Retail Globalization, Households' Diets and the Effectiveness of Sin-Food Taxes

Emilio Gutierrez, Beata Javorick, Wolfgang Keller, Faqiang Li, Ricardo E. Miranda, Kensuke Teshima and James Tybout

November 2020

Abstract

This study examines the impact of retail globalization on calorie consumption and the effectiveness of policies to combat the associated obesity in the context of Walmart expansions in Mexican cities. Using both nationally representative household-level surveys as well as home scanner data, and employing an event study approach, we document an eight percent permanent increase in the calories purchased by households that coincides with the timing of Walmart openings. We find that this increase is concentrated in unhealthy foods. Moreover, after entry, Walmart becomes one of the main stores from which households source their consumption of packaged products. Then we analyze the effectiveness of a tax on high caloric content foods. We find that consumers who shopped at Walmart reduced their calorie consumption, as opposed to the rest of consumers, in response to the introduction of a calorie tax in 2014. Furthermore, Walmart customers substituted toward healthier options that were cheaper at Walmart than at other stores. We rationalize our results with a simple shopping model. Overall, we find that the variety of food Walmart offers increases obesity, but also increases the effectiveness of preventative polices.

1 Introduction

Rising obesity rates and their health consequences are a major concern for both developed and developing nations. Since 1980, obesity rates have almost tripled worldwide (World Health Organization, 2002). One first step toward combating obesity is to recognize that it is caused by increases in the difference between calories consumed and calories burned (Hill, Wyatt, and Peters, 2012). Researchers have proposed two reasons for the increase in calorie consumption: price reductions of high caloric content foods and increases in their availability (Cawley, 2015; Currie et al., 2010; Cutler, Glaeser, and Shapiro, 2003). In response to the increase in obesity rates, sin-food taxes have emerged as a countermeasure. Using the case of Walmart openings and expansions in Mexican cities, we explore how retail globalization, which affects the prices and availability of foods with high caloric content, impacts both the composition of household diets and the effectiveness of sin-food taxes.

Mexico offers an ideal setting to investigate the relation between retail globalization, nutrition and health policies. It is a country in which the fraction of the population that is obese or overweight has grown the most in recent decades. (According to the Mexican Health and Nutrition Survey, known locally as ENSANUT, in 2012, 35% of the Mexican population was obese), to address this alarming trend, in January 2014, the Mexican government enacted a tax on high caloric content foods and beverages. Moreover, in recent years, Mexico has experienced a rapid increase in the number of Walmart stores, a large foreign retail chain, which has transformed the composition of the retail industry (Atkin, Faber, and Gonzalez-Navarro, 2018; Iacovone

et al.,2015). In addition, rich micro-level data are available. We use two types of detailed household data: the National Survey of Household Income and Expenditure, known as ENIGH, a nationally representative household consumption and expenditure survey, and scanner data collected by Kantar Worldpanel.

In the first part of the analysis, using an event study approach, we document an eight percent permanent increase in the calories purchased by households that coincides with the timing of Walmart openings. We find that this increase is concentrated in unhealthy foods. Moreover, we find that after entry, households source the largest part of their weekly consumption of packaged products from Walmart stores more frequently. In the second part of the analysis, we study the effectiveness of the tax on high caloric content foods, imposed by the Mexican government in January 2014. We find that consumers who frequently source most of their packaged products consumption from Walmart reduced their total caloric intake as opposed to the rest of consumers. The reduction of calorie consumption from untaxed products is explained by the fact that Walmart's advantage is smallest at the middle range of calorie intensity, and therefore, induced consumers to substitute toward cheaper and healthier products. We rationalize this results with a simple shopping model.

Our study is related to several strands of the literature. First, it relates to studies linking globalization and obesity. Here, cross-country studies find mixed results. For example, Miljkovic et al. (2015) and Vogli et al. (2014) find a positive and significant association between trade openness and obesity and body mass index, while no such association is found in Oberlander, Disdier, and Etilé (2017) or Costa-Font and Mas (2016). Giuntella, Rieger, and Rotunno (2017) analyze food imports and obesity in Mexico using state-level data. Our study is unique in our focus on the role of retail globalization in both rising obesity and the effectiveness of policies against it.

Our study also contributes to the literature that has studied food deserts and the nutritional implications of shopping costs. While we do no find that Walmart entries on their own improve the diet of households, we show how retail globalization increases the availability of alternatives to high caloric content foods in developing countries (Rose and Richards 2004; Morland et al., 2002 ; Cotterill and Franklin, 1995 ; Weinberg, 1995) and we document how this allowed consumers to substitute toward a wider variety of products and sizes after the tax enactment (Allcott et al., (2019)[1]; Chung and Myers Jr, 1999; Kaufman, 1998; Kaufman et al., 1997). This result, along with our finding that after entry, households start sourcing most of their packaged products consumption from Walmart stores, points in the direction of studies that have analyzed the implications of travel costs and one-stop shopping such as Thomassen et al. (2017). The implications of these purchasing behaviors for the effectiveness of sin taxes taxes remain to be studied.

Our study is also related to the growing literature that has linked Walmart and other large supermarket openings to the body mass index and diet composition of US households (Volpe, Okrent, and Leibtag, 2013; Courtemanche and Carden, 2011) [2] Our contribution to this literature is to document whether the

[1]While Allcott et al., (2019) do not find that large supermarket entries affect nutritional outcomes, our setting differs from theirs in at least two aspects. First, travel costs are different in Mexico than in the USA. For instance, only 50% of the households in our sample have a car. Second, the alternatives to globalized retail that domestic retailers offer differ between developed and developing countries.

[2]Holmes (2011); Jia (2008); Hausman and Leibtag (2007) and Basker (2005) explore the relationship between Walmart store openings and other outcomes for the US context.

relationship between Walmart openings and the composition of the diets of households is different in Mexico that in developed countries.

Our paper also contributes to the understanding of the impact of retail globalization in low and middle income coutries (Iacovone et al. 2015; Javorcik and Li 2013; Javorcik, Keller, and Tybout, 2006;). While some of the existing papers have focused on Mexico and Walmart openings, they differ from ours both in terms of methodology and research question. In particular, our study is the first to investigate the impact of Walmart on the caloric intake and diet composition of Mexican households. The closest to our study in terms of methodology and context is Atkin, Faber, and Gonzalez-Navarro (2018) who, like this work, use an event-study type methodology (using foreign supermarket entries as the event of interest) for the Mexican context. However, their analysis is broader, as it measures the impact of large supermarket stores entry on overall prices and welfare (and its distribution).

Finally, this work is linked to papers that have explored the relationship between food prices, taxes on foods and beverages and the diet of households, or obesity rates in Mexico (Aguilar, Gutierrez, and Seira, 2019; Colchero et al., 2016; Gracner, 2015) and other contexts (Harding and Lovenheim, 2017; Dubois, Griffith, and Nevo, 2014; Grossman, Tekin, and Wada, 2014; Fletcher, Frisvold, and Tefft, 2010; Powell and Chaloupka, 2009; Beydoun, Powell, and Wang, 2008). The contribution of our work to this literature is to identify retail globalization as one of the forces behind these price changes and analyze its implications.

The paper is organized as follows. The next section describes the data sources exploited in the paper. Section 3 presents the empirical strategies employed in all the analyses presented. Section 4 presents the results. Section 5 introduces a model that rationalizes our results. The final section concludes.

2 Data

2.1 ENIGH: The composition of households' diets

To observe the composition of the diets of households following the entry of Walmart to Mexican municipalities, we use the ENIGH surveys, which are administered every two years. Although the municipalities and households covered change from one survey to another, they are designed to be representative at the state level. For this reason, all surveys include households from most of the large municipalities of Mexico. For our analysis, we use the ENIGH surveys from 2008, 2010, 2012, 2014, and 2016.

The main goal of the ENIGH surveys is to capture expenditures and incomes. Households are asked to report all their food purchases during the three months prior to the survey. Expenditures are classified into multiple categories, one of which corresponds to foods and beverages. This category is partitioned into 247 different subcategories, 211 of which correspond to foods, 24 to beverages, and the remaining 12 to tobacco, food for animals, meals eaten outside the household, and in-kind transfers.

While ENIGH includes detailed information on expenditures and quantities purchased for each of the subcategories listed, it does not contains nutritional information. To assign caloric contents to each of the

foods and beverages subcategories, we use the National Nutrient Database for Standard Reference (NNDSR) published by the United States Department of Agriculture.

The NNDSR is a data set on the nutritional content of most products consumed in the United States. It comprises 1,137 categories and, in total, 85% of the food subcategories of the ENIGHs are covered. We collected caloric content information on the ENIGH subcategories that are not included in the NNDSR, which are mainly traditional Mexican foods. When the NNDSR lists products at a more detailed level than ENIGH, we assign the average calories per kg/liter of NNDSR categories to the corresponding unique subcategory in ENIGH.

Apart from expenditures, the ENIGH surveys include detailed information about the sociodemographic characteristics of households. They include household size, living-place characteristics and information on the age, employment, and health of all household members. The exact location of households is not provided but the surveys report the population of the localities in which households are located within municipalities.

2.2 KANTAR: Purchases of packaged and taxed products.

In addition to the ENIGH surveys, we exploit scanner panel data on households' consumption of packaged products collected by Kantar Worldpanel. This is a high-frequency data set that registers the purchases of households at the store and bar code levels. In addition to stores and bar codes, it registers the quantities and prices involved in each purchase and the exact date at which each transaction occurred. Our data cover the period from 2011 to 2015.

As in the case of the ENIGH surveys, the Kantar data set does not includes information on the nutritional content of bar codes. Thus, we obtain it from a database on nutritional content of packaged products in Mexico that was specifically collected to be merged with the Kantar Worldpanel data by Aguilar, Gutierrez, and Seira (2019). Nutritional content was directly collected for 71% of the bar codes that appear in the data set. This represents 68% of the observed expenditures. For the remaining 29% of bar codes, caloric content was imputed from those for which caloric content was directly collected. The nutritional imputation is made at the bar code level.

2.3 Walmart store entries

Our main source of data on the dates at which Walmart stores entered the Mexican market are the monthly financial reports of Walmart of Mexico. These can be found in the website of Walmart of Mexico and indicate the exact month and city of store openings. From the financial reports, we collected the month in which 55 Walmart supercenters opened in the cities covered by the Kantar data set as well as the opening months of an additional 30 stores in the cities covered by the ENIGH surveys. The entries occurred from 2012 to 2015.

Because the ENIGH surveys are collected every two years, most of the entries we determine from the Walmart bulletins occurred between ENIGH 2012 and ENIGH 2014. This limits the variation in the timing of entries that is required to perform an event study analysis. To address this issue, we complement our

information on entries using the registries of Walmart supercenters in the Mexican National Directory of Economic Units (DENUE). This registry is updated yearly for economic units with more than 100 employees. The frequency of these updates is sufficient for us to discern which Walmart store entries occurred in the period between ENIGH 2010 and ENIGH 2012, which increases the time variation of the entries in our sample. From this exercise, we recover 44 additional entries outside the time covered by the financial reports of Walmart of Mexico.

3 Empirical strategy

In this section, we discuss our method to estimate the effect of Walmart entries on the calorie consumption and purchasing patterns of households. In addition, we explain how we test whether consumers respond differently to a tax on high caloric content (HCC) foods based on whether they buy at Walmart or at other stores.

3.1 Effect of Walmart store entries on calorie consumption

To estimate the effect of Walmart entries to Mexican cities, we use an event study approach based on the ENIGH surveys. These data sets cover all food purchases made by households, enabling us to observe the whole composition of the diets of households and how they changed in response to the Walmart entries.

We include all entries from Walmart of Mexico bulletins between 2012 and 2015 in our regressions. As noted above, to expand the time period covered by our analysis and achieve sufficient time variation to perform an event study, we use DENUE as an additional source of entries. DENUE is updated every year for stores with more than 100 employees, which is the case for Walmart supercenters. ENIGH surveys are collected every two years. Hence, for the purpose of an event study, the dates of registry to DENUE are sufficient to define pre- and postentry surveys.

In the ENIGH surveys, municipalities are further divided into localities. From the DENUE data, we know that 93% of Walmart supercenters are in localities with more than 15,000 inhabitants. We restrict the sample for our main analysis to those localities.[3] In our analysis, we retain only those municipalities that appear in at least two surveys before and two surveys after Walmart entries. When more than one entry occurs in the same city, but at different dates relative to the ENIGH surveys, we repeat those observations. This leaves a total of 93 different entry time–city combinations, which represent 129 Walmart store openings distributed across 80 municipalities over four years.

We are interested in the caloric intake of households and the product types in which the changes in diets are concentrated. Following Hut and Oster (2015), we classify all the products that appear in the ENIGH surveys as healthy if they are "obviously healthy," *i.e.*, products that unambiguously are not harmful to human health. The healthy category includes fruits, vegetables, and low fat, fresh sources of protein, such

[3] Results for localities with less that 15,00 inhabitants are excluded from this writing sample. We find no effect of Walmart store entries on households' diets in those localities.

as fish and chicken. It excludes packaged products, such as cereals, candies, snacks, sodas, processed juices, and prepared meals. It also excludes foods with high fat contents, such as pork and beef. All the excluded products are labeled as unhealthy. To measure caloric intake, we exploit information from the NNDSR and compute the monthly caloric intake of households from healthy products, unhealthy products, and the sum of calories from both categories.

As noted above, the households in the ENIGH change from one survey to another; therefore, our panel is balanced at the municipality level, but not at the household level. For this reason, we control for households' observables in addition to time/survey and municipality fixed effects. Purchased calories depend on the size of households, the tastes of households might vary across cities, therefore, we include interactions between city indicators and households' size. Moreover, consumption is also likely to vary at different life stages. For this reason we control for household head age interacted with time fixed effects in our regressions. Our event study specification is as follows:

$$log\ Y_{tmh} = \sum_{k=-2}^{3} \delta_k \mathbf{I}_{\{t-E_{jm}=k\}} + \tau_t + \eta_m + \alpha_t a_h \mathbf{I}_{\{t\}} + \beta_m s_h \mathbf{I}_{\{m\}} + \varepsilon_{tmh} \tag{1}$$

Where Y_{tmh} is calories from the category of interest consumed by household h at time t. The function $\mathbf{I}_{\{t-E_{jm}=k\}}$ indicates the ENIGH rounds relative to entry. τ_t and η_m are time and municipality fixed effects, respectively. a_h denotes household head age and s_h denotes household size. The functions $\mathbf{I}_{\{t\}}$ and $\mathbf{I}_{\{m\}}$ are time and municipality indicators. Finally, ε_{tmh} is an error term.

3.2 Timing, purchasing patterns and calories from packaged products

Using the ENIGH surveys, we can assess the long-term effects of Walmart entries on the diets of households. However, we do not observe the exact timing of the changes in consumption nor the stores in which the purchases occur. To investigate these issues, we repeat our event study analysis using the Kantar scanner panel data. Here, we can observe monthly consumption and the stores in which purchases occur.

To ensure that our household panel is balanced, we restrict our sample to households for which we can observe consumption for at least six months before and after a Walmart entry. As in our analysis of the ENIGH surveys, we repeat observations when multiple entries to the same city occur at different times. This leaves us with a total of 2,576 households in 28 cities, for which we observe 55 Walmart entries. Because we want to observe the consumption of households at the highest possible frequency (monthly), we only use entries from the Walmart of Mexico bulletins.

Having household panel data allows us to include household fixed effects in our analyses and control for unobserved tastes and characteristics that affect calorie consumption and purchasing patterns. Thus, our event study is performed at the household–month level. Our specification is as follows:

$$lY_{tmh} = \delta_{<-6}\mathbf{I}_{\{t-E_j=<-6\}} + \sum_{k=-6}^{6} \delta_k \mathbf{I}_{\{t-E_j=k\}} + \delta_{>6}\mathbf{I}_{\{t-E_j=>6\}} + \tau_t + \eta_h + \beta_m t \mathbf{I}_{\{m\}} + \varepsilon_{tmh} \tag{2}$$

Where Y_{tmh} is the outcome of interest for household h's at time t in city m. $\mathbf{I}_{\{t-E_j=k\}}$ indicates months relative to entry, τ_t and η_h are time and household fixed effects, respectively, and ε_{tmh} is an error term. $\mathbf{I}_{\{m\}}$ is a city indicator, we include city time trends represented by $\beta_m t$.

Our main outcome variable is the total amount of calories purchased by each household, nonetheless, we are also interested in observing how purchasing patterns change after entry. In particular, we want to know if there is an increase in purchases at Walmart and if Walmart becomes the main store from which households source their consumption of packaged products. This serves two purposes, first, it confirms that our entry dates actually coincide with store openings and second, it helps us to understand the relevance of Walmart as a retailer for the shopping decisions of households. Hence, for every month and every household, we compute the proportion of weeks in which a Walmart store had the largest share of the weekly observed expenditures, and therefore, it was the household's main source of packaged products. Finally, we measure the share of total expenditures and calories that corresponds to purchases at Walmart during weeks in which a Walmart store was the households' main source of packaged products.

3.3 Effect of the tax on high caloric content foods on calorie consumption and substitution

It is possible that the prices and availability of products might differ between Walmart and other retailers and that this may induce differences in the responses of consumers to price changes depending on where they buy their groceries. In particular, the response to changes in the price of HCC products as a result of the introduction of the tax on HCC foods might differ between Walmart customers and customers of other stores. We explain how we test this hypothesis.

First, we classify all products that appear in the Kantar data set. We begin by identifying the products that are subject to the tax. The tax applies to all beverages that have added sugar and to all foods with more than 275 kilocalories per 100 grams that are not considered an essential component of the diet of Mexicans (such as oil or tortillas). We define all taxed products as HCC products. Then, we divide untaxed bar codes in two broad categories: foods and beverages. Within each category, products that fall in the first quartile of total calories are defined as low caloric content (LCC) products and all remaining products are defined as middle caloric content (MCC). The definition of LCC products does not imply that these products are healthier because both caloric density and size must be considered. For instance, sufficiently small presentations of unhealthy products could be labeled as LCC products.

To test which products are relatively cheaper at Walmart, we exploit the Kantar data set at its most disaggregated level. We regress the log of observed purchase prices on dummies that indicate if a purchase occurred at Walmart and its interactions with indicators of the type of product that was bought. We are interested in the sign of the Walmart indicator and its interactions. Our specification is as follows:

$$log\ P_{bsmp} = \gamma_b + \mu_m + \omega \mathbf{I}_{\{s=w\}} + \sum_{i \in h,m,l} \beta_{iw} \mathbf{I}_{\{s=w\}} \mathbf{I}_{\{b \in i\}} + \varepsilon_{bsmp} \tag{3}$$

Where P_{bsm} is the price of bar code b at store s in month m for purchase p. γ_b is a barcode fixed effect and μ_m is a month fixed effect. $\mathbf{I}_{\{s=w\}}$ is an indicator of purchases occurring at Walmart and $\mathbf{I}_{\{b \in i\}}$ is an indicator of product type (HCC,MCC or LCC). ε_{bsmp} an error term.

Furthermore, we must examine how the composition of the diets of households changes as a result of the tax and if this effect is the same for Walmart customers than for the rest of consumers. To do this, we classify households as Walmart customers or not according to their pre-tax purchasing behavior. We proceed as follows: first, we identify for each household the weeks in which the largest share of their expenditures in packaged products was spent at a store belonging to Walmart. Then, we define as Walmart customers all the households that used Walmart as their main store for at least one week of the month for at least nine out of the twelve months in 2013. While these variables are defined with respect to weekly expenditures, we aggregate them by month so that the level of measurement coincides with the time unit at which we observe entries and defines the frequency of our panel.

To analyze purchases of packaged products, we compute the total amount of purchased calories from all product types according to the definition used to analyze prices (HCC, MCC, and LCC products) and regress them on an indicator of the tax enactment and its interaction with a variable that indicates Walmart customers. We repeat this analysis for the total calories purchased by households, for calories from taxed and untaxed products and, finally, we separate the calories from untaxed products into calories from LCC and MCC products. Our regression equation is:

$$log\ Y_{ht} = \eta_h + \tau_t + \beta_T \mathbf{I}_{\{t \in T\}} + \beta_{TW} \mathbf{I}_{\{t \in T\}} \mathbf{I}_{\{h \in W\}} + \varepsilon_{ht} \tag{4}$$

Where Y_{ht} represents total purchased calories by household h from the category of interest (HCC, MCC, LCC and their relevant combinations) at time t. Time and households fixed effects are represented by η_h and τ_t. The tax enactment is indicated by $\mathbf{I}_{\{t \in T\}}$ and $\mathbf{I}_{\{h \in W\}}$ indicates that household h is a Walmart customer according to its pre-tax purchasing behavior. The error term is ε_{ht}.

Note that if there is a a positive association between Walmart entries and caloric intake, then, households who start attending Walmart after the tax would experience an increase in their caloric intake. This could be a confounding factor for our analysis. Therefore, we exclude from our sample households who had no purchases at Walmart during 2013 but started attending it during 2014 or 2015.

4 Empirical Results

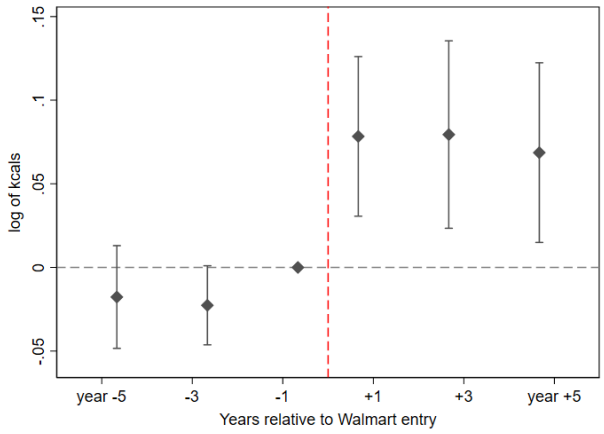
In this section, we discuss the results of our event study. We find that there was an increase in the calorie consumption of households after the Walmart entries. In addition, we provide evidence that, after the

enactment of the tax, households' substitution of taxed products with untaxed products differed depending on whether they shopped at Walmart or at other stores. We conclude that the tax was more effective in reducing calorie consumption for households that had the option to buy from Walmart.

4.1 Effect of Walmart store entries on calorie consumption

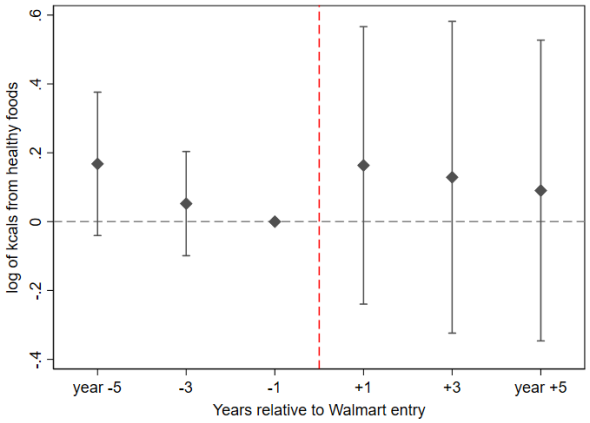
Our event study estimations using the ENIGH surveys show that the diets of households were transformed by the entry of Walmart into the Mexican municipalities. Figure 1 shows the event study coefficients for the ENIGH surveys before and after the Walmart entries. We find that there was a permanent 8% increase in households' total calorie consumption after Walmart entered the Mexican market, but there is no evidence of an increasing trend prior to its entry. Figures 2 and 3 disaggregate the effect in terms of healthy and unhealthy products. We find that the effect comes from a 6% increase in calories from unhealthy products. Our findings are summarized in columns 1 to 3 of Table 1, where we report the average effect for all postentry periods on total caloric intake and on calories from healthy and unhealthy products.

Figure 1: Effect of Walmart entries on calorie consumption of households.



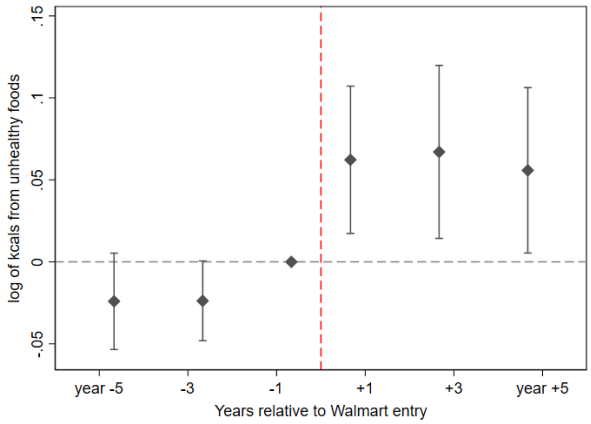
Notes: This figure depicts the event study coefficients for the log of households' calorie consumption from healthy products. The coefficients correspond to each of the ENIGH surveys immediately before and after Walmart entries. The sample is restricted to municipalities that appear in at least two surveys before and after Walmart entries.

Figure 2: Effect of Walmart entries on households' calorie consumption from healthy products.



Notes: This figure depicts the event study coefficients for log of households' calorie consumption from healthy products. The coefficients correspond to each of the ENIGH surveys immediately before and after Walmart stores entries. The sample is restricted to municipalities that appear at least in two surveys before and after Walmart entries.

Figure 3: Effect of Walmart entries on households' calorie consumption from unhealthy products.



Notes: This figure depicts the event study coefficients for log of households' calorie consumption from unhealthy products. The coefficients correspond to each of the ENIGH surveys immediately before and after Walmart stores entries. The sample is restricted to municipalities that appear at least in two surveys before and after Walmart entries.

Table 1: Event study estimation of the effect of Walmart entries on Households calorie consumption

	ENIGHs			KANTAR			
(1)	(3)	(3)	(4)	(5)	(6)	(7)
log of calories	log of calories	log of calories	log of purchased	Prop. of weeks during which	Share of exp. From	Share of cals. from
All products	Healthy products	Unhealthy products	calories	WM was the main store	WM as main store	WM as main store
-0.025	0.0311	-0.025	0.00	0.001	0.00261	0.002
(0.015)	(0.088)	(0.015)	(0.007)	(0.001)	(0.001)	(0.001)
0.079***	0.164	0.063**	0.014*	0.006***	0.007***	0.005***
(0.029)	(0.246)	(0.027)	(0.007)	(0.001)	(0.002)	(0.001)
Yes	Yes	Yes				
Yes	Yes	Yes				
Yes	Yes	Yes				
Yes	Yes	Yes				
			Yes	Yes	Yes	Yes
			Yes	Yes	Yes	Yes
0.226	0.104	0.262	0.576	0.542	0.547	0.533
232,795	232,795	232,795	381,177	381,177	381,177	381,177

Notes: Estimates for the effect of Walmart entries on the calorie consumption of households. Results are shown aggregating across all pre and post entry periods for 4 years in the case of ENIGH surveys and 6 months in the case of the Kantar data set. For ENIGH, the sample is restricted to households in municipalities that appear at least in the two consecutive periods before and after entries. Results are reported in columns 1 to 3. The first column shows results for all calories in products purchased by households. Columns 2 and 3 show results for calories from healthy and unhealthy products. For the Kantar data set, regressions are performed using a household monthly scanner panel perfectly balanced for the six months before and after entry. Results are shown in columns 4 to 7. Column 4 reports results for the log of purchased calories. For columns 5 to 7 we identified the weeks in which a single Walmart store had the largest share of total observed expenditures and therefore was the main store from which packaged products were purchased. Column 5 reports the effect of entries on the proportion of weeks in a month during which a Walmart store was the households' main source of packaged products. Columns 6 and 7 report the effect of entries on the share of total expenditures and purchased calories that corresponds to the products that were bought from Walmart stores when they where the households' main source of packaged products.

4.2 Timing, purchasing patterns and calories from bar-coded products

Because of the low frequency of the ENIGH surveys, our estimates in the previous section could raise the question of whether the increase in calorie consumption coincides with the Walmart store entries. We address

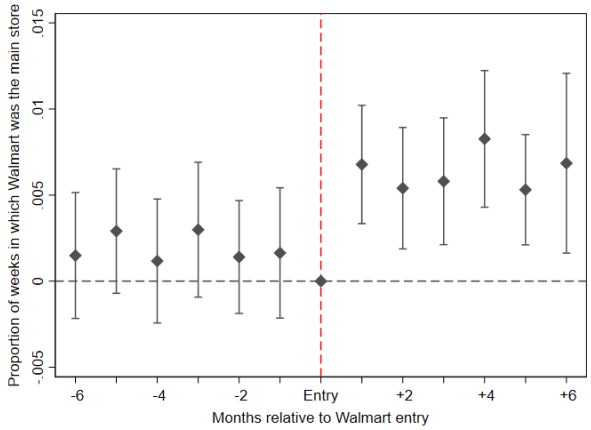
this issue using the Kantar household scanner panel data and find that increases in calories from bar-coded products coincide with the months in which Walmart stores enter the Mexican municipalities. Figures 4 to 6 depict the event study coefficients for the six months before and after Walmart stores entries based on the Kantar data. We find a 1.4% increase in calories from purchased packaged products. Although the Kantar results show the effect of entries on only a portion of households' consumption, our findings are consistent with those from the ENIGH surveys. Hence, we conclude that Walmart stores entries are a force behind the transition of Mexicans toward more calorie-intense diets.

Moreover, we find that recently opened Walmart stores become one of the main sources of packaged products for households. Figure 4 shows a significant increase of 0.6 percent in the proportion of Weeks per month during which a Walmart store had the largest share of observed households' expenditures. Moreover, the share of total expenditures that correspond to purchases at Walmart stores during weeks in which they where the households' main source of packaged products significantly rises by 0.7 percent. We observe a similar pattern for the share of calories from Walmart as main store that increase by 0.05 percent as depicted in figure 6.

Table 1 summarizes our findings for the effect of Walmart entries based on aggregating the estimation results for the six months before and after entry. We find no evidence of pre-entry trends in households' purchased calories or in the frequency with which Walmart stores are the main source of packaged products for households in our sample.

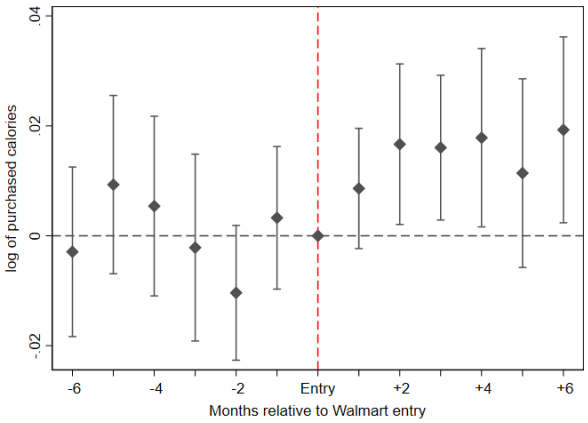
Note that the identified effects correspond to the average change among households in the city of entry. While on average there is a significant increase in the count of weeks in which Walmart is the main store from which packaged products are bought, this effect is unlikely to be homogeneous across households. Only 200 out of 2576 households in our data set used Walmart as their main store for at least one week during every month after entry, and only 18 households used Walmart as their main store every single week after entry. Walmart becomes a relevant retailer after entry, but for many households other retailers remain as the primary source of packaged products.

Figure 4: Entries and Walmart as main source of packaged products



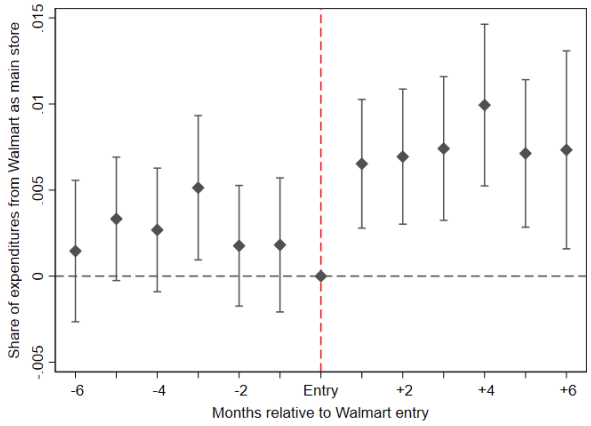
Notes: This figure depicts the event study coefficients for the proportion of weeks per month in which a single Walmart store had the largest share of total observed expenditures and therefore was the household's main source of packaged products. The coefficients correspond to each of the six months before and after entry. The sample is a perfectly balanced panel of households. The sample is restricted to cities that experience at least one entry during the sampling period.

Figure 5: Effect of Walmart entries on households' purchased calories from packaged products.



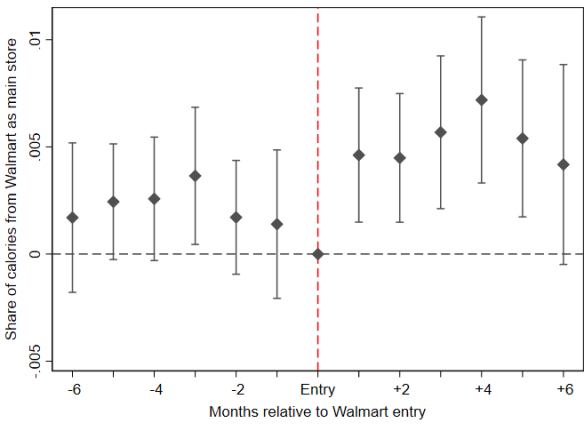
Notes: This figure depicts the event study coefficients for log of households' observed purchased calories in the Kantar data set. The coefficients correspond to each of the six months before and after entry. The sample is a perfectly balanced panel of households. The sample is restricted to cities that experience at least one entry during the sampling period.

Figure 6: Entries and the share of total expenditures from Walmart as main source of packaged products.



Notes: For this figure, we identified the weeks in which a single Walmart store had the largest share of total household observed weekly expenditures. Then, the dependent variable is the share of monthly expenditures that took place in the identified store-week combinations (*i.e.* when a Walmart store was the households' main source of packaged products). The figure depicts the event study coefficients for each of the six months before and after entry. The sample is restricted to cities that experience at least one entry during the sampling period.

Figure 7: Entries and the share of total calories from Walmart as main source of packaged products.



Notes: For this figure, we identified the weeks in which a single Walmart store had the largest share of total household observed weekly expenditures. Then, the dependent variable is the share of monthly purchased calories that comes from products purchased at the identified store-week combinations (*i.e.* when a Walmart store was the households' main source of packaged products). The figure depicts the event study coefficients for each of the six months before and after entry. The sample is a perfectly balanced panel of households. The sample is restricted to cities that experience at least one entry during the sampling period.

4.3 Effect of the tax on calorie consumption and substitution

The second goal of this work is to determine if the change in the composition of the diets of households induced by the tax on HCC foods was different for those who bought from Walmart than for other households. Moreover, we want to understand what are the forces that could drive this differential response.

Our analysis of prices shows that, on average, all products are 6% cheaper at Walmart than at other stores. Moreover, we find that both taxed and LCC packaged products are relatively cheaper at Walmart

compared with other stores. These results are summarized in Table 2. This differences in prices and relative prices suggest the mechanism by which the response to the tax might vary between consumers depending on where they shop.

Second, our estimates for the responses of households to the tax enactment shows that substitution patterns were different depending on whether the they shopped at Walmart or elsewhere. Column 1 of Table 3 shows that, in accordance with Aguilar, Gutierrez, and Seira (2019), the tax had no significant impact on the total calorie consumption from bar-coded products of the households in our sample. However, we find that the tax caused an effective reduction in the total amount of calories purchased by Walmart customers. This is explained by the fact that the increase in calories from purchases of untaxed products induced by the tax was significantly lower for Walmart customers than for other consumers. When disaggregating this effect, we find that Walmart customers substituted significantly more toward LCC products, and their consumption of MCC products increased less than did for the rest of households. Hence, we conclude that the tax on HCC foods was more effective in reshaping the composition of household diets for Walmart customers than it was for other consumers.

Table 2: Prices in Walmart by type of product relative to the rest of stores during 2013 and 2014.

	(1)	(2)	(3)	(4)	(5)	(6)
	Pre tax		Post tax		All periods	
Variables	log Price	log Price	log Price	log Price	log Price	log Price
Walmart	-0.0631***	-0.0396***	-0.0665***	-0.0488***	-0.0660***	-0.0452***
	(0.00426)	(0.00286)	(0.00274)	(0.00282)	(0.00404)	(0.00306)
Walmart#Taxed (HCC)		-0.0488***		-0.0380***		-0.0442***
		(0.00414)		(0.00293)		(0.00377)
Walmart#Untaxed Low caloric cont. (LCC)		-0.0173***		-0.0135***		-0.0134***
		(0.00440)		(0.00392)		(0.00322)
Barcode FE	Yes	Yes	Yes	Yes	Yes	Yes
Month of year FE	Yes	Yes	Yes	Yes	Yes	Yes
Period	2013	2013	2014	2014	2013-2014	2013-2014
R-squared	0.953	0.953	0.948	0.949	0.944	0.944
Observations	6367353	6367353	6227351	6227351	12594704	12594704

Robust standard errors clustered at the store level in parentheses
*** p<0.01 ** p<0.05 * p<0.1

Notes: The table shows estimation results for prices in Walmart compared to other stores. The dependent variable is the log of observed purchase price. The observations correspond to all the registered transactions at the date–store–bar-code level made by households in the Kantar data set from 2013 to 2014. Each observation is weighted by the quantities purchased. Walmart is a dummy that indicates the purchase occurring at Walmart. Taxed indicates all purchases of beverages and foods that were subject to the tax. Untaxed Low caloric cont. (LCC) indicates beverages and foods in the lowest quartile of caloric content among products that were not subject to the tax. Untaxed products with caloric content above the first quartile are the excluded category. The first two columns were estimated using only pre-tax observations whereas columns 3 and 4 were estimated using only post-tax observations. The last two columns were estimated using all observations.

Table 3: Walmart and substitution. Observed effect of the tax and the option to attend Walmart on the calorie consumption of households.

Variables	(1)	(2)	(3)	(4)	(5)
	Purchased calories				
	All products	Taxed products	Untaxed products		
	All	HCC	MCC and LCC	MCC	LCC
Tax	227.5	-1,503***	1,730***	1,698***	31.80
	(340.8)	(187.8)	(215.8)	(208.6)	(55.71)
Tax#Walmart customer	-1,599**	-536.5	-1,063**	-1,278***	215.2**
	(702.3)	(353.0)	(469.5)	(450.5)	(101.7)
Household FE	Yes	Yes	Yes	Yes	Yes
Month of year FE	Yes	Yes	Yes	Yes	Yes
Dep. var mean	78,872	34,479	44,393	39,549	4,843
Tax+Tax#Walmart F-statistic	4.989	46.56	2.562	1.109	8.427
p-value	0.0256	0	0.110	0.292	0.00372
R-squared	0.540	0.559	0.477	0.482	0.484
Observations	131,796	131,796	131,796	131,796	131,796

Notes: The table shows the effect of the tax enactment on the calorie consumption of Walmart customers and the rest of households in the Kantar data set. Walmart customers are defined according to their pre-tax purchasing behavior using the following procedure: For each household, we identify if there were weeks in which a Walmart store had the largest share of observed expenditures among all the stores from which the household bought at least one item. Then, a household is defined as Walmart customer if this was the case for at least one week of the month for at least nine out of the twelve months of the year. To avoid the bias induced by households who started attending Walmart during 2013 and therefore increased their calorie consumption, all households who made no purchases at Walmart during 2013, but began shopping at Walmart in 2014 or 2015 were excluded from the sample. The first column shows the effect on purchased calories from all products. Columns 2 and 3 show the effect on purchased calories from taxed (High caloric content products, HCC) and untaxed products, respectively. The last two columns disaggregate the effect shown in column 4 into MCC untaxed products (i.e., untaxed product bar codes associated with caloric contents above the first quartile among the untaxed products) and LCC untaxed products (untaxed product bar codes with caloric content within the first quartile of untaxed products).

5 Model

In this section, we introduce a shopping model in which an agent buys from local stores and has the option to also buy from Walmart. This simple model is consistent with our findings. It outlines how a reduction in the cost of shopping at Walmart can lead to an increase in total calorie consumption. The increase is concentrated on products that are cheaper at Walmart. The model can also explain the substitution patterns through which the option to buy at Walmart can lead to more-effective reductions in caloric intake when the price of HCC products rises.

Environment

Consider a consumer who chooses between buying from local stores and Walmart or only from local stores. An agent who decides to purchase at both types of stores will be able to buy each product from the place where it is cheapest. To buy from Walmart, the agent must incur an exogenous fixed transaction cost.

Assume that there are n goods labeled $k = 1, 2, 3, ..., n$. The agent maximizes a constant elasticity of

substitution (CES) utility function subject to a budget constraint that is affected by the cost of attending Walmart t_w. Let P_{kw} and P_{kc} denote the price of product k in Walmart and local stores respectively. The consumer solves the following problem:

$$\underset{q_1,q_2,\ldots,q_n}{max} \Big(\sum_k q_k^{\frac{\eta-1}{\eta}}\Big)^{\frac{\eta}{\eta-1}} \tag{5}$$

subject to:

$$\sum_k P_{kc} q_k \leq I \tag{6}$$

or:

$$\sum_k P_{kw} q_k \leq I - t_w \tag{7}$$

where $P_{wk} \leq P_{ck}$ for all products and $P_{wk} < P_{ck}$ for at least one.

To solve this problem it suffices to compare the maximum utility the consumer can obtain subject to inequality 6 with that obtained subject to inequality 7. A consumer will shop at the combination of stores that result in his/her utility being maximized.

Apart from price differences, suppose that each good has a different associated caloric content. This is, there is a mapping that assigns a non-negative number that represents the total amount of calories in one unit of each good $k = 1, 2, ..., n$. Consumers do not take caloric content into account when deciding their consumption bundles.

Although in theory, the model should allow for consumers shopping only at Walmart, we exclude that option because we do not observe a household purchasing solely at Walmart in our data set.

Proposition 1. *A sufficiently large reduction in the cost of attending Walmart t_w causes an increase in calorie consumption from products that are cheaper at Walmart. This effect can lead to an increase in total calorie consumption.*

The proof of Proposition 1 is omitted. However, the intuition is simple and relies on the fact that sufficiently large reductions in t_w expand the set of consumers' feasible bundles. Consequently, households that change their shopping decision as a result of the reduction in t_w increase their calorie consumption from products that are cheaper at Walmart. This effect can lead to an increase in total calorie consumption. Furthermore, for consumers who were already buying from Walmart, the reduction in t_w is equivalent to an income effect.

From Proposition 1, it follows that reductions in the cost of shopping at Walmart, such as the opening of new stores, will change households' diets and can potentially lead to increases in total caloric intake.

Proposition 2. *Suppose that goods 1 to n' are a fixed proportion $0 < \tau < 1$ cheaper at Walmart, whereas products n' to n are not. A marginal increase in the price of good k with $k \leq n'$ will lead households who buy*

from Walmart to reduce their consumption of that product more than those who buy only from local stores.

The proof is omitted, but the argument is straightforward. Under a CES utility function, the own-price elasticity of demand is constant. This implies that, at all levels of consumption, the percentage change in consumption in response to the change in price will be the same. Thus, the larger are the baseline levels of consumption, the larger is the own-price response in absolute value.

Proposition 1 identifies reductions in the cost of shopping at Walmart as a cause of increases in caloric intake. Proposition 2 is a mechanical consequence of Proposition 1. It is no surprise that taxes have a larger effect for households that consume the taxed good more. However, the effect of Walmart's presence is not limited to the magnitude of the self-price responses.

In addition to the self-price responses, households' substitution patterns change as a result of price increases, as we now analyze. To simplify exposition, assume that there are three goods, i.e., HCC, MCC, and LCC goods, which are labeled h, m and l respectively. The prices of the three goods are such that $P_{hw} = \tau P_{hc}$, $P_{mw} = P_{mc}$ and $P_{lw} = \tau P_{lc}$, *i.e*, Walmart customers face lower prices for HCC and LCC products compared with customers of other stores.

Let $\hat{I}$ denote the consumer's available income given his/her decision about where to shop and let P_{ks} be the prices that the consumers face given their shopping decisions. Demand for good $k \in \{h, m, l\}$ is:

$$q_k = \hat{I}\Big(P_{ks} + \sum_{j \neq k} P_{js}\Big[\frac{P_{ks}}{P_{js}}\Big]^{\eta}\Big)^{-1} \tag{8}$$

The change in consumption of good $k \in \{m, l\}$ as a result of an increase in P_h is:

$$\frac{\partial q_{ks}}{\partial P_{hs}} = -\hat{I}\Big(P_{ks} + \sum_{j \neq k} P_{js}\Big[\frac{P_{ks}}{P_{js}}\Big]^{\eta}\Big)^{-2}(1-\eta)\Big(\frac{P_{ks}}{P_{hs}}\Big)^{\eta} \tag{9}$$

Note that just as in the equation that characterises demand, the factor $\Big(P_{ks} + \sum_{j \neq k} P_{js}\Big[\frac{P_{ks}}{P_{js}}\Big]^{\eta}\Big)^{-2}$ depends on the price of good k as well as on its price relative to the rest of the goods. A generalized reduction in prices will increase consumption but also increase demand sensitivity. This factor will be larger for consumers who buy at Walmart if all Walmart's products are cheaper, or if product k is cheaper. The last factor of equation 9 is determined by the relative prices of k and u.

Proposition 3. *Suppose that goods h, m and l are substitutes ($1 - \eta < 0$) and $P_{hw} = \tau P_{hc}$, $P_{mw} = P_{mc}$ and $P_{lw} = \tau P_{lc}$ with $0 < \tau < 1$. A marginal increase in P_h will cause Walmart customers to increase more their consumption of good l more than do non-Walmart customers. Moreover, for some values of η Walmart customers will reduce their consumption of good m more.*

Proof. Equation 9 for good l in Walmart is:

$$q_{lw=} - (I - t_w)\Big(P_{lw} + P_{mw}\Big[\frac{P_{lw}}{P_{mw}}\Big]^{\eta} + P_{hw}\Big[\frac{P_{lw}}{P_{hw}}\Big]^{\eta}\Big)^{-2}(1-\eta)\Big(\frac{P_{lw}}{P_{hw}}\Big)^{\eta} \tag{10}$$

$$= -(I - t_w)\Big(\tau P_{lc} + \tau^{\eta} P_{mc}\Big[\frac{P_{lc}}{P_{mc}}\Big]^{\eta} + \tau P_{hc}\Big[\frac{P_{lc}}{P_{hc}}\Big]^{\eta}\Big)^{-2}(1-\eta)\Big(\frac{P_{lc}}{P_{hc}}\Big)^{\eta} \tag{11}$$

And for good m it is:

$$q_{mw} = -(I - t_w)\Big(P_{mc} + \tau^{1-\eta} P_{lc}\Big[\frac{P_{mc}}{P_{lc}}\Big]^{\eta} + \tau^{1-\eta} P_{hc}\Big[\frac{P_{mc}}{P_{hc}}\Big]^{\eta}\Big)^{-2}(1-\eta)\Big(\frac{P_{mc}}{\tau P_{hc}}\Big)^{\eta} \tag{12}$$

which can be arranged as:

$$q_{mw} = -(I - t_w)\Big(\tau^{\eta-1} P_{mc} + P_{lc}\Big[\frac{P_{mc}}{P_{lc}}\Big]^{\eta} + P_{hc}\Big[\frac{P_{mc}}{P_{hc}}\Big]^{\eta}\Big)^{-2}(1-\eta)\tau^{\eta-2}\Big(\frac{P_{mc}}{P_{hc}}\Big)^{\eta} \tag{13}$$

For a consumer who buys from local stores, equation 9 is the same for goods l and m:

$$q_{lc} = -I\Big(P_{lc} + P_{mc}\Big[\frac{P_{lc}}{P_{mc}}\Big]^{\eta} + P_{hc}\Big[\frac{P_{lc}}{P_{hc}}\Big]^{\eta}\Big)^{-2}(1-\eta)\Big(\frac{P_{lc}}{P_{hc}}\Big)^{\eta} \tag{14}$$

$$q_{mc} = -I\Big(P_{mc} + P_{lc}\Big[\frac{P_{mc}}{P_{lc}}\Big]^{\eta} + P_{hc}\Big[\frac{P_{mc}}{P_{hc}}\Big]^{\eta}\Big)^{-2}(1-\eta)\Big(\frac{P_{mc}}{P_{hc}}\Big)^{\eta} \tag{15}$$

Equations 11 to 14 allow us to describe how consumption adapts to a change in the price of h. Because $1 - \eta < 0$, demand for goods l and m will increase as a result of h becoming more expensive. The difference in the magnitude of the increase in consumption of good l between Walmart customers and local stores customers can be seen by comparing Equations 11 and 14. In Equation 11, the third and fourth factors are the same than in equation 14 but the lower prices, and the fact that good l is relatively cheaper in Walmart, increase the second factor, which makes substitution toward cheaper healthy products stronger when t_w is close to zero.

Substitution toward m can be larger in Walmart or in local stores depending on the value of η and on prices. Equations 13 and 15 describe the response depending on were households purchase the goods. The equations differ in the factors $(I - t_w)$ and $\tau^{\eta-2}$ as well as in the second term. To examine a case in which the increase in purchases of m is larger at local stores, consider the simplest case in which all goods cost the same outside of Walmart ($P_{hc} = P_{mc} = P_{lc}$). For a large value of η, the term $\tau^{\eta-2}$ that appears in the equation for Walmart customers (equation 13) approaches zero, whereas the second term tends to a positive constant. Thus, a sufficiently large η implies that the increase in consumption of good m can be larger for consumers who buy from local stores. This concludes the proof of Proposition 3. □

Proposition 3 shows how a policy such as the tax will have different effects depending on the prices of substitutes if Walmart stores sell HCC products but also LCC options at lower prices. A corrective tax can be more effective when Walmart exists in the market.

Our model illustrates a result that might seem striking at first. *i.e.*, the enactment of a tax on HCC foods can be more effective in reducing calorie consumption by customers at Walmart, despite Walmart's absolute advantage in selling HCC products and its association with the recent increases in the caloric content of

Mexicans' diets. This simple shopping model captures how the effectiveness of price-based policies depends not solely on shifting demand for the taxed goods but also on the substitutes available to consumers. Table 4 summarizes the predictions of our model and compares them with our findings for the average responses of Walmart and non-Walmart customers to the enactment of the tax on HCC food in Mexico. We confirm that the regression results shown in Table 3 are indeed consistent with the model.

Table 4: Walmart and substitution. Predicted and observed effect of the tax and the option to attend Walmart on households calorie consumption per type of product.

	Type of product				
	All products	Taxed products	Untaxed products		
	HCC, MCC and LCC	HCC	MCC and LCC	MCC	LCC
Response of consumers					
At other stores only (Δ_c)	Ambiguous (+/-) 227	Reduction (-) -1,503***	Increase (+) 1,730***	Increase (+) 1,698***	Increase (+) 31
At Walmart and other stores (Δ_w)	Ambiguous (+/-) -1,371**	Reduction (-) -966***	Increase (+) 667	Increase (+) 420	Increase (+) 247***
Difference ($\Delta_2 - \Delta_c$)	Ambiguous (+/-) -1,599***	Larger reduction at Walmart (-) -536.5	Ambiguous (+/-) -1,063**	Lower increase at Walmart (-) -1,278***	Larger increase at Walmart (+) 215**

Notes: The table provides a summary of the model's predictions and observed changes in consumption as a result of the tax. The first two rows show the predicted sign and observed magnitude of the change in purchased calories for each type of product for customers of other stores and Walmart customers. The last row shows the predicted sign and observed magnitude of the difference in differences estimator between Walmart customers and other consumers, i.e., the sign of the difference between the change in total calories purchased by a Walmart customer and the change in total calories purchased by a customer of local stores. HCC, MCC, and LCC denotes high, middle, and low caloric content products, respectively. The observed average magnitudes are reported below the predicted signs and were calculated from the regression results of Table 3. The average response of consumers who do not buy from Walmart is represented by the coefficient of a dummy that indicates the enactment of the tax on HCC foods. The average response of Walmart customers is the sum of two components, one is the coefficient of the tax dummy, and another the coefficient for the interaction between the tax enactment and the Walmart customers indicator.

6 Conclusion and future work

This study is the first to document the relation between the transition toward calorie-intense diets in developing countries and globalization of the retail industry. Using an event study approach on the ENIGH surveys from 2008 to 2016, we show that the entry of Walmart into the Mexican market increased the total caloric intake of Mexican households by 8% and that the increase was not uniform across products. Specifically, we found that the increase was concentrated in foods that are not obviously healthy. Moreover, using a high-frequency panel that captures purchases of bar-coded products, we found that the timing of the increase coincides exactly with the months in which Walmart stores entered the market in Mexican cities.

In addition to identifying retail globalization as one of the causes of the increasing trend in calorie consumption by Mexicans, we explore the implications of the globalized retail market for the effectiveness of price-based health policies. We find that the effects on caloric intake of the tax on HCC foods enacted by the Mexican government were mixed. For most households, substitution toward untaxed options compensated for the decrease in the consumption of calories from taxed products. However, this was not the case for households who had the option to shop at Walmart. We show that the lower prices of low-calorie alternatives compared with taxed products at Walmart promoted substitution toward a different set of products, which in turn led to a reduction in the number of purchased calories by Walmart customers.

One caveat of our analysis is that we are not able to fully capture substitution patterns between and within food categories. This could be done using a structural model better suited to capture this patterns. Moreover, our evidence in favor of Walmart becoming the main store from which some households source their consumption of packaged products suggests that incorporating travel costs and the trade-off between multi store and one stop shopping could explain the mechanisms by which the option to buy from Walmart affected the impact of the tax to products with high caloric content. Estimating such a model is the next step of this research project.

The success of health policies relies on the policy makers having a clear understanding of the causes and economic factors underlying the problems that they aim to alleviate. A necessary condition for "sin foods" taxes to be effective is the availability of substitute options. Although retail globalization increases households' calorie consumption, it also expands the choices available to consumers with respect to domestic retailers, which can provide the conditions under which price-based policies such as sin foods taxes can be more effective in their goal of transforming the composition of households' diets.

References

[1] Arturo Aguilar, Emilio Gutierrez, and Enrique Seira. "The effectiveness of sin food taxes: evidence from Mexico." In: *Instituto Tecnológico Autónomo de México (ITAM) Working Paper* (2019).

[2] Hunt Allcott et al. "Food deserts and the causes of nutritional inequality." In: *The Quarterly Journal of Economics* 134.4 (2019), pp. 1793–1844.

[3] David Atkin, Benjamin Faber, and Marco Gonzalez-Navarro. "Retail globalization and household welfare: Evidence from mexico." In: *Journal of Political Economy* 126.1 (2018), pp. 1–73.

[4] Emek Basker. "Job creation or destruction? Labor market effects of Wal-Mart expansion." In: *Review of Economics and Statistics* 87.1 (2005), pp. 174–183.

[5] May A Beydoun, Lisa M Powell, and Youfa Wang. "The association of fast food, fruit and vegetable prices with dietary intakes among US adults: is there modification by family income?" In: *Social science & medicine* 66.11 (2008), pp. 2218–2229.

[6] John Cawley. "An economy of scales: A selective review of obesity's economic causes, consequences, and solutions." In: *Journal of health economics* 43 (2015), pp. 244–268.

[7] Chanjin Chung and Samuel L Myers Jr. "Do the poor pay more for food? An analysis of grocery store availability and food price disparities." In: *Journal of consumer affairs* 33.2 (1999), pp. 276–296.

[8] M Arantxa Colchero et al. "Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study." In: *bmj* 352 (2016), h6704.

[9] Joan Costa-Font and Núria Mas. "'Globesity'? The effects of globalization on obesity and caloric intake." In: *Food Policy* 64 (2016), pp. 121–132.

[10] Ronald Cotterill and Andrew Franklin. *The urban grocery store gap.* Tech. rep. 1995.

[11] Charles Courtemanche and Art Carden. "Supersizing supercenters? The impact of Walmart Supercenters on body mass index and obesity." In: *Journal of Urban Economics* 69.2 (2011), pp. 165–181.

[12] Janet Currie et al. "The effect of fast food restaurants on obesity and weight gain." In: *American Economic Journal: Economic Policy* 2.3 (2010), pp. 32–63.

[13] David M Cutler, Edward L Glaeser, and Jesse M Shapiro. "Why have Americans become more obese?" In: *Journal of Economic perspectives* 17.3 (2003), pp. 93–118.

[14] Pierre Dubois, Rachel Griffith, and Aviv Nevo. "Do prices and attributes explain international differences in food purchases?" In: *American Economic Review* 104.3 (2014), pp. 832–67.

[15] Jason M Fletcher, David E Frisvold, and Nathan Tefft. "The effects of soft drink taxes on child and adolescent consumption and weight outcomes." In: *Journal of Public Economics* 94.11-12 (2010), pp. 967–974.

[16] Osea Giuntella, Matthias Rieger, and Lorenzo Rotunno. "Trade in unhealthy foods and obesity: Evidence from Mexico." In: (2017).

[17] Tadeja Gracner. "Bittersweet: how prices of sugar-rich foods contribute to the diet-related disease epidemic in Mexico." In: *Job Market Paper* (2015).

[18] Michael Grossman, Erdal Tekin, and Roy Wada. "Food prices and body fatness among youths." In: *Economics & Human Biology* 12 (2014), pp. 4–19.

[19] Matthew Harding and Michael Lovenheim. "The effect of prices on nutrition: comparing the impact of product-and nutrient-specific taxes." In: *Journal of health economics* 53 (2017), pp. 53–71.

[20] Jerry Hausman and Ephraim Leibtag. "Consumer benefits from increased competition in shopping outlets: Measuring the effect of Wal-Mart." In: *Journal of Applied Econometrics* 22.7 (2007), pp. 1157–1177.

[21] James O Hill, Holly R Wyatt, and John C Peters. "Energy balance and obesity." In: *Circulation* 126.1 (2012), pp. 126–132.

[22] Thomas J Holmes. "The diffusion of Wal-Mart and economies of density." In: *Econometrica* 79.1 (2011), pp. 253–302.

[23] Stefan Hut and Emily Oster. "Changes in Household Diet: Determinants and Predictability." In: (2015).

[24] Leonardo Iacovone et al. "Supplier responses to Walmart's invasion in Mexico." In: *Journal of International Economics* 95.1 (2015), pp. 1–15.

[25] Beata S Javorcik and Yue Li. "Do the biggest aisles serve a brighter future? Global retail chains and their implications for Romania." In: *Journal of International Economics* 90.2 (2013), pp. 348–363.

[26] Beata Javorcik, Wolfgang Keller, and James Tybout. *Openness and industrial response in a Wal-Mart world: a case study of Mexican soaps, detergents, and surfactant producers*. The World Bank, 2006.

[27] Panle Jia. "What happens when Wal-Mart comes to town: An empirical analysis of the discount retailing industry." In: *Econometrica* 76.6 (2008), pp. 1263–1316.

[28] Phil R Kaufman. "Rural poor have less access to supermarkets, large grocery stores." In: *Rural America/Rural Development Perspectives* 13.2221-2019-2662 (1998), pp. 19–26.

[29] Phillip R Kaufman et al. *Do the poor pay more for food? Item selection and price differences affect low-income household food costs*. Tech. rep. 1997.

[30] Dragan Miljkovic et al. "Globalisation and obesity." In: *The World Economy* 38.8 (2015), pp. 1278–1294.

[31] Kimberly Morland et al. "Neighborhood characteristics associated with the location of food stores and food service places." In: *American journal of preventive medicine* 22.1 (2002), pp. 23–29.

[32] Lisa Oberlander, Anne-Célia Disdier, and Fabrice Etilé. "Globalisation and national trends in nutrition and health: A grouped fixed-effects approach to intercountry heterogeneity." In: *Health economics* 26.9 (2017), pp. 1146–1161.

[33] World Health Organization. *The world health report 2002: reducing risks, promoting healthy life*. World Health Organization, 2002.

[34] Lisa M Powell and Frank J Chaloupka. "Food prices and obesity: evidence and policy implications for taxes and subsidies." In: *The Milbank Quarterly* 87.1 (2009), pp. 229–257.

[35] Donald Rose and Rickelle Richards. "Food store access and household fruit and vegetable use among participants in the US Food Stamp Program." In: *Public health nutrition* 7.8 (2004), pp. 1081–1088.

[36] Øyvind Thomassen et al. "Multi-category competition and market power: a model of supermarket pricing." In: *American Economic Review* 107.8 (2017), pp. 2308–51.

[37] Roberto De Vogli et al. "Economic globalization, inequality and body mass index: a cross-national analysis of 127 countries." In: *Critical Public Health* 24.1 (2014), pp. 7–21.

[38] Richard Volpe, Abigail Okrent, and Ephraim Leibtag. "The effect of supercenter-format stores on the healthfulness of consumers' grocery purchases." In: *American Journal of Agricultural Economics* 95.3 (2013), pp. 568–589.

[39] Zy Weinberg. *No Place to Shop: The Lack of Supermarkets in Low-income Neighborhoods: Analysis of a University of Connecticut Study on Low-income Communitites and Households Receiving Public Assistance in 21 Metropolitan Areas.* Public Voice for Food and Health Policy, 1995.