt} \quad (4)$$

where x_{jmt} is a vector of observable product attributes faced by all consumers in the market and β_i the associated vector of individual-specific marginal utilities of respective product attributes in x_{jmt}; p_{jmt} is the price of product j assumed to be the same for all consumers in market m at time t; and α_i is the individual-specific marginal disutility of price.

Similar to equation (2) and equation (3) in our theoretical framework, our structural empirical model framework specifies that consumer $i's$ conditional indirect utility in equation (4) is a function of the number of Starbucks café shops, $Nshop_{mt}$, present in the relevant market with associated parameters $\phi_{i,1}$ and $\phi_{i,2}$. Consistent with our discussions above in describing the theoretical framework, parameters $\phi_{i,1}$ and $\phi_{i,2}$ in our empirical specification enable measuring the sign and magnitude of the "demand-increasing" effect of Starbucks café shop presence on non-

[7] The outside option is a composite of several alternatives such as buying other coffee substitutes (e.g. instant, whole bean, ready-to-drink coffee beverages, etc, which are sold in the grocery stores), buying freshly-brewed coffee from a local coffee shop, or simply not consuming coffee.

Starbucks brands and Starbucks brand of packaged ground coffee sold in grocery stores. Specifically, $\phi_{i,1}$ and $\phi_{i,2}$ measure the marginal utility impact of the presence of Starbucks café shops on demand for non-Starbucks brands and Starbucks brand of packaged ground coffee sold in grocery stores, respectively.

Similar to Nevo (2000a, b), we model $\xi_{jmt} = a_y + a_{month} + a_s + a_b + \Delta\xi_{jmt}$ as a composite of product attributes that are observable to consumers and firms, but unobservable to the researchers, where a_y, a_{month}, a_s and a_b are year, month, grocery store, and brand fixed effects, respectively; and $\Delta\xi_{jmt}$ is left to be the econometric error term. Last, ϵ_{ijmt} is a mean-zero idiosyncratic error term that is assumed to follow an independent and identically distributed extreme value type I density.

The demand system is completed with the specification of an outside option/good, which in the context of our demand model includes situations in which the consumer chooses to purchase freshly-brewed coffee from a local café shop instead of packaged ground coffee from the grocery store. The indirect utility for consumer i selecting the outside option is:

$$U_{i0mt} = \delta_{0mt} + \mu_{i0mt} + \epsilon_{i0mt} \tag{5}$$

where the mean utility from the outside option, δ_{0mt}, is assumed to be a quadratic function of the number of Starbucks café shops present in the local market, i.e.:[8]

$$\delta_{0mt} = \gamma_0 + \gamma_1 Nshop_{mt} + \gamma_2 Nshop_{mt}^2 + \sum_{zipcode \in A} \gamma_{3,zipcode}\left(a_{zipcode} \times Trend\right) \tag{6}$$

where *Trend* is a time trend variable based on year-month combinations; $a_{zipcode}$ is a zero-one local area zip code dummy variable; A is the set of zip codes, i.e., distinct local areas, in our data; and $\gamma_{3,zipcode}$ is a zip code-specific parameter that captures the composite impact of local market-specific trends on the mean utility obtained from the outside option. Therefore, the last term in the above equation controls for local market-specific time-varying factors, which may include the market presence of competing non-Starbucks café shops, that influence consumers' mean utility obtained from the outside option for the relevant market. Parameters γ_1 and γ_2 together capture the potentially non-linear marginal impact on utility obtained from the outside option due to the

[8] In studying the effect of ownership structure and market geography on prices of fast-food chains (McDonald's vs. Burger King), Thomadsen (2005) model the mean utility for the outside good as a linear function of consumers demographic profile, including age, gender and race, etc. In fact, we also estimated the demand with the outside good mean utility as a linear function of *Nshop*.

number of Starbucks café shops present in the local market. Last, μ_{i0mt} and γ_0 are normalized to be zero.

Our characterization of the "business-stealing" effect is the situation in which the increasing market presence of Starbucks café shops more easily facilitates consumers stopping by one café to grab a cup of coffee and thus reduce the purchases of packaged ground coffee from grocery stores. From the perspective of our empirical demand model that focusses on packaged ground coffee in grocery stores being the "inside" goods, with coffee consumption at café shops being part of the "outside" option, the "business-stealing" effect corresponds to the mean utility obtained from the "outside" option being positively influenced by the increasing market presence of café shops. Specifically, in our empirical model the "business-stealing" effect implies $\frac{\partial \delta_{0mt}}{\partial Nshop_{mt}} > 0$ from equation (6), which is determined by parameters γ_1 and γ_2, while in our theoretical framework it implies that $m'(N_S) < 0$ from equation (1).

In summary, our structural empirical demand model is specified to separately identify the "demand-increasing" and "business-stealing" effects via parameters $(\phi_{i,1}, \phi_{i,2})$ and (γ_1, γ_2), respectively.

Last, the probability that product j is chosen, or equivalently the model-predicted market share of the j^{th} product, is the integral over the mass of consumers that select this product:

$$s_{jmt}(x_{jmt}, p_{jmt}, \xi_{jmt}; \beta, \alpha, \phi, \gamma, \Gamma, \Sigma) = \int \frac{e^{\delta_{jmt}+\mu_{ijmt}}}{e^{\delta_{0mt}}+\sum_{l=1}^{J_{mt}} e^{\delta_{lmt}+\mu_{ilmt}}} d\widehat{F(D)} dF(v) \tag{7}$$

where δ_{jmt} is the mean utility and μ_{ijmt} is the deviation from the mean utility that allows for consumer heterogeneity; $\widehat{F(D)}$ and $F(v)$ are population distribution functions for consumer demographics and random taste shocks, respectively, assumed to be independently distributed.[9]

5.2 Supply

We assume coffee manufacturers strategically set their prices for the packaged ground coffee sold in the grocery stores in a non-cooperative way to maximize their profits in a static Nash equilibrium price-setting game.[10] Suppose multi-product coffee manufacturers compete in

[9] In the actual demand estimation, we use 200 random draws from $F(\cdot)$ for the numerical approximation of $s_{jmt}(\cdot)$.

[10] To simplify the supply-side analysis, we assume retailers do not play a strategic role in setting retail prices of the coffee products in our analysis, and simply set retail prices just high enough to cover their economic retailing costs and costs to obtain coffee products from coffee manufacturers.

Bertrand-Nash fashion. Each firm f offers a menu of products in market m at time t, B_{fmt}, and sets prices of these products to maximize its variable profit as follows:

$$\max_{p_{jmt}\forall j\in B_{fmt}} VP_{fmt} = \max_{p_{jmt}\forall j\in B_{fmt}} \sum_{j\in B_{fmt}} \left(p_{jmt} - mc_{jmt}\right) q_{jmt} \tag{8}$$

where mc_{jmt} is the marginal cost incurred by the firm to provide product j in market m at time t. The quantity sold of product j in equilibrium, q_{jmt}, is equal to the market demand of product j, that is, $q_{jmt} = d_{jmt} = M_{mt} \times s_{jmt}(\boldsymbol{P})$, where M_{mt} is a measure of the potential size of market m during period t, $s_{jmt}(\boldsymbol{P})$ is product j's predicted market share based on equation (7), and $\boldsymbol{P}$ is the vector of prices for the J_{mt} packaged ground coffee products.

5.3 Estimation and Identification

Our estimation strategy closely follows the generalized method of moments (GMM) approach taken by commonly known studies in the Industrial Organization literature, such as BLP (1995), Nevo (2000a, b), and many others. The key identifying assumption in the estimation lies in the population moment conditions that are constructed by interacting instrument variables with the implied structural error term. The estimation algorithm is performed to search the unknow parameter values such that the *observed* product shares are equal to the product shares *predicted* by the demand model. Detailed discussion on the identification of structural parameter estimates as well as the procedure of the search algorithm can be found in Nevo (2000b).

Instruments

The classic econometric problem in discrete-choice demand estimation is the endogeneity of product prices, as product characteristics that are unobserved by researchers in ξ_{jmt}, are likely correlated with prices. The groups of fixed effects dummy variables in ξ_{jmt} described above account for some of the unobserved product characteristics in ξ_{jmt} and therefore substantially help with mitigating the endogeneity problem.

As for the exogenous instrument variables, we first use the direct components of marginal costs (e.g., manufacturer input prices) interacted with brand dummies as in Villas-Boas (2007a, 2007b), Nakamura and Zerom (2010), and Gayle and Lin (2022). We use the composite indicator prices calculated by the International Coffee Organization (ICO) as a proxy for the raw coffee bean prices. By interacting the raw coffee bean prices with the brand dummies, we allow the raw bean prices to influence the production costs differently across brands. Second, we interact the national average industrial electricity prices with the dummy variables that are generated from the four different coffee packaging materials in the data.[11] These interactions aim to capture the likelihood that changes in national average electricity prices affect ground coffee packaging costs differently across different packaging processes. Last, following BLP (1995) estimation procedure, we also include several instruments for prices based on some observable non-price product attributes of competing products offered in the market. We include the sum and mean of caffeine content of these competing products offered in the market.

To instrument for the random component of product prices associated with consumer-specific demographics, μ_{ijmt}, we construct three-way interaction instrument variables by using the above electricity price-packaging material dummies interactions to multiply with county-level median personal income for the population aged sixteen and above. We are convinced that after using the various fixed effects to control for a substantial part of the unobserved product attributes in ξ_{jmt}, then the remaining components in ξ_{jmt} are most likely uncorrelated with county-level average income.

To identify the standard deviations of the random coefficients on price, the organic dummy, and the constant term, we follow Gandhi and Houde (2020) and Gayle and Lin (2022) and construct product differentiation instruments along three dimensions.[12] These differentiation instruments are intended to capture the degree of differentiation of a product relative to other available products offered in the market. The variations in these differentiation measures induce consumer substitution along these dimensions, and thus identify the standard deviation preference parameters for the random coefficients. In addition, we also include a standard instrument used by many empirical industrial organization studies: the total number of coffee products offered in a market, which identifies the standard deviation preference parameter on the intercept.[13]

Another endogenous concern is the measured presence of Starbucks café shops, *Nshop*. We instrument for *Nshop* with several groups of exogenously determined cost-side influencers of Starbucks café shop market presence, which are expected to be negatively correlated with the presence of Starbucks café shops. These instruments include the county-level average weekly

[11] Electricity prices for industrial use are sourced from the U.S. Energy Information Administration (EIA) under the electricity data page. In the coffee data, packaging materials are classified into the four categories: paper bags/boxes, laminated (foil) bags, plastic canisters, and light metal tins.

[12] For the construction of these differentiation instruments, we refer the readers to Table 12 in Gandhi and Houde (2020). The predicted prices are obtained from a reduced-form regression of prices on all the non-price product characteristics as well as the exogenous cost-shifters and fixed effects previously discussed.

[13] See the relevant identifying argument in Sullivan (2020) and Miller and Weinberg (2017).

wage (both for all sectors and private sectors), and state average commercial electricity and natural gas prices.[14] These instrument variables are considered as the direct components of business operating costs for Starbucks café shops, i.e., geographic areas incurring higher employee wages or utility expenses are less likely to incentivize Starbucks café shop entry. Last, according to Wooldridge (2010), a natural instrumental variable for the interaction between an endogenous variable and an exogenous variable is to interact the instruments for the endogenous variable and this exogenous variable. Therefore, the instruments for the interaction term between *Starbucks* and *Nshop*, are simply the product of the above-mentioned cost-side influencers of *Nshop* and the Starbucks brand dummy.

6. Empirical Results

6.1 Demand Parameter Estimates

Three panel of estimates of the demand parameters are reported in Table 3. Panel (1) and panel (2) present the estimates obtained from a standard logit specification of the demand model using the ordinary least squares (OLS) estimator and the two-stage least squares (2SLS) estimator, respectively. The GMM estimates for the random coefficients logit specification are reported in panel (3).

The Wu-Hausman statistical test for endogeneity rejects exogeneity of the endogenous variables discussed above. Without instrumentation the OLS estimate on *Nshop* has a negative sign, but a positive sign when using 2SLS and GMM estimators. The OLS estimate on the interaction between *Starbucks* dummy and *Nshop*, though positive, is smaller in magnitude than the estimate obtained from 2SLS and GMM procedure. This finding therefore supports the need for instrumentation. Moreover, the Stock and Yogo (2005) statistical test for weak instruments rejects the null hypothesis that the instruments used in the demand estimation are weak. Following Gandhi and Houde (2020), we also perform the Independence of Irrelevant Alternatives (IIA) hypothesis test to further examine the possibility of weak identification problems.[15] The IIA joint test statistics validates the ability of our product differentiation instruments to identify deviations

[14] The lags of these cost-side instruments for up to 3 periods are included as additional instruments. The weekly wage rates are obtained from U.S. Bureau of Labor Statistics under "Quarterly Census of Employment and Wages" database. The state average electricity and natural gas prices are both obtained from EIA.

[15] See Gandhi and Houde (2020) for details of how to test for weak identification issues in random coefficients demand.

of the random coefficients from the standard logit preferences. As such, we focus the remainder of our analysis on the set of demand estimates from the GMM estimator in panel (3) of the table.

Table 3: Demand Estimates

	Standard Logit Model ($\boldsymbol{\mu_{ij} = 0}$)		**Random Coefficients Model ($\boldsymbol{\mu_{ij} \neq 0}$)**		
	(1) OLS	(2) 2SLS	(3) GMM		
	Mean Coef. (α, β, ϕ)	Mean Coef. (α, β, ϕ)	Mean Coef. ($\alpha, \beta, \phi, \gamma$)	Standard Deviations (Σ)	Interaction with Income (Γ)
Price ($/oz)	-2.474***	-2.076***	-2.7145***	-0.0011	-16.15***
	(0.0148)	(0.036)	(0.0558)	(1.862)	(4.146)
Constant[a]	-4.435***	-6.036***	-7.7504***	0.7521	1.1856
	(0.0877)	(0.107)	(0.0481)	(1.155)	(5.792)
Organic[a]	-0.779***	-0.824***	0.0129*	0.1935	17.842***
	(0.00854)	(0.009)	(0.0068)	(1.225)	(2.668)
Nshop ($\widehat{\phi_1}$)	-0.0079***	0.151***	0.1224***		
	(0.00158)	(0.0106)	(0.0103)		
Starbucks×Nshop ($\widehat{\phi_2}$)	0.0472***	0.0694***	0.0675***		
	(0.00169)	(0.0039)	(0.0046)		
Caffeine	0.369***	0.374***	0.3966***		
	(0.00231)	(0.0024)	(0.0023)		
Package Weight	0.0265***	0.0300***	0.0245***		
	(0.000240)	(0.0004)	(0.0005)		
			Mean Utility of the Outside Good[b]		
R-sq	0.468	0.453	*Nshop* ($\hat{\gamma}_1$)	-0.09***	(0.00242)
Wu-Hausman (F-statistic)		142.549	*Nshop*^{2} ($\hat{\gamma}_2$)	0.0045***	(0.00025)
Stock and Yogo (2005) Weak Instrument Test (F-statistic)		44.202	GMM objective value		7,213.24
			IIA joint test on differentiation IVs (Chi-sq)		7,939.08
No. of markets			6,780		
No. of observations			402,330		

Notes: ***p<0.01; **p<0.05; and *p<0.1 indicate statistical significance at 1%, 5% and 10% levels, respectively. Standard errors are in parentheses. All regressions include year, month, grocery store, and brand fixed effects. [a] Estimates in the GMM estimations are obtained from a minimum-distance procedure. Details of the minimum-distance method refer to Nevo (2000b). [b] Coefficient estimates in the outside good mean utility function are also retrieved by using a minimum-distance procedure. The outside good mean utility function includes controls for local market-specific time-varying factors even though their associated parameter estimates are not reported in the table.

All the mean coefficient estimates in the random-coefficients logit demand model are statistically significant, and of the expected signs. The mean price coefficient estimate is negative implying the marginal disutility of product prices. The mean coefficient estimate for the organic dummy variable is positive, implying that coffee drinkers prefer organic over non-organic coffee products. Furthermore, the parameter estimate for the interaction between the organic dummy and consumer income is positive and statistically significant, suggesting that consumers with higher incomes have a relatively higher marginal valuation of the organic attribute. The two product attributes, caffeine content and package weight, both serve as positive demand shifters of coffee consumption. Their mean coefficient estimates are both positive and statistically significant, yielding results that are qualitatively consistent with previous studies.[16]

The two parameter estimates ($\widehat{\phi_1}, \widehat{\phi_2}$) in the mean utility function of the inside goods are both positive and statistically different from zero. This implies that an increase in Starbucks cafés presence in a local market has an average positive "*demand-increasing*" effect on the demand for both Starbucks' and competing non-Starbucks packaged coffee products sold in grocery stores. Furthermore, the positive "*demand-increasing*" effect tends to be greater in magnitude for Starbucks' packaged coffee products compared to non-Starbucks packaged coffee products.

The mean coefficient estimates on *Nshop* and its quadratic term ($\widehat{\gamma_1}, \widehat{\gamma_2}$) in the outside option/good mean utility function are also statistically significant, indicating a non-negligible non-linear "*business-stealing*" effect of Starbucks café shop market presence on consumers' demand for packaged coffee sold in the local grocery stores.[17] The sign pattern of the two coefficient estimates in the outside good mean utility function suggests a U-shaped relationship between the mean utility of consumers choosing the outside option and *Nshop*.[18]

A rationale for the U-shaped relationship is the following. At relatively low Starbucks café presence in a market, the entry of a new Starbucks café may serve the relatively substantial role of converting potential or occasional coffee drinkers into actual and more frequent coffee drinkers who then also begin purchasing packaged coffee from the local grocery stores. In this case, the "*business-stealing*" effect is opposite to what we would normally expect and serves to reinforce, rather than counter, the "*demand-increasing*" effect associated with market entry of a new Starbucks café. However, once a threshold number of Starbucks cafés are already serving the

[16] For example, Bonnet and Villas-Boas (2016) find consumers have a negative preference for caffeine-free products. Guadagni and Little (1998), Ansari et al. (1995), and Prendergast and Marr (1997) find consumers tend to choose larger packaged products.

[17] Following Nevo (2000b)'s minimum distance procedure, we first obtain the coefficient estimates for a full set of year-month-zip code dummies included in the mean utility function for the outside option instead of directly including variable *Nshop* in this mean utility function when estimating the random coefficients model. In a secondary regression we then retrieve the parameter estimates for γs in the mean utility function for the outside option by regressing the coefficient estimates of the time-location dummies on *Nshop*, its quadratic term, and zip code-specific time trends. In this secondary regression used for retrieving the estimates of γs, we instrument for *Nshop* using the instrument variables discussed in the estimation section. Retrieving the γ estimates in this way has the advantage of allowing us to fully control for time and location varying factors unobserved to us that do influence consumers' preferences for the outside option. With a linear specification of *Nshop* in the mean outside good utility function, the coefficient estimate for *Nshop* is -0.045, which is statistically significant at conventional levels of statistical significance.

[18] The reader is reminded that for purposes of identifying the impact of variable *Nshop* on demand, *Nshop* varies in our data both over time in a given market, and across local markets at a given time.

market, approximately 10 pre-exiting Starbucks café shops according to the estimates of $(\widehat{\gamma_1}, \widehat{\gamma_2})$,[19] entry of an additional café is less likely to play a substantial role in converting potential or occasional coffee drinkers into actual and more frequent coffee drinkers, but instead play a more substantial role in pulling the demand of existing coffee drinkers away from purchasing packaged coffee in local grocery stores in favor of enjoying freshly brewed barista-prepared coffee at a café. In this case, the "*business-stealing*" effect is consistent with a priori expectations and serves to counter the "*demand-increasing*" effect. A reasonable alternate interpretation of the evidence suggested by the parameter estimates is that the "true" "*business-stealing*" effect only shows up after a threshold number of Starbucks cafés are already serving the relevant market.

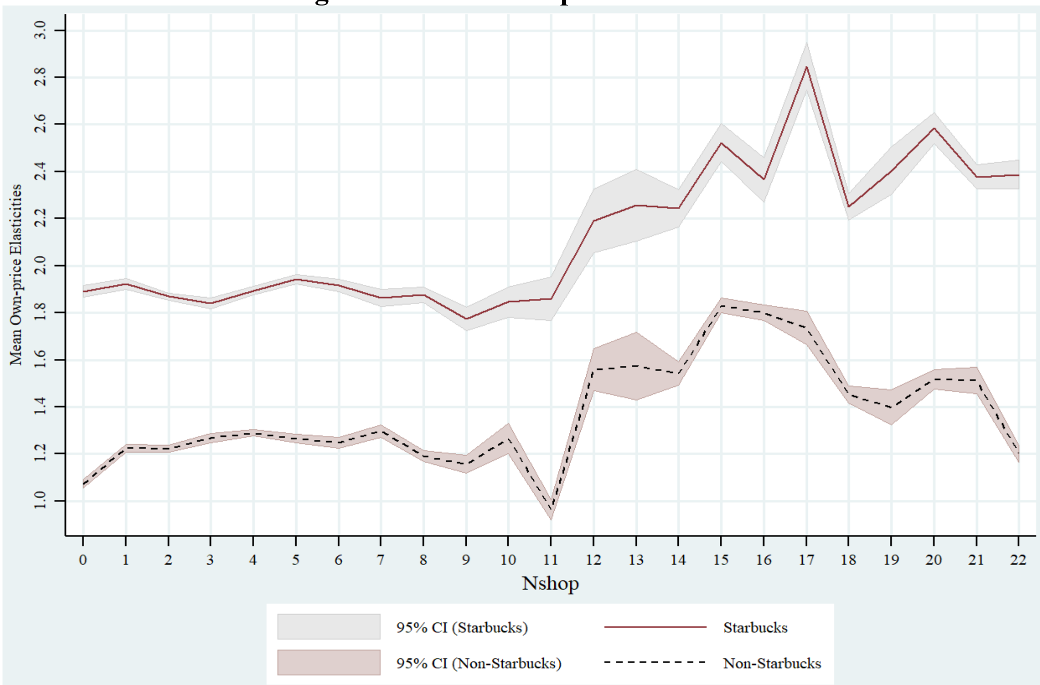
6.2 Elasticities of Own-product Prices: Starbucks versus non-Starbucks

Using the above demand estimates, we compute the implied own-price elasticities for all packaged ground coffee products sold in grocery stores. Figure 2 plots the means of these own-price elasticities (in absolute values) across all Starbucks products and all non-Starbucks products, respectively, over different levels of Starbucks café shop market presence. The shaded area surrounding each line plot in the figure is the 95% confidence interval for the mean own-price elasticity estimates.[20] The line chart clearly shows that the mean own-price elasticities of Starbucks packaged coffee products are always greater in absolute magnitude than those of non-Starbucks packaged coffee products, irrespective of the number of Starbucks café shops in the local market. That is, Starbucks coffee products are more price elastic compared to its competing products. In addition, consumers in markets with relatively high presence of Starbucks café shops (when *Nshop*≥12) tend to have greater sensitivity to changes in the prices of retail packaged coffee products.

[19] *Threshold number of Starbucks Café shops* = $-\frac{\widehat{\gamma_1}}{2\times\widehat{\gamma_2}} = -\frac{-0.09}{2\times 0.0045} = 10.$

[20] Readers may refer to the Appendix for the values of estimates in this figure.

Figure 2: Mean Own-price Elasticities



6.3 Elasticities of Demand for Packaged Coffee Products with respect to *Nshop*

Using the demand estimates, we also examine the respective sizes of the "*demand-increasing*" and "*business-stealing*" effects associated with marginal changes in the number of Starbucks café shops, *Nshop*, in the relevant local market. To obtain comparable magnitudes of the two effects, we compute the elasticities of demand for grocery store packaged coffee products with respect to *Nshop* as follows:

$$\eta_{jmt}^{full} = \frac{\partial s_{jmt}}{\partial Nshop_{mt}} \times \frac{Nshop_{mt}}{s_{jmt}} \tag{9}$$

$$\eta_{jmt}^{d-increasing} = \frac{\partial s_{jmt}}{\partial Nshop_{mt}} \times \frac{Nshop_{mt}}{s_{jmt}}\bigg|_{\Delta\delta_{0mt}=0} \tag{10}$$

$$\eta_{jmt}^{bus-stealing} = \frac{\partial s_{jmt}}{\partial Nshop_{mt}} \times \frac{Nshop_{mt}}{s_{jmt}}\bigg|_{\Delta\delta_{jmt}=0} \tag{11}$$

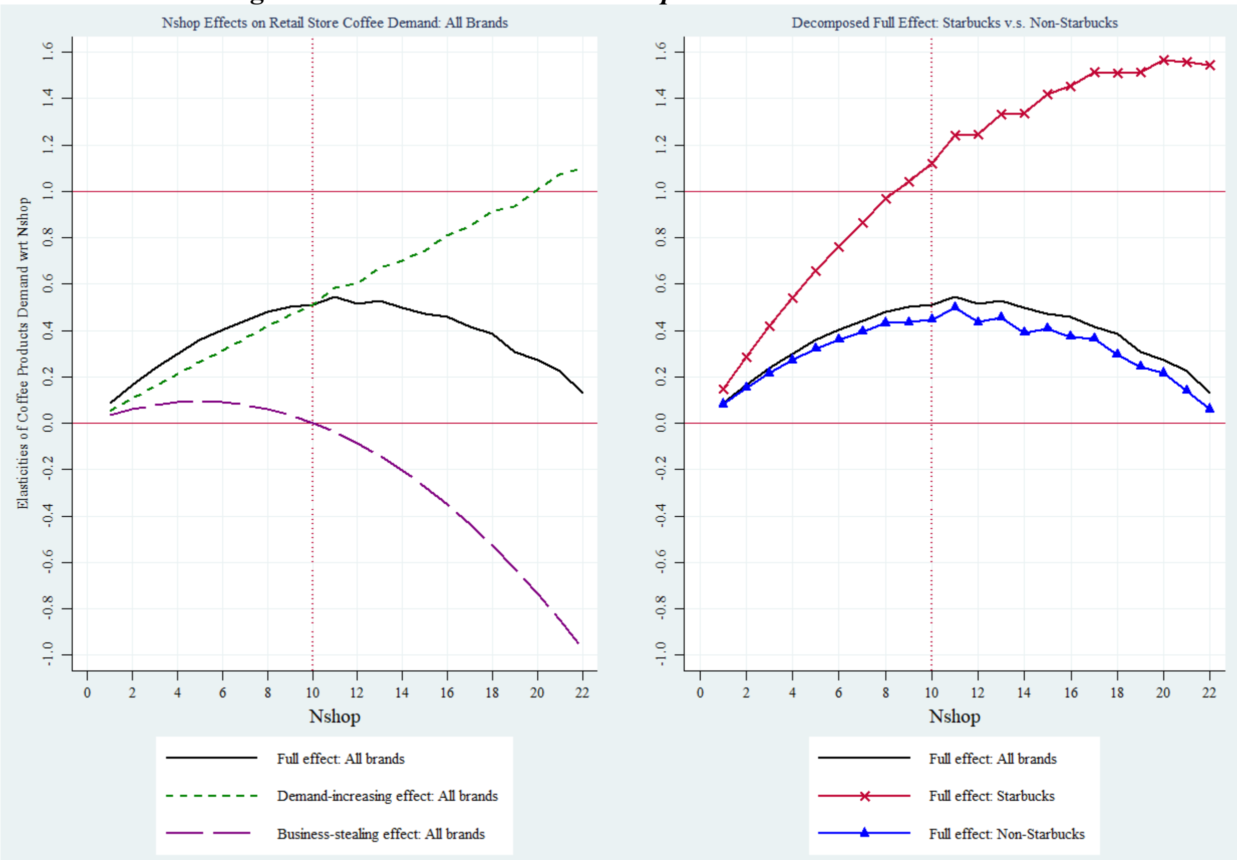
where the overall/full effect of Starbucks café shop market presence on grocery store packaged coffee demand is measured by equation (9). The size of the "*demand-increasing*" effect is obtained from equation (10), which shuts down the influence of Starbucks café presence on the mean utility of the outside good, i.e., when $\Delta\delta_{0mt} = 0$ is imposed. Last, the size of the "*business-stealing*" effect is obtained from equation (11), which focuses on only shutting down the impact of Starbucks café presence on the mean utility of the inside goods, i.e., by imposing $\Delta\delta_{jmt} = 0$.

The estimated full effect, "*demand-increasing*" effect, and "*business-stealing*" effect induced by a change in the market presence of Starbucks café shops on the coffee products sold in local grocery stores are presented in Figure 3. On the left panel, we show the above three effects across all brands; while on the right panel, we show the overall effect of *Nshop* separately for Starbucks brand and non-Starbucks brands coffee products demand.

On the left diagram in Figure 3, we first observe that an increase in *Nshop* shows a clear inverted U-shape overall effect on the grocery store coffee products demand, which is depicted by the solid line. Decomposing the full effect, we find in markets with $Nshop \leq 10$ a monotonic positive "*demand-increasing*" effect described by the short-dash line, and a positive but in smaller magnitude "*business-stealing*" effect described by the long-dash line. The two positive "*demand-increasing*" and "*business-stealing*" effects reinforce each other, leading to a rising overall effect of Starbucks café market presence on grocery chain packaged coffee demand. Therefore, in markets with relatively low presence of Starbucks cafés, additional market entries of Starbucks cafés, while building its popularity and penetration, place a gradually stronger positive demand impact on local grocery stores coffee products. However, in markets with $Nshop > 10$, the overall effect, though still positive, attenuates with an increase in *Nshop* due to the countervailing positive "*demand-increasing*" effect and a growing negative "*business-stealing*" effect. Consequently, in markets relatively saturated with Starbucks café shops, additional market entries of Starbucks cafés are less likely to place large demand impact on local grocery stores packaged coffee products.

On the right penal in Figure 3, we show the overall demand impact of *Nshop* on Starbucks brand and non-Starbucks brands retail packaged coffee products, where the solid line replicates the one measuring the full effect of *Nshop* in the left panel. The line marked with cross above the solid line represents the mean demand impact of Nshop on Starbucks brand retail packaged coffee demand, while the line with diamond marks represents the mean demand impact on all the non-Starbucks brand coffee products. These line plots suggest a relatively larger positive overall demand impact of market presence of Starbucks cafés on its own brand retail coffee products than its impact on other brands products in grocery chains.

Figure 3: Mean Elasticities of *Nshop* on Coffee Product Demand



6.4 Counterfactual Analysis: *Nshop** = *Nshop* + 1

We now use counterfactual experiments to examine the market impacts on retail packaged ground coffee products caused by the market entry of Starbucks café shops. We assume market entry of an additional Starbucks café shop conditional on the pre-existing number of Starbucks café shops in the defined market. The counterfactual experiment is operationalized by increasing the actual number of Starbucks café shops in a market by one. We then simulate the post-entry market equilibrium using the same supply-side Bertrand-Nash equilibrium assumption, holding constant the implied product-level marginal costs at pre-entry levels, and compute on a market-by-market basis the new equilibrium prices of all packaged ground coffee products sold in the grocery stores as well as the associated model-predicted quantity demand for the inside goods and the outside option, respectively.

The predicted new equilibrium price vector, $\boldsymbol{P}^*$, solves the following set of equations:

$$\boldsymbol{P}^* = \widehat{\boldsymbol{mc}} - [\boldsymbol{\Omega} * \boldsymbol{\Delta}(\boldsymbol{P}^*)]^{-1}\boldsymbol{s}(\boldsymbol{P}^*), \tag{12}$$

where $\mathbf{\Omega}$ is a $J \times J$ matrix of appropriately positioned zeros and ones based on the manufacturers' ownership structure of the J products in the relevant market; $\mathbf{\Delta}$ is a $J \times J$ matrix of first-order derivatives of predicted product shares with respect to prices; and $\mathbf{\Omega} * \mathbf{\Delta}$ is an element-by-element multiplication of the two matrices. $\widehat{\boldsymbol{mc}}$ is the vector of product-level marginal costs implied by the demand estimates in Table 3 along with the system of first-order conditions from the supply-side Bertrand-Nash equilibrium assumption evaluated at the factual number of Starbucks café shops in the relevant market.[21] With the new equilibrium price vector in hand, we then re-compute the market shares of both inside goods and the outside good, as well as their respective counterfactual quantity demand:

$$s_{jmt}\left(\boldsymbol{P}^{*}; \widehat{\Theta}\right) = \frac{1}{ns}\sum_{i=1}^{ns}\left(\frac{e^{\delta_{jmt}(p_{jmt}^{*}, Nshop_{mt}^{*})+\mu_{ijmt}(p_{jmt}^{*})}}{e^{\delta_{0mt}(Nshop_{mt}^{*})}+\sum_{l=1}^{J} e^{\delta_{lmt}(p_{lmt}^{*}, Nshop_{mt}^{*})+\mu_{ilmt}(p_{lmt}^{*})}}\right) \tag{13}$$

$$s_{0mt}\left(\boldsymbol{P}^{*}; \widehat{\Theta}\right) = \frac{1}{ns}\sum_{i=1}^{ns}\left(\frac{e^{\delta_{0mt}(Nshop_{mt}^{*})}}{e^{\delta_{0mt}(Nshop_{mt}^{*})}+\sum_{l=1}^{J} e^{\delta_{lmt}(p_{lmt}^{*}, Nshop_{mt}^{*})+\mu_{ilmt}(p_{lmt}^{*})}}\right) \tag{14}$$

where $\widehat{\Theta}$ is a vector of all demand parameter estimates, and $Nshop_{mt}^{*} = Nshop_{mt} + 1$. Evaluated at the new equilibrium prices and $Nshop_{mt}^{*}$, equation (13) yields the model-predicted market shares for the j^{th} packaged coffee product, while equation (14) yields the model-predicted outside good share.

Replacing the new predicted equilibrium price vector, $\boldsymbol{P}^{*}$, with the actual observed prices in the data, $\boldsymbol{P}$, and $Nshop_{mt}^{*}$ with $Nshop_{mt}$ in the above two share equations, yield the respective model-predicted market shares for product j and the outside good in the factual world. Last, multiplying these predicted product market shares with the potential market size measure, M_{mt}, produces the model-predicted quantity demand for the inside goods and the outside option, respectively.

Predicted Changes in Prices for Starbucks vs. non-Starbucks Packaged Coffee Products

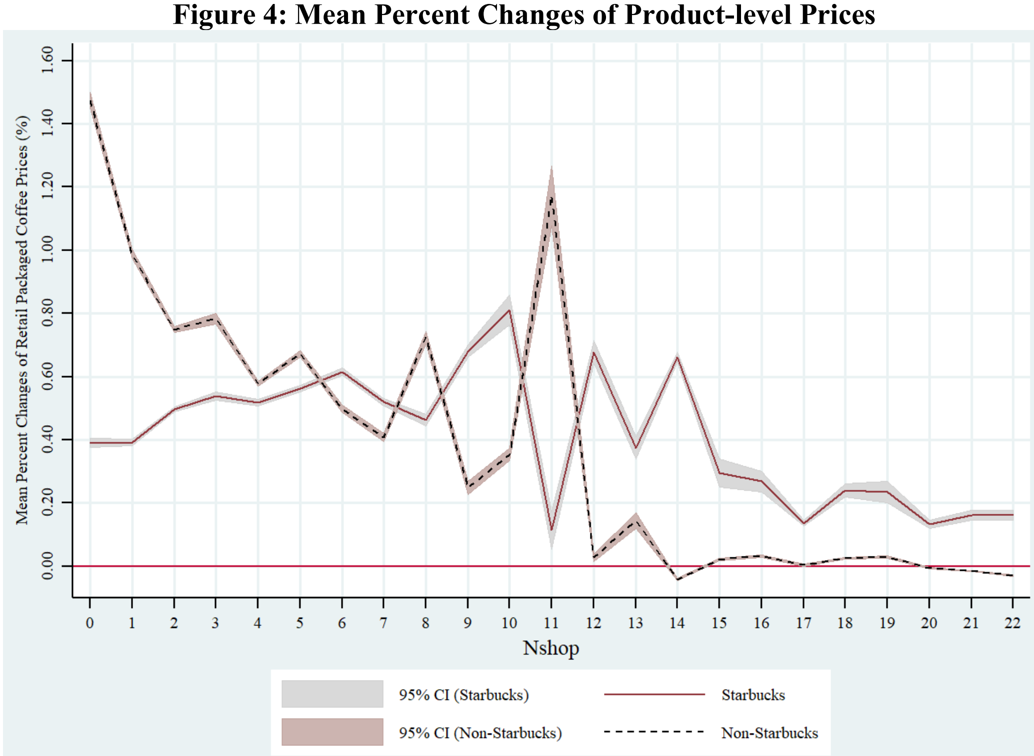
Figure 4 presents the mean percent changes of prices for the retail packaged coffee products of Starbucks brand and non-Starbucks brands, respectively, over different levels of pre-existing market presence of Starbucks cafés.[22] The shaded area surrounding each line plot in the figure is

[21] Similar to Nevo (2000a) and Villas-Boas (2007a, b), we assume cost structures of firms are constant pre- and post-experiment.

[22] Readers may refer to the Appendix for the detailed data points in the chart. Similarly, the detailed data points in the subsequent figures can be found in the Appendix. We also report the counterfactual changes in prices and quantities and the welfare effects using a linear specification of *Nshop* in the mean utility for the outside good in the Appendix.

the 95% confidence interval for the mean percent changes. The line plot for the predicted price changes of Starbucks packaged coffee products are positive, varying from 0.11% to 0.81%, and the predicted price changes of non-Starbucks products are mostly positive (between 0.004% and 1.47%). Upon market entry of a Starbucks café, the average price increase for a typical Starbucks packaged coffee product is 0.5%, but 0.7% for a typical competing product. The predicted positive changes in packaged coffee product prices for Starbucks and non-Starbucks in most markets are likely driven by a "*demand-increasing*" effect that dominates the "*business-stealing*" effect associated with market entry of the new Starbucks café shop according to our theory. For those markets with average price decline of non-Starbucks products, entry of a new Starbucks café shop may have induced a stronger "*business-stealing*" effect on these products.

Figure 4: Mean Percent Changes of Product-level Prices



Predicted Changes in Quantity Demand of Retail Packaged Coffee Products

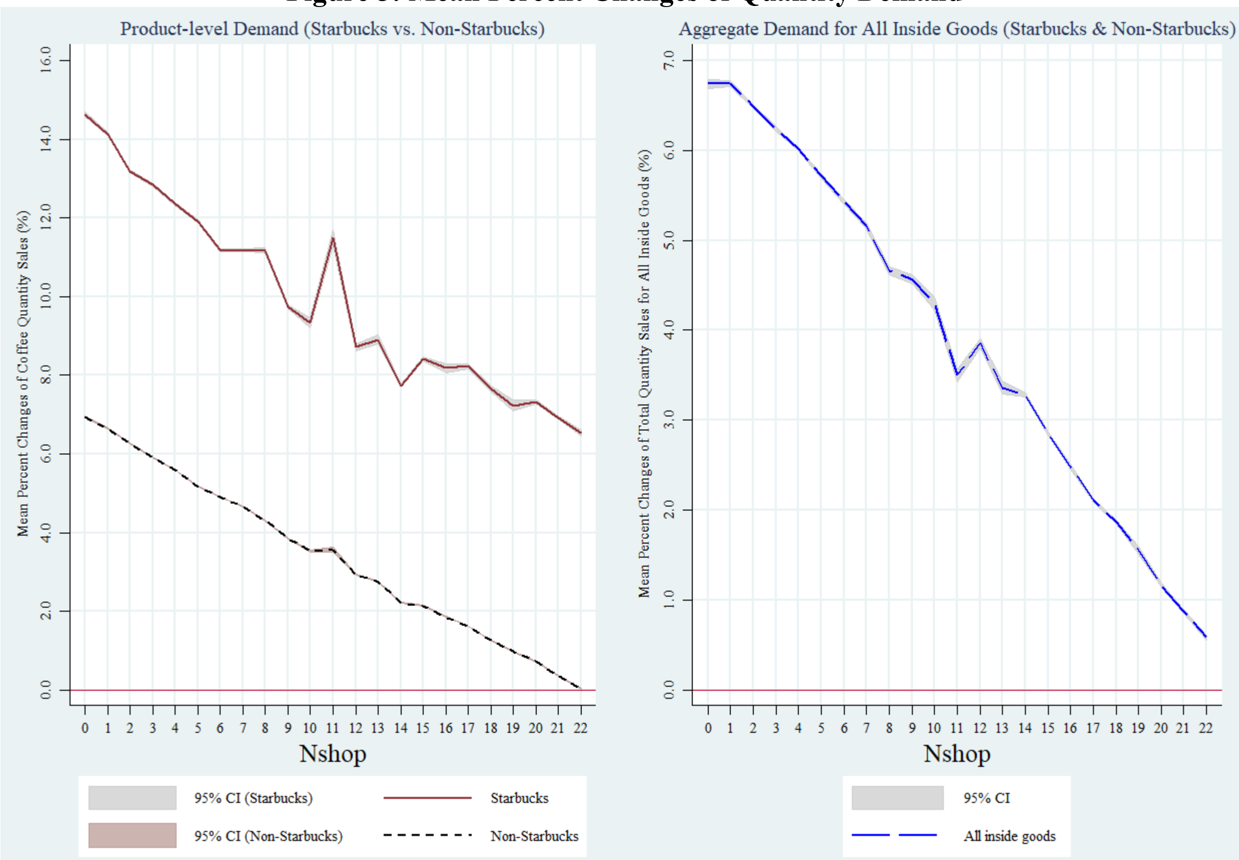
In Figure 5, we show the counterfactual predictions of the demand impacts on retail packaged coffee products resulting from the market entry of a Starbucks café shop. On the left panel of the figure, we plot the mean predicted quantity changes for Starbucks and competing non-Starbucks packaged coffee products, respectively. Both line plots in the left panel are above zero, implying an explicit boosting impact on the sales of both Starbucks and non-Starbucks coffee products with the entry of a Starbucks café shop. However, both lines slope downward with higher pre-existing levels of *Nshop*, suggesting that the positive demand impact on packaged coffee products in grocery stores caused by the market entry of a new Starbucks café shop attenuates with larger pre-exiting numbers of Starbucks café shops in the local market.

It is also notable in the left panel of Figure 5 that the solid line representing the quantity changes for Starbucks products lies above the short-dashed line that represents quantity changes for competing non-Starbucks products. Therefore, the market entry of a Starbucks café shop causes a greater boost in the sales of Starbucks branded compared to competing non-Starbucks packaged coffee products in grocery stores. On average, the quantity sold for a typical Starbucks packaged coffee product is predicted to increase by 12.3%, compared to an average increase of 5.5% for a typical competing non-Starbucks packaged coffee product.

By aggregating the predicted quantities across all packaged ground coffee for both Starbucks and competing non-Starbucks products in grocery stores, we obtain the total quantity purchased across all inside goods. We then compute the percent changes (across pre- and post-entry of an additional Starbucks café) in aggregate quantity purchase of the inside goods. On the right panel of Figure 5, we plot the means of the percent changes of the aggregate inside goods quantity sales over pre-existing levels of Starbucks café market presence. The line plot on the right panel of Figure 5 exhibits similar behavior as the plots on the left panel of the figure. There is a clear positive and downward-sloping change in the aggregate quantity sales of the inside goods with the counterfactual entry of a new Starbucks café shop.

The above findings provide empirical evidence that an increase in the market presence of Starbucks café shops is likely to induce an expansion of the retail market for packaged ground coffee products. This is driven by a "*demand-increasing*" effect that dominates a "*business-stealing*" effect discussed previously on both Starbucks and non-Starbucks packaged coffee products. However, the size of the market-expansionary effect diminishes with the increased market presence of Starbucks café shops. Specifically, the mean market-expansionary effect decreases from 6.7% in markets with no Starbucks café presence to 0.6% in markets with 22 pre-existing Starbucks café shops. The average market-expansionary effect induced by the entry of an additional Starbucks café shop is about a 5.8% increase in the aggregate sales of retail packaged coffee sold in grocery stores.[23]

Figure 5: Mean Percent Changes of Quantity Demand



Predicted Changes in Consumer Surplus

Following Nevo (2001), the money-metric measure of expected utility/surplus for consumer i can be computed as follows:

$$CS_i\left(\boldsymbol{P}, Nshop; \widehat{\Theta}\right) = \frac{\ln\left(e^{\delta_O(Nshop)} + \sum_{j=1}^{J} e^{V_{ij}(\boldsymbol{P}, Nshop; \widehat{\Theta})}\right)}{-\alpha_i} \tag{15}$$

$$CS_i\left(\boldsymbol{P}^*, Nshop^*; \widehat{\Theta}\right) = \frac{\ln\left(e^{\delta_O(Nshop^*)} + \sum_{j=1}^{J} e^{V_{ij}(\boldsymbol{P}^*, Nshop^*; \widehat{\Theta})}\right)}{-\alpha_i} \tag{16}$$

where α_i is the individual-specific random coefficient for price; $V_{ij}(\boldsymbol{P}, Nshop; \widehat{\Theta}) = \delta_j + \mu_{ij}$ is evaluated at the actual observed price vector and the pre-experiment number of Starbucks café

[23] We also calculated the mean percent changes in the outside good demand. The estimated mean percent change across all markets is -8.3%. This also suggests a market expanding impact associated with the new opening of a Starbucks café shop on the retail market for the packaged ground coffee.

shops; $V_{ij}(\boldsymbol{P}^*, Nshop^*; \widehat{\Theta})$ is evaluated at the new equilibrium price vector and the number of Starbucks café shops in the relevant market increased by 1; and $\widehat{\Theta}$ is the vector of demand parameter estimates reported in Table 3. Therefore, $CS_i(\boldsymbol{P}, Nshop; \widehat{\Theta})$ is consumer i's surplus in the factual world, while $CS_i(\boldsymbol{P}^*, Nshop^*; \widehat{\Theta})$ is the counterfactual surplus for consumer i.

It is also interesting to know the level of surplus for consumer i in an intermediate counterfactual environment in which there is counterfactual market entry of an additional Starbucks café shop, but equilibrium prices of packaged coffee products are not allowed to change in response. The following equation captures this counterfactual scenario:

$$CS_i(\boldsymbol{P}, Nshop^*; \widehat{\Theta}) = \frac{\ln\left(e^{\delta_O(Nshop^*)} + \sum_{j=1}^{J} e^{V_{ij}(\boldsymbol{P}, Nshop^*; \widehat{\Theta})}\right)}{-\alpha_i} \tag{17}$$

Equation (17) will help us to assess how much of the surplus change is attributed to changes in the market presence of a Starbucks café shop after nullifying the associated second-order effects due to equilibrium price changes.

Another interesting intermediate effect of the counterfactual experiment to quantify is the second-order consumer surplus changes attributed to the equilibrium price changes of package coffee products in grocery stores associated with the market entry of a Starbucks café shop. We use the following consumer surplus equation to assess these second-order consumer surplus changes:

$$CS_i(\boldsymbol{P}^*, Nshop; \widehat{\Theta}) = \frac{\ln\left(e^{\delta_O(Nshop)} + \sum_{j=1}^{J} e^{V_{ij}(\boldsymbol{P}^*, Nshop; \widehat{\Theta})}\right)}{-\alpha_i}. \tag{18}$$

Note that equation (18) only allows the prices of packaged coffee products to reflect the new price levels, while *Nshop* remains unchanged.

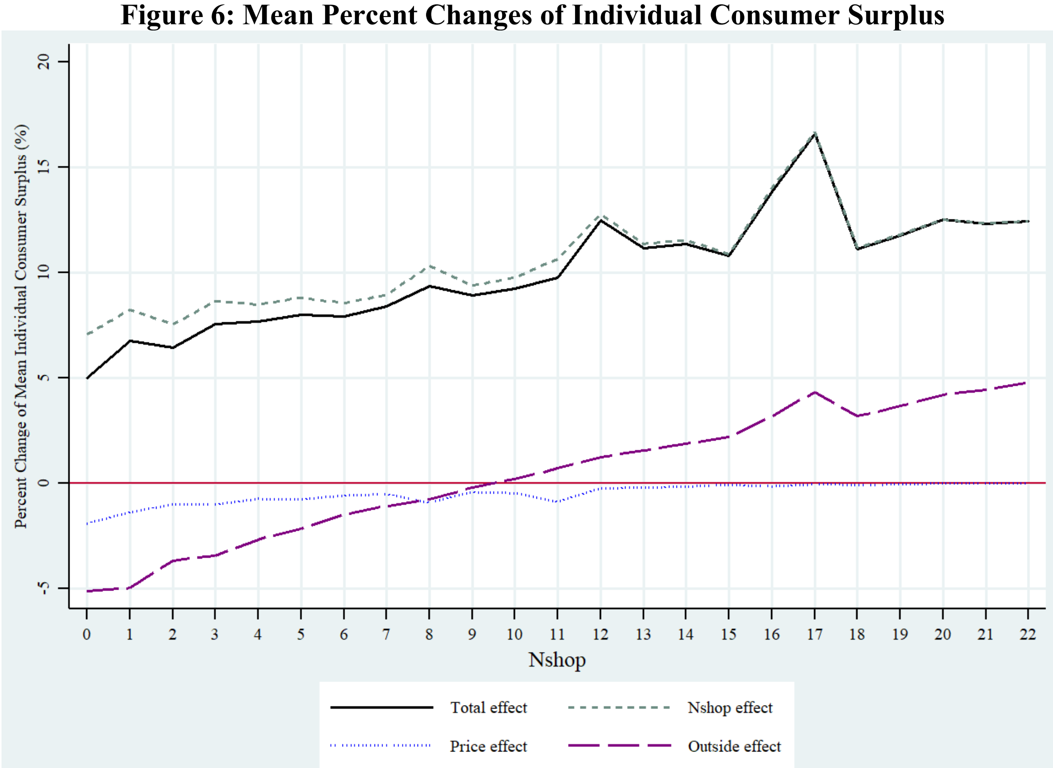
Last, we evaluate the surplus of consumer i captured by the following equation:

$$CS_i(\boldsymbol{P}, Nshop^*; Nshop; \widehat{\Theta}) = \frac{\ln\left(e^{\delta_O(Nshop^*)} + \sum_{j=1}^{J} e^{V_{ij}(\boldsymbol{P}, Nshop; \widehat{\Theta})}\right)}{-\alpha_i}, \tag{19}$$

where we only allow the market presence of Starbucks café shops to influence the mean utility obtained from the outside option/good while holding constant the mean utility obtained from the inside goods at the factual level. As such, holding everything constant in the retail packaged coffee segment of the market, the above equation enables us to examine how consumers value having an additional Starbucks café shop as an outside option in their local market.

We compute the mean percent changes of individual consumer surplus in each market based on the various counterfactual scenarios described above and plot in Figure 6 the means over the pre-existing number of Starbucks café shops in the relevant local markets. The predicted changes in consumer surplus are all statistically different from zero at conventional levels of statistical significance.[24] The solid line plot in the figure represents the percent changes between equations (12) and (13), which measures the overall effect on consumer surplus resulting from the market entry of an additional Starbucks café shop. The solid line being above zero implies an overall rise in consumer surplus caused by the market entry of an additional Starbucks café shop. There is a slight upward trend of the consumer surplus gain over *Nshop*, indicating the availability of a new Starbucks café generally benefits local coffee drinkers more in markets with greater Starbucks café penetration. We find the average gain in individual consumer surplus is about 7.7%.

Figure 6: Mean Percent Changes of Individual Consumer Surplus



Comparing estimates calculated using equation (15) with estimates obtained from equations (17) through (18) respectively, we decompose the full consumer surplus effect into three parts: (*i*) a change in surplus attributed to market entry of an additional Starbucks café shop

[24] Detailed estimates on changes in consumer surplus can be found in the Appendix.

assuming prices are unaffected by this market entry, i.e., the percent changes between surpluses obtained from equations (15) and (17), denoted as the "*Nshop effect*" and represented by the short-dashed line in the figure; (*ii*) the extra change in surplus attributed to equilibrium price changes of packaged coffee products in grocery stores induced by the market entry of a Starbucks café, i.e., the percent changes between surpluses obtained from equations (15) and (18), denoted as the "*Price effect*" and represented by the short-dotted line; and (*iii*) holding everything constant in the retail packaged coffee segment of the market, the extra change in surplus attributed to consumers having an additional Starbucks café shop as an outside option in their local market, i.e., the percent changes between surpluses obtained from equation (15) and (19), denoted as the "*Outside good effect*" and represented by the long-dashed line.

First, the "*Price effect*" represented by the short-dotted line is below the zero-reference line, implying a loss in consumer surplus due to the higher price levels for both Starbucks and non-Starbucks packaged coffee products, as shown and discussed earlier in Figure 4, caused by the market entry of a new Starbucks café shop.[25] Note however that the consumer surplus loss associated with the price increase attenuates in markets with greater penetrations of Starbucks café shops (i.e., $Nshop \geq 12$).

Second, the "*Outside good effect*" represented by the long-dashed line is below the zero-reference line when *Nshop* is 9 or less, i.e., up to 9 pre-existing number of Starbucks café shops, indicating an average loss in consumers' surplus in these markets because of the fall in the mean utility level consumers obtain from the outside option. However, the "*Outside good effect*" becomes positive when *Nshop* is 10 or greater, i.e., 10 or more pre-existing number of Starbucks café shops, suggesting a consumer surplus gain in these markets with a greater presence of Starbucks café shops. The pattern of this "*Outside good effect*" is implied by the estimated U-shaped relationship between mean outside good utility and the level of Starbucks café presence.

Last, recall that the "*Nshop effect*" measures the change in consumer surplus caused by the market entry of an additional Starbucks café shop after nullifying the "*Price effect*" on packaged coffee products sold in grocery stores. It is notable that the "*Nshop effect*" described by the short-dashed line in Figure 6, though varying across *Nshop*, yield the highest positive gain in consumer surplus. Accordingly, a comparison of the overall consumer surplus effect, represented by the solid

[25] Due to a greater price increase of Starbucks packaged coffee products, there is still a net price rise in markets with 12 or more pre-existing number of Starbucks café shops.

line in the figure, with the "*Nshop effect*" line reveals once more that the "*Price effect*" on packaged coffee products sold in grocery stores serves to attenuate the consumer surplus gain caused by the market entry of an additional Starbucks café shop.

In summary, the above consumer surplus analysis reveals that the market entry of an additional Starbucks café shop benefits coffee drinkers for sure and the "*Nshop effect*" is most responsible for the predicted changes in consumer surplus.

Social Welfare Changes and Market Entry of an additional Starbucks Café Shop

Last, we compute changes in our model-predicted aggregate surplus in each market to evaluate social welfare effects associated with market entry of a Starbucks café shop.[26] Figure 7 depicts means of dollar amount changes in market-level aggregate surplus over the pre-existing number of Starbucks café shops. Readers are reminded that measures of social welfare changes in Figure 7 are partial since they are based only on changes in consumer surplus aggregated with changes in variable profits of grocery stores that sell packaged coffee products. As such, the social welfare changes exclude the important component of profit earned by the new Starbucks café that counterfactually entered the market, as well as changes in variable profits of other competing café shops.

In Figure 7, we show that the mean dollar gains in model-predicted social welfare are positive across *Nshop*, varying from a monthly $704 in markets with 17 pre-existing Starbucks café shops to $1,387 in markets with 14 pre-existing Starbucks café shops. These estimates are all statistically different from zero at a 95% level of statistical significance based on the confidence intervals shown in the figure. The average monthly dollar gains in our social welfare measure across all markets is found to be $1,253.

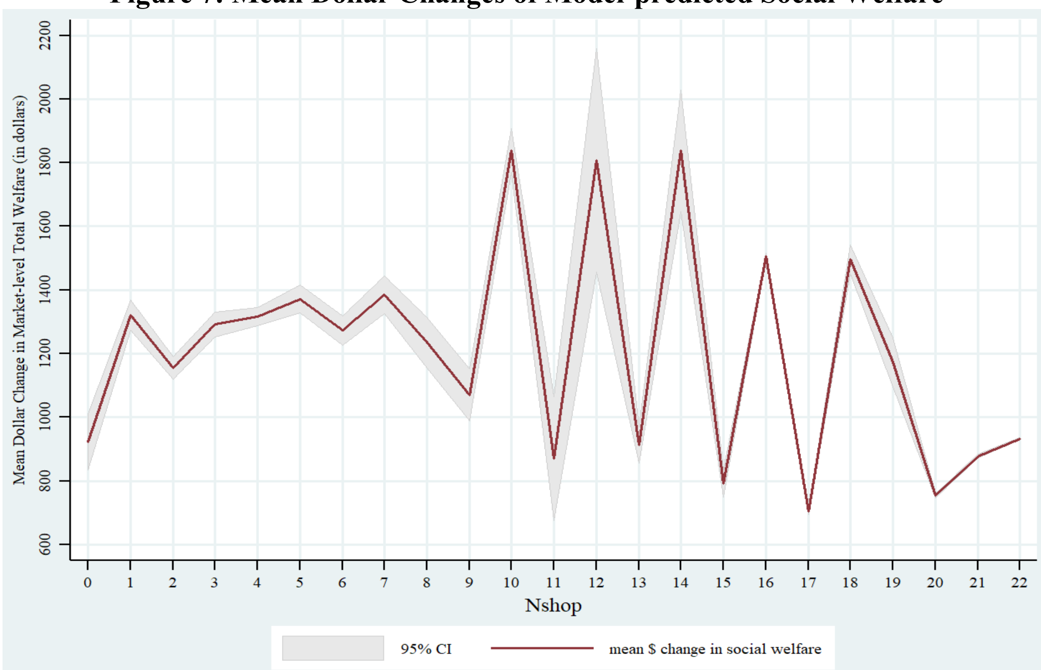
We also obtain a rough estimate of the average profitability of a Starbucks café shop by dividing Starbucks Corp.'s reported net income,[27] adjusted to 2012 dollars, by the total number of

[26] The total welfare in each market is simply the sum of market-level total consumer surplus and total grocery retailers' variable profits. The total consumer surplus is obtained by multiplying the mean individual consumer surplus with the total adult population in the market. Adult population data is obtained from the U.S. Census Bureau database. Variable profit is obtained by multiplying product markups with quantities, and then aggregate across all products in each market. The total welfare in the factual world is based on the actual price level, whereas the total welfare in the counterfactual experiment is obtained based on the new model-predicted equilibrium prices.

[27] Net income (NI), also called net earnings or net profit, reported in firms' financial statements is normally computed as the residual of total revenues and gains of the firm minus all expenses and losses in a given period (quarterly or annually). Starbucks' net income data are drawn from their 10K report of 2012, page 22. Starbucks' 10K reports can be retrieved from the following URL, which we accessed on 2/25/2021: https://investor.starbucks.com/financial-data/annual-reports/default.aspx

café shops (both reported in the 10K reports) in each year. We then compute the mean of the per café shop profit over the five sample years. The inflation-adjusted rough estimate of average profit per Starbucks café shop per month is $4,263. Therefore, a rough estimated welfare gain for a new Starbucks café shop is $5,516 after adding the mean dollar gains from the model-predicted partial social welfare.

Figure 7: Mean Dollar Changes of Model-predicted Social Welfare



7. Conclusions

This paper investigates the market impacts associated with the increasing presence of Starbucks café shops in local markets where Starbucks packaged ground coffee products as well as its competitors' packaged coffee products are sold in the grocery stores. We begin the study by specifying and using a formal theoretical model to gain insights on the potential market forces at play that may ultimately influence market outcomes resulting from the increasing market presence of Starbucks café shops. Specifically, the theoretical analysis makes clear that the increasing presence of Starbucks café shops in a market may increase or decrease the equilibrium quantities sold of packaged ground coffee products of both Starbucks and competing brands.

The theoretical model also makes clear the underlying driving forces for the ambiguous impacts on some market outcomes. An increase in the presence of Starbucks café shops in a market has two opposing effects on the demand for packaged ground coffee products sold in grocery stores, denoted as "*demand-increasing*" and "*business-stealing*" effects. The ultimate market outcomes resulting from the increasing presence of Starbucks café shops in a market depends on the relative strengths of the "*demand-increasing*" and "*business-stealing*" effects.

The theoretical insights motivate the subsequent empirical analysis that examines the systematic evidence on the market impacts on packaged ground coffee products in grocery stores resulting from increased market presence of Starbucks café shops. The empirical analysis reveals that market entry of an additional Starbucks café shop is predicted to increase retail price and the quantity sold of a typical Starbucks packaged ground coffee product by an average of 0.5% and 12.3%, respectively, and increase the retail prices and quantities sold of non-Starbucks packaged coffee products by an average of 0.7% and 5.5%, respectively. The empirical evidence validates much of our theory predictions. In particular, the empirical evidence suggests that between the two countervailing "*demand-increasing*" and "*business-stealing*" effects associated with the market entry of an additional Starbucks café shop, the "*demand-increasing*" effect dominates and results in an average increase of 5.8% in aggregated quantity sales for all packaged ground coffee products in grocery stores.

Last, we use our estimated empirical model to perform welfare analysis associated with the increased market presence of Starbucks café shops. Our analysis reveals that, on net, the average consumer benefits from the new Starbucks café shop available in the market with a mean increase in money-metric surplus by 7.7%. And the social welfare analysis shows that the market entry of a new Starbucks café shop yields model-predicted social welfare gains of an average $1,253 monthly.

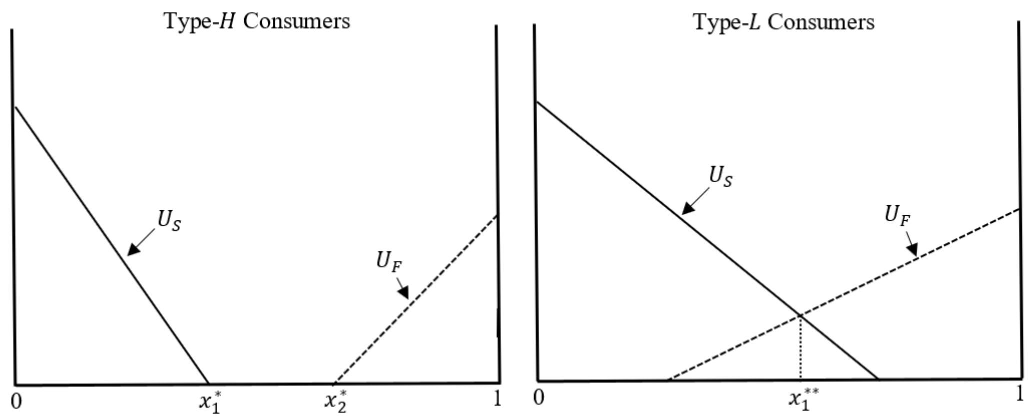
This paper joins the literature on "umbrella branding" and "brand extension". Our paper investigates the spillover effects of Starbucks café shops on the demand and pricing of its "umbrella branding" products, Starbucks packaged ground coffee products sold in grocery chains, as well as competing brands of packaged ground coffee products. Future research may use the methodological framework presented in this paper to examine umbrella branding strategies of firms in other industries.

Appendix A – Theoretical Model

Equilibrium analysis and comparative statics

In this section, we solve for the equilibrium prices of the two brands $\{p_S^*, p_F^*\}$ and then investigate the impact of the number of Starbucks café shops, N_S, on the equilibrium quantities demand of Starbucks brand and Folgers brand packaged ground coffee products sold in grocery stores to understand the "*business-stealing*" and "*demand-increasing*" effects. By the model setup, consumers of packaged ground coffee are composed of type-H and type-L consumers, whose transportation costs are t_H and t_L respectively. In order to simplify the equilibrium analysis, we assume that t_H is sufficiently high, while t_L is sufficiently low such that it is optimal for the two brands to partially cover the market for type-H consumers, but to fully cover the market for type-L consumers. In addition, we assume that θ, although positive, is small enough to guarantee Folgers has a positive market share among type-L consumers. Therefore, the demands of the two types of consumers can be illustrated in Figure A1.

Figure A1: Consumer Demand for Each Market Segment



From Figure A1, we can derive the market demand of each brand with respect to the two consumer segments. In the segment of type-H consumers, each firm sells as a local monopoly and obtains a market segment demand equal to:

$$Q_S^H = m(N_S)\alpha x_1^* \tag{A1}$$

$$Q_F^H = m(N_S)\alpha(1 - x_2^*) \tag{A2}$$

where $m(N_S)$ is the total number of consumers that purchase packaged ground coffee; α is the proportion of type-H consumers; x_1^* is the location of a type-H consumer who obtains zero utility from purchasing the Starbucks brand packaged ground coffee product; and x_2^* is the location of a type-H consumer who obtains zero utility from purchasing the Folgers brand packaged ground coffee product. Using Eq. (2) and Eq. (3) to solve for x_1^* and x_2^* yield:

$$U_S = 0 \Leftrightarrow x_1^* = \frac{v_0+(1+\theta)v(N_S)-p_S}{t_H} \tag{A3}$$

$$U_F = 0 \Leftrightarrow x_2^* = 1 - \frac{v_0+v(N_S)-p_F}{t_H} \tag{A4}$$

In the market segment of type-L consumers, the two firms compete and split the market in the following way:

$$Q_S^L = m(N_S)(1-\alpha)x_1^{**} \tag{A5}$$

$$Q_F^L = m(N_S)(1-\alpha)(1-x_1^{**}) \tag{A6}$$

where x_1^{**} is the location of a type-L consumer who is indifferent between purchasing the Starbucks and the Folgers packaged ground coffee product. Using Eq. (2) and Eq. (3) to solve for x_1^{**} yield:

$$U_S = U_F \Leftrightarrow x_1^{**} = \frac{\theta v(N_S)-p_S+p_F}{2t_L} + \frac{1}{2} \tag{A7}$$

Thus, the total demand for each brand of packaged ground coffee is:

$$Q_S = Q_S^H + Q_S^L = m(N_S)[\alpha x_1^* + (1-\alpha)x_1^{**}] \tag{A8}$$

$$Q_F = Q_F^H + Q_F^L = m(N_S)[\alpha(1-x_2^*) + (1-\alpha)(1-x_1^{**})] \tag{A9}$$

With the above demand functions, we write down the profit functions of Starbucks and Folgers:

$$\pi_S = m(N_S)[\alpha x_1^* + (1-\alpha)x_1^{**}]p_S \tag{A10}$$

$$\pi_F = m(N_S)[\alpha(1-x_2^*) + (1-\alpha)(1-x_1^{**})]p_F \tag{A11}$$

where the per-unit production cost for both brands is assumed to be zero for the ease of calculation.

Next, we solve for the equilibrium prices $\{p_S^*, p_F^*\}$ and quantities $\{Q_S(p_S^*, p_F^*), Q_F(p_S^*, p_F^*)\}$ for both brands, then derive the comparative statics of the equilibrium quantities with respect to the number of Starbucks café shops, N_S. The results are presented as follows.

Proposition 1. Denote $\{p_S^*, p_F^*\}$ and $\{Q_S(p_S^*, p_F^*), Q_F(p_S^*, p_F^*)\}$ as the equilibrium prices and quantities of Starbucks and Folgers packaged ground coffee products sold in grocery stores. Define

$$z \equiv \frac{\alpha}{t_H} \tag{A12}$$

$$w \equiv \frac{1-\alpha}{2t_L} \tag{A13}$$

$$\Delta_0 \equiv 4z^2 + 8zw + 3w^2 \tag{A14}$$

$$\Delta_1 \equiv 2z^2(1+\theta) + zw(3+4\theta) + w^2\theta \quad \text{(A15)}$$

$$\Delta_2 \equiv 2z^2 + zw(3-\theta) - w^2\theta \quad \text{(A16)}$$

$$\Delta_3 \equiv (2z+3w)(zv_0 + wt_L). \quad \text{(A17)}$$

The following statements holds:

1. Equilibrium Prices:

$$p_S^* = \frac{1}{\Delta_0}[\Delta_1 v(N_S) + \Delta_3]$$

$$p_F^* = \frac{1}{\Delta_0}[\Delta_2 v(N_S) + \Delta_3]$$

2. Comparative Statics:

When the number of Starbucks café shops, N_S, increases,

(2.1) For Starbucks brand packaged ground coffee products, $Q_S(p_S^*, p_F^*)$ changes ambiguously.

(2.2) For Folgers packaged ground coffee products:

(a) If the proportion of type-H consumers satisfies $\alpha > \alpha^*$, $Q_F(p_S^*, p_F^*)$ changes ambiguously.

(b) If the proportion of type-H consumers satisfies $\alpha < \alpha^*$, $Q_F(p_S^*, p_F^*)$ decrease for sure.

Here $\alpha^* \in (0,1)$ is the unique solution for, $2z^2 + zw(3-\theta) - w^2\theta = 0$.

Proof of Proposition 1:

Equilibrium prices:

We first solve the equilibrium price of Starbucks packaged ground coffee p_S^* and equilibrium price of Folgers packaged ground coffee p_F^*. Given the profit functions of Starbucks and Folgers:

$$\pi_S = m(N_S)[\alpha x_1^* + (1-\alpha)x_1^{**}]p_S$$

$$\pi_F = m(N_S)[\alpha(1-x_2^*) + (1-\alpha)(1-x_1^{**})]p_F$$

We can derive the first-order conditions with respect to p_S and p_F as follows:

$$(p_S): \alpha\left(\frac{v_0+(1+\theta)v(N_S)-p_S}{t_H}\right) + (1-\alpha)\left(\frac{\theta v(N_S)-p_S+p_F}{2t_L}+\frac{1}{2}\right) - p_S\left(\frac{\alpha}{t_H}+\frac{1-\alpha}{2t_L}\right) = 0 \quad \text{(A18)}$$

$$(p_F): \alpha\left(\frac{v_0+v(N_S)-p_F}{t_H}\right) + (1-\alpha)\left(\frac{-\theta v(N_S)+p_S-p_F}{2t_L}+\frac{1}{2}\right) - p_F\left(\frac{\alpha}{t_H}+\frac{1-\alpha}{2t_L}\right) = 0 \quad \text{(A19)}$$

The equilibrium prices $\{p_S^*, p_F^*\}$ are equal to

$$p_S^* = \frac{1}{\Delta_0}[\Delta_1 v(N_S) + \Delta_3] \quad \text{(A20)}$$

$$p_F^* = \frac{1}{\Delta_0}[\Delta_2 v(N_S) + \Delta_3] \tag{A21}$$

where

$$\Delta_0 \equiv 4z^2 + 8zw + 3w^2$$
$$\Delta_1 \equiv 2z^2(1+\theta) + zw(3+4\theta) + w^2\theta$$
$$\Delta_2 \equiv 2z^2 + zw(3-\theta) - w^2\theta$$
$$\Delta_3 \equiv (2z+3w)(zv_0 + wt_L)$$
$$z \equiv \frac{\alpha}{t_H}$$
$$w \equiv \frac{1-\alpha}{2t_L}$$

$$\Delta_0 \equiv 4z^2 + 8zw + 3w^2$$
$$\Delta_1 \equiv 2z^2(1+\theta) + zw(3+4\theta) + w^2\theta$$
$$\Delta_2 \equiv 2z^2 + zw(3-\theta) - w^2\theta$$
$$\Delta_3 \equiv (2z+3w)(zv_0 + wt_L).$$

Comparative Statics of the demand impact:

Next, we analyze the effect of Starbucks café shops on the equilibrium quantities of the two brands of packaged ground coffee products sold in grocery stores. First, we rewrite the demand functions in Eq. (A8) and Eq. (A9) to be:

$$Q_S = m(N_S)Q_S^0 \tag{A22}$$

$$Q_F = m(N_S)Q_F^0 \tag{A23}$$

where $m(N_S)$ is the total population of packaged ground coffee shoppers. Among these consumers, the proportion of buyers for Starbucks and Folgers are respectively:

$$Q_S^0 \equiv \alpha x_1^* + (1-\alpha)x_1^{**} = \alpha\left(\frac{v_0 + (1+\theta)v(N_S) - p_S}{t_H}\right) + (1-\alpha)\left(\frac{\theta v(N_S) - p_S + p_F}{2t_L} + \frac{1}{2}\right) \tag{A24}$$

$$Q_F^0 \equiv \alpha(1-x_2^*) + (1-\alpha)(1-x_1^{**}) = \alpha\left(\frac{v_0 + v(N_S) - p_F}{t_H}\right) + (1-\alpha)\left(\frac{-\theta v(N_S) + p_S - p_F}{2t_L} + \frac{1}{2}\right) \tag{A25}$$

Under the equilibrium prices $\{p_S^*, p_F^*\}$ in Eq. (A20) and Eq. (A21), one can check that:

$$\partial \frac{Q_S^0(p_S^*, p_F^*)}{\partial N_S} = (z+w)\frac{\Delta_1}{\Delta_0} v'(N_S) \tag{A26}$$

$$\partial \frac{Q_F^0(p_S^*, p_F^*)}{\partial N_S} = (z+w)\frac{\Delta_2}{\Delta_0} v'(N_S) \tag{A27}$$

This suggests $\partial \frac{Q_S^0(p_S^*,p_F^*)}{\partial N_S}$ is always positive, while the sign of $\partial \frac{Q_F^0(p_S^*,p_F^*)}{\partial N_S}$ depends on the value of α: $\partial \frac{Q_F^0(p_S^*,p_F^*)}{\partial N_S} > 0$ if $\alpha > \alpha^*$, and $\partial \frac{Q_F^0(p_S^*,p_F^*)}{\partial N_S} < 0$ otherwise. Therefore, the impacts of Starbucks café shops on Q_S and Q_F are as follows:

$$\partial \frac{Q_S(p_S^*,p_F^*)}{\partial N_S} = \underbrace{m'(N_S)Q_S^0}_{(-)} + \underbrace{m(N_S)\partial \frac{Q_S^0(p_S^*,p_F^*)}{\partial N_S}}_{(+)} \tag{A28}$$

$$\partial \frac{Q_F(p_S^*,p_F^*)}{\partial N_S} = \underbrace{m'(N_S)Q_F^0}_{(-)} + \underbrace{m(N_S)\partial \frac{Q_F^0(p_S^*,p_F^*)}{\partial N_S}}_{(+)\ or\ (-)} \tag{A29}$$

With the coexistence of *"business stealing"* effect and *"demand-increasing"* effect, the number of Starbucks café shops has an ambiguous effect on the sales of both brands of packaged ground coffee products in grocery stores. The only exception is the case when $\alpha < \alpha^*$, in which the impact on the sales of Folgers is negative for sure.

Q.E.D.

References

Aaker, David A., and Kevin Lane Keller, 1990. Consumer Evaluations of Brand Extensions. *Journal of Marketing* 54, no. 1, pp.27-41.

Andersson, Fredrik, 2002. Pooling reputations. *International Journal of Industrial Organization* 20, no. 5, pp.715-730.

Ansari, A., Bawa, K. and Ghosh, A., 1995. A nested logit model of brand choice incorporating variety-seeking and marketing-mix variables. *Marketing Letters*, *6*(3), pp.199-210.

Berry, S.T, and J. Waldfogel 1999. Public radio in the United States: does it correct market failure or cannibalize commercial stations? *Journal of Public Economics*, Vol. 71, pp. 189-211.

Berry, S.T, Levinsohn, J. and Pakes, A., 1995. "Automobile prices in market equilibrium." *Econometrica: Journal of the Econometric Society*, pp.841-890.

Berry, S.T., 1992. Estimation of a model of entry in the airline industry. *Econometrica*, Vol. 60, pp. 889-917.

Berry, S.T., 1994. Estimating discrete-choice models of product differentiation. *The RAND Journal of Economics*, pp.242-262.

Bonnet, C. and Villas-Boas, S.B., 2016. An analysis of asymmetric consumer price responses and asymmetric cost pass-through in the French coffee market. *European Review of Agricultural Economics*, *43*(5), pp.781-804.

Bresnahan, T., and P. Reiss 1990. Entry into monopoly markets. *Review of Economics Studies*, Vol. 57, pp. 531-553.

Bresnahan, T., and P. Reiss 1991. Entry and competition in concentrated markets. *Journal of Political Economy*, Vol. 95, pp. 57-81.

Bronnenberg, B.J., Kruger, M.W. and Mela, C.F., 2008. Database paper—The IRI marketing dataset. *Marketing Science*, *27*(4), pp.745-748.

Cabral, Luis M.B., 2009. Umbrella branding with imperfect observability and moral hazard. *International Journal of Industrial Organization,* 27(2), pp.206–213.

Cabral, Luis M.B.,2000. Stretching firm and brand reputation. *RAND Journal of Economics*, pp. 658-673.

Cai, Hongbin, and Ichiro Obara, 2009. Firm reputation and horizontal integration. *The RAND Journal of Economics* 40, no. 2, pp.340-363.

Chae, Inyoung, Andrew T. Stephen, Yakov Bart, and Dai Yao, 2016. Spillover effects in seeded word-of-mouth marketing campaigns. *Marketing Science* 36, no. 1, pp.89-104.

Choi, Jay Pil., 1998. Brand Extension as Informational Leverage. *The Review of Economic Studies* 65, no. 4, pp. 655-69.

Erdem, Tülin, 1998. An Empirical Analysis of Umbrella Branding. *Journal of Marketing Research* 35, no. 3 pp.339-51.

Gandhi, A. and Houde, J.F., 2020. "Measuring Substitution Patterns in Differentiated-Products Industries." *National Bureau of Economic Research* (Working Paper No. 26375).

Garthwaite, Craig L.,2014. Demand spillovers, combative advertising, and celebrity endorsements. *American Economic Journal: Applied Economics* 6, no. 2, pp.76-104.

Gayle, Philip G. and Lin, Ying, 2022. "Market effects of new product introduction: Evidence from the brew-at-home coffee market." *Journal of Economics & Management Strategy*, Vol. 31, Issue 3, Fall 2022, pp. 525-557. ISSN: 1058-6407, 1530-9134; DOI: 10.1111/jems.12474

Guadagni, P.M. and Little, J.D., 1998. When and what to buy: A nested logit model of coffee purchase. *Journal of Forecasting*, *17*(3 - 4), pp.303-326.

Guler, A.U., 2018. Inferring the Economics of Store Density from Closures: The Starbucks Case. *Marketing Science*, 37(4), pp.611-630.

Hakenes, Hendrik, and Martin Peitz, 2008. Umbrella branding and the provision of quality." *International Journal of Industrial Organization* 26, no. 2, pp.546-556.

Ivaldi, M. and Verboven, F., 2005. "Quantifying the effects from horizontal mergers in European competition policy." *International Journal of Industrial Organization*, *23*(9-10), pp.669-691.

Jia, Panle 2008. What happens when Wal-Mart comes to town: An empirical analysis of the discount retailing industry. *Econometrica*, Vol. 76, No. 6, November 2008, pp. 1263-1316.

Keller, Kevin Lane, and Donald R. Lehmann, 2006. Brands and branding: Research findings and future priorities." *Marketing science* 25, no. 6, pp.740-759.

Miklós-Thal, Jeanine, 2012. Linking reputations through umbrella branding. *Quantitative Marketing and Economics* 10, no. 3, pp.335-374.

Miller, N.H. and Weinberg, M.C., 2017. "Understanding the price effects of the MillerCoors joint venture." *Econometrica*, *85*(6), pp.1763-1791.

Moorthy, Sridhar, 2012. Can brand extension signal product quality? *Marketing science* 31, no. 5, pp.756-770.

Nakamura, E. and Zerom, D., 2010. Accounting for incomplete pass-through. *The Review of Economic Studies*, *77*(3), pp.1192-1230.

Nevo, A., 2000a. "Mergers with differentiated products: The case of the ready-to-eat cereal industry." *The RAND Journal of Economics*, pp.395-421.

Nevo, A., 2000b. "A practitioner's guide to estimation of random-coefficients logit models of demand." *Journal of economics & management strategy*, *9*(4), pp.513-548.

Nevo, A., 2001. "Measuring market power in the ready-to-eat cereal industry." *Econometrica*, *69*(2), pp.307-342.

Pepall, Lynne M., and Daniel J. Richard, 2002. The simple economics of brand stretching. *The Journal of Business* 75, no. 3, pp.535-552.

Prendergast, G.P. and Marr, N.E., 1997. Generic products: who buys them and how do they perform relative to each other?. *European Journal of Marketing*, *31*(2), pp.94-109.

Rasmusen, Eric B., 2016. Leveraging of Reputation through Umbrella Branding: The Implications for Market Structure. *Journal of Economics & Management Strategy* 25, no. 2, pp.261-273.

Starbucks Corporation (2008, 2009, 2010, 2011, 2012). 2008-2012 annual report (10K form), retrieved from: https://investor.starbucks.com/financial-data/annual-reports/default.aspx

Stock, J.H., Yogo, M., Andrews, D.W. and Stock, J.H., 2005. Identification and inference for econometric models: Essays in honor of Thomas Rothenberg. *Cambridge University Press*, 2005.

Sullivan, C., 2020. "The ice cream split: Empirically distinguishing price and product space collusion." *ERN: Firm Behavior (IO: Empirical) (Topic)*. *Available at SSRN 3321948*.

Sullivan, Mary, 1990. Measuring image spillovers in umbrella-branded products." *Journal of Business*, pp.309-329.

Thomadsen, R., 2005. The effect of ownership structure on prices in geographically differentiated industries. *RAND Journal of Economics*, pp.908-929.

United States Department of Agriculture (USDA) report: "Basic Report: 14209, Coffee, brewed from grounds, prepared with tap water". (see the url link: https://ndb.nal.usda.gov/ndb/foods/show/14209)

US Department of Agriculture, Agricultural Research Service, Nutrient Data Laboratory. USDA National Nutrient Database for Standard Reference, Legacy. Version Current: April 2018. Internet: /nea/bhnrc/ndl

Villas-Boas, S.B., 2007a. Vertical relationships between manufacturers and retailers: Inference with limited data. *The Review of Economic Studies*, *74*(2), pp.625-652.

Villas-Boas, S.B., 2007b. Using retail data for upstream merger analysis. *joclec*, *3*(4), pp.689-715.

Wernerfelt, Birger, 1998. Umbrella Branding as a Signal of New Product Quality: An Example of Signalling by Posting a Bond. *The RAND Journal of Economics* 19, no. 3, pp.458-66.

Wooldridge, J.M., 2002. Econometric analysis of cross section and panel data MIT Press. *Cambridge, MA*, *108*.

Appendix B – Some Details of Sample Construction

The IRI weekly scanner data sample contains more than 36 million records across 2119 grocery and drug stores in 410 U.S. counties. Concerning the difficulty of estimating the discrete choice demand model with such a large data set, we select a subsample of these weekly observations in zip code areas, where the grocery stores satisfy the following criteria: (*i*) sell both Starbucks and Non-Starbucks brand packaged coffee products in each time period (a total of 60 year-month periods); (*ii*) locate in zip code areas with Starbucks café presence (i.e., markets without Starbucks café presence over the entire sample periods are dropped); and (*iii*) locate in zip code areas with the number of Starbucks café varies over time (i.e., markets with constant number of Starbucks cafés are dropped). The resulting subsample has total weekly records of 2.4 million.

We focus on two coffee categories according to the coffee classifications in the IRI data: regular caffeinated and decaffeinated ground coffee. This is because the two categories account for more than 74% of all coffee sales in the grocery channel belonging to Starbucks Corp. during the sample periods. All other categories are characterized into "others" including: instant, whole bean, single-cup pods, and other coffee substitutes.

When constructing the product attribute variables for the demand estimation, observations due to apparent data entry coding error are removed. Caffeine content is approximated using information from USDA.[28] According to this report, on average, 0.61 gram of ground coffee contains 40 mg caffeine, equivalently, 1.86 gram caffeine per ounce of dry coffee ground. In the data, observations classified as "caffeine" are assumed to have regular caffeine content, i.e., 1.86 grams per ounce dry coffee grounds. Observations with "decaffeinated" or "caffeine-free" have zero gram caffeine. Observations with "20% more caffeine" have caffeine content of 1.86 multiplied by 1.2. Observations with "50% decaffeinated", "half caffeine", "50% less caffeine" have caffeine content of 1.86 multiplied by 0.5.

Product packages for ground coffee include laminated bags (e.g., foil bags), paper bags/boxes, plastic canisters, and light metal tins.[29] We use this information to create package-type dummies used in the demand model.

[28] National Nutrient Database for Standard Reference Release 27, "Basic Report 14209, Coffee, brewed from grounds, prepared with tap water". This report can be accessed from the following URL: https://plastics.americanchemistry.com/LCI-Summary-for-8-Coffee-Packaging-Systems/

[29] More details in URL link: https://plastics.americanchemistry.com/LCI-Summary-for-8-Coffee-Packaging-Systems/

Appendix C – Tables of Estimates

Table A1: Data Points in Figure 2 and Figure 4

	Mean Own-price Elasticities (Figure 2)				**Mean % Changes in Product-level Prices (Figure 3)**			
	Starbucks		Non-Starbucks		Starbucks		Non-Starbucks	
Nshop	mean	std. error	mean	std. error	mean (%)	std. error	mean (%)	std. error
0	-1.891***	0.012	-1.074***	0.009	0.390***	0.007	1.474***	0.013
1	-1.924***	0.012	-1.225***	0.008	0.392***	0.005	0.987***	0.008
2	-1.869***	0.007	-1.222***	0.007	0.498***	0.004	0.749***	0.005
3	-1.841***	0.012	-1.268***	0.01	0.539***	0.007	0.784***	0.009
4	-1.894***	0.009	-1.290***	0.007	0.517***	0.005	0.578***	0.004
5	-1.943***	0.011	-1.266***	0.009	0.562***	0.005	0.672***	0.005
6	-1.917***	0.014	-1.248***	0.012	0.616***	0.006	0.498***	0.005
7	-1.864***	0.019	-1.298***	0.014	0.519***	0.007	0.408***	0.007
8	-1.877***	0.016	-1.191***	0.012	0.463***	0.009	0.724***	0.01
9	-1.774***	0.025	-1.156***	0.02	0.681***	0.01	0.249***	0.011
10	-1.845***	0.032	-1.266***	0.033	0.811***	0.024	0.354***	0.011
11	-1.859***	0.046	-0.962***	0.021	0.114***	0.029	1.172***	0.048
12	-2.192***	0.066	-1.558***	0.043	0.678***	0.018	0.028***	0.006
13	-2.257***	0.075	-1.574***	0.071	0.374***	0.018	0.145***	0.013
14	-2.243***	0.04	-1.542***	0.025	0.661***	0.008	-0.042***	0.002
15	-2.523***	0.04	-1.830***	0.015	0.295***	0.022	0.022***	0.002
16	-2.365***	0.047	-1.800***	0.017	0.268***	0.017	0.033***	0.002
17	-2.848***	0.046	-1.735***	0.032	0.136***	0.005	0.004***	0.002
18	-2.250***	0.028	-1.452***	0.018	0.240***	0.011	0.026***	0.002
19	-2.404***	0.05	-1.398***	0.037	0.235***	0.017	0.029***	0.002
20	-2.585***	0.03	-1.518***	0.018	0.133***	0.006	-0.005***	0.001
21	-2.378***	0.023	-1.512***	0.026	0.161***	0.008	-0.014***	0.001
22	-2.388***	0.028	-1.202***	0.017	0.161***	0.008	-0.029***	0.001

Notes: ***p<0.01; **p<0.05; and *p<0.1 indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table A2: Data Points in Figure 5

	Mean % Changes in Aggregate Demand				Mean % Changes in Product-level Quantities				Changes in Total Demand (in 1000 oz)	
	Inside Goods		Outside Good		Starbucks		Non-Starbucks		Starbucks	Non-Starbucks
Nshop	mean (%)	std. error	mean (%)	std. error	mean (%)	std. error	mean (%)	std. error		
0	6.740***	0.024	-9.699***	0.035	14.636***	0.032	6.938***	0.01	73.811	538.037
1	6.741***	0.017	-9.700***	0.024	14.126***	0.021	6.637***	0.007	121.387	752.526
2	6.488***	0.011	-9.337***	0.016	13.181***	0.017	6.262***	0.004	274.317	1248.784
3	6.238***	0.015	-8.977***	0.021	12.836***	0.02	5.901***	0.008	220.438	854.918
4	6.016***	0.01	-8.657***	0.014	12.352***	0.017	5.599***	0.004	253.245	972.998
5	5.714***	0.012	-8.222***	0.017	11.912***	0.019	5.170***	0.005	216.867	654.835
6	5.427***	0.014	-7.809***	0.02	11.187***	0.021	4.906***	0.005	188.914	532.063
7	5.159***	0.017	-7.424***	0.025	11.178***	0.025	4.667***	0.007	95.256	275.412
8	4.661***	0.023	-6.707***	0.033	11.177***	0.034	4.312***	0.007	51.762	172.699
9	4.567***	0.024	-6.571***	0.034	9.749***	0.027	3.851***	0.008	31.664	57.490
10	4.297***	0.037	-6.184***	0.054	9.329***	0.068	3.537***	0.01	10.725	17.846
11	3.501***	0.036	-5.038***	0.052	11.495***	0.104	3.564***	0.034	1.239	22.624
12	3.856***	0.023	-5.549***	0.034	8.713***	0.044	2.932***	0.009	8.665	12.261
13	3.364***	0.037	-4.840***	0.054	8.910***	0.054	2.751***	0.01	4.969	16.901
14	3.283***	0.011	-4.725***	0.015	7.741***	0.023	2.218***	0.005	31.994	33.532
15	2.846***	0.01	-4.095***	0.015	8.424***	0.028	2.140***	0.006	3.208	5.865
16	2.484***	0.014	-3.575***	0.02	8.185***	0.057	1.857***	0.008	1.491	3.615
17	2.108***	0.01	-3.033***	0.014	8.228***	0.028	1.628***	0.004	0.872	2.110
18	1.871***	0.012	-2.692***	0.017	7.650***	0.04	1.256***	0.006	1.972	3.451
19	1.558***	0.023	-2.242***	0.032	7.226***	0.07	0.983***	0.006	1.249	2.446
20	1.166***	0.011	-1.678***	0.015	7.323***	0.026	0.725***	0.004	0.763	1.054
21	0.882***	0.01	-1.269***	0.014	6.928***	0.022	0.368***	0.003	0.888	0.574
22	0.584***	0.012	-0.841***	0.017	6.540***	0.035	0.031***	0.003	0.804	0.066

Notes: ***p<0.01; **p<0.05; and *p<0.1 indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table A3: Data Points in Figure 6 and Figure 7

Nshop	Mean % Changes in Individual Consumer Surplus (Figure 6)								Mean Dollar Changes in Market-level Total Welfare (Figure 7)	
	Total Effect **(Solid line)**		**Price** Effect **(Short-dotted line)**		**Nshop** Effect **(Short-dashed line)**		**Outside Good** Effect **(Long-dashed line)**			
	mean (%)	std. error	mean (%)	std. error	mean (%)	std. error	mean (%)	std. error	mean	std. error
0	4.977***	0.087	-1.926***	0.053	7.047***	0.075	-5.145***	0.057	922.03***	44.63
1	6.738***	0.074	-1.389***	0.038	8.227***	0.081	-4.992***	0.056	1320.40***	24.09
2	6.427***	0.049	-1.025***	0.02	7.525***	0.047	-3.687***	0.025	1155.47***	18.03
3	7.543***	0.078	-1.023***	0.024	8.637***	0.083	-3.436***	0.036	1292.24***	19.77
4	7.672***	0.053	-0.751***	0.015	8.473***	0.053	-2.677***	0.018	1316.71***	14.62
5	7.972***	0.062	-0.776***	0.017	8.797***	0.065	-2.164***	0.017	1372.07***	22.2
6	7.909***	0.056	-0.596***	0.017	8.543***	0.057	-1.514***	0.013	1273.09***	23.77
7	8.370***	0.089	-0.532***	0.023	8.934***	0.091	-1.091***	0.013	1385.70***	30.38
8	9.337***	0.186	-0.925***	0.043	10.309***	0.198	-0.762***	0.015	1234.92***	40.25
9	8.903***	0.119	-0.432***	0.023	9.360***	0.127	-0.212***	0.004	1070.42***	41.43
10	9.242***	0.173	-0.483***	0.02	9.753***	0.175	0.202***	0.003	1837.64***	34.58
11	9.727***	0.488	-0.887***	0.069	10.648***	0.497	0.690***	0.032	870.29***	96.09
12	12.480***	0.3	-0.251***	0.027	12.749***	0.32	1.244***	0.027	1807.46***	170.02
13	11.126***	0.239	-0.217***	0.033	11.354***	0.226	1.544***	0.031	912.30***	28.31
14	11.341***	0.121	-0.174***	0.008	11.529***	0.123	1.859***	0.019	1837.76***	95.74
15	10.770***	0.183	-0.086***	0.005	10.862***	0.185	2.179***	0.039	791.16***	21.03
16	13.834***	0.281	-0.158***	0.012	14.000***	0.287	3.175***	0.063	1507.42***	4.01
17	16.591***	0.75	-0.063***	0.005	16.658***	0.752	4.314***	0.191	704.46***	4.43
18	11.094***	0.099	-0.079***	0.006	11.177***	0.099	3.171***	0.031	1496.81***	23.07
19	11.728***	0.362	-0.067***	0.005	11.799***	0.359	3.653***	0.112	1173.12***	38.66
20	12.488***	0.321	-0.018***	0.002	12.507***	0.321	4.199***	0.104	754.02***	3.24
21	12.321***	0.195	-0.011***	0.001	12.333***	0.196	4.432***	0.069	878.61***	2.48
22	12.437***	0.197	-0.003***	0.002	12.441***	0.197	4.761***	0.074	933.09***	1.88

Notes: ***p<0.01; **p<0.05; and *p<0.1 indicate statistical significance at 1%, 5% and 10% levels, respectively.