Retail Globalization and Household Welfare: Evidence from Mexico*

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Abstract

The arrival of global retail chains in developing countries is causing a radical transformation in the way that households source their consumption. This paper draws on a new and unique collection of Mexican microdata to estimate the effect of foreign supermarket entry on household welfare and its underlying channels. The richness of the data allow us to estimate a general expression for the welfare gains from retail FDI, and to decompose the total effect into several distinct components. To base our estimates on plausibly exogenous variation in foreign retail entry we propose an event study design that exploits data on the universe of foreign store locations and opening dates in combination with high frequency data on barcode-level store prices, consumption quantities, and household incomes in those same locations over the period 2002-2014. We find that foreign retail entry causes large and significant welfare gains for the average household that are mainly driven by a reduction in the cost of living. A substantial share of this price index effect is due to pro-competitive effects on consumer prices charged by domestic stores. We find little evidence of significant changes in average municipality level incomes, wages or employment. We do, however, find evidence of adverse effects on the incomes of traditional retail sector workers. Finally, we present evidence that the gains from retail FDI are positive for all income groups but regressive, and quantify the opposing forces that underlie this finding.

Keywords: Supermarket revolution; foreign direct investment; gains from trade
JEL Classification: F15; F23; F63; O24

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1 Introduction

A radical transformation is occurring in the way households in developing countries source their consumption. A key driver of this so called 'supermarket revolution' has been the arrival of global retail chains in developing countries (Reardon et al., 2003; Humphrey, 2007). Retail globalization has already reached substantial levels and the process continues at pace. In 2012, the 250 largest retailers reported 4.3 trillion USD in revenues, of which 25 percent were due to foreign affiliate sales. This represents an increase of more than 400 percent relative to foreign affiliate sales of these firms in the year 2000, and a doubling of the foreign sales share in total revenues.[1] Over the same period, the share of the world stock of inward retail FDI accounted for by developing countries also more than doubled to 25 percent (UNCTAD, 2013).

Perhaps unsurprisingly in this context, retail globalization has led to heated policy debates.[2] Those against foreign retailers point to the large share of employees working in traditional stores, while those in favor emphasize potential benefits from lower consumer prices. Importantly, these debates have also led to stark differences in the policy approaches to retail FDI across countries. While some countries such as Argentina, Brazil, Mexico and most of Eastern Europe chose to fully liberalize retail FDI at the beginning of the 1990s, several developing countries including India continue to severely restrict foreign retail entry and others such as Indonesia, Malaysia and Thailand re-imposed regulatory barriers on foreign retailers after initially allowing entry (Dufey et al., 2008; Wrigley and Lowe, 2010). These policy differences matter because retail is a key sector of the economy in terms of both employment and consumption: Retail accounts for approximately 20% of total employment, 10-15% of total GDP, and more than 50% of total household expenditure in developing countries.[3]

Despite the rapid globalization of retail in the developing world and widespread policy interest, the existing literatures in trade and development have so far paid relatively little attention to this facet of international integration. This paper brings to bear a new and uniquely rich collection of microdata to assess the consequences of retail FDI in the context of Mexico, a country whose retail landscape underwent a dramatic transformation as foreign retailers came to dominate its market over the last 20 years. Our analysis coincides with the major wave of foreign store expansion in Mexico, providing an ideal empirical setting to study the process of retail globalization. The number of foreign supermarkets close to quadrupled from 365 stores at the end of 2001 to 1335 stores at the end of our estimation period in March 2014.[4]

The paper aims to answer three central questions: 1) What is the effect of retail FDI on average household welfare in the municipality of entry?; 2) What are the channels underlying this effect?; and 3) To what extent do the gains from retail FDI differ across the pre-existing distribution of household incomes?

[1] Source: Deloitte Global Powers of Retail 2014.

[2] For example, it took India's Congress Party several years and many failed attempts to finally approve foreign entry into multi-brand retail in 2012. This process was accompanied by street protests, and several Indian states, such as Delhi, subsequently voted to block foreign entry. Most recently, the new ruling party BJP has announced its intention to move back to an outright nationwide ban of foreign retailers.

[3] These figures are based on reporting developing countries in ILO data (employment), UN National Accounts statistics (GDP), and household consumption surveys (retail expenditures).

[4] These figures are based on the Mexican national association of retailers (ANTAD). See Sections 2 and 4 for further details.

In answering these questions, the paper also makes two methodological contributions to the literature that focuses on quantifying the gains from trade and multinational production. The first is that rather than imposing theoretical structure ex ante to limit the data requirements to a set of readily observable aggregate moments, we take advantage of massive recent improvements in the collection and availability of microdata in developing countries which allows us to estimate a very general expression of the welfare gains from retail FDI. In particular, the combination of rich microdata on barcode-level consumer prices and quantities, worker-level incomes and store-level profits allows us to empirically capture all major components of household welfare. The second contribution is that, rather than relying on cross-sectional moments that may or may not capture the causal effects of integration, we propose an event study design to ensure that the moments we feed into the welfare expression are causally identified.

At the center of the analysis lies the construction of an extremely rich collection of microdata that allow us to analyze the impacts of retail FDI on all major components of household welfare. We combine data on all foreign store locations and opening dates over the period 1999-2014, with household, product and store level microdata from multiple sources: monthly barcode-by-store level consumer prices over the period 2002-2014 from the confidential microdata of the Mexican Consumer Price Index; daily household-by-barcode-by-store level data on consumption quantities and prices from the uncensored Mexican AC Nielsen Consumer Panel over the period 2011-2014; store level revenues, costs and profits for the universe of urban retail establishments from the confidential microdata of the Mexican retail census; and quarterly individual level labor and business incomes, occupations and employment over the period 2002-2012 from Mexico's income and employment surveys (ENEU/ENOE).

The analysis proceeds in four steps. In Step 1, we write down a general theoretical framework that decomposes the welfare effect of retail FDI into six distinct components. Using our data, we are able to express these fully in terms of two types of observable empirical moments: a set of causal effects on local economic outcomes due to foreign entry, and a set of household demand parameters. In Step 2, we turn to estimating the causal effects of foreign store entry on consumer prices, quantities, and household incomes using an event study design. In Step 3, we estimate the key demand parameters that govern the substitutability across local stores as a function of price differences. Finally, in Step 4 we utilize the theoretical framework in combination with the empirical estimates from the previous steps to quantify the total household gains from retail FDI, the underlying channels, and the distribution of the gains across the pre-existing income distribution. We now discuss each of these steps in more detail.

In Step 1, we derive a very general expression for the effect of retail FDI on household welfare. We decompose the total effect into three distinct effects on household cost of living (the price index) and three effects on household nominal incomes. We express the total cost of living effect as the sum of a direct price index effect and a pro-competitive price index effect. The direct price index effect captures the implicit changes in consumer prices due to foreign stores offering new varieties, pre-existing varieties at cheaper prices, as well as different shopping quality. The pro-competitive effect comprises an intensive margin, the effect of foreign entry on consumer prices in continuing domestic stores, and an extensive margin, the implicit price index changes due to domestic store exit. We express the total effect on nominal incomes as the sum of a retail income

effect and an effect on incomes from other sectors. Within the retail income effect, we separate business income effects for domestic store owners and labor income effects for workers in both the modern and traditional domestic retail sectors. To relate this general estimation framework to the recent quantitative literature on the gains from trade and multinational production, we show that, under a set of functional form assumptions that the data allow us to test directly, this welfare expression collapses to the import-share sufficient statistic in Arkolakis et al. (2012) and extended to foreign production shares for the case of horizontal FDI in Ramondo and Rodriguez-Clare (2013).

In Steps 2 and 3 we estimate the various empirical moments required to quantify the six effects that underlie the total household gains from retail FDI. We tackle the pro-competitive effect among continuing domestic stores first. The first empirical challenge in identifying this effect is that the composition of goods and stores within consumer product groups changes over time. This implies that changes in unit values reported in household consumption surveys yield imperfect measures of local consumer price changes. We address this challenge by exploiting nationally representative store price surveys at the barcode-by-store level that are administered by Mexico's statistical agency INEGI to calculate the CPI. These data allow us to construct monthly time series of prices for individual barcode products sold in a particular retail outlet in a particular municipality over the period 2002-2014.

The second empirical challenge is non-random entry of foreign retailers. To ensure that we are identifying the causal effect on consumer prices in domestic stores, we propose an event study design. We argue that over our period of study, foreign retailers operated under the objective of establishing store presence in every major urban location in Mexico. In turn, the precise timing of opening within these locations was determined by the speed of obtaining zoning permits and the completion of construction, and so the month of opening will be uncorrelated with location specific changes in prices or incomes that may confound estimates of the price and income effects of foreign retail entry. We test this identifying assumption by estimating a full set of 48 monthly treatment effects starting one year prior to the opening event and continuing for three years after opening. By looking for evidence of pre-trends in these monthly treatment effects we are able to transparently and non-parametrically test for the validity of this identifying assumption.

While our data allow us to observe the price changes of continuing store-by-product varieties in order to estimate the intensive margin pro-competitive effect, the implicit price changes that result from either the arrival of new store-by-product varieties in foreign stores (the direct price index effect) or the exit of domestic stores (the extensive margin of the pro-competitive effect) are inherently unobservable because neither first period prices of new varieties nor second period prices of exiting varieties can be recorded. To quantify the cost of living implications of these changes in the available set of consumer choices, we require functional form assumptions about consumer demand in order to estimate a virtual price, the price at which demand would be zero.

To this end, we use two different approaches. The first approach assumes a multi-tier CES preference structure. This approach has the appeal of being widely used in the trade literature that evaluates the gains from new products starting with Feenstra (1994), in part because it yields a very parsimonious expression for the welfare gain from new products (or stores in our case). This expression requires information on the ex post household expenditure shares on foreign

stores in combination with estimates of the elasticity of substitution across local outlets. To obtain these estimates, we exploit the uncensored microdata of the Mexican AC Nielsen Consumer Panel which contain barcode-level prices and household consumption quantities matched to retailer identities. A second benefit of the CES structure is that it allows us to relate our results to the recent quantitative literature on the gains from trade: We show that under CES preferences, the expression for the direct price index effect of foreign entry is identical to the well known sufficient statistic for the gains from trade of Arkolakis et al. (2012) and Ramondo and Rodriguez-Clare (2013).

While the assumption of CES preferences has its virtues, it is also well understood that, due to its infinite reservation prices, this preference structure likely yields an upper bound for the welfare gains from variety (Feenstra and Shiells, 1996). To address such concerns, we also estimate virtual price changes under the symmetric translog preferences proposed by Feenstra and Weinstein (2010). These preferences allow additional flexibility in so far as price elasticities can vary with the local retail environment. This additional flexibility requires additional information on the number of stores in different retail segments both before and after foreign store entry, which we obtain from the confidential microdata of the Mexican retail census.

To estimate the effects on nominal household incomes, we construct a quarterly time series of individual incomes, wages, occupation, and employment status that allows us to track individual workers and business owners over time in a given municipality. The identification issues are very similar to those we address in the price regressions. Accordingly, we follow a similar event study approach and examine how incomes, wages and employment status change in quarters before and after the month of entry of a foreign retailer. Similar to the consumer price regressions, this quarterly event study design allows us to test for pre-existing differences in the growth rates of local household economic outcomes without imposing parametric structure.

In Step 4, we combine the estimates from Steps 2 and 3 to quantify the general welfare expression from Step 1 and present several new findings. We find that foreign supermarket entry causes large and significant welfare gains for the average household that are in the order of ten percent of initial household income. The majority of this effect is driven by a significant reduction in the cost of living. Interestingly, about one third of the price index effect appears to be driven by pro-competitive effects on consumer prices charged by pre-existing domestic stores. This effect arises in addition to the direct price index effect that is due to foreign supermarkets offering cheaper quality-adjusted prices and new varieties to consumers. The finding that the majority of the price index effect is driven by the direct effect of foreign entry is also consistent with the fact that foreign retailers charge on average 12 percent lower prices for the identical barcodes within the same month and municipality, offer several times the barcode variety compared to domestic stores, and constitute on average more than one third of average household retail spending after foreign entry. We find no evidence of an effect on average municipality level household incomes or employment rates. We do, however, find that workers in the traditional retail sector experience significant adverse income effects. Finally, we present evidence that while all household income groups experience significant gains from retail FDI, this effect is larger for initially higher income households, and quantify the interplay of opposing forces that underlie this result.

The paper is related to the recent literature that estimates the gains from international inte-

gration for developing countries and the distribution of those gains (Porto, 2006; Goldberg and Pavcnik, 2007; Topalova, 2010; Atkin, 2013; Donaldson, forthcoming; Faber, 2014; Fajgelbaum and Khandelwahl, 2014). Relative to the existing literature on trade and development, we focus on the consequences of retail globalization, a channel of integration that has received relatively little attention. Another difference is this paper's careful empirical evaluation of all major components of household welfare and, in particular, the cost of living implications of the policy in question. Rather than relying on household consumption surveys in combination with simulated price changes at the level of aggregate product groups as in Porto (2006) and earlier work by Deaton (1989), or relying on cross-country trade flows as in Caron et al. (2012) and Fajgelbaum and Khandelwal (2014), this paper draws on price and consumption data at the level of individual households, barcodes, and stores to provide the first empirical estimate of the effect of foreign retail entry on household price indexes.

The paper closely relates to a small body of work that explores the economic consequences of foreign supermarkets in developing and emerging countries (Neven and Reardon, 2004; Iacovone et al., 2011; Javorcik and Li, 2013).[5] Relative to these papers which have focused on the spill-over effects on domestic suppliers in both agriculture and manufacturing, this paper instead focuses on the consequences for consumers, workers and business owners located in the municipality where the foreign store entry occurs. To the best of our knowledge, this is the first paper to provide empirical evidence on these first order effects of retail globalization. [6]

The paper also relates to the recent quantitative literature on the gains from multinational production (Ramondo, 2012; Ramondo and Rodríguez-Clare, 2013). The richness of the collected microdata allow us to empirically estimate a very general expression of the welfare effect of retail FDI which is a form of horizontal multinational production. Because our expression nests as one of its terms the recent sufficient statistic approach pioneered in Arkolakis et al. (2012), this paper provides empirical evidence on a number of commonly made assumptions in the literature. For example, we empirically estimate the size and nature of the pro-competitive effects of foreign entry, separately estimate price index and nominal income effects, and document to what extent the estimated average effect of multinational production on household welfare differs across the income distribution.

In so far as we are estimating the welfare effects of new foreign retail choices, the work is also related to the trade literature that estimates the gains from new product variety (Feenstra, 1994; Broda and Weinstein, 2006; Feenstra and Weinstein, 2010; Handbury and Weinstein, 2013). In addition to studying foreign retailer entry at the level of a municipality as opposed to extensive margin changes in country level import flows, the richness of the collected data allows us to directly trace foreign production shares across the consumption baskets of individual households at the level of disaggregated product groups. To the best of our knowledge, this is the first time that an empirical analysis exploits information on import shares in consumption directly (in our setting expenditure shares on foreign-owned stores) at the household-by-product group level in

[5] Varela (2013) uses Walmart's entry decisions into local markets in Mexico to estimate a structural model of diseconomies of scale in outlet expansion.

[6] We note that this paper's focus is on quantifying the effects of foreign retail entry on the local population living within the municipality, and is silent on potentially interesting national level effects such as changes in manufacturing productivity that are absorbed by time fixed effects in our empirical setting.

order to quantify the gains from integration. The key data that allow us to make progress on this front are the uncensored microdata of the Mexican Nielsen Consumer Panel in which we observe retailer identities that we can link to foreign ownership status.

Finally, since Walmart de México is by far the biggest foreign retailer in Mexico (and in fact is more dominant in Mexico than it has ever been in the United States), the paper relates to an extensive literature on the effects of Walmart in the United States. Basker (2005) analyzes effects on retail employment. Jia (2008) focuses on entry and exit decisions between Walmart and competing retailers. Hausman and Leibtag (2007) estimate the consumer benefits of Walmart entry. And Holmes (2011) infers economies of store density for Walmart from the centrifugal but dense expansion of Walmart. This paper offers two main innovations relative to the existing literature. First, developing countries offer a very different pre-existing retail environment to study the effect of modern big box store entry. That is, rather than analyzing the effect of modern store entry in the context of an already modernized retail sector, this paper sheds light on the effect of exposing a largely traditional retail environment to what is arguably the world's technological frontier in retailing. Second, to the best of our knowledge this paper is the first to provide a comprehensive measurement of the total welfare effect of retail formats such as Walmart for local households. Somewhat surprisingly, the estimation of the effect of retail modernization on both nominal incomes and household cost of living in a unified empirical framework has not been attempted in the existing literature to date.

The remainder of the paper is structured as follows. Section 2 describes the background and policy context of retail globalization in Mexico. Section 3 presents the theoretical framework. Section 4 describes the data sets used to estimate each component of the welfare expression. Sections 5 and 6presents the empirical strategy and estimation results. Section 7 draws on these estimation results in combination with estimates of household demand parameters to quantify the average household welfare gain from retail FDI, its underlying channels, and how it varies across the pre-existing distribution of household incomes. Section 8 concludes.

2 Background on Retail Globalization in Mexico

Mexico's 1981 sovereign debt default was followed by a radical transition from a closed economy import substitution model towards liberalization and opening its market to foreign competition. Major reforms included the 1986 joining of GATT and the 1989 loosening of Mexico's FDI restrictions, such as licensing and local majority ownership of firms. Towards the late 1980's the government focused its efforts on inflation control and public deficit reduction, leading to a significant privatization program and opening of the economy to FDI to foster a more competitive domestic economy. The reform process culminated with the negotiation of NAFTA which came into effect in January of 1994. NAFTA signaled a long term commitment to open trade and investment and has been credited with turning Mexico into a major worldwide destination for FDI in the ensuing years.

Foreign investments in retail and other sectors were originally governed by the 1973 Foreign Investment Law which required FDI to be approved on a case by case basis, and generally required a minimum 51% Mexican ownership. Over the 1980's restrictions were relaxed allowing

FDI in most sectors up to 49% without explicit authorization, and allowing specific sectors to have up to full foreign ownership. The major final step in Mexico's opening to FDI was brought about by NAFTA which allowed full foreign ownership in all (including retail) but a few reserved sectors such as energy. Of particular importance was the fact that NAFTA guaranteed full freedom to repatriate profits and a third-party dispute resolution mechanism.

The first significant foreign investment in retail we are aware of is the purchase of 49% of Casa Ley (a regional retailer in Northern Mexico) by Safeway of the U.S. in 1981 under pre-NAFTA regulations. However, the truly transformative event has proven to be Walmart's decision to enter the Mexican market in the early 1990's around the time of NAFTA's negotiation. Walmart initially arrived under a joint venture partnership with Mexican retailer Cifra, a successful local retailer focused on the Mexico City region with around 100 supermarket units. By 1997 Cifra was bought out by Walmart, and in 2000 the name of the company was changed to Walmart de México (WALMEX). In the ensuing years, Walmart de México became the largest retail chain and the largest employer in the country with 210,000 employees in January 2014.

The entry of global retail chains and their modern store formats into Mexico created a setting in which the domestic retail market, which was dominated by street markets, traditional store formats and independent shop owners, was exposed to what is arguably the world technological frontier in retailing. Major operational and technological differences included the introduction of distribution centers, modern logistics such as cold-chain logistics for fresh products, and sourcing from global supply chains (Biles, 2008).

The expansion of Walmart and other foreign supermarket chains, such as Casa Ley-Safeway, Costco, HEB, Smart and Waldos, proceeded relatively slowly during the second half of the 1990s, serving predominantly metropolitan and relatively high income neighborhoods in the major cities. As depicted in Figure 1, the number of foreign supermarkets in Mexico expanded from 204 stores at the end of 1995 to 365 stores at the end of 2001. In both periods, the presence of foreign stores was strongly concentrated in a handful of central locations in the major metropolitan centers of Mexico. Between 2002 and 2014, the estimation period of our empirical analysis, foreign retailers expanded close to fourfold from 365 supermarkets to 1335 at the beginning of 2014. As is apparent in Figure 1, this period saw the expansion of foreign supermarkets way beyond the large metropolitan city centers, towards establishing presence among the wide range of second and third tier urban areas as small as 15,000 inhabitants.

3 Theoretical Framework

In this section we derive a general expression for assessing the impact of foreign supermarket entry on local household welfare. We allow foreign supermarket entry to affect welfare through a variety of channels that affect both the cost of living (i.e. the price index) as well as household nominal incomes. We distinguish between three separate channels on the cost of living side: (1) a direct price index effect whereby the entry of foreign stores lowers the household cost of living by offering new varieties, pre-existing varieties at potentially cheaper prices, as well as different levels of shopping quality, (2) an intensive margin pro-competitive effect whereby foreign supermarkets affect consumer prices charged by continuing domestic retailers due to greater

competition in the local retail market, and (3) the extensive margin of the pro-competitive effect on domestic retail prices whereby foreign entry affects the available local variety due to the potential exit of domestic stores. On the nominal income side, we also distinguish between three separate channels: (4) an income effect for workers in both the traditional and modern domestic retail sector due to wage and employment changes that result from foreign entry, (5) a retail business income effect for domestic store owners due to increased competition with foreign retailers, and (6) additional general equilibrium effects on non-retail household income.

3.1 A General Estimation Framework

Consumers purchase goods from a set of "items" indexed by a product b by store s pair. Each product is sold by potentially many stores. These stores may belong to either the modern retail sector i_m (e.g. supermarkets or big box stores) or to the traditional retail sector i_t (e.g. market stalls or mom-and-pop stores) with the two retail sectors indexed by $i \in \{i_m, i_t\}$, respectively. For notational convenience, we distinguish prices at foreign retailers in the modern sector (indexed by f with product-store prices stacked in a vector $\mathbf{P}_f$) from domestic retailers (indexed by d with product-store prices stacked in a vector $\mathbf{P}_d$), with the latter category including both modern and traditional retailers.

A household h's nominal expenditure on all goods and services, $e(\mathbf{P_d}, \mathbf{P_f}, u_h)$, is equal to household nominal income:

$$e(\mathbf{P}_d, \mathbf{P}_f, u_h) = y_h = \sum_{i \in \{i_m, i_t\}} w_i l_{ih} + \sum_{i \in \{i_m, i_t\}} \pi_{ih}(\mathbf{P}_{ih}; \mathbf{w}) + x_h. \tag{1}$$

where nominal income y_h is the sum of three terms: wage earnings w_i from household labor l_{ih} (with $\sum l_{ih} \leq n_h$ where n_h is household labor supply) across both retail sectors; profits π_{ih} from domestic modern or traditional retail enterprises owned by the household that depend on the vector of output prices $\mathbf{P}_{ih}$ and the vector of input prices $\mathbf{w}$ including potentially household labor; and income from other sources x_h.

In order to calculate the welfare effects we consider the compensating variation[7], the change in exogenous income required to maintain utility when foreign retail arrives between period 1 and period 0, with periods denoted by superscripts:

$$CV = \underbrace{\left[e(\mathbf{P}_d^{1*}, \mathbf{P}_f^1, u_h^0) - e(\mathbf{P}_d^0, \mathbf{P}_f^{0*}, u_h^0)\right]}_{\text{Cost of living effect } (CLE)} - \underbrace{\left[\sum_i w_i^1 l_{ih}^1 - \sum_i w_i^0 l_{ih}^0 + \sum_i \pi_{ih}^1(\mathbf{P}_{ih}^1; \mathbf{w}^1) - \sum_i \pi_{ih}^0(\mathbf{P}_{ih}^0; \mathbf{w}^0) + x_h^1 - x_h^0\right]}_{\text{Income effect } (IE)}. \tag{2}$$

Or in proportional terms (relative to period 0 expenditure):

$$\frac{CV}{e(\mathbf{P}_d^0, \mathbf{P}_f^{0*}, u_h^0)} = \underbrace{\left[\frac{e(\mathbf{P}_d^{1*}, \mathbf{P}_f^1, u_h^0)}{e(\mathbf{P}_d^0, \mathbf{P}_f^{0*}, u_h^0)} - 1\right]}_{\text{Cost of living effect } (CLE)} - \underbrace{\left[\frac{\sum_i w_i^1 l_{ih}^1 + \sum_i \pi_{ih}^1(\mathbf{P}_{ih}^1; \mathbf{w}^1) + x_h^1}{\sum_i w_i^0 l_{ih}^0 + \sum_i \pi_{ih}^0(\mathbf{P}_{ih}^0; \mathbf{w}^0) + x_h^0} - 1\right]}_{\text{Income effect } (IE)}. \tag{3}$$

[7] This approach follows earlier work by Hausman (1981) and Hausman and Leonard (2002).

The first term is the cost of living effect, whereby foreign retail entry may lower the prices consumers pay. Of course foreign retailers' prices are not observed prior to their entry and so the foreign retail prices in period 0 are replaced with virtual prices $\mathbf{P}_f^{0*}$, the foreign prices that would ensure that exactly zero quantity was consumed given the price vector of other goods. These virtual prices can be estimated with additional assumptions on the form of demand. Similarly, prices are not always observed for domestic items that exit between periods 0 and 1 and these unobserved prices are also replaced with virtual prices; the vector $\mathbf{P}_d^{1*}$ contains actual prices for the observed domestic items in period 1 (continuously available items and new items) and virtual prices for item exits, while the vector $\mathbf{P}_d^0$ contains actual prices for domestic items in period 0.[8]

The second term is the income effect, whereby foreign retail entry may change wages, particularly in the retail sector, and may alter profits for firms competing with foreign retailers.

In the following sections we consider the various sub-components of the cost of living and income effects as well as the moments in the data that we will use to identify them.

3.2 Estimating the Cost of Living Effect

The cost of living effect can be divided into two quite distinct sub-components: a direct effect due to new items sold at foreign retailers (either previously available varieties of a product sold by foreign retailers at lower shopping-quality-adjusted prices, or new varieties of products); and a pro-competitive effect due to domestic retailers exiting or changing prices as a result of the entry of foreign retailers. To see these distinct terms, note that

$$CLE = \underbrace{\left[e(\mathbf{P}_d^{1*}, \mathbf{P}_f^1, u_h^0) - e(\mathbf{P}_d^{1*}, \mathbf{P}_f^{1*}, u_h^0)\right]}_{\text{(1) Direct effect } (DE)} + \underbrace{\left[e(\mathbf{P}_d^{1*}, \mathbf{P}_f^{1*}, u_h^0) - e(\mathbf{P}_d^0, \mathbf{P}_f^{0*}, u_h^0)\right]}_{\text{Pro-competitive effect } (PE)}. \quad (4)$$

where using the virtual price notation defined above, $\mathbf{P}_f^{1*}$ are the prices required to set demand for foreign products equal to zero given domestic prices in period 1. The first expression which we label the direct effect is the cost difference between obtaining u_h^0 at period 1 prices with and without the presence of foreign retail. These are the gains from foreign retail arrival holding fixed competitors prices. The second expression which we label the pro-competitive effect is the cost difference between obtaining u_h^0 at period 1 domestic prices and at period 0 domestic prices accounting for domestic product exit through the use of virtual prices (in the absence of foreign retail in either period). These are the gains from foreign retail working through changes in domestic competitors on the intensive and extensive margins.

The pro-competitive effect can itself be divided into two terms by separating the price effects on continuing domestic items with a price vector $\mathbf{P}_{dc}$, from domestic item exiters with prices $\mathbf{P}_{dx}$:

$$PE = \underbrace{\left[e(\mathbf{P}_{dc}^1, \mathbf{P}_{dx}^{1*}, \mathbf{P}_f^{1*}, u_h^0) - e(\mathbf{P}_{dc}^0, \mathbf{P}_{dx}^{0*}, \mathbf{P}_f^{0*}, u_h^0)\right]}_{\text{(2) Pro-competitive intensive margin } (PEI)} + \underbrace{\left[e(\mathbf{P}_{dc}^0, \mathbf{P}_{dx}^{0*}, \mathbf{P}_f^{0*}, u_h^0) - e(\mathbf{P}_{dc}^0, \mathbf{P}_{dx}^0, \mathbf{P}_f^{0*}, u_h^0)\right]}_{\text{(3) Pro-competitive exit margin } (PEX)} \quad (5)$$

[8] It is straightforward to also allow for domestic product entry through virtual prices $\mathbf{P}_d^{0*}$. Empirically we find no evidence of such entry in response to foreign retail arrivals and so abstract from this possibility in the theoretical exposition.

Estimating both the direct effect and the pro-competitive effect requires us to place additional structure on demand. Most obviously, since virtual prices are not observed they must be estimated which requires a demand function for the good or at least an approximation to one. Below we propose two such demand structures.

Before doing so, we note that since we have extremely detailed price data before and after the arrival of foreign retail as well as sampling weights that are proportional to representative consumption weights across products, we can approximate the pro-competitive effect on the intensive margin (PEI) to the first-order without additional assumptions on demand. Taking a first order Taylor expansion around period 0 prices and applying Shepherd's lemma we obtain:

$$PEI \approx \sum_b \sum_{s \in S_b^{dc}} \left[q_{bsh}^0 (p_{bs}^1 - p_{bs}^0) \right], \tag{6}$$

where q_{bsh}^t is the quantity consumed of product b in store s by household h in period t and S_b^{dc} is the set of domestic stores continuously selling product b across both periods. Rewriting the PEI in proportional terms:

$$\frac{PEI}{e(\mathbf{P}_d^{0*}, \mathbf{P}_f^{0*}, u_h^0)} \approx \sum_b \sum_{s \in S_b^{dc}} \left[\phi_{bsh}^0 \left(\frac{p_{bs}^1 - p_{bs}^0}{p_{bs}^0} \right) \right], \tag{7}$$

where ϕ_{bsh}^t is the household expenditure share spent on the item. To a first-order approximation, the pro-competitive effects are simply expenditure-share weighted price changes of pre-existing store-by-product varieties due to the entry of foreign retail.

In a similar manner, without further demand assumptions we can obtain an approximation of a key part of the direct effect of foreign retail that comes from foreign retailers charging lower prices than domestic stores. If we assume that the only difference between foreign and domestic stores is the fact that they charge different prices for identical products, we can evaluate the approximate welfare change from raising the prices charged in foreign stores so that they are equal to p_{bd}^1, the average price of product b in domestic stores in period 1. More precisely, if there are no differences in shopping quality or product variety between domestic and foreign stores then

$$\frac{DE}{e(\mathbf{P}_d^{1*}, \mathbf{P}_f^1, u_h^0)} \approx \sum_b \sum_{s \in S_b^f} \left[\phi_{bsh}^1 \left(\frac{p_{bs}^1 - p_{bd}^1}{p_{bs}^1} \right) \right]. \tag{8}$$

We now present two approaches for estimating both the exact direct and pro-competitive effects with the addition of more structure.

CES demand Our first approach assumes a nested CES demand structure that is common in the trade literature. This approach has several advantages. As first shown by Feenstra (1994), the CES structure produces an intuitive and straightforward expression for the cost of living change due to the introduction of new varieties. In addition, the assumption of CES preferences allows us to relate the estimation results to the recent quantitative literature on the gains from trade: Under CES, the expression for the direct price index effect in our expression for the total welfare effect due to foreign retail entry is identical to the well known sufficient statistic of Arkolakis et al. (2012), extended to horizontal multinational production by Ramondo and Rodriguez-Clare

(2013).

We propose a three tier demand system: in the upper tier there are Cobb-Douglas preferences over product groups $g \in G$ (e.g. Beverages), in the middle tier there are CES preferences over local retailers selling that product group $s \in S$ (e.g. Walmex, a foreign retailer; Soriana, a domestic retailer in modern retail; or a mom-and-pop store in the traditional retail sector), and in the final tier there are preferences over the products within the product groups $b \in B_g$ (e.g. a product such as a 330 ml Coca Cola can) that we can leave unspecified for now:

$$U = \prod_{g \in G} \left[Q_{gh}\right]^{\alpha_{gh}} \tag{9}$$

$$Q_{gh} = \left(\sum_{s \in S_g} \beta_{gsh} q_{gsh}^{\frac{\eta_{gh}-1}{\eta_{gh}}}\right)^{\frac{\eta_{gh}}{\eta_{gh}-1}} \tag{10}$$

where α_{gh}, β_{gsh} and are (potentially household-specific) preference parameters that are fixed over periods. Q_{gh} and q_{gsh} are consumption aggregates with associated price indexes P_{gh} and r_{gsh} respectively. Under this demand system, consumers choose separately for each broad product group how much they are going to buy in each store. Consumers then choose the particular products purchased within each store. This seems like a reasonable assumption given that certain stores specialize in certain product groups and, at least within a month, consumers visit multiple stores. While the demand system is homothetic, we capture potential heterogeneity across the income distribution by allowing for the preference parameters and elasticities to differ across households in different income groups.[9]

Building on Feenstra (1994), the following expression provides the exact proportional cost of living effect:

$$\frac{CLE}{e(\mathbf{P}_d^{0*}, \mathbf{P}_f^{0*}, u_h^0)} = \frac{e(\mathbf{P}_d^{1*}, \mathbf{P}_f^{1}, u_h^0)}{e(\mathbf{P}_d^{0*}, \mathbf{P}_f^{0*}, u_h^0)} - 1 = \prod_{g \in G} \left\{ \left(\frac{\sum_{s \in S_g^{dc}} \phi_{gsh}^1}{\sum_{s \in S_g^{dc}} \phi_{gsh}^0}\right)^{\frac{1}{\eta_{gh}-1}} \prod_{s \in S_g^{dc}} \left(\frac{r_{gsh}^1}{r_{gsh}^0}\right)^{\omega_{gsh}} \right\}^{a_{gh}} - 1. \tag{11}$$

where S_g^{dc} denotes the set of continuing domestic retailers within product group g, $\phi_{gsh}^t = r_{gsh}^t q_{gsh}^t / \sum_{s \in S_g} r_{gsh}^t q_{gsh}^t$ is the expenditure share for a particular retailer of product group g, and the ω_{gsh}'s are ideal log-change weights

$$\omega_{gsh} = \left(\frac{\tilde{\phi}_{gsh}^1 - \tilde{\phi}_{gsh}^0}{\ln \tilde{\phi}_{gsh}^1 - \ln \tilde{\phi}_{gsh}^0}\right) / \sum_{s^{dc} \in S_g^{dc}} \left(\frac{\tilde{\phi}_{gsh}^1 - \tilde{\phi}_{gsh}^0}{\ln \tilde{\phi}_{gsh}^1 - \ln \tilde{\phi}_{gsh}^0}\right)$$

which in turn contain expenditure shares of different retailers within product groups where the shares consider only expenditure at continuing retailers $\tilde{\phi}_{gsh}^t = r_{gsh}^t q_{gsh}^t / \sum_{s \in S_g^{dc}} r_{gsh}^t q_{gsh}^t$. The price terms r_{gsh}^t are themselves price indexes of product-specific prices p_{gsb}^t within stores which, in principle, could also account for new product varieties using the same methodology.

[9] Notice that while convenient for estimation, this somewhat ad hoc treatment of non-homotheticity is unlikely to significantly bias our results in our empirical setting. Unless foreign retail entry causes large effects on either average household incomes, or the distribution of incomes—which we do not find to be the case empirically—income effects would only play a minor role in evaluating the causal effect of retail FDI on household price indexes.

As above, the cost of living effect can be broken up into the direct effect and the pro-competitive effect as follows:

$$\frac{CLE}{e(\mathbf{P}_d^{0*},\mathbf{P}_f^{0*},u_h^0)} = \underbrace{\left[\prod_{g\in G}\left\{\left(\frac{\sum_{s\in S_g^{dc}}\phi_{gsh}^1}{\sum_{s\in S_g^{dc}}\phi_{gsh}^0}\right)^{\frac{1}{\eta_{gh}-1}}\prod_{s\in S_g^{dc}}\left(\frac{r_{gsh}^1}{r_{gsh}^0}\right)^{\omega_{gsh}}\right\}^{a_{gh}} - \prod_{g\in G}\left\{\left(\frac{1}{\sum_{s\in S_g^{dc}}\phi_{gsh}^0}\right)^{\frac{1}{\eta_{gh}-1}}\prod_{s\in S_g^{dc}}\left(\frac{r_{gsh}^1}{r_{gsh}^0}\right)^{\omega_{gsh}}\right\}^{a_{gh}}\right]}_{\text{(1) Direct effect } (DE)}$$
$$+ \underbrace{\left[\prod_{g\in G}\left\{\left(\frac{1}{\sum_{s\in S_g^{dc}}\phi_{gsh}^0}\right)^{\frac{1}{\eta_{gh}-1}}\prod_{s\in S_g^{dc}}\left(\frac{r_{gsh}^1}{r_{gsh}^0}\right)^{\omega_{gsh}}\right\}^{a_{gh}} - 1\right]}_{\text{Pro-competitive effect } (PE)}. \quad (12)$$

Once more we can further break up the pro-competitive effect into extensive and intensive margins:

$$\frac{PE}{e(\mathbf{P}_d^{0*},\mathbf{P}_f^{0*},u_h^0)} = \underbrace{\left[\prod_{g\in G}\left\{\left(\frac{1}{\sum_{s\in S_g^{dc}}\phi_{gsh}^0}\right)^{\frac{1}{\eta_{gh}-1}}\prod_{s\in S_g^{dc}}\left(\frac{r_{gsh}^1}{r_{gsh}^0}\right)^{\omega_{gsh}}\right\}^{a_{gh}} - \prod_{g\in G}\left\{\prod_{s\in S_g^{dc}}\left(\frac{r_{gsh}^1}{r_{gsh}^0}\right)^{\omega_{gsh}}\right\}^{a_{gh}}\right]}_{\text{(3) Pro-competitive exit margin } (PEX)}$$
$$+ \underbrace{\left[\prod_{g\in G}\left\{\prod_{s\in S_g^{dc}}\left(\frac{r_{gsh}^1}{r_{gsh}^0}\right)^{\omega_{gsh}}\right\}^{a_{gh}} - 1\right]}_{\text{(2) Pro-competitive intensive margin } (PEI)}. \quad (13)$$

This decomposition can be written more compactly if we consider the log change in expenditure holding fixed utility at the base period:

$$\ln\frac{e(\mathbf{P}_d^{1*},\mathbf{P}_f^{1},u_h^0)}{e(\mathbf{P}_d^{0*},\mathbf{P}_f^{0*},u_h^0)} = \underbrace{\sum_{g\in G}a_{gh}\frac{1}{\eta_{gh}-1}\ln\sum_{s\in S_g^{dc}}\phi_{gsh}^1}_{(1)\,DE} - \underbrace{\sum_{g\in G}a_{gh}\frac{1}{\eta_{gh}-1}\ln\sum_{s\in S_g^{dc}}\phi_{gsh}^0}_{(3)\,PEX} + \underbrace{\sum_{g\in G}a_{gh}\sum_{s\in S_g^{dc}}\omega_{gsh}(\ln r_{gsh}^1 - \ln r_{gsh}^0)}_{(2)\,PEI}. \quad (14)$$

In the simple case where there are no pro-competitive effects (such as when firms are monopolistically competitive as in Krugman 1980):

$$\frac{CLE}{e(\mathbf{P}_d^{0*},\mathbf{P}_f^{0*},u_h^0)} = \prod_{g\in G}\left\{\left(\sum_{s\in S_g^{dc}}\phi_{gsh}^1\right)^{\frac{1}{\eta_{gh}-1}}\right\}^{a_{gh}} - 1 \quad (15)$$

which is precisely the welfare gain from trade highlighted in recent work by Arkolakis at al. (2012) and Ramondo and Rodríguez-Clare (2013), but here in a multi-sectoral environment.

As described in detail in Section 4, the richness of the Mexican data we have compiled allows us to calculate each of these components of the cost of living effect. In particular, we first draw on detailed price and quantity data and the precise timing of foreign retail openings to calculate causal changes in the price index of domestic stores (the r_{gsh}^1/r_{gsh}^0 ratio) and market shares due

to foreign retail entry. We then use barcode-by-store level consumption surveys to provide an estimate of the elasticity of substitution between store types (η_{gh}). Finally, we combine these two estimates with expenditure shares of different store types and product groups to perform the quantification.

Translog demand Our second approach is more general in so far as we allow price elasticities to depend on consumption quantities and the number of stores in a location. To do so, we draw on a flexible functional form expenditure function which provides a 2nd order approximation to an arbitrary expenditure function. We use the symmetric translog expenditure function introduced by Bergin and Feenstra (2000) that maintains homotheticity but unlike the CES case above has non-constant price elasticities. As well as allowing for this extra dimension of flexibility, the translog also has finite reservation prices. This stands in contrast to the CES demand system above where reservation prices are infinite. Since we are essentially integrating under the demand curve to calculate the welfare gains from a new store-by-product variety, the predicted welfare gains are likely to be larger with CES than under other demand systems with finite reservation prices (Feenstra and Shiells, 1996). Hence, the translog would be expected to produce lower and potentially more plausible estimates of the welfare gains from new varieties.

Given that the translog expenditure function has no closed form utility function, we turn to the dual expenditure function. As with the CES case, we assume that the product group upper tier is Cobb Douglas with expenditure on the middle tier (store type) determined by the following translog expenditure function, and we leave the lowest tier unspecified for now:

$$\ln e(.,u_h^0) = \sum_{g\in G} a_{gh} \ln P_{gh}^t + c \tag{16}$$

$$\ln P_{gh}^t = \beta_{gh} + \sum_{s\in S_g} \beta_{gsh} \ln r_{gsh}^t + \frac{1}{2} \sum_{s\in S_g} \sum_{s'\in S_g} \beta_{gss'h} \eta_{gh} \ln r_{gsh}^t \ln r_{gsh}^t \tag{17}$$

where P_{gh}^t is the price index for product group g in period t; S_g is the set of stores in product category g open in either period; N_g is the count of stores in this set;$\beta_{gss'h} = \frac{1}{N_g}$ if $s \neq s'$ and $\beta_{gss'h} = -\frac{N_g-1}{N_g}$ if $s = s'$; and $r_{gsh}^t$is the price index for product group g in store s in period t. Similarly, B_{gs} is the set of products available in either period; and N_{gs} is the count of products in this set.

Building on Feenstra and Weinstein (2013), the exact cost of living effect can be calculated from the Tornqvist price index that is exact for the translog expenditure function:

$$\ln \frac{e(\mathbf{P}_d^{1*}, \mathbf{P}_f^1, u_h^0)}{e(\mathbf{P}_d^{0*}, \mathbf{P}_f^{0*}, u_h^0)} = \left[\sum_{g\in G} a_{gh} \left(\sum_{s\in S_g^{dc}} \frac{\phi_{gsh}^0 + \phi_{gsh}^1}{2} (\ln r_{gsh}^1 - \ln r_{gsh}^0) + \sum_{s\notin S_g^{dc}} \frac{\phi_{gsh}^0 + \phi_{gsh}^1}{2} (\ln r_{gsh}^{1*} - \ln r_{gsh}^{0*}) \right) \right], \tag{18}$$

where as before S_g^{dc} is the set of continuing domestic stores. The translog share equations,

$$\phi_{gsh}^t = \beta_{gsh} + \frac{1}{N_g^t}(1 - \sum_{s\in S_g^t} \beta_{gsh}) - \eta_{gh}(\ln r_{gs}^t - \frac{1}{N_g^t} \sum_{s\in S_g^t} \ln r_{gsh}^t), \tag{19}$$

allow us to substitute for the virtual prices in the Tornqvist price index as shown in Feenstra and Weinstein (2013):

$$\ln \frac{e(\mathbf{P}_d^{1*}, \mathbf{P}_f^1, u_h^0)}{e(\mathbf{P}_d^{0*}, \mathbf{P}_f^{0*}, u_h^0)} = \sum_{g \in G} a_{gh} \left(\sum_{s \in S_g^{dc}} [\frac{\tilde{\phi}_{gsh}^0 + \tilde{\phi}_{gsh}^1}{2}](\ln r_{gsh}^1 - \ln r_{gsh}^0) \right. \tag{20}$$

$$\left. + \frac{1}{2\eta_{gh}} \sum_{s \in S_g^{dc}} (\tilde{\phi}_{gsh}^0 + \tilde{\phi}_{gsh}^1)[\phi_{gsh}^1 - \phi_{gsh}^0] - \frac{1}{2\eta_{gh}} \sum_s [(\phi_{gsh}^1)^2 - (\phi_{gsh}^0)^2] \right) \tag{21}$$

As before, the price index terms r_{gsh}^t are themselves translog price indexes of product-specific prices within stores which in principle could also account for new product varieties using the same methodology.

As in the CES case, the cost of living effect can be decomposed into three terms. The direct effect, which encapsulates the impacts of foreign retail store entry that do not work through the exit of or price changes in domestic stores, and two pro-competitive effects that work through domestic store exit and domestic store price changes:

$$\ln \frac{e(\mathbf{P}_d^{1*}, \mathbf{P}_f^1, u_h^0)}{e(\mathbf{P}_d^{0*}, \mathbf{P}_f^{0*}, u_h^0)} = \sum_{g \in G} a_{gh} \left(\underbrace{\frac{1}{2\eta_{gh}} \sum_{s \in S_g^{dc}} [\tilde{\phi}_{gsh}^1 - \phi_{gsh}^1][\phi_{gsh}^1 - \tilde{\phi}_{gsh}^0] - \frac{1}{2\eta_{gh}} \sum_{s \notin S_g^{dc}} [(\phi_{gsh}^1)^2]}_{\text{(1) Direct effect } (DE)} \right) \tag{22}$$

$$+ \sum_{g \in G} a_{gh} \left(\underbrace{\frac{1}{2\eta_{gh}} \sum_{s \in S_g^{dc}} [\tilde{\phi}_{gsh}^0 - \phi_{gsh}^0][\phi_{gsh}^1 - \phi_{gsh}^0] - \frac{1}{2\eta_{gh}} \sum_{s \in S_g^{dc}} [\tilde{\phi}_{gsh}^1 - \phi_{gsh}^1][\phi_{gsh}^0 - \tilde{\phi}_{gsh}^0] - \frac{1}{2\eta_{gh}} \sum_{s \notin S_g^{dc}} [-(\phi_{gsh}^0)^2]}_{\text{(3) Pro-competitive exit margin } (PEX)} \right)$$

$$+ \sum_{g \in G} a_{gh} \left(\underbrace{\sum_{s \in S_g^{dc}} [\frac{\tilde{\phi}_{gsh}^0 + \tilde{\phi}_{gsh}^1}{2}](\ln r_{gsh}^1 - \ln r_{gsh}^0}_{\text{(2) Pro-competitive intensive margin } (PEI)} \right).$$

As in the CES case, in order to calculate these expressions we will combine the causal changes in store price indexes and market shares due to foreign retail with estimates of the translog parameter η_{gh}. However, unlike the CES where the quantification only requires aggregate expenditure shares of different store types by product groups, the translog case also requires information on the number of stores and the Herfindahl index both before and after foreign entry. To obtain these variables we exploit the confidential microdata of the Mexican retail census.

3.3 Estimating the Income Effect

The income effect in equation 2 can also be separated into distinct sub-components. Taking a second order Taylor approximation on the income effect in period 1 we obtain the following:

$$\frac{IE}{e(\mathbf{P}_d^{0*}, \mathbf{P}_f^{0*}, u_h^0)} \approx \underbrace{-\sum_i \left[\theta_{ih}^{w0}\left(\frac{w_i^1 - w_i^0}{w_i^0} + \frac{l_{ih}^1 - l_{ih}^0}{l_{ih}^0} + \frac{w_i^1 - w_i^0}{w_i^0}\frac{l_{ih}^1 - l_{ih}^0}{l_{ih}^0}\right)\right]}_{\text{(4) Wage effects}} \underbrace{-\sum_i \left[\theta_{ih}^{\pi 0}\left(\frac{\pi_{ih}(\mathbf{P}_{ih}^1; \mathbf{w}) - \pi_{ih}(\mathbf{P^0}_{ih}; \mathbf{w}^0)}{\pi_{ih}(\mathbf{P^0}_{ih}; \mathbf{w}^0)}\right)\right]}_{\text{(5) Household business effects}} - \underbrace{\left[\theta_h^{o0}\frac{x_h^1 - x_h^0}{x_h^0}\right]}_{\text{(6) Other income effects}} \tag{23}$$

where θ_{ih}^{w} is the share of wages from industry i in household total income, θ_{ih}^{π} is the share of total income derived from selling product b in a household retail enterprise in sector i and θ_h^{o0} is the share of other income in household total income.

Foreign retail entry may change wages generally, or specifically in certain industries such a formal retail or informal retail (the $\theta_{ih}^{w0}\frac{w_i^1 - w_i^0}{w_i^0}$ term). There may also be changes along the employment margin with workers reducing their labor supply to certain industries, for example informal retail that competes with foreign retail, and increasing their labor supply to other industries or moving into unemployment (the $\theta_{ih}^{\pi 0}\frac{l_{ih}^1 - l_{ih}^0}{l_{ih}^0}$ term).

Households may also own businesses, for example traditional retail stores, and these may be hurt by foreign retail entry (the household business effects term). Finally, income from other sources may respond to foreign retail entry through general equilibrium wage effects or because households are producing goods that are sold through the retail sector.

The household business effect can be further broken down into effects due to output and input price competition. For simplicity we assume that retail profits are an additive function of profits from each good sold in that store type,

$$\pi_{ih}(\mathbf{P}_{ih}; \mathbf{w}) = \sum_b \pi_{bih}(p_{bih}; w_i, \tilde{p}_b),$$

with product-by-product profits a function of wages in that sector w_i, and a common wholesale price for that good $\tilde{p}_b$. Taking a second order Taylor approximation and applying Hoteling's lemma on the profits in period 1 we obtain two effects:

$$\underbrace{\sum_i \left[\theta_{ih}^{\pi 0}\left(\frac{\pi_{ih}(\mathbf{P}_{ih}^1; \mathbf{w}) - \pi_{ih}(\mathbf{P^0}_{ih}; \mathbf{w}^0)}{\pi_{ih}(\mathbf{P^0}_{ih}; \mathbf{w}^0}\right)\right]}_{\text{(5) Household business effects}} \approx \underbrace{\sum_i \sum_b \left[\theta_{bih}^{\pi 0}\left((\frac{p_{bih}^1 - p_{bih}^0}{p_{bih}^0}) + \frac{1}{2}\mu_{bibih}(\frac{p_{bih}^1 - p_{bih}^0}{p_{bih}^0})^2\right)\right]}_{\text{(5a) Household business effects (output price competition)}} \tag{24}$$

$$\underbrace{-\sum_i \left[\omega_{ih}^0(\frac{w_i^1 - w_i^0}{w_i^0}) + \frac{1}{2}\omega_{ih}^0\xi_{iih}(\frac{w_i^1 - w_i^0}{w_i^0})^2 + \sum_b\left(\omega_{bih}^0(\frac{\tilde{p}_b^1 - \tilde{p}_b^0}{\tilde{p}_b^0}) + \frac{1}{2}\omega_{bih}^0\varrho_{bibih}(\frac{\tilde{p}_b^1 - \tilde{p}_b^0}{\tilde{p}_b^0})^2 + \omega_{ih}^0\chi_{biih}(\frac{\tilde{p}_b^1 - \tilde{p}_b^0}{\tilde{p}_b^0})(\frac{w_i^1 - w_i^0}{w_i^0})\right)\right]}_{\text{(5b) Household business effects (input price competition)}}$$

where $\theta_{bih}^{\pi 0}$ is the share of income from selling product b in total income; $\mu_{bibih} = \frac{\partial q_{bih}^S}{\partial p_{bih}}\frac{p_{bih}}{q_{bih}^S}$ is the elasticity of supply; ω_{ih} is the share of wage costs in total income; ω_{bih} is the share of whole-

sale costs for good b in total income; and $\xi_{iih} = \frac{\partial \tilde{l}_{bih}}{\partial w_i}\frac{w_i}{\tilde{l}_{bih}}$, $\varrho_{bibih} = \frac{\partial \tilde{q}^S_{biih}}{\partial \tilde{p}_b}\frac{\tilde{p}_b}{\tilde{q}^S_{bih}}$ and $\chi_{biih} = \frac{\partial \tilde{l}_{biih}}{\partial \tilde{p}_b}\frac{\tilde{p}_b}{\tilde{l}_{bih}}$ are the various input elasticities. In terms of output price competition, household business profits may decline through lowering the prices the firm receives (the $\theta^{\pi 0}_{bih}(\frac{p^1_{bih}-p^0_{bih}}{p^0_{bih}})$ term). Households may also substitute into other businesses in order to avoid competition with foreign retailers (the $\theta^{\pi 0}_{bih}\frac{1}{2}\mu_{bibih}(\frac{p^1_{bih}-p^0_{bih}}{p^0_{bih}})^2$ term). In terms of input price competition, household businesses may suffer from higher wages in retail if foreign entry bids up salaries, as well as potentially gain from lower wholesale prices if foreign entry lowers producer price.

In our empirical work we will explore these terms allowing the effects of foreign entry to differ across industry and hence across households depending on the household's initial labor allocation and businesses. In order to do so, we draw on data from ENEU and ENOE, the Mexican employment surveys, which allow us to observe a quarterly time series of household income before and after foreign retail entry as well as, for example, whether households are working in various forms of retail or own a retail business.

In summary, our theoretical framework allows us to express the total household gains from retail FDI as a function of causal effects on retail prices, consumption quantities and household nominal incomes in combination with household demand parameters. The next section describes the data sources we draw on to obtain these estimates. We then proceed in three steps. In step 1, we present the empirical strategy to estimate the causal effects of foreign entry on retail prices, consumption quantities and household incomes. In step 2, we estimate the necessary demand parameters needed for the quantification. Finally, in step 3, we combine the estimates obtained in the two previous steps with data on both household expenditure shares and income sources to quantify the gains from retail FDI across the income distribution.

4 Data

This section provides an overview of the main data sets that we use to estimate the welfare expression.

Monthly Mexican CPI Microdata

Monthly price data at the barcode and store level are used to estimate the intensive margin pro-competitive effect: the effect of foreign entry on consumer prices among continuing domestic stores. These data consist of retail price quotes that are administered by Mexico's nationalstatistics agency INEGI every month to compute the Mexican CPI.[10] Because the main objective of the CPI is to compute price inflation for identical product items in identical retail outlets over time, these data are ideally suited to estimate price effects among pre-existing products and stores that are unconfounded by unobserved changes in product quality or changes in the composition of stores over time.

The data collection effort for the Mexican CPI is substantial. Every month enumerators obtain price quotes for over 85,000 items covering 315 product categories in 46 metropolitan areas cov-

[10] In July 2011 this operation was passed from Mexico's Central Bank to INEGI.

ering 141 urban municipalities.[11] These individual price quotes are made publicly available on a monthly basis in the country's official government gazette (Diario Oficial de la Federación).[12] Obviously the CPI includes many product groups which do not refer to physical goods sold by retailers, such as housing, education, health or public transport. We exclude all non-retail product groups from the analysis of the effect of foreign entry on consumer prices in pre-existing retail establishments. The implicit assumption for the welfare analysis is that the entry of a foreign supermarket has no significant effects on the prices of non-retail consumption. We also exclude product groups whose price quotes are not based on barcode level information. CPI prices of fast changing product groups, such as clothing, or unprocessed product groups, such as fruit and vegetables or fresh meat, are based on store samples that do not credibly control for changes in product characteristics over time. The time series of prices for barcode-equivalent items (i.e. fresh whole milk Alpura brand 1 liter carton) that we use to estimate the pro-competitive effects of foreign retail entry comprise more than one third of all reported price quotes in the Mexican CPI microdata, and account for more than 40% of average household retail expenditure. Price quotes are inclusive of any promotions (sales) as well as value added tax.

In addition to the public access data of the Mexican CPI, we also obtain access to the confidential data columns.[13] These allow us to observe the municipality in which the price quote was taken, as well as store format type and retailer names. The latter information allow us to explore the heterogeneity of the effect of foreign entry on consumer prices across different types of domestic competitors. The final estimation sample of the event study described in the following section consists of 3.3 million store price observations over the period 2002-2014 comprising 120 product groups with barcode-equivalent goods across 76 urban municipalities.

These price data have a number of additional advantages for our purposes. First, the sampling of prices being collected is designed to be representative of Mexican household consumption and covers not only supermarkets, convenience, and department stores but also street vendors, traditional markets, and specialized stores. A second important advantage is that within a product group, the selection of barcode items and store types is designed to capture the consumption patterns obtained in the urban segment of the ENIGH household consumption surveys discussed below (Salas, 2006).

ANTAD Store Opening Dates and Locations

We obtain data on store locations and dates of opening from Mexico's national association of retail businesses ANTAD (Asociación Nacional de Tiendas de Autoservicio y Departamentales). All major retailers in Mexico are part of ANTAD. The association represents more than 34,000 retail units with close to 25 million square meters of retail space. ANTAD collects an unusually detailed data set with information from all its members about location and date of opening for every unit in the country. The store openings at the municipality level by retailer over the 2002-2014 period are the source of the independent variable of interest in the empirical analysis—the

[11] For comparison, the U.S. CPI collects prices on 80,000 items in 211 product categories.

[12] We thank Etienne Gagnon for access to the data he assembled directly from the Gazette.

[13] We thank Rafael Posse and Javier Romero at INEGI and José Antonio Murillo at Banco de México for access to these data.

entry of a foreign retailer in a municipality.[14]

Mexican AC Nielsen Consumer Panel Data

The estimation of the effects of changes in product variety on household cost of living requires data on the ex post retail market shares of foreign stores, as well as estimates of the elasticity of substitution of household consumption across local stores as a function of price differences. The data we exploit for this purpose are the microdata of the Mexican AC Nielsen Consumer Panel, which was made available to us through an academic collaboration with the AC Nielsen office in Mexico City. The Mexican Consumer Panel data are available for the years 2011-2014. These data are similar to the Homescan data Nielsen collects on US consumers. AC Nielsen Mexico collects information from roughly 6,000 urban households distributed across 151 Mexican municipalities. Households are visited biweekly to obtain consumption diary information on all products purchased by the household. The Nielsen sample is updated annually to be representative of all cities over 50,000. Importantly, we obtain access to the uncensored AC Nielsen records including retailer identities that can be linked to every barcode transaction in a household's consumption basket. These data are ideally suited to observe retailer market shares embodied in household consumption baskets, as well as for the estimation of household elasticities of substitution that capture the extent to which households source their consumption from different local stores as a function of price differences. The Nielsen microdata provide us with roughly 24 million transaction level observations over the period between January 2011 and June 2014.

Mexican Retail Census Microdata

For the purpose of estimating the effect of foreign entry on retail business profits, as well as obtaining Herfindahl indexes for local retailer market shares that we require to implement the translog demand approach, we use the confidential version of the Economic Census microdata for the years 2003 and 2008 (Censos Económicos 2004 and 2009) from INEGI. The Economic Census records establishment level information for the universe of urban establishments in the country, including the universe of urban retail establishments. The restricted access version of the data we use allows us to observe store level revenues and costs in addition to distinguishing between foreign and domestic establishments as well as modern and traditional store formats.

Quarterly Data on Household Incomes, Income Sources and Employment

To estimate the effect of foreign entry on nominal household incomes and employment, we require high frequency data to exploit the same event study design for incomes as we use for consumer prices. To this end, we make use of the National Employment and Occupation Surveys (ENOE) from INEGI. The ENOE has a similar design to the U.S. Current Population Survey in that it is a quarterly survey with a rotating panel of sampled households in which a given household

[14]We thank Mauricio Varela for access to his data on Walmart store openings during years in which Walmart was not a member of ANTAD (2002-2007). We also extended the foreign store openings database for the period after 2007 using monthly or annual reports from firms and in some cases newspaper coverage and phone calls to track down opening dates for stores with missing information on opening dates that were present at the beginning of 2014.

is followed over 5 quarters. The survey tracks occupation and income in a manner equivalent to the ENIGH data set described below and has the advantage of being representative at the state level and for 32 large cities. Every quarter more than 100,000 individual residences are surveyed. The ENOE replaced the national urban employment survey ENEU (1987-2004) which we use for the pre-2005 years. The final estimation sample comprises roughly 5 million observations across 172 urban municipalities.

Household Data on Consumption and Income Shares

In the final quantification exercise in section 7, we make use of Mexican household microdata that allow us to observe both the incomes and income sources of each household as well as its expenditure shares across all product groups contained in the store price microdata and the Nielsen microdata described above. We obtain these data from the Mexican National Income and Expenditure Surveys (ENIGH), which are administered biannually by INEGI. These data provide us with the distribution of incomes, income sources, and consumption habits that we require to quantify the welfare effect for different income groups in Section 7. The final estimation sample for the welfare quantification contains 17,340 householdsin 273 urban municipalities between 2002-2008 that had not experienced foreign retail entry at the time of the ENIGH survey.

5 Estimating the Causal Effects of Foreign Retail Entry

This section draws on the collection of microdata described above to empirically estimate the causal effect of foreign retail entry on local consumer prices, retail market shares, store exit, and household incomes and employment across Mexican municipalities over the period 2002-2014. As well as being of interest in their own right, these causal effects enter into the welfare expressions derived in the theoretical framework and hence form the basis of the quantification of the household gains from retail FDI in Section 7.

5.1 Effect on Consumer Prices

5.1.1 Effect on Retail Prices in Pre-Existing Stores

Empirical Strategy To estimate the effect of foreign supermarket entry on retail prices in pre-existing domestic stores in expression 6, we combine the universe of foreign store opening dates and locations with monthly panel data on local barcode level prices from the Mexican CPI microdata. We estimate the following event study specification:

$$\ln p_{gsbmt} = \sum_{\tau=-12}^{36} \beta_\tau \, I\left(MonthsSinceEntry_{mt} = \tau\right) + \delta_{gsbm} + \eta_t + \epsilon_{gsbmt}\,, \tag{25}$$

where $\ln p_{gsbmt}$ is the log price of a product in product-group g, individual store s, with barcode b, in municipality and month t. $I\left(MonthsSinceEntry_{mt} = \tau\right)$ is an indicator function, and $MonthsSinceEntry_{mt}$ counts the months since foreign entry for each municipality m at a given point in time t (with negative values counting months before entry, positive values counting the

months after entry, so that $MonthsSinceEntry_{mt} = 0$ in the month that a foreign store enters a municipality for the first time).[15] Since we are looking only at pro competitive effects on domestic stores, we restrict attention to prices at domestic stores before and after the first foreign store opening. The parameter β_τ captures the effect of foreign store entry for each of τ months before and after the opening event. δ_{gsbm} is a barcode-by-store fixed effect, and η_t is a month fixed effect. If we estimated expression 25 with a single time-invariant β coefficient on a foreign treatment dummy that takes the value 1 for all periods where there is a foreign store in the municipality, the coefficient would capture the mean difference in log prices before and after foreign entry (while treating each individual barcode-by-store combination as a separate price time series and conditioning on average monthly price growth across stores in all sample municipalities). As mentioned in 3, since the pre-existing sampling weights across the store price quotes were designed to be representative of national consumption (the weighting to calculate the Mexican CPI), this change in log prices pre and post foreign entry, if properly identified, would provide a first-order (Laspeyres) approximation of the effect of foreign entry on the local retail price index for barcode-equivalent product groups. This estimate only considers the intensive margin of retail price changes, while abstracting from the effect on cost of living through exit and entry, to which we turn in the following subsection.

The concern when estimating a single time-invariant β coefficient is that foreign retail entry could be associated with other time varying factors that also affect retail prices, but are not accounted for by the barcode-by-store and month fixed effects. In particular, foreign stores might target municipalities with higher pre-existing price growth. They could also decide the timing of the opening in a way that is correlated with positive local store price shocks. Both of these scenarios would lead to an upward biased estimate of the treatment effect of foreign entry on domestic store prices. Conversely, foreign stores could target faster growing municipalities whose retail environments are also becoming more competitive, so that store prices could be on a pre-existing downward trajectory for reasons other than foreign entry. A final scenario is that rather than targeting a particular subset of municipalities or particular points in time, foreign retailers expand rapidly over the sample period with the long term aim of establishing store presence in most urban municipalities. In that scenario, given that our municipality sample is drawn from 46 large and entirely urban metropolitan regions one would expect a limited potential for biased estimates as neither the selection of municipalities nor the timing of opening would likely be correlated with differential pre-existing price growth in our sample.

To explore these scenarios, we draw on the monthly time series of the CPI microdata to estimate specification 25. By estimating the treatment effect in the 12 months leading up to the opening event as well as the 36 months after, this approach allows us to test for the presence and slope of potential trends or leads in the run-up to the foreign store opening event in a transparent way, and without imposing parametric structure. The absence of trends or leads would suggest that the endogeneity concerns above are not an issue, while if there are trends or leads, the event study design allows us to sign and quantify any bias.

To estimate the event study on a fully balanced sample of municipalities both before and

[15] We also define the indicator variable $I\,(MonthsSinceEntry_{mt} = 36)$, that picks up the last treatment effect, to take the value 1 for all $MonthsSinceEntry_{mt} \geq 36$.

after the store opening, we exclude municipalities where the first foreign store opened in the first twelve months of our data set (July 2002-June 2003), and municipalities where the first foreign store opened in the last 36 months our data set (April 2011-March 2014) or later. This sample restriction leads to the exclusion of six percent of our store price observations, and ensures that the event study point estimates are based on a fully balanced estimation sample starting one year before the store opening event and extending to three years after.

In addition to the baseline event study specification in 25, we also estimate several additional specifications that serve as robustness checks. First, we replace the 141 month fixed effects, with 16,818 product-group-by-month fixed effects in order to account for potential concerns that foreign store openings are correlated with a particular product mix that also affects price growth.[16] Second, to address concerns that the municipality sample is not fully balanced earlier than 12 months before the opening event, we include municipality-specific time trends in the event study regression. Finally, we make use of the urban income and employment surveys to additionally include a rich set of quarterly municipality level controls for log average household income, employment rates, log population as well as third order polynomials for average age and average years of schooling.

Estimation Results Figure 2 and Table 1 present the estimation results for the effect of foreign supermarket entry on consumer prices in pre-existing domestic retail outlets. Figure 2 presents the event study graph. The absence of pre-existing differential trends in price growth provides no evidence suggesting that foreign retailers over the post-2002 estimation period have targeted a particular subset of municipalities among our urban estimation sample, or targeted store opening events at a particular points in time that coincide with local price shocks. Instead, the results appear to be consistent with a scenario in which foreign retailers rapidly expanded their store networks to establish presence in a wide range of urban locations subject to a longer term planning horizon.

The point estimates are close to zero and not statistically significant in the run up to the opening event, and a negative and significant effect starts to appear approximately ten months after the opening. Interestingly, the point estimate continues to get more negative until about two years after the opening, after which it levels off at about negative three percentage points. As discussed above, given that the initial store price survey weights were designed to reflect a representative household consumption basket, this point estimate can be interpreted as a first order approximation of the effect of foreign entry on the local retail price index for barcode equivalent product groups.

Table 1 also reports additional specifications that serve as robustness checks. In particular, we obtain estimates of the same sign, size and statistical significance after including product-by-month fixed effects, municipality specific time trends, and a rich set of quarterly time-varying

[16] Note, we do not include barcode-by-month fixed effects for two reasons. First, the product descriptions which we use to define barcodes are recorded consistently within stores, but not necessarily across stores, and we are currently working on the enormous task of harmonizing the barcode-level product descriptions. Second, even with harmonized barcode-level product descriptions across stores, because the store price data doesn't sample an exhaustive list of products, or the same products in every location, including such fixed effects absorbs much of the variation in the data set.

municipality-level controls.

After reporting the event study on the average retail price effect of foreign store entry, we also explore the heterogeneous effects of foreign entry on domestic retail prices across product groups as well as domestic store formats. This analysis is possible since the confidential version of the Mexican CPI microdata allows us to observe store formats and retailer names in addition to product groups. We estimate the following specification:

$$\ln p_{gsbmt} = \sum_{gs} \beta_{gs} \left(ForeignEntry_{mt} \times Product_{gs} \right) + \delta_{gsbm} + \eta_{gst} + \epsilon_{gsbmt} \,, \tag{26}$$

where $ForeignEntry_{mt}$ is an indicator that takes the value of 1 if there is a foreign store in the municipality m in period t and $Product_{gs}$ is an indicator variable that takes the value of 1 if the retail price quote belongs to a product in product g and store type s, and δ_{gsbm} is a barcode-by-store fixed effect. To control for time-varying product-group by store-type specific shocks to price growth, we also include product-group by store-type by month fixed effects η_{gst}. The β_{gs} estimates capture the differential effect of foreign entry on domestic retail prices across product-group by store-type categories relative to a reference category. This specification on the heterogeneous effects of foreign entry is subject to similar identification concerns as discussed for the simple pre versus post mean comparison of the average effect above. We follow a similar strategy and rely on the lack of pre trends in the event study reported above. We also exclude all price observations during a 24 month adjustment period immediately after the foreign opening event. We choose to exclude the first 24 months after store opening because the price coefficients in the event study level off by that time so our single coefficient here will capture the long-run price adjustment.

Table 2 reports the results of the treatment interactions with respect to domestic supermarkets as opposed to traditional stores, and with respect to food items as opposed to other consumer categories. The results suggest that modern domestic store formats are driving the bulk of the pro-competitive average effect, and that food prices appear to be marginally less affected by foreign entry in both domestic supermarkets and traditional store formats. We present this selected set of heterogeneity results for the sake of brevity, but the welfare quantification will use a full set of product group-by-store type specific treatment effects of foreign entry on domestic retail prices.[17]

5.1.2 Ex-Post Price Gaps between Foreign and Domestic Stores for Identical Barcode Products

Empirical Strategy To estimate the average ex-post price difference charged by foreign stores relative to domestic stores in the same municipality for identical barcode items in expression 7, we use the microdata of the Mexican AC Nielsen Consumer Panel over the period 2011-2014 to estimate the following specification:

$$\ln p_{gsbmt} = \beta ForeignStore_{s} + \delta_{gbmt} + \epsilon_{gsbmt} \,, \tag{27}$$

where $ForeignStore_{s}$ is a dummy that takes the value of 1 if the retailer is a foreign store and δ_{gbmt} is a barcode-by-municipality-by-month fixed effect. This specification estimates the average price gap between foreign stores and domestic stores for identical barcode items observed in the same location and during the same month. As discussed in Section 3, these estimates provide a

[17] The full set of results are shown in Appendix XXX.

simple and transparent empirical approximation for the direct price index effect of foreign retail entry. This only provides an approximation for two reasons. First, we are using a first-order approximation that amounts to using Paasche weights. Second, we are ignoring variety and quality differences across stores. Hence, the expression would provide an accurate first-order approximation to the direct price effect if foreign and domestic stores do not differ in the variety of products that they offer, and if foreign and domestic stores are not differentiated in with respect to shopping quality (for example, there are no differences in search costs, security, transport costs, convenience, ambiance, friendliness or social status from shopping in the store).

Estimation Results Table 3 presents the estimation results. On average, foreign stores charge approximately 12 percent lower prices for identical barcode items compared to domestic stores in the same location during the same month. Interestingly, this effect is reversed when including product group-by-month fixed effects instead of barcode-by-month fixed effects, suggesting that foreign stores offer a higher quality composition of products compared to domestic retailers.

5.2 Effect on Consumption Quantities

5.2.1 Effect on Foreign Retail Market Shares

Empirical Strategy To calculate the direct price index effect in expressions 14 and 22, we require estimates of the effect of foreign supermarket entry on the retail expenditure shares of foreign stores (broken down by product group and by household income group). To obtain these estimates we turn to the uncensored microdata of the Mexican AC Nielsen Consumer Panel and estimate the following specification:

$$\sum_{s \in S^f_{gmt}} \phi_{ghmt} = \beta_{gh} + \epsilon_{ghmt} \tag{28}$$

where $\sum_{s \in S^f_{gmt}} \phi_{ghmt}$ are local retail market shares of all foreign retailers $s \in S^f_{gmt}$. We allow for these shares to differ across product-group g and household-type h, where household type is one of seven income-groups. As above, we focus on the time period 24 months after initial foreign entry which we interpret as the long run (recall the price effects leveled off by that point). Accordingly, we restrict our sample to municipalities and time periods where foreign retailer had been open for 24 or more months. Thus, this specification estimates the mean long-run foreign retailer shares across 7 household income groups and 13 product groups.[18]

The choice to estimate average ex post foreign retailer shares after 24 months raises the concern that foreign entry could be correlated with other changes in the municipality that also affect foreign retail market shares. For example, income growth or changes in local transport infrastructure may differentially affect retail expenditures on foreign and domestic stores. To limit potential bias, as a robustness exercise we we restrict the estimation of 28 to municipalities where foreign retail first arrived between 2 and three years ago. The identifying assumption is that up to three

[18]These 13 broad product categories are the product group definitions that we currently work with in the welfare quantification exercise below.

years after the foreign entry event, the predominant factor that affects foreign retail shares is the fact that a foreign store opened in the municipality, rather than other time varying factors, such as income growth, that could affect the relative expenditure shares on domestic and foreign outlets independently of a foreign store opening.

Estimation Results Figure 3 presents the estimation results using the microdata of the AC Nielsen Consumer Panel. The Nielsen data allow us to trace each retailer's expenditure shares by product group across individual household consumption baskets. The average ex-post quarterly share of total household retail expenditure on foreign stores is more than 30 percent. Given that the median number of foreign stores across urban Mexican municipalities is one single store, these results provide prima facie evidence of a substantial and significant direct price index effect of retail FDI in a developing country context.

Importantly, the estimated ex post expenditure shares on foreign stores significantly differ across the distribution of household incomes. Figure 3 suggest that the poorest income group spend approximately 40 percent less of their retail expenditure in foreign supermarkets compared to the richest income group. For the welfare analysis in 7, however, retail expenditure does not provide the complete metric to evaluate household cost of living if different income groups spend different proportions of their income on retail goods. The graph on the right hand side of the Figure shows the differences in shares of total expenditure on retail (as opposed to other consumer categories such as education, health, housing, etc.) across household income groups . It is clear from these graphs that while the direct price index effect within retail is likely to favor higher income households, the fact that higher income households spend a significantly lower share of their total expenditure on retail provides a counterbalance to these heterogenous effects.

5.2.2 Effect on Domestic Store Exit

Empirical Strategy To estimate the effect of foreign store entry on domestic store exit in expressions 14 and 22, we intend to use the retail census microdata that provides store counts across periods of foreign store entry. As these data are still in the process of being acquired, instead we make use of information on the number of workers who report being store owners every quarter in the Mexican income and employment surveys (ENEU). As this is the same data source we use below for the income and employment regressions, we discuss the empirical strategy and report these estimation results alongside the other income and employment results in the next subsection.

5.3 Effect on Nominal Incomes and Employment

Empirical Strategy To calculate the income effect in expression 23 of Section 3, we require estimates of the causal impact of foreign retail entry on nominal incomes and employment in the location where retail entry occurred. We start by analyzing the effect on average nominal incomes

by running the following event study specification:

$$\ln Income_{jmt} = \sum_{\tau=-10}^{20} \beta_\tau \, I\left(QuartersSinceEntry_{mt} = \tau\right) + \gamma X_{jmt} + \delta_m + \eta_t + \epsilon_{jmt}, \tag{29}$$

where subscripts j, m and t index individuals, municipalities and quarters respectively. X_{jmt} are person controls including gender and third order polynomials for age and years of schooling. Alternatively, we replace log monthly incomes with an employment indicator that takes the value of one if the person is employed:

$$Employment_{jmt} = \sum_{\tau=-10}^{20} \beta_\tau \, I\left(QuartersSinceEntry_{mt} = \tau\right) + \gamma X_{jmt} + \delta_m + \eta_t + \epsilon_{jmt}, \tag{30}$$

Hence, quarterly individual income or employment outcomes are thus regressed on foreign store opening events in addition to person controls, municipality fixed-effects and quarter fixed-effects.

As discussed for the price regressions above, the event study design allows us to transparently and non-parametrically explore pre-existing trends in the run up to the store opening event. Again, there are several possibilities . Foreign retailers could target urban municipalities with higher pre-existing income growth rates, or decide on the timing of the opening in a way that is correlated with positive local economic shocks. Conversely, it could be the case that foreign retailers target urban municipalities with higher income levels that in turn could be characterized by lower income growth rates. Finally, it could be that, as found to be the case in the price regressions, foreign retailers expanded rapidly during the estimation period with a longer-term planning horizon to establish store presence in a wide range of urban municipalities, so that store openings are uncorrelated with local shocks or pre-existing trends in incomes or employment.

One important difference relative to the retail price event study above is the municipality estimation sample. While both the CPI price microdata as well as the ENEU income and employment surveys explicitly include only urban municipalities, the ENEU data comprises a much wider range of urban municipalities compared to the store price microdata. The CPI microdata are collected in around 140 urban municipalities located in the 46 major metropolitan centers of Mexico. In contrast, the ENEU data include more than 500 urban municipalities across all of Mexico, where urban is defined to be any municipality with more than 2500 inhabitants. The income event study is thus based on a much wider and more heterogeneous range of urban municipalities compared to the more homogenous municipalities in the store price data, and so the endogeneity concerns may differ across the two samples.

With these points in mind, we proceed to implement the event study in the same way as described above for the price regressions. As above, we balance the estimation sample between one year before and two years after the store entry event. This restriction excludes approximately ten percent percent of our income and employment observations. The majority (6 percent) of these excluded observations are in urban municipalities that had not yet received a foreign store at the end of our sample in March 2014.

Since the ENEU data is a rotating panel where individuals are followed for 5 quarters, we

have the possibility of including person fixed effects. Therefore, we run an additional specification in 29 where replace municipality fixed effects with individual fixed effects. The interpretation of our coefficients is quite different when we include individual fixed effects. First, we miss any compositional changes in the number of working age people in the municipality if individuals are not followed across locations. For example, there may be migration responses to a foreign supermarket opening. Both the data as well as anecdotal evidence would point against this channel playing a significant role.[19] Second, because each individual is observed for a maximum of 5 consecutive quarters, the individual fixed-effect mechanically restricts the treatment effect to a short run estimate. For example, someone may lose their job as a result of foreign retail competition and only obtain a new job after they have left the panel. With this qualification in mind, we report estimates both with and without individual fixed-effects.

Before turning to the results on differential income effects, we note that our empirical methodology is only able to estimate income gains or losses within the location where the foreign store opened. Any changes in national income due to foreign store entry are absorbed in the fixed effects. Undoubtedly there are such effects. The owners, headquarter employees and shareholders of large domestic supermarket chains are likely to experience profit declines, and employees at foreign firms Mexican headquarters will see gains. These income effects will be concentrated in Mexico City and other major cities where the headquarters are located and are excluded from our analysis. Accordingly, this paper provides estimates of the local welfare effects of foreign retail entry rather than the complete national welfare effects.

For our quantification we require estimates of the nominal income effects broken down by occupation. Any differences across occupations will lead to heterogeneous welfare impacts on households depending on their pre existing occupation breakdown. Therefore, to estimate to what extent household incomes are affected differently depending on the primary source of income (indexed by i below), we also run specifications that allow for heterogeneity.

Since individuals may work in several occupations or become unemployed over time, and we only follow individuals over 5 consecutive quarters, if we want to assess the impact on workers in different occupations prior to foreign entry we are necessarily restricted to shorter-run responses. In order to obtain longer run responses that match our price results, we therefore evaluate aggregate changes in incomes and employment across different occupations. As with the price regressions, we remove observations from the first two years after foreign store entry to explore long run adjustments. We regress log income or employment on a foreign entry dummy that takes the value 1 when there is a foreign store in the municipality interacted with an occupation dummy that takes the value of 1 if a worker is employed in that occupation:

$$\ln(Income)_{jimt} = \sum_i \beta_i \left(ForeignEntry_{mt} \times Occupation_i\right) + \gamma X_{jimt} + \delta_{mt} + \eta_{im} + \theta_{it} + \epsilon_{jimt}\,, \qquad (31)$$

where subscripts j, i, m and t index individuals, occupations, municipalities and quarters respectively. We focus on different retail occupations, where i includes categories for retail workers in modern store formats, retail workers in traditional store formats, retail business owners and workers in other sectors. δ_{mt} is a municipality-by-quarter fixed effect, η_{im} is an occupation-by-municipality fixed effect, and θ_{it} is an occupation-by-quarter fixed effect. The coefficients β_i cap-

[19] We find no effects on municipality population.

ture the differential effect of foreign store entry on the incomes of retail workers in modern store formats, traditional store formats and retail business owners (conditional on flexible trends at the municipality-quarter level and initial earnings differences across occupation groups within the municipality and the quarter). Similarly, we estimate specification 31 with employment dummies on the left hand side to capture the differential effect on employment propensities.

The empirical issue with both these specifications is that the ENEU survey is a sample of potential workers, and so the number of retail employees and owners is necessarily small around the time of foreign retail openings (the median quarter-by-municipality sample count is 200). In the future we plan to supplement this section with additional evidence from the retail census that would provide larger sample sizes and more precise inference. With this important data limitation in mind, we proceed to the empirical results.

Estimation Results Figure 4 and Tables 4 and 5 present the estimation results on the income and employment effects of foreign supermarket entry. The estimation results on the average effects in Figure 4 and Table 4 suggest that foreign retail entry is occurring in locations that are ex ante different to locations where foreign retail does not enter. The event study graph portrays a pattern in which foreign retailers open stores in urban municipalities with pre-existing positive trends in log incomes, i.e. higher income growth rates. However, accounting for this pre-trend, there is no change in levels or growth trends in either average incomes or employment, as shown in Table 4.

These findings differ from the event study design on local retail prices presented above, in which no pre-existing trends were apparent even without municipality time trends. As mentioned above, one possible explanation for this are the differences in the urban municipality samples between the two event studies: whereas the effect on retail prices is estimated in a sample of metropolitan municipalities, the income effect is estimated off a much more heterogeneous and wider range of urban municipalities. This could give rise to spurious OLS income effects because the control group includes somewhat remote and very different municipalities which were treated at a later point in time. We explore this explanation by rerunning the event study on the same sample of municipalities as in our price analysis. The results of this event study are reported in Figure **??** and provide support for this explanation. When estimated on the same sample of urban municipalities as the retail price event study, the results show no pre-existing trends while confirming the finding of no significant effect on average municipality level nominal incomes due to foreign retail entry. In conclusion, while the event study on retail prices reveals a clear break in the pre-existing (flat) time trend, no such break in trend or jump in levels is apparent in the event study on average municipality level incomes or employment propensities.

Table 5 presents the results that explore heterogeneity across retail workers in modern store formats, traditional formats, and retail business owners. In contrast to the average income regressions, we find a negative and significant effect on the incomes of traditional retail workers. This point estimate is robust to including income group-by-quarter fixed effects as well as state-by-income-group specific time trends, implying that this effect is not driven by pre-existing differential trends that are specific to particular income groups. The point estimate corresponds to a reduction in the monthly incomes of traditional sector retail workers of approximately 5 percent as a result of foreign retail entry. It is important to keep in mind that the ENEU allows us

to estimate the effect on retail worker earnings conditional on employment in that sector during any given quarter. What the ENEU do not allow us to quantify is the extensive margin effect of workers or store owners that lose their job or business as a consequence of foreign retail entry because of the very short 5 quarter panel structure.

The final four columns of the table aim to shed light on such extensive margin effects using the ENEU data. Unsurprisingly, we find insignificant and noisy estimates of the effect of retail entry on the employment propensities across the three retail sectors relative to average changes in employment in the municipality. As briefly discussed above, the likely reason for these estimates is that the ENEU are not thick enough in order to rely on changes in the municipality level sampling probabilities for workers across different sectors in order to estimate the extensive margin responses on exit or entry. We are currently in the process of collecting richer data to provide better estimates of these effects.

6 Estimating Demand Parameters from the Nielsen Consumer Panel

We now turn to the estimation of the preference parameters using the Nielsen Consumer Panel which records individual household shopping patterns across multiple stores. These data allow us to estimate our key elasticity, the degree to which households substitute across local outlets as a function of retailer price differences.

The estimation procedure differs slightly in the CES and Translog cases. In both cases we will draw on the elasticity of household shopping responses with respect to variation in store-specific prices, either across locations or across time periods, to identify these parameters. The cross-location estimates form our baseline specification as we believe that these provide more reasonable estimates of the long run elasticity relevant for estimating the gains from new foreign retail store openings. The cross-time period estimates serve as a robustness check with the caveat that they are likely smaller due to short-run stickiness in shopping choices by households.

6.1 Estimation of the CES Elasticity Parameter

In the CES case, note that the logged share equation can be written as

$$\ln \phi_{gshmt} = (1 - \eta_{gh}) \ln r_{gshmt} - (1 - \eta_{gh}) \ln c_{ghmt} + \eta_{gh} \ln \beta_{gshmt} \tag{32}$$

where $c_{ghmt} = \left(\sum_{s \in S_{gmt}} (\beta_{gsh})^{\eta_{gh}} (r_{gshmt})^{1-\eta_{gh}}\right)^{\frac{1}{1-\eta_{gh}}}$ is the CES price index, g indexes product groups, s indexes stores, h indexes household income groups, m indexes location, and t indexes time. If we had measures of r_{gshmt}, the price index for product group g within store s for income group h, we could simply run the following regression:

$$\ln \phi_{gshmt} = b_{gh} \ln r_{gshmt} + \delta_{ghmt} + \gamma_i + u_{gshmt} \tag{33}$$

where u_{gshmt} is measurement error on log budget shares that needs to be uncorrelated with prices, δ_{ghmt} are product-group-by-income-group-by-municipality-by-time fixed effects, γ_i is a fixed effect across as-yet-unspecified dimension i that absorbs unobserved taste differences across stores

which we discuss in more detail in the following paragraphs. Finally, $1 - b_{gh}$ is the parameter of interest: the elasticity parameter η_{gh} that governs the degree of substitutability between local retail outlets as a function of store price differences. When we carry out the estimation, we restrict this parameter to be identical across households and product groups as our baseline estimation approach. We later relax this assumption, and allow the parameter to differ across income groups as well as product categories.[20]

We allow the store-specific taste shifters to vary across either time or location. In the former case, we include store-time fixed effects, γ_{st}, in lieu of γ_i in equation 33. Essentially we are then comparing store market shares across locations with different relative price indexes across stores (where prices indexes across stores are all demeaned by product group, income group, municipality and time through the δ_{ghmt} fixed effects). Exploiting the cross section in this manner provides estimates of long run elasticities since if price differences are persistent over time, when we look across munciiaplities we see consumers that have had time to adjust their shopping patterns in response to these price differences across stores.

As an alternate specification, we allow the store-specific taste shifters to vary across locations. In this case we include store-municipality fixed effects, γ_{sm}, in lieu of γ_i in equation 33. Here we are identifying the elasticity off store market shares changes over time within a municipality in response to changes in the relative prices. These are short-run elasticity estimates since consumers are likely to be slow to respond to quarter-by-quarter relative price changes by instantly switching shopping habits. Accordingly, we follow Griliches (1959) and include 2 years of lagged log price indexes $\ln r_{gshmt}$ directly in the estimating equation and sum the coefficients on both the contemporaneous and lag terms to obtain an estimate of $1 - \eta_{gh}$.

Turning to our measures of the store price index, r_{gshmt}, recall we left the third tier of the demand system unspecified in Section 3. In principal we could use any demand system to calculate the price index. For simplicity and transparency, we use a Stone-price index, $\ln r_{gshmt} = \sum_{b \in B_{gshmt}} \phi_{gsbhmt} \ln p_{gsbhmt}$, or a budget share weighted sum of log prices. As barcodes differ across stores, and some stores may sell higher-quality varieties, we ensure that we are only comparing identical products to extract price differences by recovering $\ln r_{gshmt}$ from regressing budget-share-weighted log prices at the barcode level (where budget shares are income group-specific) on store-by-product-group-by-income-group-by-municipality-by-time fixed effects. The coefficient on the fixed effects provides an estimate of the store price index for a product and income group relative to other stores in that municipality and time period.

Given the nature of the Nielsen data, we collapse the price data to averages at the (retailer identity)-(barcode)-(income-group)-(quarter)-(municipality) level in order to estimate the specifications above.[21]

When estimating either specification we address the standard simultaneity concern that arises when estimating demand. For example, suppose that the taste parameters β are not constant

[20] Notice that despite the richness of the AC Nielsen microdata, the variation starts to become thin once we allow for heterogeneity along the h or g dimension. To see this more clearly, notice that there are on average 40 households observed in a given quarter in a given municipality.

[21] The retailer identity is one of the retailers we can identify from the Nielsen data with all traditional stores (for which Nielsen does not brand-identify a retailer) grouped together. The Nielsen data divide consumers into six income groups.

across the i dimension (either store-location or store-time period) as assumed in the theory. Deviations in taste shifters would then enter the error term and potentially be correlated with $\Delta \ln p^i_{gsh}$ due to supply side considerations. To deal with this concern we follow Hausman (1997) and instrument price indexes with price indexes in stores of the same retailer in nearby municipalities. The assumption here is that deviations in the taste shifters within dimension i are idiosyncratic, a similar assumption required for the identification through heteroskedasticity approach in Feenstra (1994), Broda and Weinstein (2006) and Feenstra and Weinstein (2011), and so these deviations do not confound prices in nearby locations which serve as valid instruments in the presence of common supply side price determinants.

6.2 Estimation of the Translog Parameter

[XXX Work in progress, waiting for detailed retail census data required for estimating changes in store counts and Herfindahls XXX]

6.3 Estimation Results

Table 6 presents the preliminary estimation results for the average household elasticity of substitution under CES. We estimate this parameter by exploiting the two separate sources of identifying variation discussed above: The first estimate is based on variation in relative store prices across municipalities (taking store-by-quarter fixed effects in addition to the δ_{ghmt} fixed effects), whereas the second estimate is based on variation in relative store prices within a municipality over time (taking store-by-municipality fixed effects in addition to the δ_{ghmt} fixed effects). Table 6 reports the preliminary estimation results for the specifications using the across-municipality variation. The remaining specifications using the Nielsen microdata are currently work in progress. The IV point estimate reported in Table 6 that we use for the welfare quantification in this draft is $\eta = 3.12$.

7 Quantifying the Welfare Effect of Foreign Retail

This section calculates the expressions derived in the theoretical framework of Section 3, using both the causal effects estimated in Section 5 and the demand parameters from Section 6, to quantify the welfare effects of foreign retail entry across Mexican households. The first subsection explains how we map our various estimates into the theoretical welfare expressions, while the second subsection reports the results of the quantification both for the average household and for the full distribution of households.

7.1 Calculating the Welfare Effect of Foreign Retail Entry

This subsection explains how we use the causal estimates of the price, quantity, and income effects reported in Section 5 in combination with the demand parameter estimates of the previous section to quantify the gains from retail FDI across households. At the center of this exercise

lies household microdata from the Mexican income and expenditure surveys (ENIGH), which provide us with household specific budget shares at the product group-by-store type level in addition to household income shares across different occupations and business income sources. These data allow us to separately quantify the welfare effects of foreign entry for every household in the dataset and hence for us to obtain the full distribution of welfare effects across households.

To be consistent with the empirical estimates of the previous sections, we restrict attention to ENIGH households surveyed over the period 2002-2008 (four bi-annual cross-sections) who reside in urban municipalities without foreign stores at the time of the survey. That is, we use ex ante household income shares as well as ex ante household expenditure shares as baseline parameters that enter into the quantification exercise that we outline in the following paragraphs.

To quantify the cost of living effect, ideally we would separately estimate the causal price changes and budget share changes for every barcode product in every domestic store. Given the available store price microdata that we use in the event study methodology presented in Section 5, estimating such a large number of causal price effects is not feasible. Instead, we make a simplifying assumption that still allows for substantial heterogeneity. We assume that causal price changes within a product-group-by-store-type are the same, where the two store types are domestic continuing modern, m, stores and domestic continuing traditional, t, stores:

Assumption 1:

$$\frac{p^1_{gsb}}{p^0_{gsb}} \equiv p_{gs} \ \ \forall s \in S^{dc}_g$$

where j takes two values, m or t. Note that we allow these price changes to differ by product group as well as store type, so for example beverage prices could fall more than the prices of snacks, and relatively more so in domestic modern than traditional stores.

With this assumption in hand, and the estimates of the causal effects on price changes and ex post foreign retail shares reported in Section 5, we have almost all we need to carry out the quantification exercise in the CES case. The only remaining inputs are causal estimates of post-foreign-entry market shares of continuing domestic varieties that enter into the ideal log change weights. In the CES case, these can be easily calculated since the estimated elasticities of substitution allow us to calculate ex post budget shares for continuing stores as a function of initial expenditure shares in the ENIGH surveys and the estimated prices effects:[22]

$$\tilde{\phi}^1_{gsh} = \tilde{\phi}^0_{gsh}\left(\frac{(p_{gs})^{1-\eta_{gh}}}{(p_{gm})^{1-\eta_{gh}}\sum_{s\in S^{dcm}_g}\tilde{\phi}^0_{gsh} + (p_{gt})^{1-\eta_{gh}}\sum_{s\in S^{dct}_g}\tilde{\phi}^0_{gsh}}\right).$$

Note that $\sum_{s\in S^{dcm}_g}\tilde{\phi}^0_{gsh}$ is the expenditure share of continuing domestic store purchases of product group g spent in modern retail.

In the translog case, an additional hurdle presents itself. In addition to the estimated price effects and observations on initial household budget shares, the translog case also requires information on changes in local retail Herfindahl indexes. Empirically, we use two moments to

[22]This approach assumes that there are no new or exiting products in domestic continuing stores around the time of foreign retail entry.

estimate these changes. First, we make use of the microdata of the Mexican retail census in 2004 and 2009 to observe pre-existing Herfindahl indexes among the ENIGH municipalities which had not yet experienced foreign store entry in those two cross-sections. Second, to obtain the ex-post Herfindahl indexes as a consequence of foreign entry, we combine these data with the causal estimate on domestic store exit reported in Section 5. With these data in hand, we can obtain causal changes in budget shares for the translog case through the following formulas:

$$\phi^1_{gsh} = \phi^0_{gsh} - \eta_{gh}(\ln r^1_{gs} - \ln r^0_{gs}) + \Delta \frac{1}{N^t_g}(1 - \sum_{s \in S^t_g} \beta_{gsh}) + \eta_{gh} \Delta \frac{1}{N^t_g} \sum_{s \in S^t_g} \ln r^t_{gs}$$

where note that

$$\frac{\sum_{s \in S^{dc}_g} [\phi^1_{gsh} - \phi^0_{gsh} + \eta_{gh}(\ln r^1_{gs} - \ln r^0_{gs})]}{N^{dc}_g} = [\Delta \frac{1}{N^t_g}(1 - \sum_{s \in S^t_g} \beta_{gsh}) + \eta_{gh} \Delta \frac{1}{N^t_g} \sum_{s \in S^t_g} \ln r^t_{gs}]$$

Hence we can obtain ϕ^1_{gsh} from

$$\phi^1_{gsh} = \phi^0_{gsh} - \eta_{gh} \ln p_{gs} + \frac{\sum_{s \in S^{dc}_g} [\phi^1_{gsh} - \phi^0_{gsh} + \eta_{gh} \ln p_{gs}]}{N^{dc}_g}$$

where N^{dc}_g is the number of domestic continuing stores that we obtain from the retail census prior to foreign entry in combination with the estimate of the causal effect on domestic store closures, and $\sum_{s \in S^{dc}_g} \phi^1_{gsh}$ are total market shares that we obtain from the effect on ex post foreign market shares reported in Section 5.can be obtained from a sample of data.

7.2 Quantification Results

Table 7 and Figures 6, 7 and 8 present the estimation results for the welfare gains from foreign retail entry for households across the pre-existing income distribution. The present draft simply reports the distribution of gains obtained from our various point estimates. Our final draft will bootstrap the entire process to provide confidence intervals around these welfare effects, but unfortunately these results are not yet ready.

Several findings emerge. Foreign store entry leads to large and significant welfare gains for the average household in the municipality where the store opened. These gains are in the order of 10 percent in the CES case, and in the order of XXX percent when estimated under translog demand.

The majority of the total welfare effect appears to be driven by a significant reduction in the cost of living. Interestingly, around one quarter of this price index effect comes from pro-competitive effects on the intensive margin, i.e. reductions in prices at domestic stores induced by the entry of foreign retailers. The remaining three quarters are due to the direct price index effect of foreign entry, a finding already foreshadowed in the raw data by both the significantly lower prices charged by foreign stores and their large ex-post retail market shares reported in Section 5.

Turning to the income effects, the lesson to be learned from the estimation results is that while

the adverse effects on the household incomes of traditional retail workers are quantitatively large (an estimated negative 5 percent change), these effects appear to be muted when analyzing the municipality as a whole. The reason why neither the average income effect nor its distribution turn out to make a large difference is that only a small share of households derive a substantial part of their incomes from this source.

Turning to the distribution of the gains from retail FDI, we find that while all income groups significantly benefit from foreign retail entry, richer households do so slightly more than poorer households. The regressiveness of the gains from retail FDI is clear in the data, but not substantial: The maximum estimated difference in the welfare effect is about 5 percent between the poorest and the richest households. Ex ante, this result is surprising. The microdata on household consumption (both the ENIGH and the Nielsen data) clearly show that richer households disproportionately source their consumption from modern retail store formats such as supermarkets and big-box stores of which the largest chain, WalMex, is foreign (in contrast to the US where poor consumers disproportionately shop at stores such as Wal-Mart as pointed out by Broda et al., 2007). Looking at Figure 3, one would have expected a priori that the direct price index effect works in favor of richer households to a much stronger extent than is present in Figure 7.

Figure 8 illuminates why, despite this disproportionality in shopping patterns, the gains are relatively equitable. The figure confirms that the retail price index of the richest households decreases substantially more than for the poorest income households. However, retail expenditures account for a much smaller share of total household expenditure (including housing, education, transport, health) for richer households. The overall price index reduction combines these two counterbalancing forces. Interestingly, these two forces appear to offset one another, so that retail FDI appears to be one of the rare cases in which globalization leads to both large and significant gains for the average household as well as a relatively equal distribution of those gains across income groups.

8 Conclusion

[Work in progress.]

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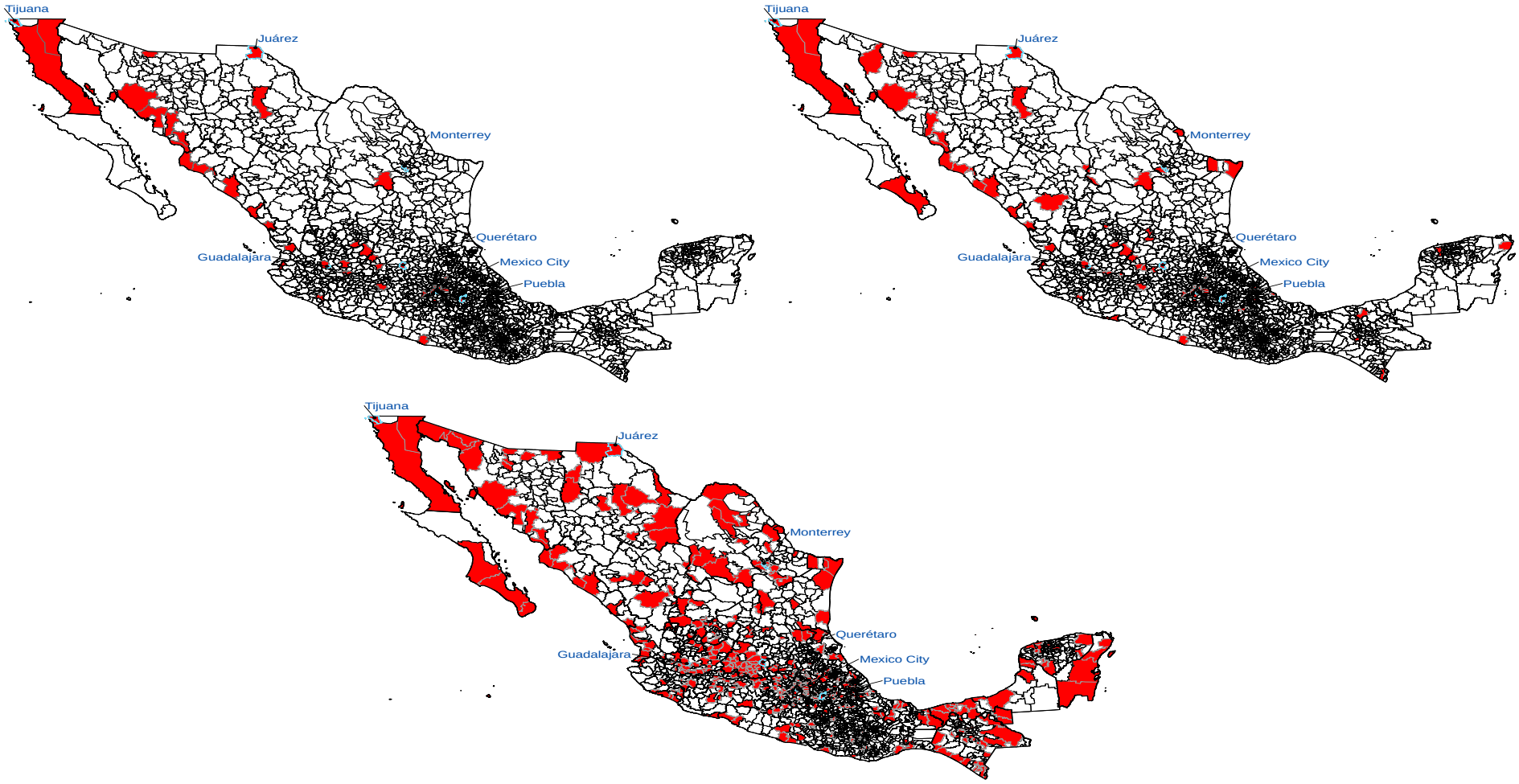
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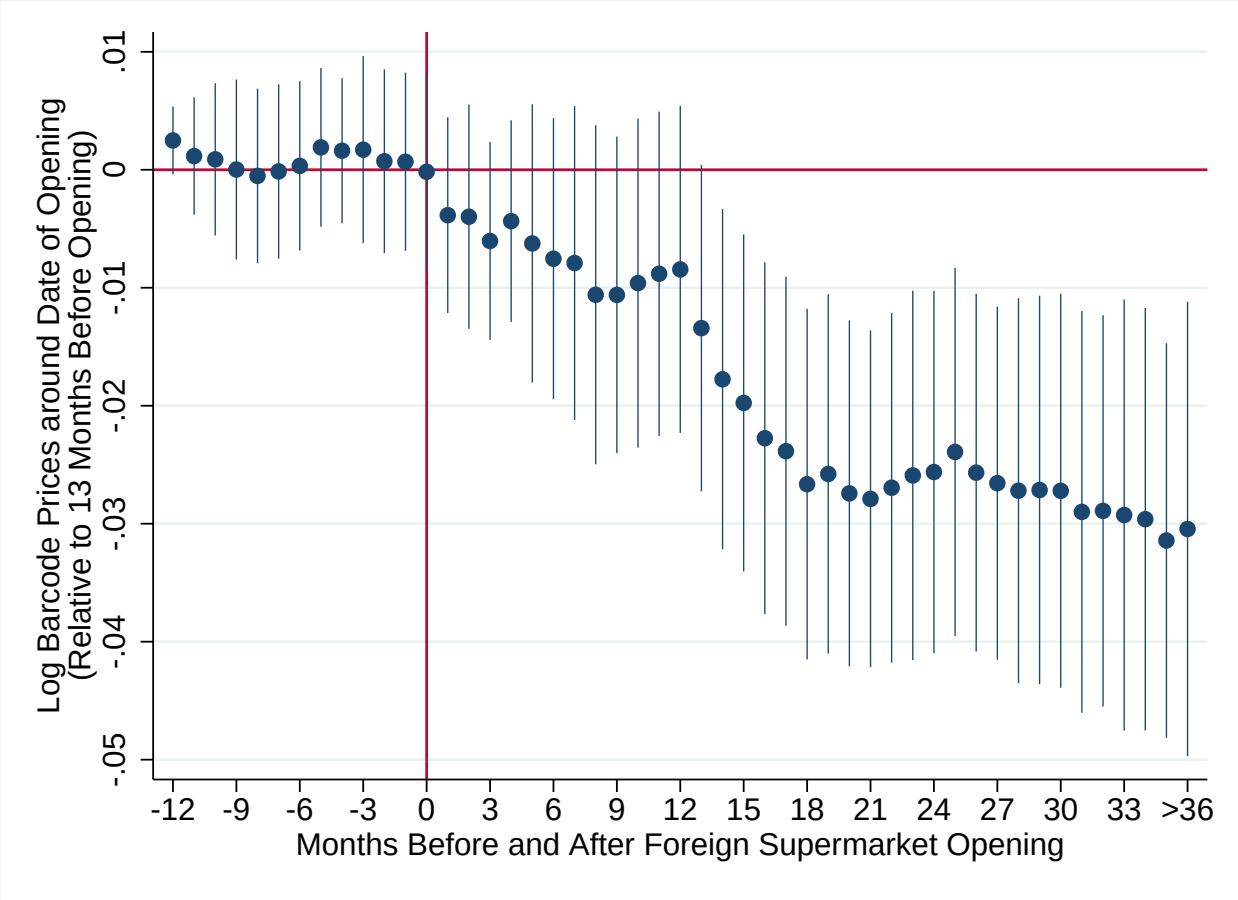
Figures and Tables

Figure 1: Retail Globalization in Mexico - Left to Right: Foreign Store Presence at the End of 1995, 2001, and 2013



Notes: Municipalities in red indicate foreign store presence at the end of 1995 (upper left, 204 stores), 2001 (upper right, 365 stores), and 2013 (lower, 1335 stores). The data source are annual publications of the Mexican National Association of Supermarkets (ANTAD).

Figure 2: Effect on the Prices of Domestic Retailers: Monthly Event Study



Notes: Point estimates are based on 149,273 monthly price series of unique barcode-by-store combinations over the period 2002-2014. The dots correspond to coefficient estimates from a regression with 3,228,544 observations in which log prices are regressed on the indicated monthly treatment effects in addition to barcode-by-store fixed effects and month-by-product group fixed effects. The reference category are barcode prices 13 months before foreign entry. The graph depicts 95% confidence intervals based on standard errors that are clustered at the municipality level.

Figure 3: Effect on Foreign Retail Market Shares: Heterogeneity across the Household Income Distribution

Figure 4.1: Within Retail Heterogeneity

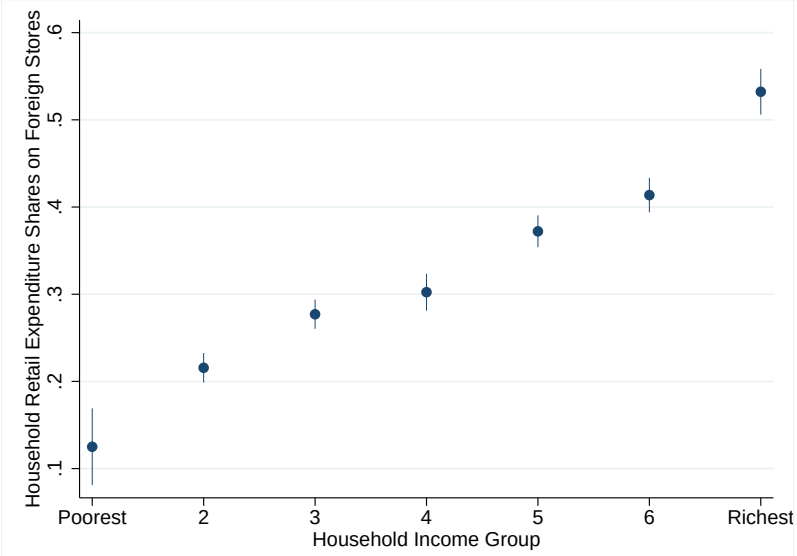
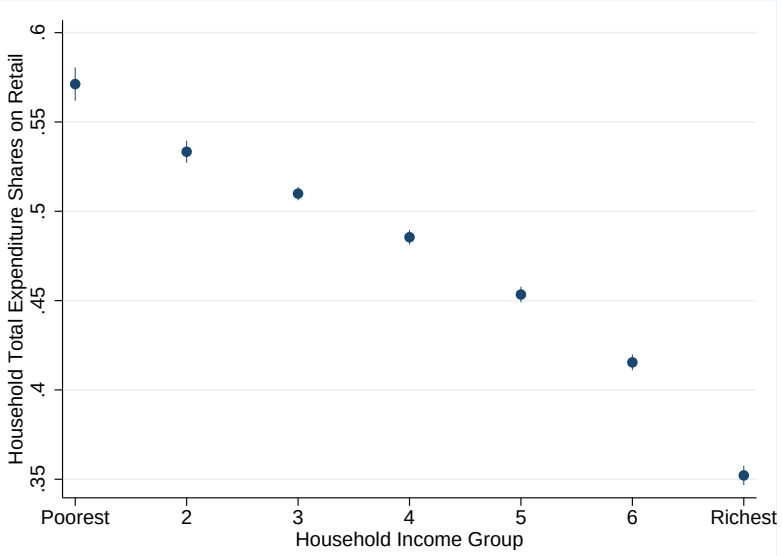


Figure 4.2: Retail as a Share of Total Expenditure



Notes: The graph on the left depicts quarterly household retail expenditure shares of foreign stores among municipalities that have experienced foreign store entry more than two years ago. The data source for this graph is the Mexican AC Nielsen Consumer Panel for the years 2011-14. The graph on the right depcits the share of retail expenditure in total household expenditure. The data source for this graph is the Mexican income and expenditure survey ENIGH over the years 2002-2008. Both graphs depict 95% confidence intervals based on standard errors that are clustered at the municipality level.

Figure 4: Effect on Average Municipality Incomes and Employment

Figure 6.1: Average Monthly Incomes

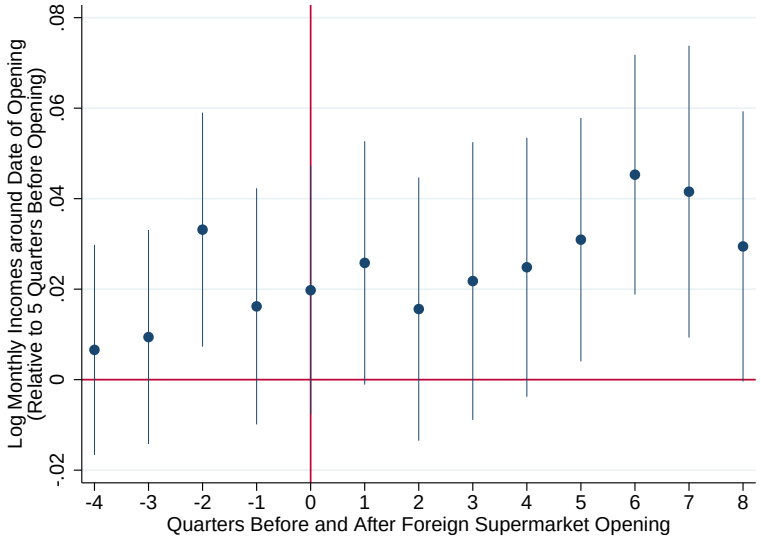
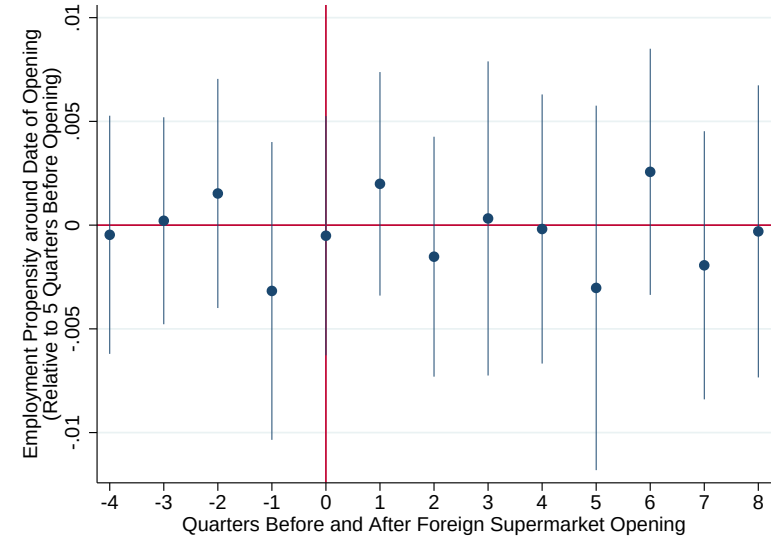


Figure 4.2: Average Employment Propensities



Notes: Point estimates are based on the quarterly income series of 1,606,213 individuals (left) and the quarterly employment series of 1,828,567 individuals (right) over the period 2002-2012. The dots correspond to coefficient estimates from a regression with 4,377,393 observations (left) and 5,705,807 observations (right) in which log monthly incomes or employment identifiers are regressed on the indicated monthly treatment effects in addition to municipality and quarter fixed effects and and time changing person controls. The reference category in both graphs are incomes or employment 5 quarters before foreign entry. Both graphs depict 95% confidence intervals based on standard errors that are clustered at the municipality level.

Figure 5: Effect on Average Municipality Incomes and Employment - Identical Municipality Sample as for Event Study on Retail Prices

Figure 6.1: Average Monthly Incomes

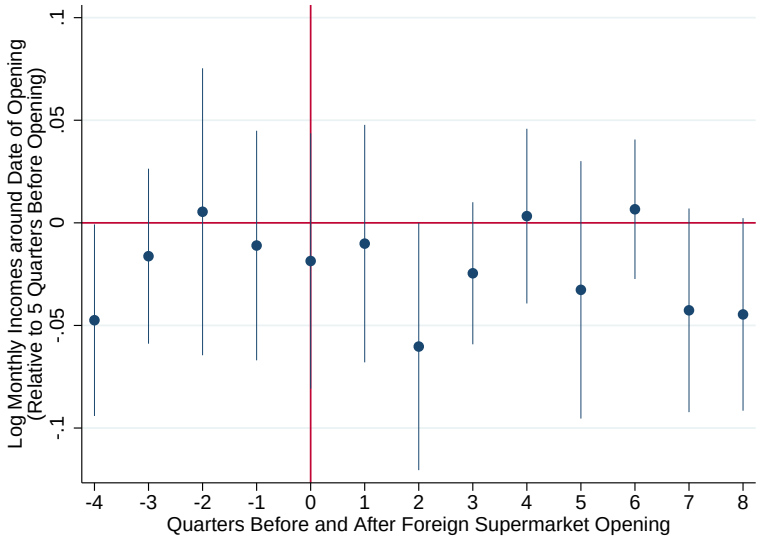
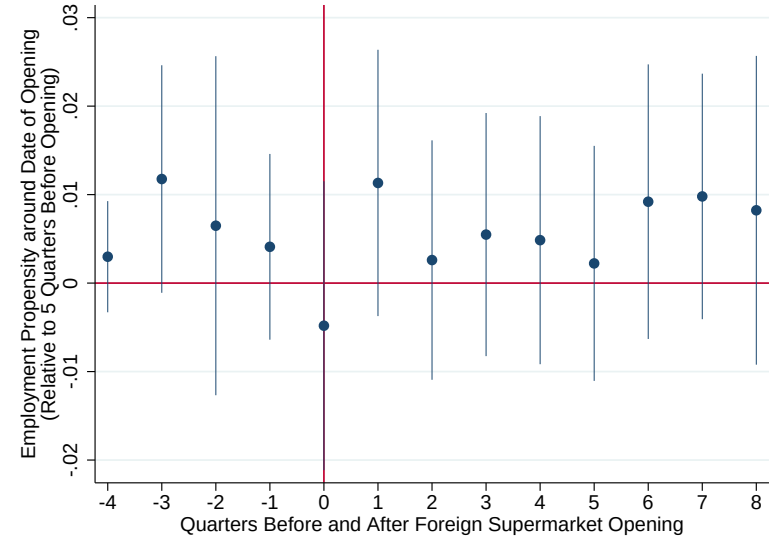
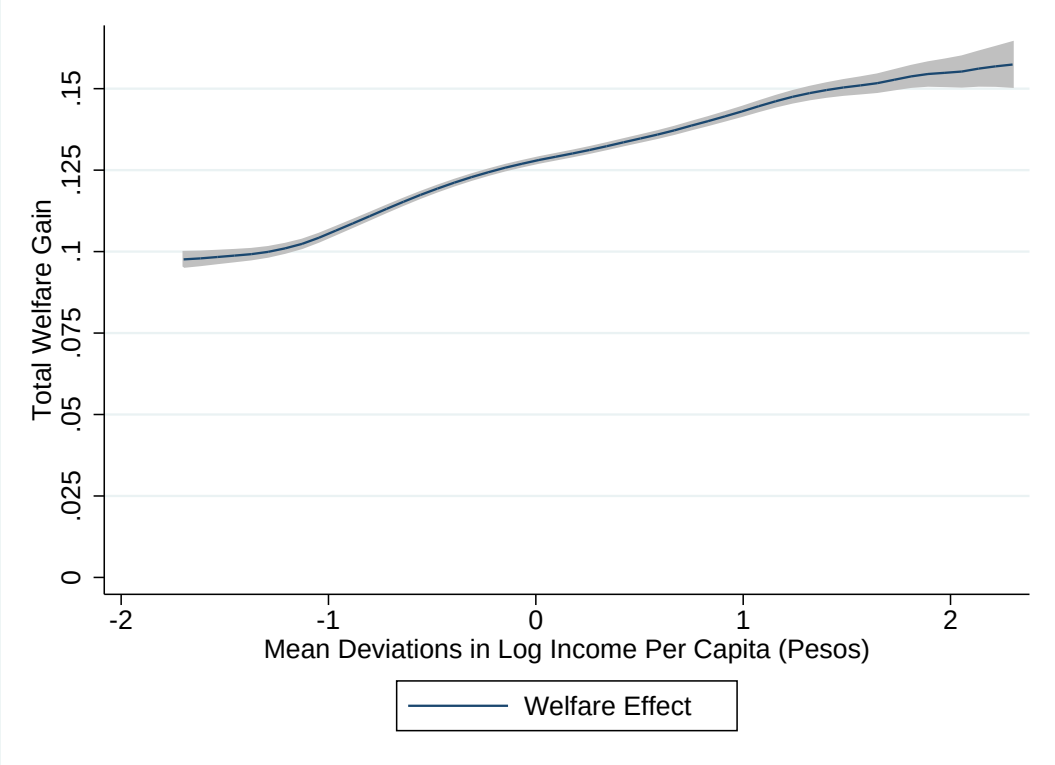


Figure 4.2: Average Employment Propensities



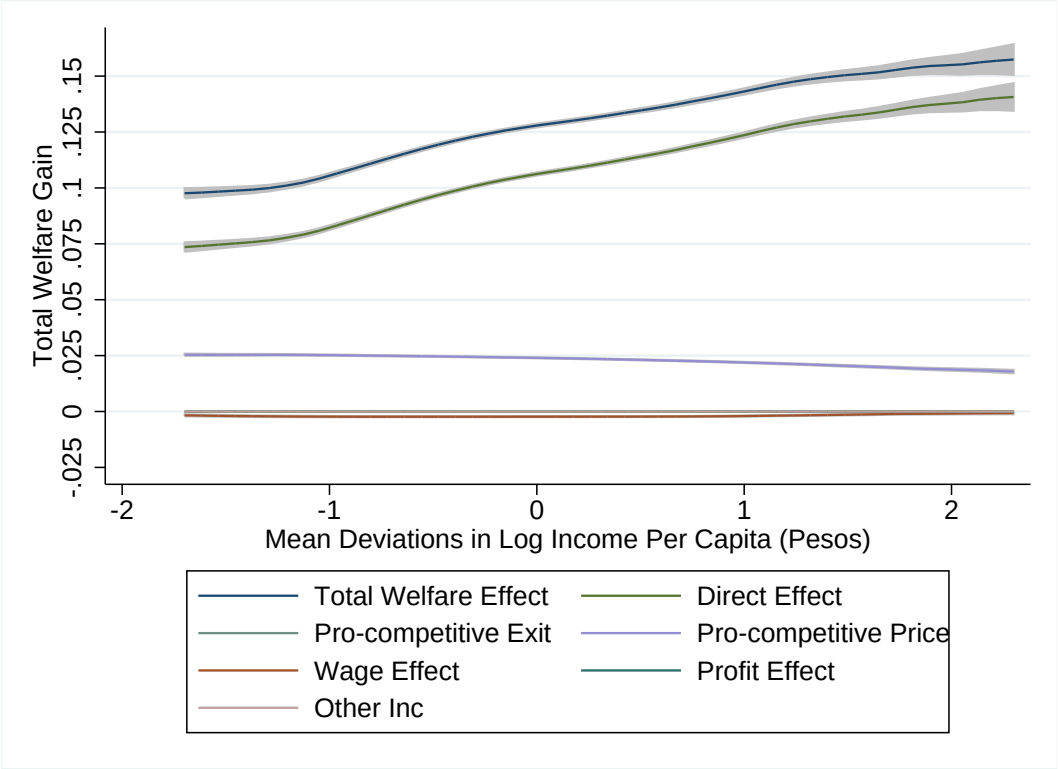
Notes: Point estimates are based on the quarterly income series of 1,061,578 individuals (left) and the quarterly employment series of 1,208,949 individuals (right) over the period 2002-2012. The dots correspond to coefficient estimates from a regression with 2,901,437 observations (left) and 3,820,601 observations (right) in which log monthly incomes or employment identifiers are regressed on the indicated monthly treatment effects in addition to municipality and quarter fixed effects and and time changing person controls. The reference category in both graphs are incomes or employment 5 quarters before foreign entry. Both graphs depict 95% confidence intervals based on standard errors that are clustered at the municipality level.

Figure 6: Gains from Foreign Retail Entry across the Household Income Distribution



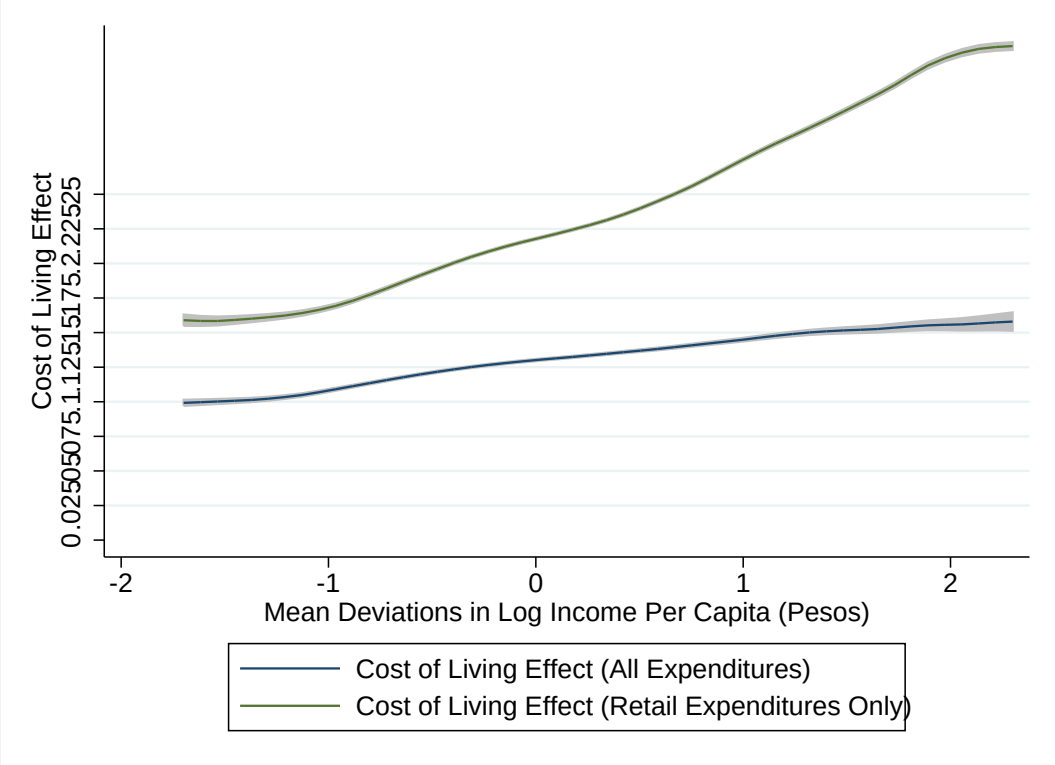
Notes: The graph is based on 17,340 households among 273 urban municipalities between 2002-2008 that had not experienced foreign retail entry at the time of the ENIGH survey. The graph depicts 95% confidence intervals based on standard errors that are clustered at the municipality level.

Figure 7: Gains from Foreign Retail Entry - Decomposition



Notes: The graph is based on 17,340 households among 273 urban municipalities between 2002-2008 that had not experienced foreign retail entry at the time of the ENIGH survey. The graph depicts 95% confidence intervals based on standard errors that are clustered at the municipality level.

Figure 8: Understanding the Cost of Living Effect



Notes: The graph is based on 17,340 households among 273 urban municipalities between 2002-2008 that had not experienced foreign retail entry at the time of the ENIGH survey. The graph depicts 95% confidence intervals based on standard errors that are clustered at the municipality level.

Tables

Table 1: Effect on the Prices of Domestic Retailers

Dependent Variable:	(1) Log Price	(2) Log Price	(3) Log Price	(4) Log Price	(5) Log Price
Foreign Entry - Four Quarters Before	-0.00257	-0.00348	-0.00389	-0.00366	-0.00188
	(0.00594)	(0.00471)	(0.00457)	(0.00441)	(0.00517)
Foreign Entry - Three Quarters Before	-0.00260	-0.00521	-0.00525	-0.00491	-0.00412
	(0.00642)	(0.00500)	(0.00558)	(0.00567)	(0.00783)
Foreign Entry - Two Quarters Before	-0.00354	-0.00374	-0.00333	-0.00300	-0.00334
	(0.00751)	(0.00626)	(0.00614)	(0.00649)	(0.00846)
Foreign Entry - One Quarter Before	-0.00523	-0.00401	-0.00275	-0.00322	-0.00417
	(0.00923)	(0.00753)	(0.00677)	(0.00692)	(0.00858)
Foreign Entry - One Quarter After	-0.00828	-0.00770	-0.00589	-0.00630	-0.00819
	(0.00940)	(0.00765)	(0.00684)	(0.00688)	(0.00858)
Foreign Entry - Two Quarters After	-0.00924	-0.0106	-0.00813	-0.00837	-0.0112
	(0.00953)	(0.00784)	(0.00716)	(0.00719)	(0.00916)
Foreign Entry - Three Quarters After	-0.0136	-0.0137	-0.0105	-0.0121	-0.0153*
	(0.00914)	(0.00849)	(0.00802)	(0.00767)	(0.00861)
Foreign Entry - Four Quarters After	-0.0156*	-0.0147*	-0.0106	-0.0126	-0.0167*
	(0.00909)	(0.00876)	(0.00835)	(0.00815)	(0.00954)
Foreign Entry - Five Quarters After	-0.0184*	-0.0183*	-0.0136	-0.0163*	-0.0206*
	(0.0103)	(0.00958)	(0.00913)	(0.00930)	(0.0111)
Foreign Entry - Six Quarters After	-0.0279**	-0.0271**	-0.0218**	-0.0251**	-0.0288**
	(0.0114)	(0.0104)	(0.0101)	(0.0104)	(0.0129)
Foreign Entry - Seven Quarters After	-0.0344***	-0.0316***	-0.0256**	-0.0291***	-0.0330**
	(0.0116)	(0.0105)	(0.0101)	(0.0107)	(0.0134)
Foreign Entry - Eight Quarters After	-0.0340***	-0.0320***	-0.0250**	-0.0294***	-0.0337**
	(0.0109)	(0.0103)	(0.0102)	(0.0112)	(0.0139)
P-Value (Eight Quarters=Post Eight Quarters)	0.4262	0.7481	0.3403	0.2086	0.3404
Month FX	✓	✓	✓	✓	✓
Barcode-By-Municipality FX	✓	✓	✓	✓	✓
Barcode-By-Store FX	×	✓	✓	✓	✓
Municipality Time Trends	×	×	✓	✓	✓
Product-By-Month FX	×	×	×	✓	✓
Quarterly Municipality Controls	×	×	×	×	✓
Observations	3,228,544	3,228,544	3,228,544	3,228,544	2,726,484
R-squared	0.990	0.996	0.996	0.996	0.996
Number of Barcode-By-Store Cells	149,273	149,273	149,273	149,273	134,635
Number of Product-By-Month Cells	16,818	16,818	16,818	16,818	15,018
Number of Municipality Clusters	76	76	76	76	76

Notes: The dependent variable is log barcode prices. Regressions are based on monthly price observations of 152,223 unique barcode-by-store combinations over the period 2002-2014 in 120 product groups and 76 municipalities. Foreign Entry indicates the presence of a foreign supermarket in a municipality. Quarterly municipality controls include average log monthly incomes, employment propensities, log population, and two third order polynomials of average years of schooling and average age. Standard errors are clustered at the municipality level and reported in parenthesis below the point estimates. * 10%, ** 5%, *** 1% significance levels.

Table 2: Effect on the Prices of Domestic Retailers - Heterogeneity

Dependent Variable:	(1) Log Price	(2) Log Price	(3) Log Price	(4) Log Price
Foreign Entry	-0.00574	-0.0256**	-0.0103	-0.00852
	(0.0164)	(0.0121)	(0.0178)	(0.0191)
Foreign Entry X Chain Store	-0.0475**		-0.0567***	-0.0630**
	(0.0213)		(0.0190)	(0.0253)
Foreign Entry X Food Products		0.000863	0.0240*	0.0148
		(0.0186)	(0.0136)	(0.0215)
Foreign Entry X Chain X Food				0.0173
				(0.0315)
Month FX	✓	✓	✓	✓
Barcode-By-Store FX	✓	✓	✓	✓
Product-By-Store Type-By-Month FX	✓	✓	✓	✓
Observations	2,790,780	3,157,767	2,790,780	2,790,780
R-squared	0.996	0.996	0.996	0.996
Number of Barcode-By-Store Cells	123,937	148,479	123,937	123,937
Number of Product-By-Store Type-By-Month Cells	33,516	33,516	33,516	33,516
Number of Municipality Clusters	76	76	76	76

Notes: The dependent variable is log barcode prices. Regressions are based on monthly price observations over the period 2002-2014 in 120 product groups and 76 municipalities. Foreign Entry indicates the presence of a foreign supermarket in a municipality. Estimations are based on regressions after excluding an adjustment period of 24 months. Standard errors are clustered at the municipality level and reported in parenthesis below the point estimates. * 10%, ** 5%, *** 1% significance levels.

Table 3: Ex-Post Price Differences for Identical Barcodes

	(1)	(2)
Dependent Variable:	Log Price	Log Price
Foreign Store Dummy	0.254***	-0.119***
	(0.0151)	(0.00896)
Municipality FX	✓	✓
Municipality-By-Product-By-Month FX	✓	✓
Municipality-By-Barcode-By-Month FX	✗	✓
Observations	17,467,996	17,467,996
R-squared	0.361	0.919
Number of Municipalities	151	151

Notes: The dependent variable is log barcode prices. Regressions are based on the uncensored microdata of the Mexican Nielsen Consumer Panel for the years 2011-2014. Standard errors are clustered at the municipality level and reported in parenthesis below the point estimates. * 10%, ** 5%, *** 1% significance levels.

Table 4: Effect on Municipality Average Incomes and Employment

Dependent Variable:	(1) Log Monthly Income	(2) Log Monthly Income	(3) Log Monthly Income	(4) Employed	(5) Employed	(6) Employed
Foreign Entry	0.0424***	0.0341***	-0.0134	0.00150	0.00176	0.00118
	(0.0121)	(0.00990)	(0.00824)	(0.00184)	(0.00182)	(0.00186)
Quarter FX	✓	✓	✓	✓	✓	✓
Municipality FX	✓	✓	✓	✓	✓	✓
Person Controls	×	✓	✓	×	✓	✓
Municipality Time Trends	×	×	✓	×	×	✓
Observations	4,377,393	4,377,393	4,377,393	5,705,807	5,705,807	5,705,807
R-squared	0.084	0.303	0.306	0.005	0.020	0.021
Number of Individuals	1,606,213	1,606,213	1,606,213	1,828,567	1,828,567	1,828,567
Number of Municipality Clusters	298	299	300	301	302	303

Notes: The dependent variable is log monthly incomes in Columns 1-4 and binary employment indicators in Columns 5-8 across 172 urban municipalities over the period 2002-2012. Standard errors are clustered at the municipality level and reported in parenthesis below the point estimates. * 10%, ** 5%, *** 1% significance levels.

Table 5: Effect on Incomes - Heterogeneity

Dependent Variable:	(1) Log (Monthly Income)	(2) Log (Monthly Income)	(3) Log (Monthly Income)	(4) Log (Monthly Income)	(5) Employed	(6) Employed	(7) Employed	(8) Employed
Foreign Entry X Modern Retail Worker	-0.0581***	-0.000169	-0.0280	-0.0284	0.0613***	0.0364***	-0.00277	0.00123
	(0.00611)	(0.0188)	(0.0194)	(0.0189)	(0.00142)	(0.00402)	(0.00396)	(0.00325)
Foreign Entry X Traditional Retail Worker	-0.260***	-0.0337*	-0.0493**	-0.0499**	0.0734***	0.0277***	-0.00275	4.58e-05
	(0.00776)	(0.0200)	(0.0213)	(0.0216)	(0.00171)	(0.00276)	(0.00376)	(0.00455)
Foreign Entry X Retail Shop Owner	-0.296***	-0.0966***	0.0153	0.00892	0.0513***	0.0200***	-0.000988	0.00310
	(0.0114)	(0.0230)	(0.0253)	(0.0245)	(0.00141)	(0.00232)	(0.00288)	(0.00332)
Person Controls	✓	✓	✓	✓	✓	✓	✓	✓
Municipality-by-Quarter FX	✓	✓	✓	✓	✓	✓	✓	✓
Municipality-by-Group Fixed Effects	×	✓	✓	✓	×	✓	✓	✓
Group-by-Quarter FX	×	×	✓	✓	×	×	✓	✓
State-by-Group Time Trends	×	×	×	✓	×	×	×	✓
Observations	4,222,154	4,222,154	4,222,154	4,222,154	5,500,588	5,500,588	5,500,588	5,500,588
R-squared	0.323	0.255	0.256	0.256	0.037	0.028	0.038	0.039
Number of Individuals	1,568,257	1,568,257	1,568,257	1,568,257	1,787,095	1,787,095	1,787,095	1,787,095
Number of Municipality-by-Quarter Cells	9,184	9,184	9,184	9,184	9,184	9,184	9,184	9,184
Number of State-by-Group Time Trends	128	128	128	128	128	128	128	128
Number of Municipality Clusters	298	298	298	298	298	298	298	298

Notes: Estimations are based on 172 urban municipalities over the period 2002-2012. We exclude an adjustment period of two years. Standard errors are clustered at the municipality level and reported in parenthesis below the point estimates. * 10%, ** 5%, *** 1% significance levels.

Table 6: Demand Parameter Estimates Mexican Nielsen Consumer Panel Data

Dependent Variable:	(1) Log(Phi) Cross-Municipality Estimate OLS	(2) Log(Phi) Cross-Municipality Estimate IV	(3) Log(Phi) Cross-Time Estimate OLS	(4) Log(Phi) Cross-Time Estimate IV
Log(Store Price Index)	0.662***	-2.12***	.	.
	(0.00665)	(0.761)	.	.
Product-by-Income-by-Municipality-by-Quarter FX	✓	✓	✓	✓
Store-by-Quarter FX	✓	✓	×	×
Store-by-Municipality FX	×	×	✓	✓
Observations	370,775	110,547	.	.
R-squared	0.688	0.173	.	.
First-Stage F Statistic		21.466		

Notes: The estimates are based on the microdata of the Mexican Nielsen Consumer Panel and the specifications discussed in 6.

Table 7: Household Welfare Effect - Decomposition

Dependent Variable:	(1) Total Effect	(2) Direct Price Index Effect	(3) Pro-Comp Price Index Effect	(4) Pro-Comp Exit	(5) Wage Effect	(6) Profit Effect	(7) Other Income Effect
Average Effect	0.127***	0.105***	0.0233***	0	-0.00193***	0	0
	(0.000849)	(0.000719)	(0.000369)	(0)	(9.89e-05)	(0)	(0)
Maximum	0.3361	0.2989	0.0635	0.0000	0.0000	0.0000	0.0000
Minimum	-0.0227	0.0000	-0.0047	0.0000	-0.0500	0.0000	0.0000
Observations (Number of Households)	17,340	17,340	17,340	17,340	17,340	17,340	17,340
Number of Municipality Clusters	273	273	273	273	273	273	273

Notes: The graph is based on 17,340 households among 273 urban municipalities between 2002-2008 that had not experienced foreign retail entry at the time of the ENIGH survey. The graph depicts 95% confidence intervals based on standard errors that are clustered at the municipality level. * 10%, ** 5%, *** 1% significance levels.