The Distributional Consequences of Entry at the Top: Estimating the Whole Foods Effect

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Abstract

Increased competition has been shown to increase consumer welfare. But does increased competition, especially when it arrives at the top of a vertically differentiated market, benefit all consumers equally? In this paper, I study the growing "better-for-you" segment of the food retail market, which at first seems like a positive transformation for both consumer welfare and the environment. However, these products are mainly targeted at high-income consumers. Increasing income inequality may have accelerated the development of this high-end market, with positive consequences on the welfare of these consumers, but possibly negative consequences for low-income consumers through decreased competition, higher prices and/or lower quality for basic groceries. In this paper, I test this hypothesis by studying the impact of the entry of Whole Foods in a new area - a symbol of gentrification - on the incumbent grocery stores' offers in terms of prices and quality. I find that on average incumbent stores increase prices for the same goods and decrease the variety of the goods their offer, which translates into a decrease in welfare for low-income households who cannot switch to the high-quality, high-price entrant.

Keywords: entry, inequality, environment, health

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"The capitalist process, not by coincidence but by virtue of its mechanism, progressively raises the standard of life of the masses"

Joseph Schumpeter, *Capitalism, Socialism, and Democracy*

1 Introduction

Who benefits from accrued competition? Starting with Smith (1776), economists have emphasized the role of competition between firms in increasing the welfare of consumers. Bertrand (1883) and Cournot (1838) later developed models to describe the competition phenomenon, and in particular to explain what happens when more firms enter in a market. Generally, these models predict that when there are more firms in a market, *ceteris paribus*, quantities are higher, prices are lower and consumer welfare increases more than profits decrease. For a long time, the literature viewed consumers as a single block, and therefore all individuals were thought of as benefiting equally from new entry.

This changed with the increased scrutiny of differentiation models (Hotelling (1929), Shaked and Sutton (1982)). When thinking about additional entry in a high-end submarket (or for high-end products in a given market), the same predictions hold true. For example, more firms making luxury cars is predicted to lower prices, increase quantities sold and increase the welfare of luxury-car consumers. An important question is how that affects the low-end goods in that market. In my example, the intensification of competition for luxury cars may have contributed to cost cutting discoveries, leading to decreases in prices, or increases in quality for basic cars. This idea is embedded in the notion of the life-cycle of products and creative destruction, which was developed in by Schumpeter (1942). The "trickle-down hypothesis" was often evoked by the Reagan administration (1981-1989) to express the idea that cutting tax on the wealthy would stimulate investment and growth for the rest of consumers. This was widely criticized and remains an important question today in a context of rising economic inequality: the top 1% earning individuals earned 13% of the national earnings in the United States in 2005, compared to just 6% in the 1980's according to Kopczuk et al. (2010). The increasing number of extremely rich consumers creates higher incentives for firms to compete for high-end products than to compete for low-end products. Jaravel (2016) suggests that this phenomenon contributes to differential inflation between high-income households and low-income households. He documents a 0.7 percentage points effect between the top income quintile and the bottom income quintile, resulting from increasing variety and competition for the high-end segments of each consumer goods market. In this paper, I go further by investigating the mechanisms behind the trickle-down effect or its absence: the reactions of incumbent firms to entry and in particular their endogenous choice of quality and its implication for consumer welfare.

To study this question, I focus on the food retail market in the US. This is a relevant sector, because growth in this inferior-good market for one of the richest and most well-fed country in the world is fundamentally limited. In figure 1, I show that real grocery store sales have increased slower than both real GDP and population over the last 25 years. This feature of the market has made it very important for firms to differentiate in order to keep creating value.

In the 1980's and 1990's, grocery stores focused on the low-end segment of the market. They invented private-value labels, which often offer goods produced by the same manufacturers as branded items but with less marketing, less advertisement spending and for cheaper prices. It was also the era of mass retail and discount stores, as documented in Jia (2008) and Zheng (2016). More recently, however, the focus has been on the high-end of this market: products that are better for the consumer's health ("better-for-you" segment), products that are better for the environment or the producers (organic, fair-trade, etc.) and products that are exotic, rare or original. These products seem intuitively - and I will document this fact - oriented towards high-income households, contrary to private-value labels or bulk products.

Differences in food consumption patterns between high-income and low-income households, like differences in consumption of other kinds of good, are a consequence of socioeconomic inequality. Households with different resources have different tastes and make different choices. But what makes studying this sector particularly interesting is that differences in food consumption are also a cause of more socioeconomic inequality: cheap and high-fat diets, which are cheaper, contribute to health problems such as obesity and diabetes that impede upward social mobility (Cawley (2004)). While the first relationship may be seen as a purely political choice, the second one is an illustration of two economic problems. For a lot of people, cheap and unhealthy food is a trap into a cycle of poverty (internality). Moreover, health problems are not only undesirable *per se* for a society, but also economically costly, not the least through Medicaid and Medicare programs (externality).

The development of organic food and other "healthy foods" trends in developed countries appears as a movement against both of these market failures. Allcott et al. (2018) show that observed differences in choices are accounted for much more by preferences than by access, contradicting the popular idea that "food deserts" are responsible for the unhealthiness of poor households' food purchases. Trends like the increase in the consumption of organic food as documented in figure 2 are an example of a change in consumer preferences towards healthier products. However, these trends are supported by high-income households, who go to new high-end stores to buy healthy and expensive food. The entry of Whole Foods in a neighborhood is often described as a symbol of gentrification[2]. Put differently, the rise of organic food is an example of a potential increase in quality differentiation and price discrimination. In general, price discrimination need not be welfare decreasing, in particular if it enables low willingness to pay consumers to access a good that would otherwise only be provided to consumers with high willingness to pay. For example, DellaVigna and Gentzkow (2017) show that the use of uniform pricing (across stores) by large supermarket chains tends to rise the prices paid by poorer households relative to the rich. They argue that if grocery stores were able to price independently, poor households would enjoy lower prices. This may limit the possible effect of local entry on local incumbents' prices. However, their research question by nature restricts the kind of products they study to the ones present in all chains and sold in 80% of store-weeks (1,365 products, 8 percent of revenue). The question I am interested in is how stores use both

[2]http://nymag.com/intelligencer/2017/07/harlem-gentrification-whole-foods-vanishing-new-york.html

prices and assortment or quality to cater to different segments of the population. While stores might be constrained by their chains to offer a certain branded orange juice for a certain price, they are able to choose whether to offer it or not, and in combination or as a substitution to an organic orange juice or a frozen fruit drink, for example. Therefore, when more firms compete in the high-end segment, this may mean that firms in the low-end segment decrease quality to cater more precisely to the lower-income households (which has an ambiguous welfare effect), or increase quality to compete with the new entrant (which also has an ambiguous welfare effect since it may mean lower-income households are priced out).

In this paper, I study the impact of the increasing competitiveness of the organic segment of the food retail sector, which I argue is a good example of a growing high-end segment of a vertically differentiated sector, on the rest of the market. I do this by combining several datasets, including Nielsen Homescan, Nielsen's Retail Measurement Services, and new data I collected on the announcement and entry dates, as well as exact locations, of all new Whole Foods supermarkets that opened in the United States between 2006 and 2016.
In a first step, I study the reaction of incumbent stores to the entry of Whole Foods. I do this using Nielsen's scanner dataset (which does not cover Whole Foods). Using the entry dates and addresses computed by combining industry and newspaper sources, I perform an event study to look at the evolution of sales, prices and assortment across time, before and after the first entry of a Whole Foods outlet. I find that on average, prices increase by 1.5% (on top of inflation) by 24 months after entry and variety decreases over the 36 months following entry.
In a future step, I will study the consequences of entry and reaction to entry on consumer demand, for both low-income and high-income families. I will do this using Nielsen's homescan panel dataset. Since this dataset covers all the products panelists buy, products sold only by Whole Foods are covered and I will be able to track both substitution between purchases at incumbent stores (including an incumbent that's similar in terms of offer, but further away) and the new store, as well as substitutions between products and other stores in reaction to possible changes in assortment decisions of local stores. Assuming preferences are constant over a short period of time, this will enable be to compute the welfare impact of the entry of a store from the high-end specialized organic chain. In a third step, I intend to link products I observe in the Nielsen data to nutritional information published by the USDA to think about the potential consequences of the effect of Whole Foods on the quality of food consumed by shoppers at incumbent stores.

This paper contributes to a literature within industrial organization which looks at the consequences of entry. Some papers have shown that in the context of quality differentiation, entry of new firms does not necessarily lead to better outcomes for consumers: Perloff et al. (1995) show that entry leads to higher prices but also higher consumer welfare in a context of horizontal differentiation, while Ershov (2018) shows that the entry of extremely popular firms ("superstar") in a market leads to higher (excessive) entry and lower prices, but also lower quality in a context of horizontal and vertical differentiation and search costs. Chen and Riordan (2008) explain that the market share effect (decrease in quantity sold) creates an incentive for

firms to decrease their price after entry, but it may be compensated by the price sensitivity effect. The latter emerges from the fact that when there are more firms in the market, each offering a different quality level, consumers who shift to the new entrant reveal a preference for their quality, and are therefore less willing to switch back to another product for a slight price increase. The authors identify the conditions under which the price under duopoly is higher than the price under monopoly in a symmetric two-product, two-firm market. In this paper, I take this idea to the data by studying empirically an oligopolistic market with entry at the top. The context I study offers a clean vertical differentiation dimension.

This paper relates to a small group of papers that study the consequences of the entry of foreign supermarkets in developing countries, where they usually disrupt the grocery sector from the top (Javorcik and Li (2013), Iacovone et al. (2015)). In particular, Atkin et al. (2018) study the impact of the opening of Wal-Mart in thousands of Mexican municipalities on consumer welfare. In Mexico, a developing country whose grocery store was until recently dominated by small-scale "mom-and-pop" stores, Wal-Mart entered as a top-quality competitor, offering cheaper prices for the same products, but higher quality and higher prices on average. They show that the entry of Wal-Mart in a municipality led incumbent stores to decrease prices of existing goods, which means that all consumers benefited from entry at the top, although high-income consumers benefited more since they were also able to upgrade quality by switching to Wal-Mart. The authors do not document the evolution of quality in the incumbent stores, which I offer to do in my context.

This paper also contributes to a literature that studies the impact of new grocery stores in the United States, in particular Walmart (Basker (2005), Hausman and Leibtag (2007), Jia (2008), Holmes (2011)), which has been shown to put a lot of pressure on smaller-scale competitors. In a future development of this paper, I could expand the theoretical framework to think about firms' profit functions and entry decisions in markets where there is horizontal differentiation on top of the organic (vertical) dimension. In particular, since I am thinking about both the product space and the store space, it would be interesting to think about Whole Foods' expansion and assortment strategy, as in Zheng (2016).

I structure the remainder of the paper as follows: Section 2 describes the food retail context and provides motivating evidence. Section 3 sketches the theoretical framework. Section 4 describes the three datasets. Section 5 presents the empirical strategy and the estimation results. Section 6 concludes. All figures and tables are in section 7.

2 Background and motivating evidence

In this section, I describe the organic food retail market in the US and how it fits the description I gave in the introduction of (1) growing market with where many new firms enter and (2) the high-end segment of a larger market.

2.1 Background

The organic label[3] regulated by the United States Department of Agriculture (USDA) guarantees that the products have been grown 'without excluded methods' (e.g. genetic engineering, ionizing radiation, or sewage sludge) and 'using allowed substances', which exclude a wide range of pesticides; and have been controlled by an auditor - private firms who are contracted and supervised by the USDA.

The organic certification is more about the processes than the results: the label is not given or taken away from a farmer because there are no residuals of forbidden substances, but because the farmer has demonstrated that they have followed the accepted protocols, which implies precise documentation of all of their activities. The organic label in the US can therefore be interpreted as a signal of quality in the vertical sense: for two products (in the barcode sense) that are the same food item but one has the organic label and one does not, it is fair to say that most consumers would value the organic one more, even if not all are willing to pay the corresponding price premium.

The National Organic Program was created in 2000. Although certified organic food is a still niche market ($50 billion, about 5% of US food sales), it is one of the most dynamic segments of the US food market, averaging a 10% annual growth rate in the last 15 years, as illustrated in figure 2. This reflects a long-term trend in consumer tastes, that now put more and more value on health and sustainability aspects. The early indications of this trend were picked up by Kiesel and Villas-Boas (2007), who identified the shift of fluid milk consumers away from private labels mentioning organic practices, and towards the USDA's organic label in the few years following the introduction of the latter.

The organic grocery market emerged with the National Organic Program (before, it was confounded with the "natural" and "healthy" grocery market) and it expanded greatly in the late 2000's and through the 2010's. As illustrated in figure 3, between 2006 and 2016, my sample period, the number of supermarkets selling organic food[4] quadrupled from 455 to 2115. At the start of my sample in 2006, there were 555 organic stores in 262 counties. In contrast, in 2016 1,985 organic stores were present in 470 counties.

I focus on the expansion of Whole Foods Market stores now, because they are the flagship chain of this high-end market, claim to be "America's healthiest grocery store" and have acquired the nickname "whole paycheck" on top of often being associated with the gentrification of a neighborhood. All of these reputational elements illustrate the hypothetical high-end market segment I was describing earlier. Moreover, Whole Foods, a corporation that started from a single natural store foods store in Austin, Texas in 1978, now has almost 500 stores[5] across three countries (although mostly located in the US). It almost doubled its number of stores over the 11 years of my data, going from 213 stores in 262 counties in 2006 to 454 stores in 470 counties in 2016 (see figure 7). I may expand to other specialized high-end stores later.

[3] https://www.ams.usda.gov/rules-regulations/organic/labeling

[4] registered under SIC code 549935 in the database ReferenceUSA

[5] 499 stores as of today, April 6, 2019. Source: https://www.wholefoodsmarket.com/company-info

2.2 Motivating evidence

How do organic products and the consumers in this submarket differ from the rest of the market? In this subsection, I use prices from Nielsen's scanner data and the consumer panel data from Nielsen's Homescan dataset (described in section 4) to document stylized fact about the organic market.

I describe the organic premium observed in my data in table 1. It comforts the intuition that organic products are much more expensive than very similar non-organic products. The average price premium is almost 30% even when controlling for product codes, which describe items in a precise way (for example, "frozen french beans"). One may be concerned that this does not describe completely the products, as organic items may be sold in smaller sized-packages for a price. While I acknowledge this issue, I think that it is likely to be a downward bias on the organic premium.

I describe the correlation between household incomes and organic food consumption in table 2, fitting a GLS logit model on the proportion of dollars spent on food that are spent on organic food by households present in the 2016 Nielsen panel data[6]. Nielsen does not give the actual income of the households but gives a bracket. Being in the fifth income group (household income of $100,000 or over) is predicted to increase the share of organic food dollars by 0.77 compared to being in the first group (income below $10,000). In addition, the current study is motivated by the results of a previous project which estimated the demand for fresh apples in the United States. Tables 3 and 4 present the results obtained from estimating a logit demand model for fresh apples in a high-income market and a low-income market, respectively. I focused on displaying the coefficients for price and the organic characteristic but controlling for variety and grade (a measure of quality for fresh apples). Quite consistently across specifications, price sensitivity is low for the high-income market while the valuation for the organic characteristic is positive and significant, while price sensitivity is high for the low-income markets and the valuation for the organic characteristics is nil.

I believe this is evidence that the organic food market is a high-end market with higher prices and geared towards high-income consumers, making it a clear example of a high-end market where where increased competition may not at first appear to affect the rest of the market.

3 Theoretical framework

In this section, I describe a framework to study the impact of entry in a high-end market on outcomes in the low-end version of that market, in the context of oligopolistic competition with vertical differentiation, following Mussa and Rosen (1978). To simplify, I focus on entry at the top in a two-firm market but may expand it to N firms later.

3.1 Setup

Consider an industry with two incumbent firms, A and B, who are vertically differentiated. Consumers buy exactly one good each. The utility of a consumer of type $\theta \in [0, 1]$ when she

[6] a 10% random subsample of them

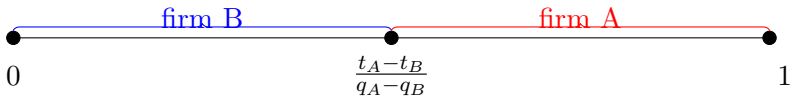
consumes a product of quality $q \in [0, \bar{q}]$ and pays the price t is given by:

$$U(q,t) = v + \theta q - t$$

where $v > 0$ is a gross utility parameter common to all consumers. The parameter θ is uniformly distributed over $[0,1]$ and there is a mass 1 of consumers. I assume that v is sufficiently high, so that all consumers will purchase the good in equilibrium, which is a reasonable assumption in the case of groceries (may be less so in other markets). The expected consumer welfare generated by a firm offering good of quality q at price t to D consumers is

$$E[CS(q,t)] = D \times \left(v + \int \theta f(\theta) d\theta q - t \right)$$

Firms A and B choose their qualities $q_A \in [0, \bar{q}]$ and $q_B \in [0, \bar{q}]$ and their prices $p_A \geq 0$ and $p_B \geq 0$. All production costs are set equal to zero. A consumer of type θ purchases from firm A if $U_\theta(q_A, p_A) \geq U_\theta(q_B, p_B)$, and from firm B otherwise. Firms first choose their qualities simultaneously, then their compete in prices. Consumers choose their good under full information. Suppose w.l.o.g. $q_A > q_B$, consumers split according to their taste for quality:



In equilibrium, there is maximal differentiation: $(q_A = \bar{q},\ t_A = \frac{2}{3}\bar{q})$ and $(q_B = 0,\ t_B = \frac{1}{3}\bar{q})$. The threshold is at $\frac{1}{3}$, which means $\frac{2}{3}$ of customers buy the high-quality good from firm A.

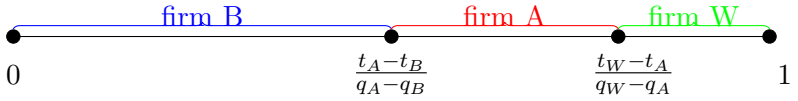
$$CS_A = \frac{2}{3}\left(\left(v - \frac{2}{3}\bar{q}\right) + \bar{q}E\left[\theta | \theta > \frac{1}{3}\right]\right) = \frac{2}{3}\left(v - \frac{2}{3}\bar{q}\right) + \bar{q}\frac{8}{18}$$

$$CS_B = \frac{1}{3}\left(v - \frac{1}{3}\bar{q}\right)$$

$$\text{Total } CS = v - \frac{5}{9}\bar{q} + \bar{q}\frac{8}{18} = v - \frac{1}{9}\bar{q}$$

3.2 Entry at the top, short term

Suppose this is the *status quo* and a new firm, W, enters the market with $q^W > \bar{q}$.



If the incumbents are not able to adjust either quality or price, the entrant simply steals business away from the previous top quality firm (firm A) while firm B is not affected by this increased entry at the top. This case serves as a benchmark and may also correspond to a real-life issue of sticky prices, if the incumbents are taken by surprise. Consumer welfare necessarily increases overall, which entirely comes from the fact the switchers from firm A to firm W, as

by revealed preference they prefer the bundle (q_W, t_W) to the bundle $(\bar{q}, \frac{2}{3}\bar{q})$. The optimal price for firm W is $t_W = \frac{q_W}{2} - \frac{\bar{q}}{6}$, which leads to an increase in welfare of

$$\Delta CS_W = \underbrace{1 - F\left(\frac{t_W - t_A}{q_W - \bar{q}}\right)}_{\text{Switchers}} \left[\underbrace{(q_W - \bar{q}) E\left[\theta \middle| \theta > \frac{t_W - t_A}{q_W - \bar{q}}\right]}_{\text{Quality effect}} - \underbrace{(t_W - t_A)}_{\text{price effect}} \right]$$

Prediction 1 In the very short term (sticky prices), entry at the top benefits high-income consumers and has no impact on the welfare of other consumers.

3.3 Entry at the top, medium term

If the incumbents are able to adjust their price but not their quality; both incumbents react by decreasing their price. Firm A maintains a large market share, $\frac{2}{3}$ (as in the two-firm case), at the expense of firm B. This means there are now two type of switchers: from good A to good W and from good B to good A. Consumer welfare increases for both of these consumers by revealed preference: either they benefit from a lower price or they benefit from a higher quality good (with potentially a higher price). If they choose the latter it means they are gaining more from that than from just the price decrease. In addition, "stayers" also benefit from a decrease in price.

$$\begin{aligned}
\Delta CS_W = & \underbrace{1 - F\left(\frac{t_W - t_A^*}{q_W - \bar{q}}\right)}_{\text{Switchers A to W}} \left[\underbrace{(q_W - \bar{q}) E\left[\theta \middle| \theta > \frac{t_W - t_A^*}{q_W - \bar{q}}\right]}_{\text{Quality effect}} - \underbrace{(t_W - t_A)}_{\text{price effect}} \right] \\
& + \underbrace{\left(F\left(\frac{t_W - t_A^*}{q_W - \bar{q}}\right) - F\left(\frac{t_A^* - t_B^*}{\bar{q}}\right)\right)}_{\text{Switchers B to A}} \left[\underbrace{\bar{q} E\left[\theta \middle| \frac{t_A^* - t_B^*}{\bar{q}} < \theta < \frac{t_W - t_A^*}{q_W - \bar{q}}\right]}_{\text{Quality effect}} - \underbrace{(t_A^* - t_B)}_{\text{price effect}} \right] \\
& + \underbrace{F\left(\frac{t_W - t_A^*}{q_W - \bar{q}}\right) - F\left(\frac{1}{3}\right)}_{\text{Stayers A}} \left[- \underbrace{\left(t_A^* - \frac{2}{3}\bar{q}\right)}_{\text{Price difference}} \right] + \underbrace{F\left(\frac{t_A^* - t_B^*}{\bar{q}}\right)}_{\text{Stayers B}} \left[- \underbrace{\left(t_B^* - \frac{1}{3}\bar{q}\right)}_{\text{Price effect}} \right]
\end{aligned}$$

Prediction 2 In the medium term (flexible prices but fixed quality), entry at the top benefits high-income consumers who switch to a higher-quality good (directly thanks to entry) and some low-income consumers who switch to a higher-quality good thanks to the pro-competitive effect of entry. Consumers who do not switch also benefit from this pro-competitive effect as they face lower prices.

3.4 Entry at the top, long term

If the incumbents are able to adjust their quality and all firms compete in price in a later stage; the model becomes very quickly intractable, as has been made clear by Anderson et al. (1992). To simplify, I impose that $q^W = 1$ and I focus on firm A's optimal choice of quality (forcing firm B to stay at $q_B = 0$). An important modeling choice is how to represent the cost of changing quality. I represent it as a one time investment, with $C = c\left(\bar{q} - q^A\right)^2$. I find that the optimal

quality,

$$q_A^* = \frac{9c\bar{q} - 1}{9c - 2} \geq \bar{q} \text{ iff } \bar{q} \geq 0.5$$

which I interpret as the idea that if the gap between the entrant's quality and the top incumbent is small, the entrant will increase its quality to compete at the top, while if the gap is too large, the entrant will decrease its quality to compete at the bottom.

The second result is very intuitive: the higher the cost to upgrade quality, the smaller the quality upgrading will be for firm A, with a quick convergence to zero change. The welfare consequences are more complex. Switchers from good A to good W prefer good W to the new bundle offered by firm A, but it does not mean they have a net gain. Similarly for switchers from firm B to firm A and for stayers at firm A who may experience a contraction of their consumer surplus. Stayers at firm B benefit from a price decrease, but this is because I constrain firm B to stay at quality zero.

$$\begin{aligned}
\Delta CS_W = & \underbrace{1 - F\left(\frac{t_W - t_A^{**}}{q_W - \bar{q}}\right)}_{\text{Switchers A to W}} \left[\underbrace{(q_W - \bar{q}) E\left[\theta \middle| \theta > \frac{t_W - t_A^{**}}{q_W - \bar{q}}\right]}_{\text{Quality effect}} - \underbrace{(t_W - t_A)}_{\text{price effect}} \right] \\
& + \underbrace{\left(F\left(\frac{t_W - t_A^{**}}{q_W - \bar{q}}\right) - F\left(\frac{t_A^{**} - t_B^{**}}{\bar{q}}\right)\right)}_{\text{Switchers B to A}} \left[\underbrace{q_A^{**} E\left[\theta \middle| \frac{t_A^{**} - t_B^{**}}{\bar{q}} < \theta < \frac{t_W - t_A^{**}}{q_W - \bar{q}}\right]}_{\text{Quality effect}} - \underbrace{(t_A^{**} - t_B)}_{\text{price effect}} \right] \\
& + \underbrace{F\left(\frac{t_W - t_A^{**}}{q_W - q_A}\right) - F\left(\frac{1}{3}\right)}_{\text{Stayers A}} \left[\underbrace{(q_A^{**} - \bar{q}) E\left[\theta \middle| \frac{1}{3}\theta < \frac{t_W - t_A^{**}}{q_W - \bar{q}}\right]}_{\text{Quality effect}} - \underbrace{\left(t_A^{**} - \frac{2}{3}\bar{q}\right)}_{\text{price effect}} \right] \\
& + \underbrace{F\left(\frac{t_A^{**} - t_B^{**}}{q_A^{**}}\right)}_{\text{Stayers B}} \left[- \underbrace{\left(t_B^{**} - \frac{1}{3}\bar{q}\right)}_{\text{Price effect}} \right]
\end{aligned}$$

Prediction 3 In the long term, entry at the top has ambiguous welfare benefits on all consumers. In particular, middle-income consumers may suffer from a contraction of their surplus with lower quality and higher price.

3.5 Entry at the top in a context of internalities

As described above, it is difficult to study the welfare effect of changes in the market structure in a context of vertical differentiation. What makes it even more complex, and of course more interesting in this context, is the internality problem. Consuming cheap food might appear like the best choice in terms of instantaneous welfare, but may be suboptimal once we take into account future health. Therefore, being "forced into" a higher-quality market (in the sense that the consumer surplus now is lower than what it would have been in the two-firm case) can increase welfare in the long term. In future work, I hope to take this into account empirically and will therefore expand the model in this direction.

4 Data

4.1 Nielsen Retail Scanner Data

I work with Nielsen's scanner dataset for the fresh produce and frozen departments[7] between 2006 and 2016. This data reports prices charged for each product (defined by its barcode) each week and the volume sold each week, in the 35,000 participating stores across the United States. I only work with grocery stores, which is a sample of about 10,000 stores[8]. My main analysis is at the month unit, so I aggregate the weekly data and compute prices for each barcode by taking the weighted average of the weekly prices for each month. I measure quality of grocery stores by the variety of their assortment, which I define as the number of different products available in each category each month, for organic and non-organic products. Another important quality dimension of groceries if their nutritious quality but I postpone this analysis to future work.

4.2 Nielsen Homescan Data

I also work with Nielsen's panel dataset from 2004 to 2016. About 40,000 to 60,000 households participate each year. They report all of their purchases, including the barcode and the price paid thanks to an in-home scanner. This is complementary to the scanner data because they report purchases from any outlet, so beyond Nielsen's partner stores. I also observe some demographic information about the households, including where they live and an income bracket.

4.3 Healthy Grocery Retail Establishments

I obtained the list of establishments selling "organic foods and services" (SIC 5499-35) on ReferenceUSA. In 2016 there were 2,145 such businesses in the US, 477 of which were Whole Foods Markets' stores. I cross-checked this list with the current list of stores given on the corporation's website, where I also collected the exact locations of each store.
I then collected the opening dates and announcement dates of Whole Foods Market new stores using ProQuest' news database, and occasionally Factiva. The process was as follows: for each store present in a given city, I entered in ProQuest search engine the following words "Whole Foods + opening city". I usually found the report in a local newspapers of the event hosted at the store on the opening day, which gave me the date. I then looked for the earliest news piece mentioning the upcoming entry of Whole Foods in that city among the first 20 news piece coming up in the search "Whole Foods + opening city + year" where year is the year of opening. This news piece was either local newspapers again or comments on Whole Foods' quarterly earning reports filed by the SEC. I always stored the link to the news sources, available upon request. When I went past the first 20 results of ProQuest and Factiva for the first step, I then collected the opening date from Yelp's website and did not complete the second step. Usually these are stores that opened before the start of my data.

[7] two of the 10 departments defined by Nielsen. The other eight are health/beauty, dry grocery, dairy, deli, packaged meat, non-food, alcohol, general

[8] The other stores in the dataset are described as belonging to the following channels: drug, mass, convenience and liquor

5 Estimating the Whole Foods Effect

In this section, I describe reduced form evidence of the effect of the entry of Whole Foods in a market on prices at the product level and on several outcomes at the store level.

5.1 Effect on Consumer Prices

To estimate the effect of the entry of Whole Foods on prices faced by consumers in that market, I combine information on new Whole Foods locations and opening dates with weekly panel data on barcode-level prices at the store level from the Nielsen scanner dataset (produce and frozen food departments) for the 2006-2016 period. I focus on the first time Whole Foods enters a given market (defined below), following Atkin et al. (2018)'s approach.

Studying the rapid expansion (200 more stores over 11 years) of a chain seems to offer the ideal setting for a staggered difference-in-difference study. However, since Whole Foods stores are not randomly allocated, this does not work as it appears that Whole Foods entered in markets where prices were increasing more than in markets where it did not enter. I focus instead on the markets where Whole Foods eventually opened a store over the period and perform an event study. The obvious identification concern with the event study is that store openings coincided with some kind of pre trends. A common intuition is that Whole Foods opened stores in locations with increasing prices, because they are experiencing income growth for example (gentrification argument). This would lead to an upward-biased estimate of the treatment effect of the entry of Whole Foods on other stores' prices. Alternatively, Whole Foods might target markets where there is a growing competition for high-end products, so that prices in other store are decreasing prior to their entry. This would lead to a downward-biased estimate. Last, it could be the case that Whole Foods has expanded as fast as possible without targeting particular areas. In this scenario, there would not be a substantial bias, as neither the locations or the timing would be very correlated with pre-existing time trends. In my event study, I can check for these pre-trends. I estimate the following regression:

$$\ln p_{bgsmt} = \sum_{j=-12}^{36} \beta_j \mathbb{I}(\text{Months Since Entry}_{mt} = j) + \delta_{gsbm} + \eta_t + \epsilon_{gsbmt}$$

where $\ln p_{bgsmt}$is the log price of a barcode-product b in product group g, individual store s, in market m and month t. I() is an indicator function, and Months Since Entry$_{mt}$ counts the months since the first foreign entry for each market m at time t (with negative values counting months before entry, positive values counting months after entry and zero being the month the first Whole Foods store enters a market). I chose the event window to be -12 to + 36 months to match Atkin et al. (2018)'s specification. In practice, this limits the events that I can look at, so I show my results for + 24 months.

I define markets by combining administrative data with knowledge about consumers' transportation habits. In Nielsen's scanner data, stores are anonymized and only their county and 3-digit zipcode is indicated. A county or a 3-digit zipcode area seem too large to be defined as a market: according to the 2017 National Household Travel Survey[9], the mean shopping trip

[9]https://nhts.ornl.gov/

distance was 7.1 miles, while the median and 75th percentile of shopping travel distance were 3 and 7 miles, respectively. Around each Whole Foods store, I therefore create a circle of radius 10 miles that corresponds to the area of influence of that store. I intersect it with the maps of the counties and the 3-digit zipcode areas (see figure 5). I define an area as affected by a Whole Foods during my study if it hosts exactly one - which excludes many areas where there are several Whole Foods close to each other -, and I exclude areas that are covered by the 10-mile radius circle but do not host the store itself. Using both counties and zipcodes allows this analysis to be finer than just using counties. Below, when I say area I always mean "intersection of county and 3-digit zipcode zone that hosts at least a Whole Foods in 2016 (area in green on the map in figure 5). To estimate the event study on a balanced sample of areas, I exclude zones where the first Whole Foods opened in the first 12 months of my dataset (2006) or in the last 36 months of my dataset (2014-2016). I am left with just 13 entry events, described in table 5. The results of this event study on log prices are shown in figure 6 and table 6. The coefficients for the months before the event are not significantly different from zero, start increasing right after entry and are consistently positive for 24 months after entry. I find that on average after two years, prices for similar products have increased by 2.5% (on top of time-related inflation, which is controlled for by the date fixed effects).

There are many caveats in this analysis, some which may be addressed with further work and some which are idiosyncratic to this context - and call for a different approach, which I take in the sections below. The first concern is that I am using only data from the fresh produce and the frozen department. I intend to expand this in further work. The second is that I only have about 100 events to study after I remove the ones that don't satisfy my "clean" criteria. I can also improve this aspect by expanding the analysis to more specialized high-end organic stores. To do this I intend to purchase the Nielsen TDlinx dataset covering the universe of "Natural Gourmet Foods Channel" stores entry and exit.

Perhaps more fundamentally, the problem is that most of the stores in the Nielsen scanner data belong to a chain and are not necessarily flexible in their prices, as was underlined by DellaVigna and Gentzkow (2017). This was not as much a concern in Atkin et al. (2018)'s study because the incumbent stores were traditional and independent retailers. However, one of the ways stores belonging to the same chain adapt to the varying market conditions they face in different markets is by varying assortment, as underlined by Hristakeva (2017). I therefore go on to study the variety of choices offered by each store.

5.2 Effect on incumbent stores' sales and quality

To estimate the effect of the entry of Whole Foods on incumbent stores in that market, I reproduce a similar event study as above - therefore with the same caveats - but at the store level. I look at sales in the two departments, as well as the average price overall (weighted by sales) and variety defined as the number of different items (barcodes) sold in a month.

$$y_{smt} = \sum_{j=-12}^{36} \beta_j \mathbb{I}(\text{Months Since Entry}_{mt} = j) + \delta_{sm} + \eta_t + \epsilon_{smt}$$

The result of this event study on sales is shown in figure 7. The coefficients for the months before entry are mostly not significant from zero and negative but not significantly different from zero after entry. This event study must be taken with precaution as I only aggregate the sales of stores over the produce and frozen categories.
The result of this event study on the average (sales-weighted) price in each store is shown in figure 8 and table 7. Although the confidence intervals are large, all the coefficients on the months after entry are zero, which suggests that if the price for similar products increased over time, as evidenced in 5.1, the price of the average item sold by these stores did not move. This means that the quality of the products sold must have decreased.
It is difficult to study quality empirically. In a future version of this project, I hope to define it using the U.S. Department of Agriculture's nutrition facts, building on a similar exercise carried by Allcott et al. (2018). For now, I focus on quality at store level, which for a retail outlet and a grocery store in particular depends on the variety of products available, measured here as the number of different barcodes sold in the store each month. The result of this event study on variety is shown in figures 9 and 8. The coefficients for the months before the event are not significantly different from zero, are quite unstable a few months after entry and start decreasing about 6 months after entry. They are significantly below zero at the 90% confidence interval (not shown here) for the period 12-36 months after entry. Although this result also has caveats because I am focusing on the frozen and produce departments (the latter department has a significant share of items without a barcode), it suggests that incumbent stores decrease their quality in terms of the variety they offer to consumers after Whole Foods enters. What is interesting is that this effect is entirely driven by a reduction in the variety of non-organic products (see figures 10 and 11 for organic and non-organic, respectively). This result probably hints at the fact that in most grocery stores there are so few organic products that there is little room to reduce their variety. Interestingly, in the first few months after entry the variety available of organic products seems to increase. Further study is determined to test whether this is an economically significant channel.

6 Conclusion

I study whether increased competition in the form of firm entry can have different impacts on different segment of consumers, in particular whether it can hurt low-income households even when consumer welfare increases overall. I study this in the context of the groceries market in the United States, where I argue the organic characteristic is clear example of vertical differentiation. The recent growth of that market, with the rapid expansion of high-end and specialized (health/organic) grocery stores across the country offers the ideal setting to study this question with the growing income inequality in mind. In this paper, I use scanner data to perform an event-study based on the first entry of Whole Foods, the main high-end organic grocery store chain, in an area. I find that prices for the same products at incumbent grocery stores increase, while the average product sold at this store does not change. However, variety of goods offered decrease, which reflects a decrease in quality and suggests overall a decrease in welfare for consumers I call "stayers" - who do not switch to the high-quality, high-price entrant

when they open.

In the future, I propose to take this project by expanding my analysis to more products and more events using Nielsen's TDLinx dataset. A structural extension is possible: estimating the demand model for groceries in particular would enable me to compute precisely the welfare effects I have described. Last, I intend to refine my definition of quality by incorporating the USDA's nutrition data to my study, following Allcott et al. (2018). A first step would be to observe how the nutritional quality offered by supermarkets varies in response to entry at the top. A second step would be to observe the variation in quality inside products.

References

Allcott, Hunt, Rebecca Diamond, Jean-Pierre H. Dube, Jessie Handbury, Ilya M. Rahkovsky, and Molly Schnell, "Food Deserts and the Causes of Nutritional Inequality," *Stanford University Graduate School of Business Research Paper*, 2018, *18* (6).

Anderson, Simon P, Andre De Palma, and Jacques-Francois Thisse, *Discrete choice theory of product differentiation*, MIT press, 1992.

Atkin, David, Benjamin Faber, and Marco Gonzalez-Navarro, "Retail globalization and household welfare: Evidence from mexico," *Journal of Political Economy*, 2018, *126* (1), 1–73.

Basker, Emek, "Job creation or destruction? Labor market effects of Wal-Mart expansion," *Review of Economics and Statistics*, 2005, *87* (1), 174–183.

Bertrand, Joseph, "Comptes-rendus de La théorie mathématique de la richesse sociale de Léon Walras et Des recherches sur les principes mathématiques de la théorie des richesses dAugustin Cournot," *Journal des Savants*, 1883, pp. 499–508.

Cawley, John, "The impact of obesity on wages," *Journal of Human resources*, 2004, *39* (2), 451–474.

Chen, Yongmin and Michael H Riordan, "Price-increasing competition," *The RAND Journal of Economics*, 2008, *39* (4), 1042–1058.

Cournot, Antoine-Augustin, *Recherches sur les principes mathématiques de la théorie des richesses par Augustin Cournot*, chez L. Hachette, 1838.

DellaVigna, Stefano and Matthew Gentzkow, "Uniform pricing in us retail chains," Technical Report, National Bureau of Economic Research 2017.

Ershov, Daniel, "Competing with superstars in the mobile app market," *Available at SSRN 3265662*, 2018.

Hausman, Jerry and Ephraim Leibtag, "Consumer benefits from increased competition in shopping outlets: Measuring the effect of Wal-Mart," *Journal of Applied Econometrics*, 2007, *22* (7), 1157–1177.

Holmes, Thomas J, "The diffusion of Wal-Mart and economies of density," *Econometrica*, 2011, *79* (1), 253–302.

Hotelling, Harold, "Stability in competition," *Economic Journal*, 1929, *39*, 41–57.

Hristakeva, Sylvia, "Vertical Contracts and Endogenous Product Selections: An Empirical Analysis of Vendor Allowance Contracts," 2017.

Iacovone, Leonardo, Beata Javorcik, Wolfgang Keller, and James Tybout, "Supplier responses to Walmart's invasion in Mexico," *Journal of International Economics*, 2015, *95* (1), 1–15.

Jaravel, Xavier, "The unequal gains from product innovations: Evidence from the us retail sector," 2016.

Javorcik, Beata S and Yue Li, "Do the biggest aisles serve a brighter future? Global retail chains and their implications for Romania," *Journal of International Economics*, 2013, *90* (2), 348–363.

Jia, Panle, "What happens when Wal-Mart comes to town: An empirical analysis of the discount retailing industry," *Econometrica*, 2008, *76* (6), 1263–1316.

Kiesel, Kristin and Sofia B Villas-Boas, "Got organic milk? Consumer valuations of milk labels after the implementation of the USDA organic seal," *Journal of agricultural & food industrial organization*, 2007, *5* (1).

Kopczuk, Wojciech, Emmanuel Saez, and Jae Song, "Earnings inequality and mobility in the United States: evidence from social security data since 1937," *The Quarterly Journal of Economics*, 2010, *125* (1), 91–128.

Mussa, Michael and Sherwin Rosen, "Monopoly and product quality," *Journal of Economic theory*, 1978, *18* (2), 301–317.

Perloff, Jeffrey M, Valerie Y Suslow, and Paul J Seguin, "Higher prices from entry: Pricing of brand-name drugs," *U of California, Berkeley, Competition Policy Working Paper No. CPC99-03*, 1995.

Schumpeter, Joseph, "Creative destruction," *Capitalism, socialism and democracy*, 1942, *825*, 82–85.

Shaked, Avner and John Sutton, "Relaxing price competition through product differentiation," *The review of economic studies*, 1982, pp. 3–13.

Smith, Adam, *An Inquiry Into the Nature and Causes of the Wealth of Nations...*, T. Nelson and Sons, 1776.

Zheng, Fanyin, "Spatial competition and preemptive entry in the discount retail industry," *Columbia Business School Research Paper*, 2016, (16-37).

7 Figures and tables

Figures

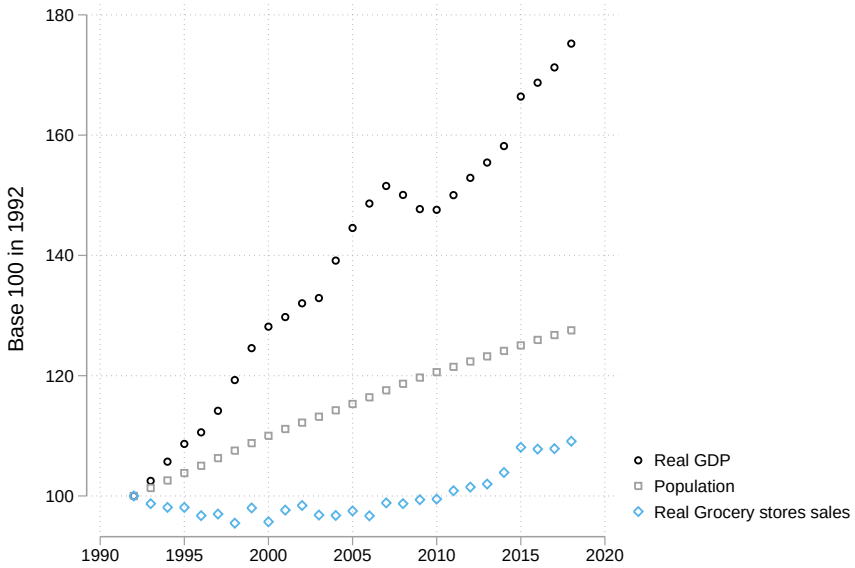


Figure 1: Evolution of real grocery store sales against real GDP and population, source: FRED St Louis Fed and Census Bureau

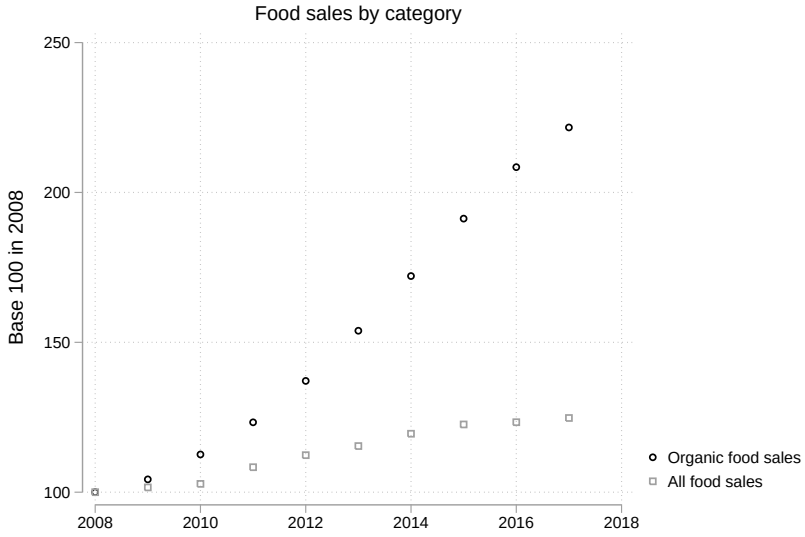


Figure 2: Evolution of food sales for organic and all food, source: Organic Trade Association

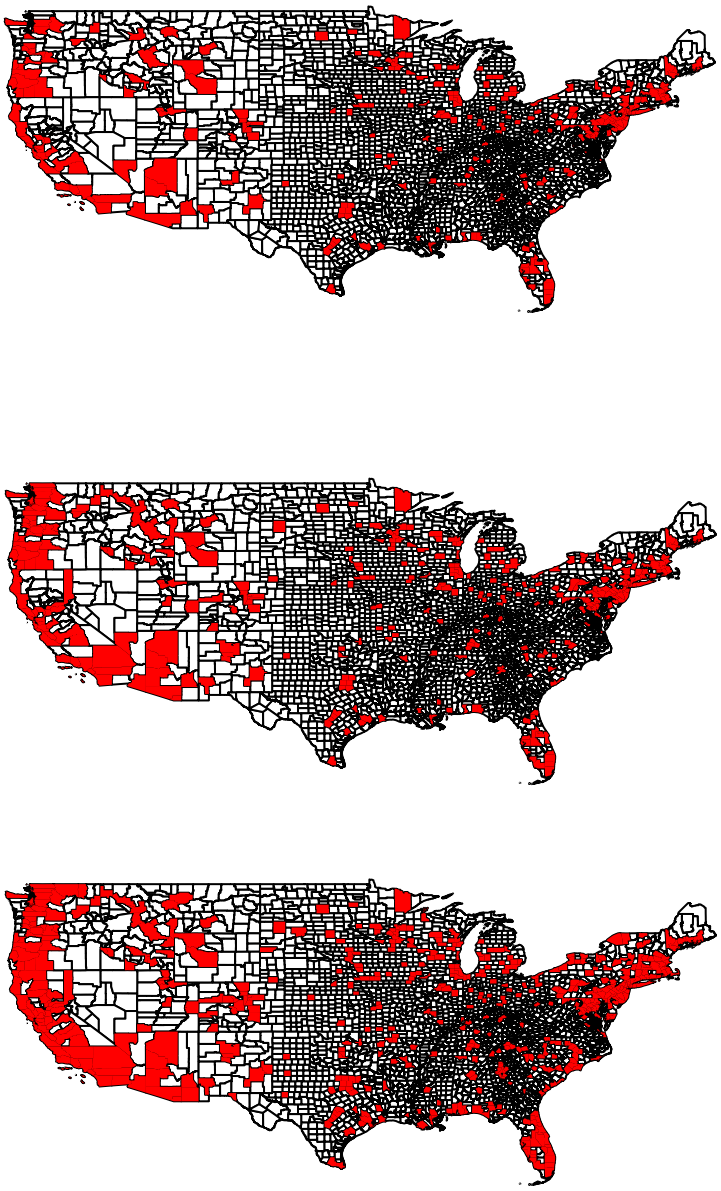


Figure 3: SIC 549935 stores presence by county at the end of 2005 (top), 2010 (middle), 2018

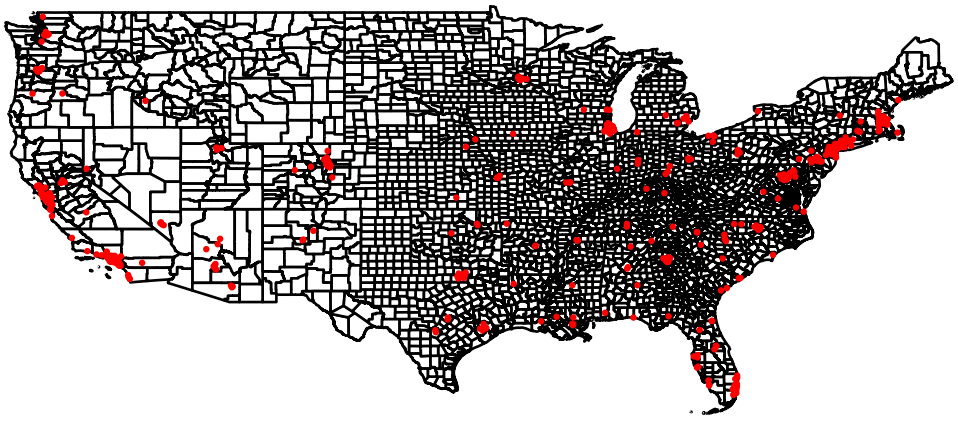


Figure 4: All Whole Foods stores as of December 31st, 2016

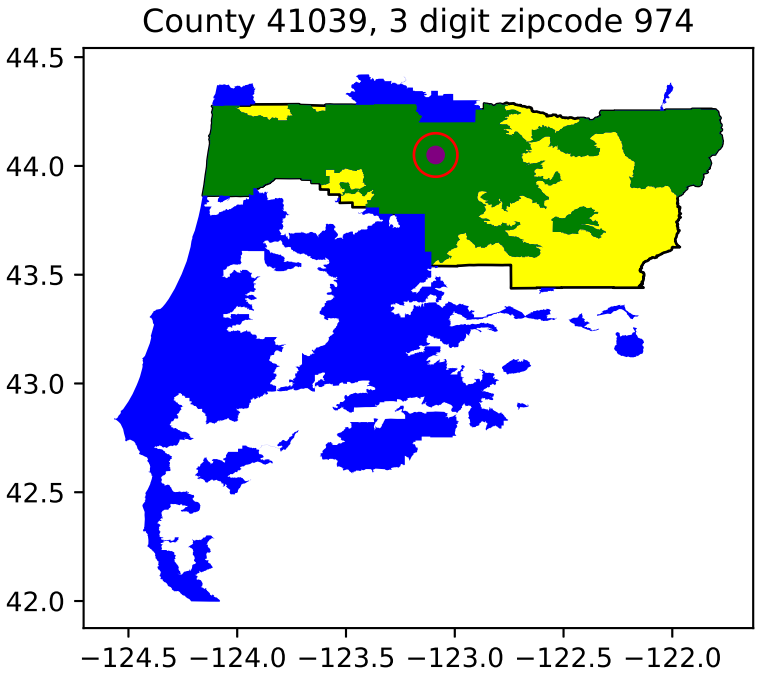


Figure 5: Lane county, OR. In blue the county, in yellow the 3-digit zipcode area, in green the area that matches both. The small filled circle represents the Whole Foods in Eugene and the empty transparent circle around it the 10-mile radius.

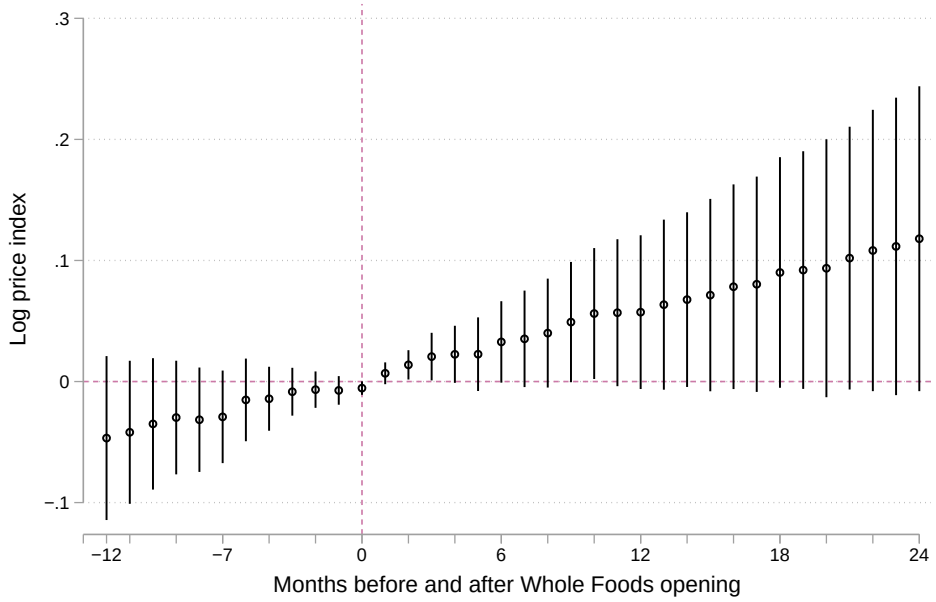


Figure 6: Effect of the first entry of Whole Foods on log prices of produce and frozen food. The default is the month of entry. Note: each circle corresponds to the coefficient of the regression of the outcome on the monthly treatment indicator, in addition to barcode-by-store fixed effects and month fixed effects. The graph shows the 95 percent confidence intervals based on standard errors clustered at the treatment area level.

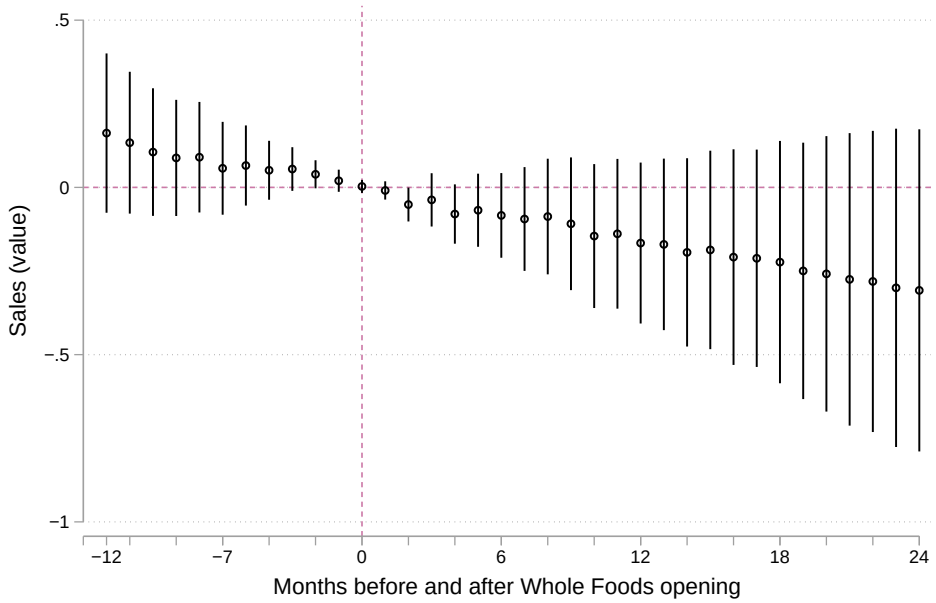


Figure 7: Effect of the first entry of Whole Foods on log sales of produce and frozen food

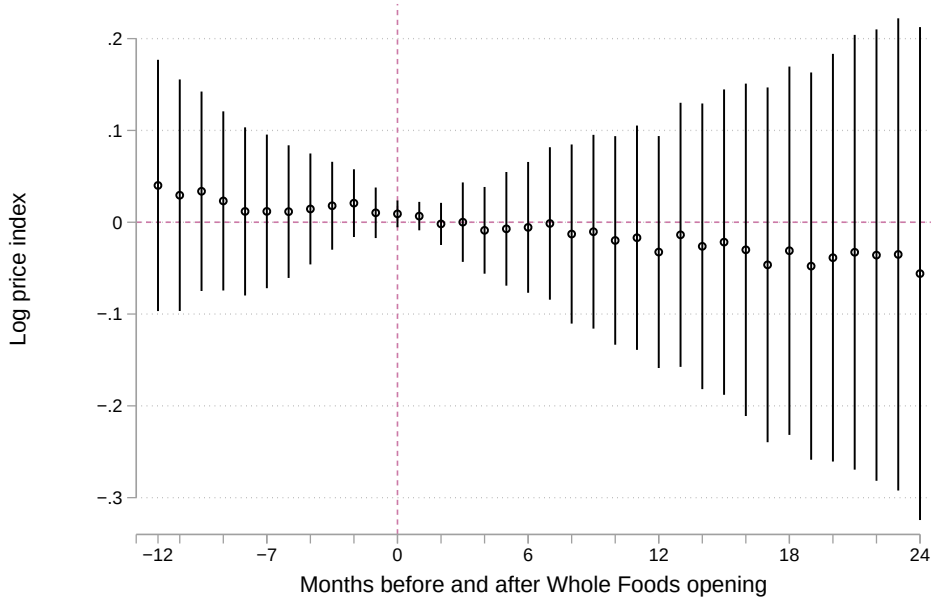


Figure 8: Effect of the first entry of Whole Foods on price index of produce and frozen food

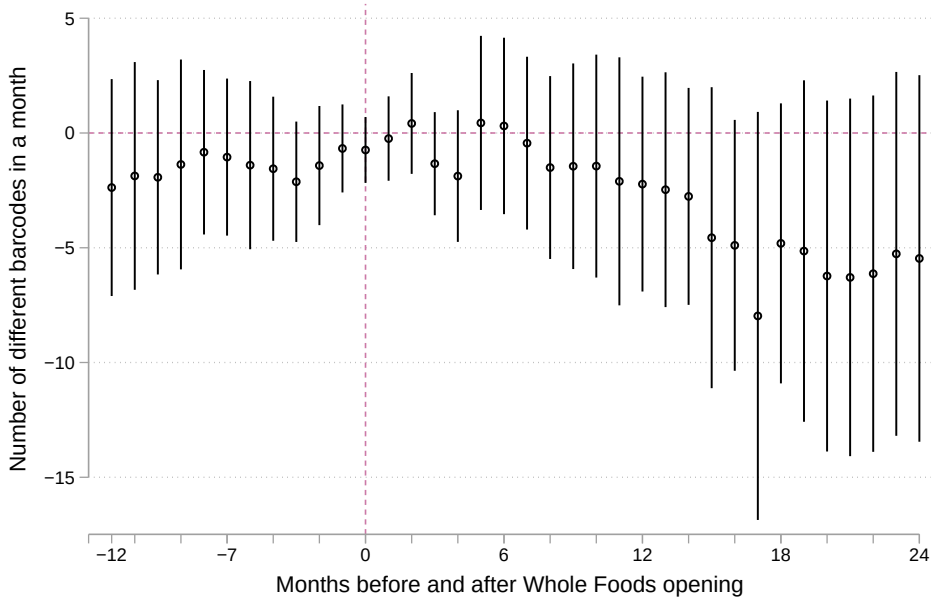


Figure 9: Effect of the first entry of Whole Foods on variety of all products

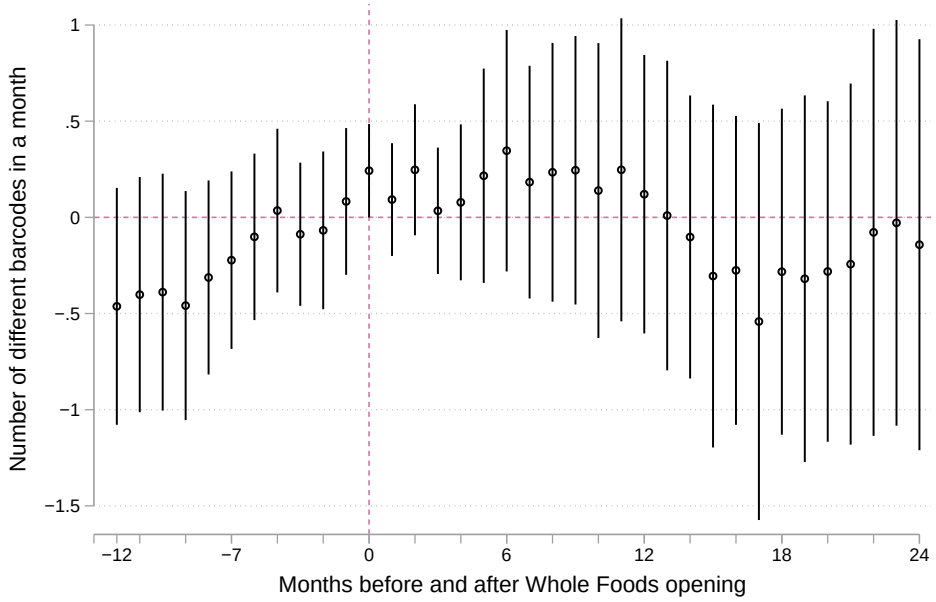


Figure 10: Effect of the first entry of Whole Foods on variety of organic products

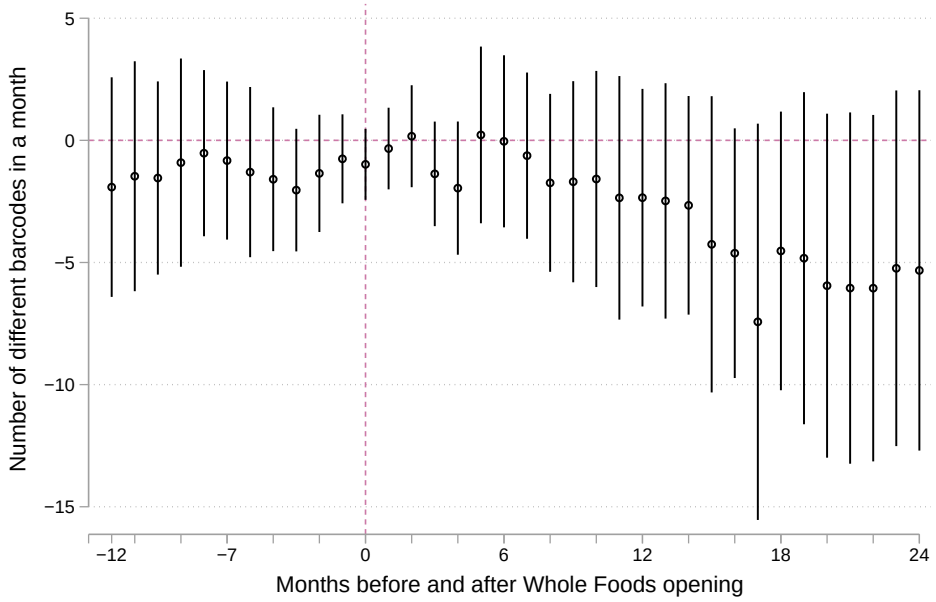


Figure 11: Effect of the first entry of Whole Foods on variety of non-organic products

Tables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Log price						
organic	0.204***	0.278***	0.292***	0.294***	0.293***	0.287***	0.269***
	(89.28)	(131.29)	(147.40)	(160.12)	(160.32)	(157.35)	(149.04)
Group FEs	No	Yes	No	No	No	No	No
Module FEs	No	No	Yes	No	No	No	No
Product FEs	No	No	No	Yes	Yes	Yes	Yes
Date FEs	No	No	No	No	Yes	Yes	Yes
N	7926459	7918604	7918604	7918604	7918604	7918604	7918604
r2	0.00100	0.143	0.260	0.409	0.412	0.415	0.430

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1: The organic price premium. Results of a hedonic OLS regression of log price on a variety of fixed effects indicated in the table. There are two "groups" here, fresh produce and frozen. "Modules" are more precise, they indicate for example baby carrots and frozen vegetables. Products fixed effects only refine the analysis for frozen goods, they indicate for example "frozen French beans". Regional fixed effects did not affect the results and are therefore not reported here.

	(1)
	share_organic
2.income_group	0.0218
	(0.10)
3.income_group	0.488*
	(2.18)
4.income_group	0.609**
	(2.71)
5.income_group	0.777***
	(3.41)
N	6317
r2	

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: The organic income relationship. Result of a GLM logit regression of the share of food dollars spent on organic food for a random 10% of households (about 6,000) in the 2016 Nielsen homescan sample. The income groups are defined based on the reported household income, with the baseline group below $10,000, the second $10,000-$40,000, the third $40,000-$70,000, the fourth $70,000 to $100,000 and the fifth over $100,000.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Price per pound	−0.35***	−0.48***	−0.23***	−0.38***	−0.80***	−0.31***	−0.38***	−0.85***	−0.36***	−0.51***	−0.26*	−0.56***
	(0.03)	(0.11)	(0.07)	(0.03)	(0.12)	(0.07)	(0.03)	(0.12)	(0.07)	(0.03)	(0.14)	(0.10)
organic				0.80***	0.96***	0.88***	0.83***	1.02***	0.93***	0.01	−0.01	0.18*
				(0.11)	(0.12)	(0.11)	(0.11)	(0.12)	(0.11)	(0.11)	(0.11)	(0.11)
Variety FEs	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Grade FEs	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Store FEs	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Instrument	No	W	H	No	W	H	No	W	H	No	W	H
N	4744	4744	4641	4744	4744	4641	4744	4744	4641	4744	4744	4641
r2	0.02	0.02	0.02	0.03	0.00	0.03	0.04	−0.00	0.04	0.32	0.31	0.31

Table 3: High-income county logit demand estimates for fresh apples. Morris county, NJ (Median household income of $97,979 according to the 2012 ACS) 2012 Nielsen scanner data on all grocery stores. The first two lines represent the coefficients obtained on the price and organic characteristics. Fixed effects are described in the lines below. For each combination of fixed effects, I present a result with no instrument ("No"), wholesale price instruments obtained from the USDA AMS data ("W") and Hausman instruments ("H").

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
pricelb	−1.29***	−0.36	−3.10***	−1.26***	0.39	−3.09***	−0.88***	−0.62	−2.82***	−0.97***	−1.44	−3.65***
	(0.08)	(0.54)	(0.26)	(0.08)	(0.72)	(0.27)	(0.08)	(0.53)	(0.48)	(0.08)	(1.07)	(0.69)
organic				−0.72***	−1.34***	−0.25	−0.18	−0.23	0.01	−0.51**	−0.47*	−0.49
				(0.26)	(0.40)	(0.42)	(0.25)	(0.27)	(0.41)	(0.24)	(0.26)	(0.42)
Variety FEs	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Grade FEs	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Store FEs	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Instrument	No	W	H	No	W	H	No	W	H	No	W	H
N	1323	1323	1238	1323	1323	1238	1323	1323	1238	1323	1323	1238
r2	0.16	0.08	−0.06	0.17	−0.10	−0.06	0.26	0.26	0.03	0.40	0.39	0.07

Table 4: Low-income county logit demand estimates for fresh apples. De Soto and Hardee counties, FL (Median household income of $36,000 according to the 2012 ACS). 2012 Nielsen scanner data on all grocery stores.

Date of entry	County	State
24oct2007	Providence	Rhode Island
13dec2007	Fort Bend	Texas
03sep2008	Henrico	Virginia
15mar2010	Dallas	Texas
01nov2010	Collin	Texas
22jun2011	Harris	Texas
14mar2012	Delaware	Pennsylvania
18jul2012	Polk	Iowa
24oct2012	Virginia Beach	Virginia
10apr2013	St Joseph	Indiana
09oct2013	Leon	Florida
17dec2013	Lancaster	Nebraska
01jan2014	Denton	Texas

Table 5: List of events dates and places

	(1) Log price
MinusQuarter_4	0.000
	(0.006)
MinusQuarter_3	0.001
	(0.004)
MinusQuarter_2	0.006
	(0.003)
MinusQuarter_1	0.001
	(0.002)
PlusQuarter_1	0.006**
	(0.002)
PlusQuarter_2	0.006
	(0.004)
PlusQuarter_3	0.011**
	(0.005)
PlusQuarter_4	0.014**
	(0.005)
PlusQuarter_5	0.014*
	(0.007)
PlusQuarter_6	0.019**
	(0.007)
PlusQuarter_7	0.020**
	(0.008)
PlusQuarter_8	0.025**
	(0.009)
N	5851988
R2	0.0126

Table 6: Result of the event-study on logprice, by quarter. The default is the month of entry. Standard errors are clustered at the market level. This table includes barcode-by-store and month fixed effects.

	(1) Average log price	(2) Sales (value)	(3) Sales (volume)
MinusQuarter_4	0.007	0.000	-0.007
	(0.007)	(0.012)	(0.017)
MinusQuarter_3	-0.003	-0.017*	-0.013
	(0.007)	(0.009)	(0.012)
MinusQuarter_2	0.001	0.001	-0.001
	(0.008)	(0.008)	(0.011)
MinusQuarter_1	0.005	0.002	-0.003
	(0.004)	(0.012)	(0.013)
PlusQuarter_1	0.004	0.000	-0.004
	(0.004)	(0.009)	(0.010)
PlusQuarter_2	-0.002	-0.007	-0.005
	(0.005)	(0.009)	(0.010)
PlusQuarter_3	0.007	0.011	0.004
	(0.005)	(0.008)	(0.008)
PlusQuarter_4	-0.003	-0.005	-0.002
	(0.005)	(0.009)	(0.007)
PlusQuarter_5	0.004	-0.003	-0.007
	(0.007)	(0.011)	(0.006)
PlusQuarter_6	-0.002	0.005	0.007
	(0.005)	(0.008)	(0.010)
PlusQuarter_8	0.002	-0.000	-0.003
	(0.007)	(0.006)	(0.007)
N	9230	9230	9230
R2	0.513	0.588	0.590

Table 7: Result of the event-study on average logprice, sales and volume, by quarter. The default is the month of entry. Standard errors are clustered at the market level. This table includes barcode-by-store and month fixed effects.

	(1) Variety (total)	(2) Variety (organic)	(3) Variety (regular)
MinusQuarter_4	-2.186	-0.435	-1.751
	(2.340)	(0.306)	(2.217)
MinusQuarter_3	-1.086	-0.332	-0.753
	(1.786)	(0.245)	(1.690)
MinusQuarter_2	-1.694	-0.051	-1.643
	(1.512)	(0.190)	(1.438)
MinusQuarter_1	-0.941	0.086	-1.027
	(0.895)	(0.152)	(0.857)
PlusQuarter_1	-0.388	0.123	-0.510
	(0.914)	(0.133)	(0.863)
PlusQuarter_2	-0.380	0.213	-0.593
	(1.717)	(0.248)	(1.611)
PlusQuarter_3	-1.129	0.220	-1.349
	(1.966)	(0.321)	(1.785)
PlusQuarter_4	-1.915	0.166	-2.080
	(2.481)	(0.366)	(2.303)
PlusQuarter_5	-3.220	-0.127	-3.093
	(2.508)	(0.389)	(2.361)
PlusQuarter_6	-5.931*	-0.371	-5.560*
	(3.281)	(0.428)	(3.036)
PlusQuarter_7	-5.873	-0.282	-5.592
	(3.838)	(0.465)	(3.524)
PlusQuarter_8	-5.548	-0.107	-5.441
	(3.997)	(0.537)	(3.676)
N	686475	686475	686475
R2	0.472	0.118	0.501

Table 8: Result of the event-study on variety, by quarter. The default is the month of entry. Standard errors are clustered at the market level. This table includes barcode-by-store and month fixed effects.