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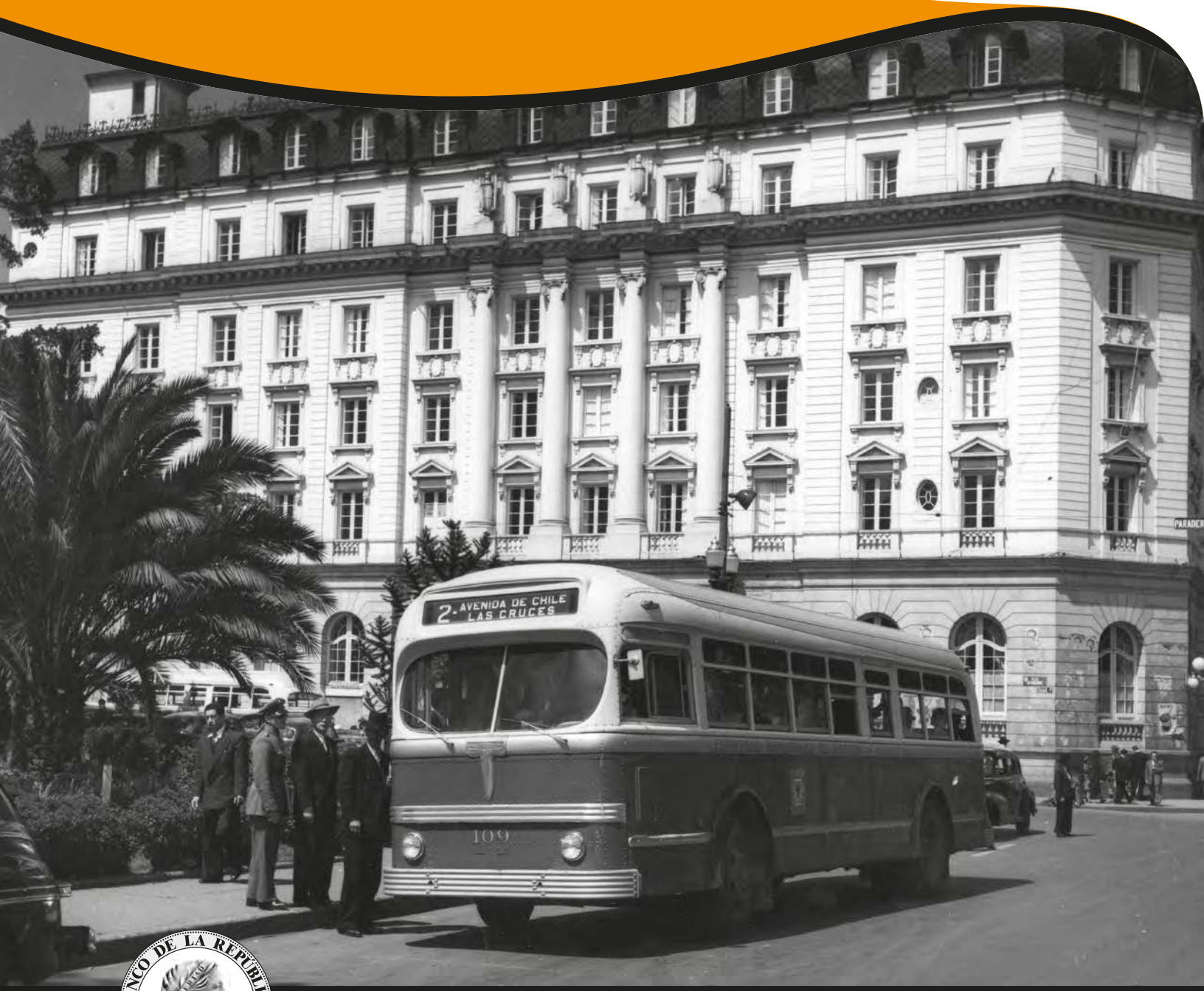

BANCO DE LA REPÚBLICA COLOMBIA

Rising Staple Prices and Food Insecurity: The Case of the Mexican Tortilla

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Abstract

We study the relationship between rising prices of tortillas—the Mexican staple par excellence—and household food insecurity between 2008 and 2014, a period in which global food prices experienced dramatic increases. The use of a unique combination of household-level data and official state-level information on prices allows us exploit significant variation in prices across the Mexican states. Since households cannot be tracked across time, we follow Deaton (1985) by constructing a series of pseudo-panels to control for time-invariant unobserved heterogeneity and measurement error. The regression estimates suggest that increasing tortilla prices affected food insecurity rates in Mexico. More specifically, households with children or those in the second or third income quintile are more likely to be affected.

Keywords: Mexico, food insecurity, food prices, households
JEL Classification: D12, O54, Q11, Q18

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Crecimiento de los Precios de Alimentos Esenciales e Inseguridad Alimentaria: El caso de la Tortilla Mexicana

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Resumen

Estudiamos la relación entre el aumento de precios de la tortilla—el alimento esencial por excelencia en México—y la inseguridad alimentaria de los hogares entre 2008 y 2014, un periodo en el que los precios globales de los alimentos sufrieron incrementos extraordinarios. El uso de una combinación única de datos de encuestas de hogares e información oficial de precios por estados nos permite explotar una variación significativa a travs de las distintas unidades administrativas del territorio mexicano. Dado que los hogares no pueden ser seguidos a través del tiempo, nos apoyamos en Deaton (1985) para construir una serie de pseudo-páneles para controlar en nuestras estimaciones por error de medición y heterogeneidad no observada que no varía con el tiempo. Los estimadores sugieren que el incremento de los precios de la tortilla aumentó la inseguridad alimentaria en México, principalmente en hogares con niños y aquellos que se ubican en el segundo y tercer quintil de la distribución de ingresos per cápita.

Palabras clave: México, inseguridad alimentaria, precios de alimentos, hogares
Clasificación JEL: D12, O54, Q11, Q18

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1 Introduction

Increasing food prices have adverse effects on the demand for food; households that are poor, less educated, landless or farming at a small scale, or living in urban areas, are among the most vulnerable to this problem (Brinkman et al., 2010; Headey and Fan, 2008; Ruel et al., 2010; Zezza et al., 2008). Households follow different coping strategies to mitigate the effects on their wellbeing, such as purchasing lower-quality products, reallocating intra-household resources, using different ingredients and cooking methods, or reducing the consumption of other basic goods or services (Ruel et al., 2010; Green et al., 2013). According to Hadley et al. (2012), households first change the quality of the food purchased and, when the situation deteriorates, they apply reversible strategies (e.g., borrowing) to alleviate food insecurity; finally they switch to irreversible strategies such as selling productive assets. Otherwise, households are forced to reduce overall food intake.

Since 2006, global food prices have increased, following a volatile trajectory, reaching their peak between 2008 and 2011 (FAO, 2017). Several studies have analyzed the effects of these changes in food prices on household wellbeing, particularly on poverty, food consumption, nutrition, and food insecurity (Brinkman et al., 2010; Hadley et al., 2012; Ruel et al., 2010). In developing countries, many grains and tubers, which also experienced significant price surges during the global food price crisis, are considered food staples and represent a large proportion of households diets. According to Melgar-Quinonez et al. (2006), food staples represent more than 10 percent of food-at-home expenditures in developing countries.

In this paper, we address how household food security is affected by the price surge of a very important staple in Mexico: the maize tortilla, a product that accounts for more than 9 percent of total food-at-home expenditures. The tortilla is a thin flat bread made from maize or wheat; it has been part of Mexico's culinary culture for centuries (Corona, 2016;

EcuRed, 2008), and is commonly used with products such as beans, beef, chicken, pork, vegetables, or cheese to make traditional Mexican dishes.

Using a unique combination of household-level data with official prices, we estimate the impact of rising tortilla prices on food insecurity in Mexico between 2008 and 2014. During this period—which coincides with the global food price crisis—the price of Mexican maize tortillas increased between 8.7 and 35.8 percent, depending on the place of purchase. Tortillas are generally purchased from *tortillerías*—local and independent stores that produce and sell fresh tortillas to the public—or grocery stores that sell tortillas produced by large-scale factories. Tortilla production in tortillerías differs from large-scale factories. Tortillerías use *nixtamalized* flour or combine fresh maize dough with nixtamalized flour to make tortillas.[1] In addition to using nixtamalized flour, factories add chemical preservatives to conserve their characteristics (e.g., flexibility, humidity, and whitening) for longer periods of time (Vazquez Carrillo et al., 2011). The estimations in this paper account for differences in income and education levels—as proxies of wellbeing—among Mexican households, in order to determine whether the observed price surge has heterogeneous effects among different groups.

Since we do not count with household-level panel data for Mexico that simultaneously tracks food consumption and food insecurity conditions, we follow Deaton (1985) by constructing a series of panel data sets, based on aggregating data by categories of household types. The construction of these pseudo-panels allows us to estimate fixed-effect models that address the effects of tortilla prices on the incidence of food insecurity across Mexican states. This estimation strategy is similar to that of Bellemare et al. (2018), a paper that analyzes the effect of quinoa prices—a non-staple product—on household per capita consumption,

[1] "Nixtamalization" refers to the process where maize is soaked and cooked in limewater, and then washed two or three times. This procedure adds nutritional value to maize and has been used since pre-Hispanic times (Paredes Lopez et al., 2009).

and allows us to correct for both time-invariant unobserved heterogeneity and measurement error. The main finding of this paper is that increasing tortilla prices—especially prices in tortillerías—have an impact on food security rates in Mexico, particularly on households in the lowest income quintiles, residing in urban areas, or with children.

The remainder of this paper is organized as follows: Section 2 provides background about the Mexican tortilla. Section 3 describes the data used in this research and a description of recent trends regarding food insecurity in Mexico. Section 4 explains the econometric estimation methodology and provides the identification strategy for estimating causal effects. Section 5 presents and discusses the estimates, while section 6 provides some robustness checks. Finally, Section 7 presents a discussion of the conclusions of the research.

2 Background

According to the official household-level data from the Mexican Institute of Statistics (INEGI) for our period of study (2008–2014), about 80 percent of Mexican households bought maize tortillas during that time. Dissagregating by per capita household income, those belonging to the middle-income quintiles (3 and 4) are among those who consume the most (more than 85 percent of these households), whereas the poorest and richest quintiles (1 and 5) are among those who consume the least (shares of less than 75 and 80 percent, respectively), as displayed in Figure 1. The maize tortilla represents an average of 9.4 percent of total food-at-home expenditures and corresponds to more than 42 percent of household expenditures on cereal-based products, as displayed in Figure 2.

Vazquez Carrillo et al. (2011) state that households prefer buying tortillas in tortillerías rather than in grocery stores because consumers are capable of noticing sensory differences

between traditional and packaged tortillas. As explained by these authors, traditional tortillas are distinguished by the smell of nixtamalized maize, ease of rolling, and astringency, without lumpiness or dryness; packaged tortillas are characterized by their lack of the smell of nixtamalized maize. Packaged tortillas smell like acetic acid, and are lumpier, non-astringent, and drier than their locally-produced counterparts. The tendency of households to purchase from tortillerías, however, has changed in recent times. According to the official household-level data from the INEGI, 56.5 percent of consuming households bought tortillas at tortillerías in 2008; this dropped to 49.1 percent in 2014, meaning that tortillas sold in grocery stores have gained market share during recent years, as displayed in Figure 3. Analyzing by income quintiles (Figure 4), we observed that poorest and richest households are more prone to buy tortillas at grocery stores, whereas middle-income households are more likely to buy them at tortillerías. Furthermore, tortillas from grocery stores have increased in demand every year of the study.

Anecdotal evidence suggests that, in general, the production of tortillas is a labor-intensive process.[2] Indeed, the procedure followed by tortillerías involves more labor than the process implemented by factories. Moreover, tortillerías produce on a smaller scale so that they can sell tortillas the same day that they are produced. In contrast, factories sell a higher volume of tortillas, so the product is designed to have a longer lifespan between production and its use by the consumer. Due to their higher cost of production, tortillerías may offer a more expensive product compared to grocery stores. Official data from the Mexican Department of Economic Affairs indicate that tortillas available at grocery stores are more affordable than those from tortillerías. For 2008, the average real price of packaged tortillas was 6.5 MEX$ per kilogram, while the average real price of traditional tortillas was 10.2

[2]We interviewed the manager of a tortillería located in the Minneapolis-Saint Paul area. Full transcript of the interview is available in the Appendix.

MEX$ per kilogram.[3] Both tortilla prices have increased over time: the average real prices at tortillerías and grocery stores rose by 8.7 and 35.8 percent respectively between 2008 and 2014, as displayed in Figure 5.

Finally, it is important to note that recent crime trends may also have some impact on the shift of the aforementioned market shares. Newspapers have reported that owners and employees of tortillerías have been extorted or even killed by groups related to drug trafficking; this situation has caused the closure of several tortillerías (Balderas, 2016). Although the reports state that overall sales at supermarkets or grocery stores have been affected by the recent insecurity episodes, there is no evidence that it has also had an impact on tortilla sales (Ruel et al., 2010; Empresarial, 2012).

3 Data

We use the Mexican National Survey of Household Income and Expenditure (ENIGH), which is conducted biannually by the National Institute of Statistics, Geography and Information (INEGI). The ENIGH collects detailed information on household income, tracking its sources, amounts, and expenses. It also includes data on dwelling characteristics, household composition, economic activity, labor, and education. The ENIGH is representative at the national level, as well as at the urban and rural levels. The ENIGH does not track households across years. Thus, this study uses the repeated cross sections from 2008 to 2014, which together contain 85,604 household-year observations. Section 4 provides details on the construction of the different pseudo-panels based on repeated cross-sectional data.

A useful feature of the ENIGH is the within-year tracking INEGI employs to collect data.

[3]Between 2008 and 2014, the average exchange rate was 12.7 MEX$ per USD.

Each household is interviewed over seven consecutive days to obtain information about daily expenses. This follow-up does not occur simultaneously for all participating households. The INEGI collects data from households using ten different schedules. After collecting the 7-day data from each household, INEGI extrapolates this information to compute 3-month expenditures. In the public database, researchers observe the 3-month period to which the corresponding expenditure data belong. As explained below, this arrangement allows us to exploit more time series variation in tortilla prices.

INEGI introduced a food security supplement (FSS-ENIGH) to the ENIGH in 2008, and since that year it has been part of the survey. The FSS-ENIGH addresses daily life episodes where households might have faced trouble having enough and varied food consumption due to the lack of monetary resources during the previous 90 days. The FSS-ENIGH follows the guidelines of the Latin American and Caribbean Food Security Scale (ELCSA is its acronym in Spanish), with some minor changes. ELCSA defines food insecurity as "the household-level condition of limited or uncertain access to sufficient and adequate food products," based on the Food Security Supplement to the U.S. Current Population Survey (FSS-CPS).[4] The original ELCSA includes a battery of 15 questions to identify food insecurity (eight for households without children).[5] The 2008 FSS-ENIGH questionnaire included 12 questions (six for households without children), and for 2010 onwards, the questionnaire included 16 questions (nine for households without children). The FSS-ENIGH is collected during the first day of each of the ten interview schedules.

In this paper, the outcome of interest is measured in two ways. First, we construct an indicator variable that is equal to one if the household is food insecure, zero otherwise. For this variable, we count the number of affirmative answers, since every question from the

[4] `https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/measurement/`

[5] Comité Científico de la ELCSA (2012) describes in more detail the construction of the ELCSA.

FSS-ENIGH is constructed in such a way that households can only answer either "yes" or "no". The indicator variable of food insecurity is constructed based on questions that are included in every ENIGH round from 2008 to 2014. In this study, we categorize households as food insecure if they answer "yes" to three or more questions; this is the same threshold established by the United States Department of Agriculture when using the Current Population Survey (FSS-CPS) as the data source. The ELCSA establishes the threshold that determines food insecurity after one affirmative answer, but several previous works that have addressed food insecurity in Mexico use different thresholds, and only when we use the same rule from the USDA we are able to replicate the official national food insecurity rates reported by the Mexican Secretariat of Social Development (SEDESOL is its acronym in Spanish). Our second measure of food insecurity—that we use as a robustness check—is the number of affirmative answers of the household. This variable is bounded between zero and six because we are considering only those questions that were asked to all households—with or without children, just to make this measure comparable across all households regardless their composition.

For the period 2008–2014, an average of 24.4 percent of Mexican households are categorized as food insecure. As displayed in Figure 6, food insecurity rates have increased over time. Households from the poorest income quintile are more likely to be food insecure, averaging an incidence rate of above 40 percent, with a small decrease in 2014. As expected, households from the fifth quintile (the wealthiest one) exhibit the lowest food insecurity rates. However, we find that the incidence of food insecurity for this group not only increased in 2014, but also went closer to 5 percent. Figure 7 displays a significant variation in food insecurity rates across states. For example, in 2012 the incidence of food insecurity across all Mexican states ranged between 4 percent and 48 percent.

Our explanatory variable of interest is the price of maize tortilla. For this paper, we

distinguish between prices at tortillerías and at grocery stores because the quality of tortillas can differ greatly according to the place of purchase (Vazquez Carrillo et al., 2011). These differences in tortilla attributes—in addition to the differences in the scale of production between tortillerías and grocery stores—are reflected in their prices. Therefore, we use three measures of tortilla prices: prices at tortillerías, prices at grocery stores, and average tortilla prices. As in González Dávila (2010), the data on tortilla prices used in this paper come from the National System of Market Information (SNIIM).[6] SNIIM collects these data every Monday, Wednesday, and Friday from selected tortillerías and grocery stores in cities across all Mexican states. These data are representative at the national and state levels. The sample includes 384 tortillerías and 120 stores in 53 cities.

To exploit the time variation from the ENIGH explained at the beginning of this section, we calculate state-level average tortilla prices in tortillerías and grocery stores for the previous 90 days with respect to the first day of each of the ten interview periods for each household. Then, we assign to each household the corresponding state average prices, according to the date they were interviewed. Although this data structure reduces variation in prices, it is more accurate and less subject to measurement error than the prices self-reported by households in the ENIGH.

4 Empirical Framework

In this section we present the main regression model we estimate in this study, and, then, we provide a discussion about the identification strategy derived from the equation of interest.

[6] `http://www.economia-sniim.gob.mx/Tortilla.asp`

4.1 Econometric Estimation

Food security depends on food consumption, and the latter is a function of food availability, income, and food prices. Schmitz and Kennedy (2015) present a static model in which an income supplement for the poor increases their food consumption despite higher food prices, and as a result, their food security status improves. These authors present another static model in which research and development expands food supply for each price, so food prices decrease and food consumption rises. Regarding preferences, Just et al. (2011) explains that food choice can be modeled as a dual process in which the individual makes brief evaluations based on affect or emotion, and the cognitive process in which the individual makes more deliberative evaluations based on rational thinking. Regarding the individual's evaluation of taste, Just et al. (2011) points out that it depends on several factors such as appearance, name, price, brand, or information given by others.

Consider the following linear regression model that accounts for household-level food insecurity status as a function of food prices and income:

$$FI_i = \beta_0 + \beta_1 P_i + \beta_2 W_i + \beta_3 G_i + e_i \tag{1}$$

where FI_i corresponds to household i's food insecurity measure (incidence or number of affirmative answers), P_i refers to tortilla prices, W_i represents household per capita income, G_i correspond to the consumer price index of a specific food group, and e_i is a zero-mean error. The estimation of Equation 1 through OLS could lead to biased estimators of the parameter of interest (β_1), mostly due to omitted variables (e.g., unobserved consumers' preferences, differences in the scale of production between tortillerías and factories that sell to big-scale grocery stores, persistence of past shocks, macroeconomic conditions, or changes

in some relevant household characteristics that are correlated with the price measure). Even with the inclusion of a comprehensive battery of household-level characteristics (X_i) and geographic-level indicators (i.e., unit fixed effects), this regression model is unlikely to be able to fully correct for unobserved heterogeneity, and to capture all factors that could affect households' food insecurity status. As explained in Section 3, the ENIGH does not track households across years. Therefore, it is not possible to conduct any fixed-effect model estimation when using households as the unit of observation.

To overcome this data limitation, we follow Deaton (1985) by constructing pseudo-panels that use groups of observations (e.g., districts, municipalities, states, year of birth of the household head) as the units of analysis. For instance, previous work regarding the welfare effects of rising food prices in Peru (Bellemare et al., 2018) or the state-level determinants of the incidence of food insecurity in the United States (Gundersen et al., 2011) used this methodology. Suppose that there are H_j households ($h = 1, 2, H$) in the cohort or unit j, and there are J units in year t. All units are tracked over time and are constructed by grouping households with similar characteristics. Therefore, the dependent variable ($\overline{FI}_{jt}$) is the average of households classified as food insecure in unit j at time t, which is calculated by taking the average of the indicator variable that is equal to one if household i is food insecure, and zero otherwise. Regarding the number of affirmative answers, $\overline{FI}_{jt}$ represent the average over all households in unit j at year t. The explanatory variable of interest—tortilla price—($\overline{P}_{jt}$) is the average tortilla price of one of the three ways to measure tortilla prices among all households in unit j at year t. Then, $\overline{W}_{jt}$ is the average real per capita income among all households of group j at year t. $\overline{G}_{jt}$ represents the average consumer price index of a particular food group among households who belong to cohort j in year t. In addition, we have cohort fixed effects (γ_j) rather than household fixed effects.

The following equation illustrates the computation of the food insecurity rate for the

corresponding unit of analysis, at a given point of time:

$$\overline{FI}_{jt} = \frac{1}{H_{jt}} \sum_{i=1}^{H_{jt}} I[FI_{ijt} = 1] \tag{2}$$

where H_{jt} indicates the total number of households in unit j in year t, and $I[FI_{ijt} = 1]$ denotes the indicator function that is equal to one if household i is food insecure, and zero otherwise. Alternatively, the following equation displays the computation of the average number of affirmative answers over households at a given point of time:

$$\overline{FI}_{jt} = \frac{1}{H_{jt}} \sum_{i=1}^{H_{jt}} AS_{ijt} \tag{3}$$

where AS_{ijt} indicates the number of affirmative answers of household i in unit j in year t.

Our set of price measures corresponds to real tortilla prices at tortillerías and grocery stores, and the average of real tortilla prices (all of them measured in logarithms), in a given year:[7]

$$\overline{PT}_{jt} = \frac{1}{H_{jt}} \sum_{i=1}^{H_{jt}} log(PT_{ijt}) \tag{4}$$

$$\overline{PG}_{jt} = \frac{1}{H_{jt}} \sum_{i=1}^{H_{jt}} log(PG_{ijt}) \tag{5}$$

[7]To convert from nominal to real values, we use the nationwide yearly-average Mexican Consumer Price Index (CPI).

$$\overline{PA}_{jt} = \frac{1}{H_{jt}} \sum_{i=1}^{H_{jt}} log\left(\frac{1}{2}\left(PG_{ijt} + PT_{ijt}\right)\right) \tag{6}$$

Figure 5 displays considerable collinearity between tortilla prices at tortillerías and grocery stores. More precisely, the coefficient of correlation is about 0.57 and is statistically significant at the one-percent level. Therefore, including both price variables simultaneously in our regression model would lead to larger standard errors of the parameters of interest. For that reason, we estimate our regression model by including one price measure at a time.

The following equation displays the computation of the real per capita income for the corresponding unit of analysis, at a given point of time:

$$\overline{W}_{jt} = \frac{1}{H_{jt}} \sum_{i=1}^{H_{jt}} W_{ijt} \tag{7}$$

Regarding the consumer price indices of food groups, INEGI provides monthly indicators at the national level; we calculate the annual averages of these indices considering the period in which household i was interviewed. The consumer price indices correspond to the following eight food groups: bread; crackers, pastries, and wheat flour; rice and flaked cereals; meat; fish and seafood; dairy products and eggs; edible oils and fats; and fruits and vegetables. Our average consumer price index for a particular food group at year t in state j is:

$$\overline{G}_{jt} = \frac{1}{H_{jt}} \sum_{s=1}^{S} \sum_{i=1}^{H_{jt}} G_{ijst} \tag{8}$$

where G_{ijst} represents the consumer price index of a particular food group assigned to household i that was interviewed in state j in period s at year t.[8]

[8]Period refers to the time when the household was interviewed. For instance, in 2008, the first and second

Our regression model also includes a variable that captures whether households received in-kind transfers of tortillas. This is a relevant coping strategy used by the poorest households when facing positive price shocks. At the same time, the inclusion of this variable would also help to explain the lower share of households from the poorest income quintile that purchase tortillas. Our aggregated measure of in-kind transfers is the following:

$$\overline{K}_{jt} = \frac{1}{H_{jt}} \sum_{i=1}^{H_{jt}} I[K_{ijt} = 1] \tag{9}$$

where $I[K_{ijt} = 1]$ corresponds to the indicator variable that is equal to one if household i in unit j receives in-kind transfers of tortilla at time t, zero otherwise.

We include a variable that accounts for the levels of violence across Mexican states. As explained in Section 2, the increasing violence in Mexico has caused the closure of an important number of tortillerías. Using administrative data from INEGI, we construct a variable that measures the percent of violent deaths among all deaths in each Mexican state at a given point of time:[9]

$$\overline{V}_{jt} = \frac{A_{jt}}{D_{jt}} \times 100 \tag{10}$$

where A_{jt} indicates the total number of violent deaths in state j at year t, and D_{jt} denotes the total number of deaths in state j at year t.

Therefore, by taking the average of each variable in Equation 1 and adding the aggregated measure of the square of real per capita income, as well as the aggregated indicators of in-kind transfers of tortilla and percent of violent deaths, our regression model is:

periods go from February to July, while the third, fourth, and fifth schedules go from March to August.

[9] `http://www.beta.inegi.org.mx/proyectos/registros/vitales/mortalidad/`

$$\overline{FI}_{jt} = \beta_0 + \beta_1 \overline{P}_{jt} + \beta_2 \overline{W}_{jt} + \beta_3 \overline{W}^2_{jt} + \beta_4 \overline{K}_{jt} + \beta_5 \overline{V}_{jt} + \sum_{g=1}^{G} \alpha_g \overline{G}_{jt} + \gamma_j + \epsilon_{jt} \qquad (11)$$

where $\overline{W}^2_{jt}$ is the square of real per capita income. $\overline{K}_{jt}$ corresponds to the average share of households that receive in-kind transfers of tortilla; $\overline{V}_{jt}$ represents the percent of violent deaths over the total number of deaths for unit j in year t; γ_j is the unit fixed effect, and ϵ_{jt} is the zero-mean error term. The regression estimates of the parameters associated with the logarithm of tortillerías, grocery stores, and average tortilla price represent the percentage-point change in food insecurity rates after a one-percent change of prices.

Regression estimates using pseudo-panel data sets bring an important trade-off: grouping observations into larger units of analysis may reduce omitted variable bias, but it also leads to fewer observations in the final data set, decreasing statistical power. To analyze this trade-off, we aggregate the data using four different units of analysis based on geographical, educational, and household income criteria. First, we construct a pseudo-panel at the state level, comprised of 128 state-year observations, since states are the smallest geographical unit represented consistently in every wave of the ENIGH. The Mexican territory is divided in 32 states including the federal district of Mexico City—the nation's capital—and 2,457 municipalities.[10] The INEGI uses census information to divide the country into geographically-based sampling units, composed of households that share certain socioeconomic characteristics. At each sampling unit, INEGI randomly selects a sub-sample of households that conforms to a nationally representative sample. As a result, the ENIGH does not include households from every Mexican municipality.[11]

Second, since we expect that households can react differently to tortilla price shocks

[10] `http://cuentame.inegi.org.mx/territorio/division/default.aspx?tema=T`

[11] Only state capitals are represented in all samples.

according to their income level, we estimate per capita income for each of the household in order to construct a distribution that allows us to categorize households into five different income quintiles.[12] More specifically, we group households based on their geographic location (i.e., state) and the per capita income quintile to which they belong; this which allows us to construct a 640 state-income quintile-year observation pseudo-panel. For each year, we have at least one observation that belongs to each income quintile in every state, creating a balanced pseudo-panel data set.

Third, we split our state-level pseudo-panel between urban and rural areas because there is evidence that rural households have more coping strategies to mitigate the effects of rising food prices, as explained by Headey and Fan (2008), Ruel et al. (2010), and Brinkman et al. (2010). Ruel et al. (2010) indicate that 97 percent of urban residents are net food buyers, compared with 75 percent of rural inhabitants. These authors argue that even though about 50 percent of urban households in Latin America practice urban agriculture, usually this activity is not considered the primary source of food consumption. Moreover, food producing households in urban areas depend on their plot production for only a few months yearly.

Fourth, we also split the state-level pseudo-panel according to the educational attainment of the household head: less than primary, primary, lower secondary, upper secondary, and tertiary education. The reason for evaluating the impact of prices on food insecurity by the educational attainment of the head is that households may suffer positive (negative) income shocks that take them above (below) their expected level of income, so the income quintile groups might not be comparable over time. This argument of the income mobility of households is supported in the literature. Cuesta et al. (2011) point out that Latin America as a whole is slightly mobile in income but mobility increases when socioeconomic characteristics

[12]We convert all household per capita income values as well as the income thresholds from nominal to real terms by using the nationwide yearly-average Mexican Consumer Price Index (CPI) as deflator. Data are taken from the INEGI (`http://www.inegi.org.mx/est/contenidos/proyectos/inp/inpc.aspx`)

are considered. Antman and McKenzie (2007) explain that income mobility is low, but households that experience shocks recover almost fully to their expected level within two years. Regarding educational mobility in Latin American countries, Behrman et al. (2001) explain that children have surpassed the school attainment of their parents. However, we are analyzing a short time period so we do not expect the educational attainment of heads to change noticeably from one survey round to the next. Hence, to divide the households by the educational attainment of the head may be a suitable alternative way to construct pseudo-panels because they are comparable across years.

4.2 Identification Strategy

We can claim to estimate a causal effect of our parameters of interest in Equation 11 if the regression model convincingly controls for the three potential sources of statistical endogeneity: (i) unobserved heterogeneity, (ii) measurement error, and (iii) reverse causality.

With respect to unobserved heterogeneity, recall from Section 4.1 that INEGI randomly selects households from different sampling units to construct a nationally representative sample. Thus, groups of households in our aggregated units of observation of interest (e.g., states or states by income quintiles) should be comparable across years, in terms of both observable and unobservable characteristics. Therefore, the implementation of the pseudo-panel technique allows us to construct units of analysis that can be tracked over time, permitting the estimation of fixed-effect models that account for time-invariant unobserved characteristics at the unit of analysis. Additionally, in our state-level regressions we include a set of variables that account for the share of households that belong to the different income quintiles. At the same time, to address the effect of unobservable variables that might help to explain the variation in food prices, we include a linear time trend.

Measurement error could come from both the dependent variable (food insecurity rates) and the price measures. On one side, categorization of households as food (in)secure comes from self-reported answers from questionnaires. Therefore, the estimation of the incidence of food insecurity is likely to come with some noise, but that noise is likely to be random. For example, households could have provided wrong answers by misunderstanding the questions. If the error that comes from the dependent variable is uncorrelated with the independent variables, we expect the standard errors from the regression estimates to be larger, but the estimated parameters to remain unbiased. On the other hand, any measurement error that comes from the data on tortilla prices will cause attenuation bias on the estimation of β_1. However, we expect this bias to be much smaller than errors from self-reported data on prices from households. Furthermore, averaging data over households may cause that most of the measurement error is canceled out.

Finally, we do not consider reverse causality (i.e., changes in food insecurity rates cause changes in tortilla prices) to be an issue. As described in Section 1, the increase in local prices has been mostly due to the rise of international maize prices rather than changes in local demand. Regarding the control variables, there may be a bidirectional relationship between food insecurity and transfers or donations or tortillas; however the estimates analyzed in the next section reveal that the inclusion of this variable does not noticeably change the estimated parameters of prices.

5 Results

Table 1 displays the fixed effects regression estimates when using the state-level pseudo-panel. Each cell of this table—and most the remaining tables in this paper—contains the estimated parameter (and its standard error in parentheses) from the regression model that includes

the corresponding price measure and the additional controls that are listed at the bottom. As explained in Section 4.1, tortillería and grocery store prices are highly correlated. Thus, we estimate the regression models including only one price variable at a time.[13] Regarding per capita household income, we control for real per capita income and its square because it allows us to take into account that the effect of income may have a non-linear relationship with food insecurity. We do not include income and income-squared as covariates for the state-income-quintile pseudo-panel because there is a positive correlation between the income quintile of a given state and its corresponding income.

From Table 1 we observe that tortilla prices have a positive impact on average food insecurity rates for the first four regression models. When we include the consumer price index for food or the linear time trend separately (columns 5 and 6), the significance of the parameters of interest vanishes because the magnitude of coefficients is smaller and, at the same time, standard errors go up (columns 5 and 6). We suspect this is the result of some degree of collineality between tortilla prices and the CPI. [14] This result persists on almost all regression models we estimate for this paper. When including all controls, a one-percent increase of average tortilla prices has an effect on food insecurity rates of 0.11 percentage points (column 7), and is statistically significant at 10 percent or less. With respect to prices at tortillerías, the estimated average impact is between 0.14 and 0.20 percentage points. These magnitudes are the greatest, which is expected because tortillas from tortillerías are more expensive. With respect to grocery store prices, the estimated average impact lies between 0.08 and 0.09 percentage points; when we include the consumer price index for food or the linear time trend the coefficients of prices are no statistically significant. Regarding the effect of income on food insecurity, the estimated parameters displayed in columns 2 and 7 of Table 1 indicate that states with lower average per capita income are more likely to have

[13] We include both prices simultaneously just as a robustness check

[14] Replacing the linear time trend with fixed effects by year yields similar results.

greater shares of food insecure households, and this likelihood diminishes as average income increases.

Table 2 reports the regression estimates for the state-income quintile-level pseudo-panel, which aims to capture differences in the impact of prices across different income levels. As in Table 1, the inclusion of consumer price indices of food groups makes our coefficients of interest to lose statistical significance—via smaller coefficients and greater standard errors, as displayed in columns 4 and 5, except in the case of prices at tortillerías. The effect of average prices lies around 0.11 percentage points (as in the full model of column 6). With respect to prices at tortillerías, the average impact is between 0.11 and 0.21 percentage points, and the coefficient of interest is significant for all models. Regarding prices at grocery stores, the average impact lies around 0.09 percentage points, but the estimated parameters of interest are no longer statistically significant for regression models that include either the linear time trend, the consumer price indices, or both.

In summary, we find that tortilla prices have a positive effect on food insecurity in Mexico for the period $2008-2014$, when we do not control for time or consumer price indices of other food groups in the regression models. Although the magnitudes of the estimated parameters are small, we have to remark that tortilla is a complementary good, since it is consumed with meat, rice, beans, among others. Therefore, one might expect that reductions in tortilla consumption could also reflect less consumption of other goods, increasing the likelihood of being food insecure. Also, it is important to remark that the estimated coefficients indicate the price of tortillas at tortillerías has the greatest effect with respect to the other two price measures. As described in Section 2, the prices of tortillas at grocery stores increased at a greater pace compared with the price at tortillerías, but they still have a lower effect on food insecurity rates compared to prices in tortillerías.

Next, we build a series of state-level pseudo-panels for each income quintile. The results from Tables 3 to 7 display some interesting findings. For quintiles 1 to 4, we find that all price measures have a positive impact on food insecurity rates, but only for the regression models that do not include either the linear time trend or the consumer price indices (columns 1 to 3 of Tables 3 to 6, except in the case of prices at tortilleras in Table 6). For these estimates, the greatest impact of tortilla prices on food insecurity takes place on households belonging to the second income quintile (Table 4). On average, a one-percent increase in average tortilla prices increases food insecurity by 0.20 percentage points. With respect to the price at tortillerías and grocery stores, the estimated average effect is 0.27 and 0.12 percentage points, respectively.

Surprisingly, we find that tortilla prices still affect food insecurity on households at the fourth quintile (Table 6). A one-percent increase of average tortilla prices boosts food insecurity rates around 0.16 percentage points, although the estimated coefficients are not significant when we include consumer price indices or the linear time trend. With respect to tortillería prices, the estimated parameters are always statistically significant, regardless of the econometric specification. On average, the estimated effect lies between 0.15 (column 5) and 0.23 (columns 1 and 2) percentage points. Regarding the price in grocery stores, the effect is positive and significant only for regression models that exclude both the linear time trend and the consumer prices indices (columns 1 to 3); the effect ranges around 0.09 percentage points.

Then, we split our state-level pseudo-panel between urban and rural areas because there is evidence that rural households have more coping strategies to mitigate the effects of rising food prices (Headey and Fan, 2008; Ruel et al., 2010; Brinkman et al., 2010). The results from Table 8 indicate that the impact of tortilla prices is no longer significant when we add time trends and the consumer price index for food to our model, only the coefficient of

prices at tortilleras is significant in all specifications. The effect from average tortilla prices is between 0.13 and 0.14 percentage points, while the impact of tortillera prices lies between 0.11 and 0.19 percentage points. With respect to grocery store prices, the impact lies around 0.08 percentage points.

We also split the state-level pseudo-panel according to the educational attainment of the household head: less than primary, primary, lower secondary, upper secondary, and tertiary education. The results from Table 9 display consistent findings with those presented previously. For instance, the effects of prices at tortillerías are the greatest among the three tortilla price measures and these effects are significant except when we add the time trend only (column 5 of Table 9). The estimated effect of average tortilla prices lies around 0.17 percentage points, while the impact of prices in tortillerías and grocery stores lies around 0.23 and 0.11 percentage points, respectively. The impact of prices in tortillerías is significant in almost all cases, while the effect of prices in grocery stores is not significant and have negative signs in columns 4, 6, and 7. It is important to highlight that the inclusion of the dummy variable for transfers and donations of tortillas yields similar coefficients to the model that includes all controls (columns 6 and 7).

6 Robustness Checks

In this section, we present some robustness checks that investigate heterogeneity in the effect of tortilla prices on food insecurity using alternate measures of prices and a different proxy of food insecurity.

6.1 Using Two Prices Simultaneously and Principal Components Score as a Measure of Prices

As a robustness check to our measure of average price, we first include the prices in tortillerías and grocery stores simultaneously in Equation 11. Therefore, we estimate the following equation:

$$\overline{FI}_{jt} = \beta_0 + \beta_1 \overline{PT}_{jt} + \beta_2 \overline{PG}_{jt} + \beta_3 \overline{K}_{jt} + \beta_4 \overline{V}_{jt} + \sum_{g=1}^{G} \alpha_g \overline{G}_{jt} + \gamma_j + \epsilon_{jt} \tag{12}$$

We expect from Equation 12 to obtain larger standard errors because the two tortilla prices are highly correlated. Tables 10 and 11 partially corroborate our hypothesis and, at the same time, report mixed findings. When we use the state-income quintile pseudo-panel, we find that tortillería prices have a positive impact on household food insecurity on the model that accounts either for the CPI for food and the linear time trend (columns 4 to 6). On average, the effect of a one-percent increase in this price rises food insecuirty rates by 0.15 percentage points. Although not statistically significant, we observe a negative sign on the estimated coefficients for the price at grocery stores at the aforementioned columns. Likewise, using the state-education group pseudo-panel, only one of the tortilla prices is statistically significant. Overall, results suggest that tortillería prices do increase food insecurity in Mexico, but prices in grocery stores impact food insecurity rates positively when we do not either add the linear time trend or consumer price indices (columns 1 to 3). However, the magnitudes of coefficients reported in Tables 10 are 11 are smaller compared to the estimates displayed in Tables 1 and 2.

As a alternative robustness check to our measure of average prices, we conduct a principal components analysis (PCA) to construct a series of scores that represent a linear combination

between our prices of interest, while capturing the highest variance possible. In this particular case, the first component score accounts for more than 90 percent of the total variation on both prices. Moreover, the value of the loading factors (i.e., eigenvectors) for the first component is the same for prices in tortillerías and grocery stores, allowing us to interpret the corresponding predicted score as a normalized representation of the simple average between prices. On the other hand, the second component score has the same loading factors as the first component score, but the sign of the score from the price at tortillerías is negative. Therefore, we interpret the second score as a normalized variable that captures household characteristics that help explain the observed variation on each price, but not simultaneously for both. As a consequence, we only use the first component in our regression estimates. The results from Tables 12 and 13 report a positive relationship between the first component score and food insecurity rates.

6.2 Using Separate Subsamples of Households with or without Children

As explained in Section 3, the 2008 FSS-ENIGH questionnaire includes 12 questions (six for households without children); for 2010 onward, the questionnaire includes 16 questions (nine for households without children). The indicator variable of food insecurity used in the previous subsection is constructed based on those questions that are included in every ENIGH wave from 2008 to 2014. Hence, the food insecurity indicator variable is based on six questions in the case of households without children and 12 questions in the case of households with children; as a result, the latter families are more prone to be classified as food insecure. The average rates of food insecurity in Mexico calculated from this indicator variable do replicate the food insecurity rates reported by official Mexican institutions such

as the National Council for the Evaluation of Social Development Policy (CONEVAL).

Wilde (2004)—for the case of the United States—proposes that one solution to make the measure of food insecurity more comparable between households with and without children would be to modify or eliminate some questions; another solution would be that the USDA bases the national prevalence estimates on adult-referenced questions only. We mention the case of the United States for two reasons. First, the FSS-ENIGH contains questions that are asked of all households and a subset of items asked only of households with children. Second, we classify households as food insecure if they answer "yes" to three or more questions, which is the same cutoff established by the USDA when using the Current Population Survey (FSS-CPS) as the data source.

Following Wilde (2004), we construct a food insecurity measure taking into account only the six questions that were asked of all households; this dummy variable is equal to one if the household answered "yes" to three or more questions. Figure 8 reveals that in 2008, around 16 percent of households were food insecure; the prevalence was slightly greater in households with children. For 2010 onward, food insecurity rates in households with children reached more than 35 percent, whereas less than 12 percent of families without children were food insecure. Therefore, rising food insecurity rates over time in Mexico is driven by families with children.

We estimate Equation 11 using the food insecurity measure calculated separately for each family type (with or without children). The results from Tables 14 and 15 indicate that tortilla prices have no effect on food insecurity rates for households without children. The negative impacts of prices in grocery stores (columns 1 and 2) seems counterintuitive because the tortilla is the main food staple in Mexico.

Results from Tables 16 and 17 are consistent with the findings of Tables 2 and 9, although

the magnitude of coefficients is higher. Results from Table 17 reveal that the effect from average tortilla prices is between 0.24 and 0.58 percentage points, while the impact of tortillería prices lies between 0.23 and 0.69 percentage points. Regarding grocery store prices, the effect lies between 0.17 and 0.39 percentage points, but the impact goes away when we include consumer price indices or the linear time trend, reflecting the financial burden that children represents in terms of obtaining enough food for their daily needs. In other words, families with children have fewer coping strategies to face rising food prices.

6.3 Using the Number of Affirmative Answers as Alternative Measure of Food Security

We construct an alternative measure of food insecurity for each family type. This variable is the number of affirmative answers of the household, which is bounded from zero to six. Trends displayed in Figure 9 are consistent with trends of the food insecurity rates computed by family type (Figure 8); since 2010, families with children answered more questions affirmatively, while the opposite happens with childless families.

Since we aggregate data from the repeated cross-sections to construct the pseudo-panel, we are no longer using integer numbers. Hence, we interpret the parameters of interest as the effect of one-percent change of tortilla prices on the average number of affirmative answers (a continuous number). The results from Tables 18 and 19 suggest that a one-percent increase of average tortilla prices causes households without children to decrease the number of affirmative answers in one question (0.37 to 1.1 questions); the effect of prices in tortillerías (from -0.3 to -1.7 questions) and grocery stores (-0.28 to -1.1 answers) are very similar.

On the other hand, the results from Tables 20 and 21 reveal that a one-percent increase in average tortilla prices boosts the average number of affirmative answers of households with children from 2.0 to 3.3 questions. The effect of prices in tortillerías is ever greater (from 1.7 to 4.0 questions). Concerning grocery store prices, their impact on households with children lies between 1.3 and 2.2 questions. The analysis of this subsection suggests the effect of tortilla prices on food insecurity in Mexico is explained by the vulnerability of families with children.

7 Conclusions

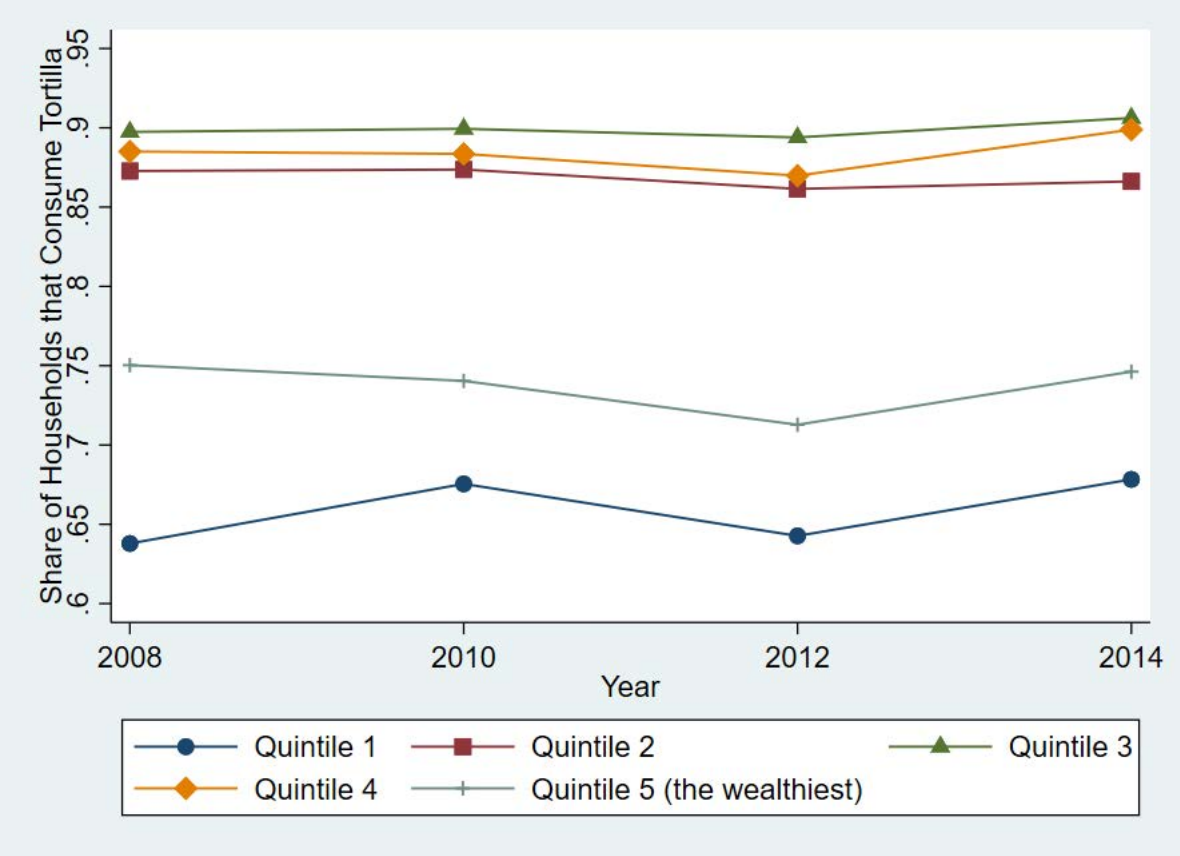
In this paper, we estimate the effects of the rising maize tortilla prices on household food insecurity in Mexico. These prices experienced a significant increase during the period 2008 − 2014, coinciding with the global food price crisis. As noted in the literature, rising food prices have adverse effects on poverty, food consumption, nutrition, food insecurity, and even on health and wellbeing (Hadley et al., 2012). Using repeated cross-section data from the ENIGH, we construct a series of pseudo-panels—as proposed by Deaton (1985)—to estimate fixed-effect regression models that allow us to control for time-invariant unobserved heterogeneity and error measurement. Additionally, we use official tortilla price data, which are disaggregated by the place of purchase—tortillerías or grocery stores— and their average, that enables us to evaluate which tortilla price has a greater effect on food insecurity.

The main finding of this paper is that increasing tortilla prices boosts food insecurity rates in Mexico, and this result is consistent using different types of pseudo-panels. Furthermore, the effects of tortilla prices on food insecurity are heterogeneous according to income level and family type. As has been documented in the literature, households from lower income quintiles and whose head has low educational attainment are the most affected by food price

rises (Mundo-Rosas et al., 2014). Moreover, households with children (in other countries besides Mexico) are more vulnerable to rising food prices, and thus are at higher risk to be food insecure.

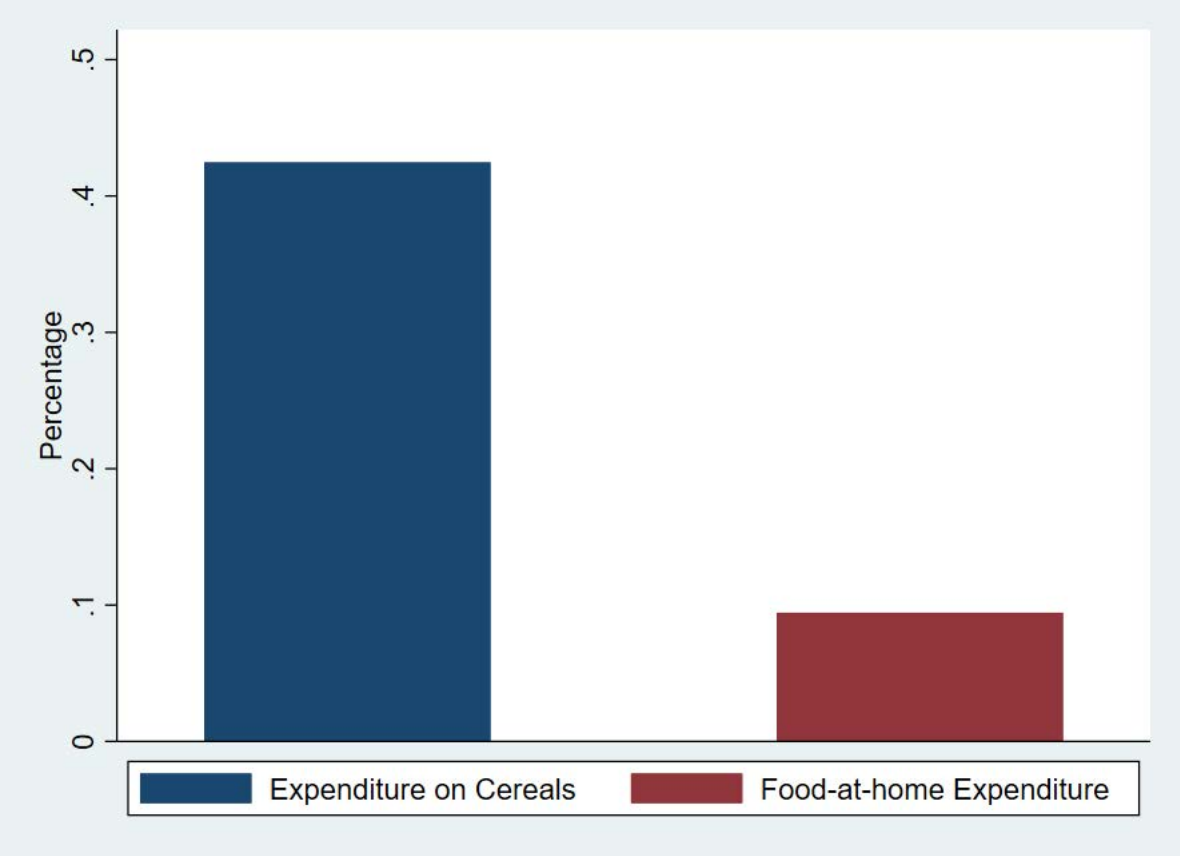
Prices of tortillerías have a higher effect on food insecurity rates in Mexico, but we cannot conclude that households maintain their consumption level by substituting tortillas from tortillerías for tortillas from grocery stores. An interesting finding of the cross-sectional research of Vega-Macedo et al. (2014) is that the consumption of tortillas is greater as the household belongs to a group at higher risk of food insecurity, while the opposite happens with the consumption of animal products such as red meat, chicken, and fish. Further work would assess whether the consumption of complementary goods to tortillas—such as meat, cheese, rice, or beans—has diminished because of the increase of tortilla prices. Those goods are more expensive than maize tortillas but are also part of the Mexican diet. Changes in these consumption patters might also affect food insecurity rates.

Figure 1: **Tortilla Consumption in Mexico by Income Quintiles (Share of Households)**



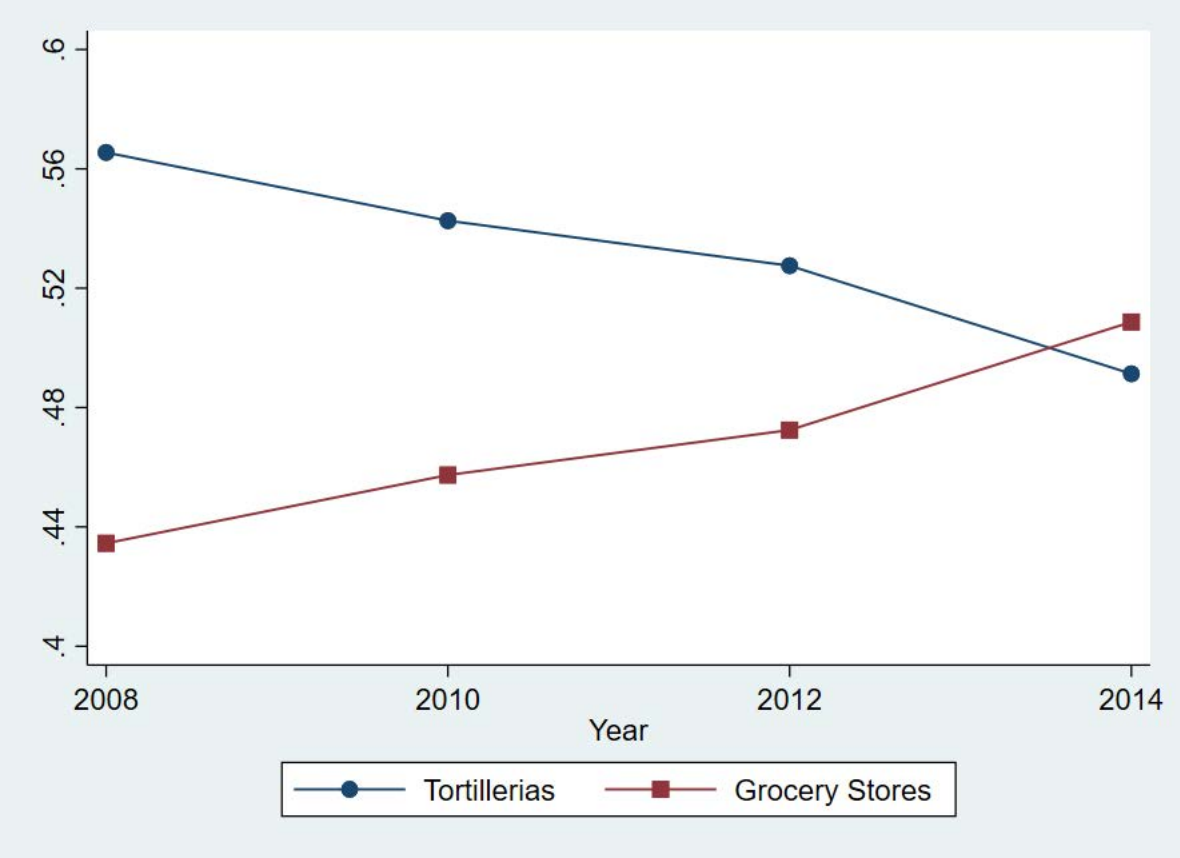
Source: 2008, 2010, 2012, and 2014 Mexican National Survey of Household Income and Expenditure (ENIGH).

Figure 2: **Tortilla Expenditure in Mexico as a Share of Total Household Expenditure)**



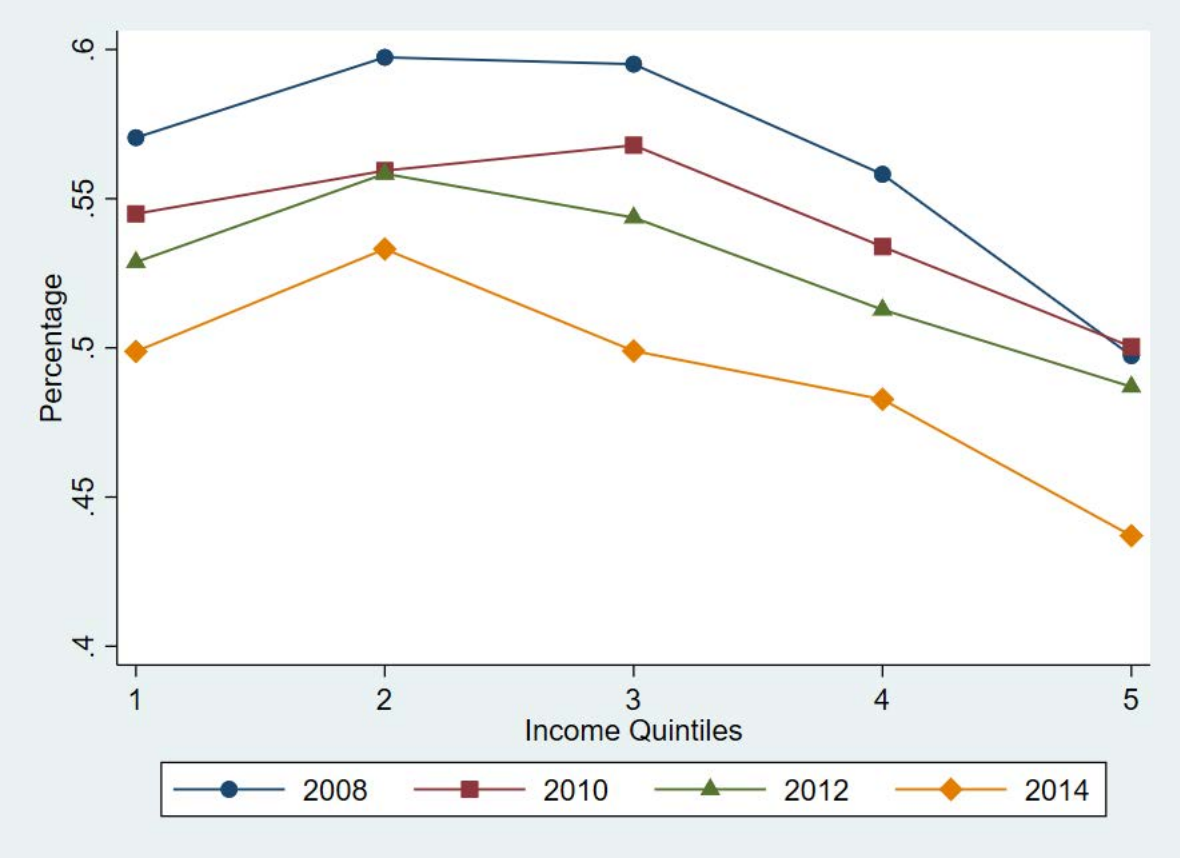
Source: 2008, 2010, 2012, and 2014 Mexican National Survey of Household Income and Expenditure (ENIGH).

Figure 3: **Tortilla Consumption by Purchasing Place (Share of Households that Purchase Tortilla)**



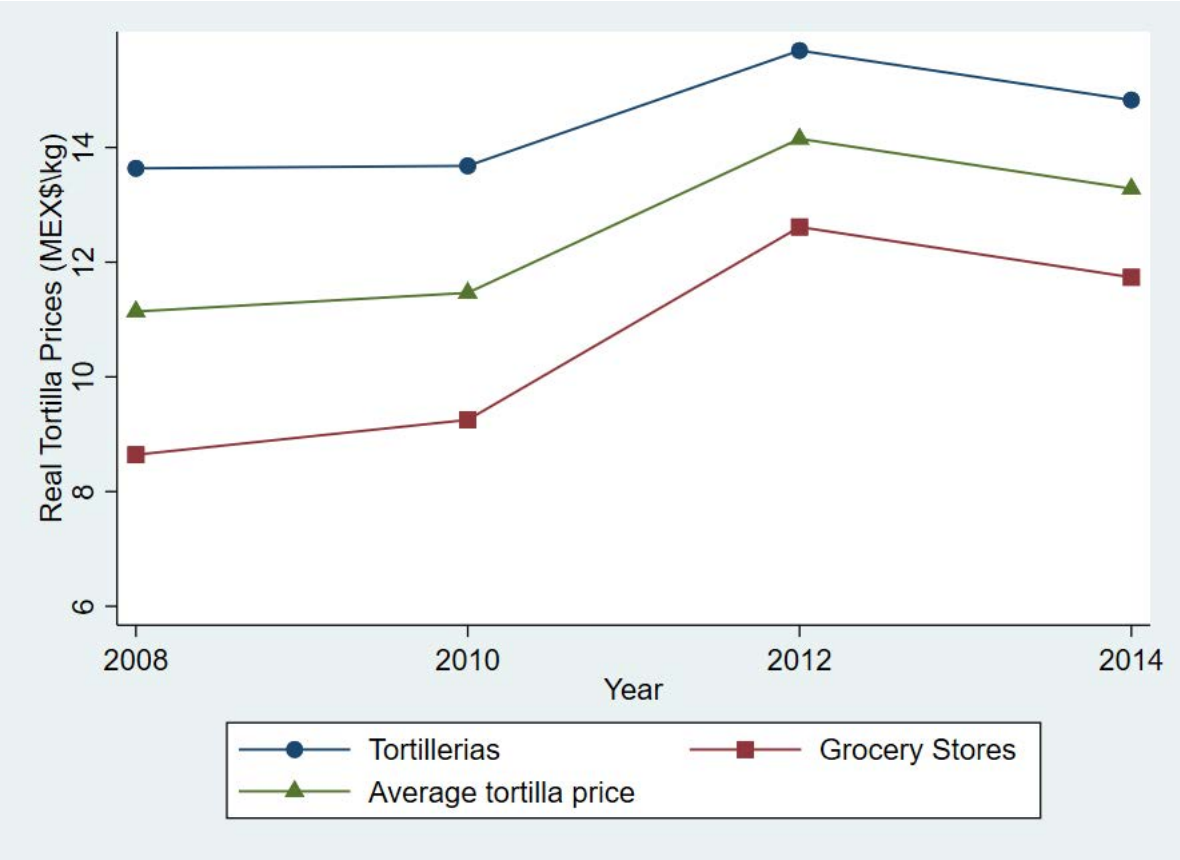
Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Figure 4: **Tortilla Purchasers at Tortillerías by Income Quintiles (Share of Households that Purchase Tortilla)**



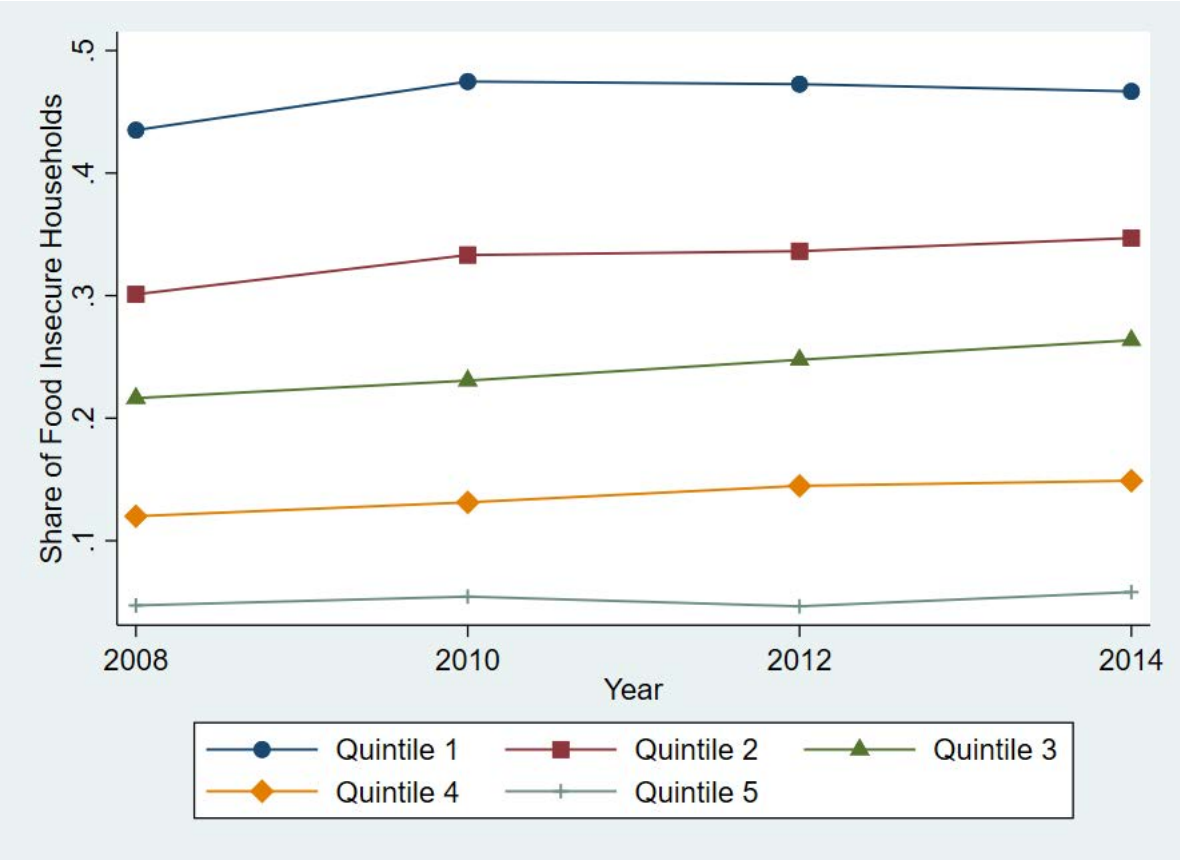
Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Figure 5: **Real Tortilla Prices, National Averages (Mexican Pesos)**



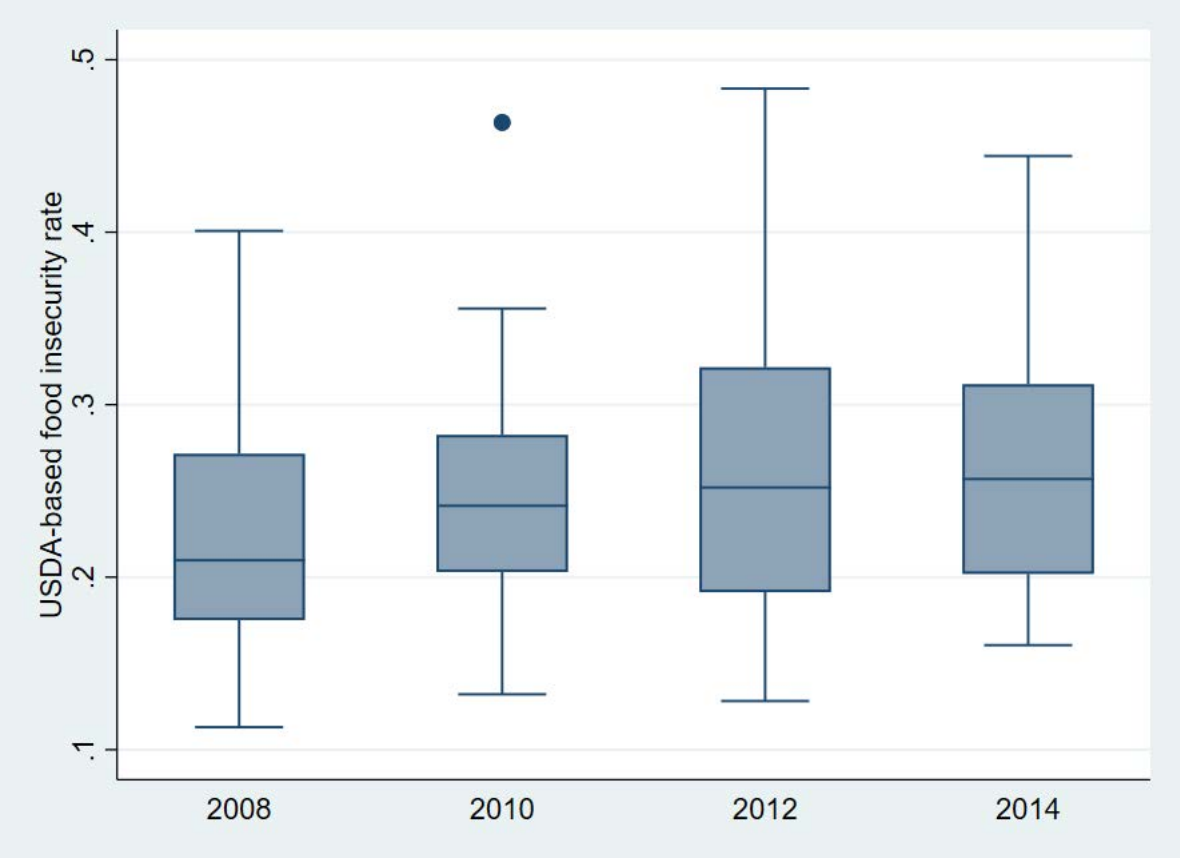
Source: Mexican Department of Economic Affairs.

Figure 6: **Food Insecurity Rates by Income Quintiles (Share of Households)**



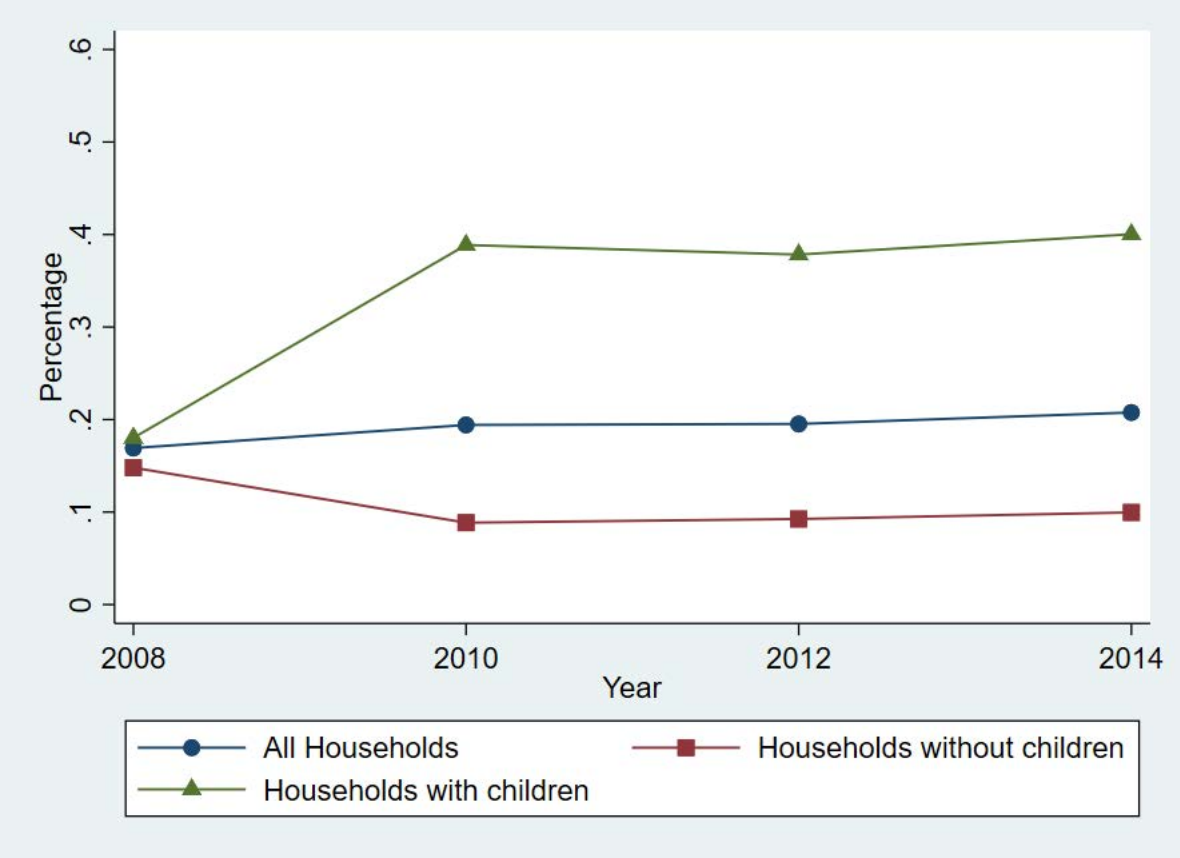
Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Figure 7: **Food Insecurity Rates, State-Level Averages (Share of Households)**



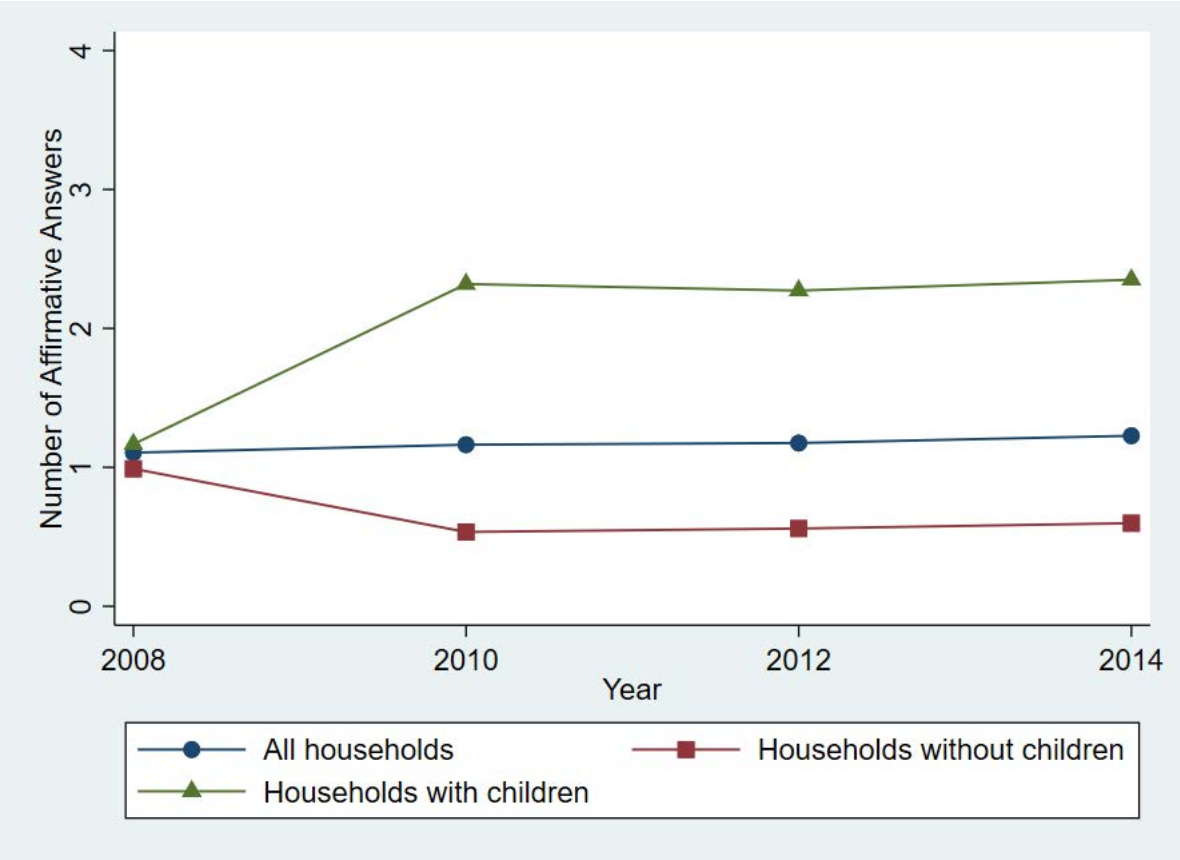
Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Figure 8: **Food Insecurity Rates by Family Type, Using Alternative Measure (Share of Households)**



Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Figure 9: **Average Number of Affirmative Answers by Family Type**



Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 1: **State Pseudo-Panel Estimates**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(Real avg. tortilla price)	0.144***	0.129***	0.143***	0.143***	0.060	0.060	0.110*
	(0.039)	(0.036)	(0.039)	(0.040)	(0.059)	(0.058)	(0.064)
Real per capita income		−0.119***					−0.100**
		(0.032)					(0.043)
Real per capita income squared		0.000***					0.000***
		(0.000)					(0.000)
log(Real avg. price at tortillerías)	0.200***	0.185***	0.199***	0.197***	0.102	0.102	0.138**
	(0.050)	(0.045)	(0.050)	(0.051)	(0.065)	(0.064)	(0.063)
Real per capita income		−0.124***					−0.095**
		(0.033)					(0.044)
Real per capita income squared		0.001***					0.000***
		(0.000)					(0.000)
log(Real avg. price at grocery stores)	0.088***	0.077***	0.088***	0.087***	0.017	0.017	0.046
	(0.026)	(0.025)	(0.027)	(0.027)	(0.044)	(0.043)	(0.050)
Real per capita income		−0.120***					−0.102**
		(0.032)					(0.045)
Real per capita income squared		0.000***					0.000***
		(0.000)					(0.000)
Observations	128	128	128	128	128	128	128
Real Per Capita Income		Yes					Yes
Transfers/Donations Var.			Yes				Yes
Violence Var.				Yes			Yes
CPI for Food					Yes		Yes
Linear Time Trend						Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Real per capita income is divided by ten thousand. Standard errors clustered at the state level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 2: **State-Income Quintile Pseudo-Panel Estimates**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	0.148***	0.147***	0.151***	0.065	0.065	0.107**
	(0.026)	(0.026)	(0.026)	(0.044)	(0.043)	(0.052)
log(Real avg. price at tortillerías)	0.207***	0.205***	0.209***	0.109**	0.109**	0.140***
	(0.038)	(0.037)	(0.037)	(0.047)	(0.047)	(0.052)
log(Real avg. price at grocery stores)	0.090***	0.090***	0.092***	0.020	0.020	0.042
	(0.017)	(0.017)	(0.017)	(0.031)	(0.031)	(0.037)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-income quintile level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 3: **State Income Pseudo-Panel Estimates, Quintile 1 Only**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	0.193***	0.191***	0.193***	0.129	0.126	0.210
	(0.071)	(0.071)	(0.071)	(0.127)	(0.125)	(0.165)
log(Real avg. price at tortillerías)	0.269***	0.265***	0.266***	0.171	0.169	0.225
	(0.101)	(0.101)	(0.102)	(0.140)	(0.139)	(0.165)
log(Real avg. price at grocery stores)	0.121***	0.119**	0.120***	0.071	0.069	0.127
	(0.046)	(0.046)	(0.046)	(0.086)	(0.085)	(0.109)
Observations	128	128	128	128	128	128
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 4: **State Income Pseudo-Panel Estimates, Quintile 2 Only**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	0.195***	0.195***	0.197***	0.067	0.067	0.129
	(0.067)	(0.067)	(0.065)	(0.107)	(0.106)	(0.112)
log(Real avg. price at tortillerías)	0.270***	0.270***	0.271***	0.126	0.127	0.177
	(0.093)	(0.094)	(0.091)	(0.111)	(0.110)	(0.115)
log(Real avg. price at grocery stores)	0.120***	0.119***	0.121***	0.013	0.014	0.036
	(0.043)	(0.043)	(0.041)	(0.080)	(0.078)	(0.082)
Observations	128	128	128	128	128	128
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 5: **State Income Pseudo-Panel Estimates, Quintile 3 Only**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	0.179***	0.175***	0.191***	0.056	0.059	0.076
	(0.058)	(0.055)	(0.060)	(0.105)	(0.104)	(0.111)
log(Real avg. price at tortillerías)	0.270***	0.273***	0.282***	0.150	0.152	0.191*
	(0.080)	(0.073)	(0.082)	(0.107)	(0.107)	(0.104)
log(Real avg. price at grocery stores)	0.102***	0.098***	0.110***	−0.019	−0.015	−0.040
	(0.037)	(0.036)	(0.038)	(0.074)	(0.074)	(0.081)
Observations	128	128	128	128	128	128
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 6: **State Income Pseudo-Panel Estimates, Quintile 4 Only**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	0.158***	0.160***	0.150***	0.113	0.110	0.170*
	(0.056)	(0.058)	(0.056)	(0.089)	(0.088)	(0.103)
log(Real avg. price at tortillerías)	0.226***	0.232***	0.216***	0.155*	0.154*	0.197**
	(0.076)	(0.080)	(0.076)	(0.087)	(0.087)	(0.093)
log(Real avg. price at grocery stores)	0.094**	0.094**	0.089**	0.050	0.048	0.080
	(0.036)	(0.037)	(0.036)	(0.066)	(0.065)	(0.077)
Observations	128	128	128	128	128	128
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 7: **State Income Pseudo-Panel Estimates, Quintile 5 Only**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	0.017	0.017	0.023	−0.040	−0.038	−0.029
	(0.032)	(0.032)	(0.033)	(0.048)	(0.048)	(0.063)
log(Real avg. price at tortillerías)	0.001	0.003	0.007	−0.058	−0.056	−0.050
	(0.044)	(0.043)	(0.044)	(0.052)	(0.051)	(0.063)
log(Real avg. price at grocery stores)	0.016	0.016	0.020	−0.016	−0.015	−0.005
	(0.021)	(0.021)	(0.021)	(0.037)	(0.036)	(0.046)
Observations	128	128	128	128	128	128
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 8: **State-Urban and Rural Pseudo-Panel Estimates**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(Real avg. tortilla price)	0.134***	0.130***	0.130***	0.137***	0.067	0.077	0.083
	(0.038)	(0.037)	(0.038)	(0.038)	(0.067)	(0.066)	(0.066)
Real per capita income		−0.094***					−0.095***
		(0.027)					(0.033)
Real per capita income squared		0.000***					0.000***
		(0.000)					(0.000)
log(Real avg. price at tortillerías)	0.188***	0.188***	0.184***	0.190***	0.106	0.113*	0.118*
	(0.050)	(0.048)	(0.050)	(0.049)	(0.066)	(0.066)	(0.063)
Real per capita income		−0.096***					−0.095***
		(0.027)					(0.032)
Real per capita income squared		0.000***					0.000***
		(0.000)					(0.000)
log(Real avg. price at grocery stores)	0.081***	0.077***	0.079***	0.083***	0.023	0.032	0.032
	(0.025)	(0.025)	(0.025)	(0.025)	(0.052)	(0.051)	(0.052)
Real per capita income		−0.092***					−0.092***
		(0.028)					(0.034)
Real per capita income squared		0.000***					0.000***
		(0.000)					(0.000)
Observations	255	255	255	255	255	255	255
Real Per Capital Income		Yes					Yes
Transfers/Donations Var.			Yes				Yes
Violence Var.				Yes			Yes
CPI for Food					Yes		Yes
Linear Time Trend						Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Real per capita income is divided by ten thousand. Standard errors clustered at the state-rurality level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 9: **State-Education Group Pseudo-Panel Estimates**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(Real avg. tortilla price)	0.172***	0.171***	0.171***	0.032	0.033	0.059	0.062
	(0.026)	(0.026)	(0.026)	(0.042)	(0.041)	(0.046)	(0.046)
log(Real avg. price at tortillerías)	0.227***	0.225***	0.223***	0.073	0.074	0.098**	0.099**
	(0.036)	(0.036)	(0.036)	(0.046)	(0.046)	(0.049)	(0.049)
log(Real avg. price at grocery stores)	0.108***	0.108***	0.108***	−0.001	0.001	0.009	0.012
	(0.017)	(0.017)	(0.017)	(0.030)	(0.029)	(0.033)	(0.033)
Observations	640	640	640	640	640	640	640
Transfers/Donations Var.		Yes				No	Yes
Violence Var.			Yes			Yes	Yes
CPI for Food				Yes		Yes	Yes
Linear Time Trend					Yes	Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-education group level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 10: **State-Income Quintile Pseudo-Panel Estimates, Using Both Tortilla Prices Simultaneously**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. price at tortillerías)	0.131	0.128	0.130	0.151*	0.151*	0.154*
	(0.084)	(0.084)	(0.085)	(0.079)	(0.079)	(0.081)
log(Real avg. price at grocery stores)	0.043	0.043	0.045	−0.042	−0.042	−0.018
	(0.039)	(0.039)	(0.040)	(0.054)	(0.054)	(0.057)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Standard errors clustered at the state-income quintile level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 11: **State-Education Group Pseudo-Panel Estimates, Using Both Tortilla Prices Simultaneously**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. price at tortillerías)	0.095	0.092	0.095	0.124**	0.125**	0.129**
	(0.062)	(0.062)	(0.062)	(0.059)	(0.059)	(0.060)
log(Real avg. price at grocery stores)	0.074***	0.075***	0.073**	−0.051	−0.050	−0.039
	(0.028)	(0.028)	(0.029)	(0.039)	(0.038)	(0.042)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Standard errors clustered at the state-education group level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 12: **State-Income Quintile Pseudo-Panel Estimates, Using a Principal Component Score for Prices**

Price variable	(1)	(2)	(3)	(4)	(5)	(6)
First Component Score	0.014***	0.013***	0.014***	0.020	0.010	0.022
	(0.003)	(0.003)	(0.003)	(0.020)	(0.008)	(0.020)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Standard errors clustered at the state-income quintile level in parentheses.

Significant at *** p<0.01, ** p<0.05, * p<0.1

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 13: **State-Education Group Pseudo-Panel Estimates, Using a Principal Component Score for Prices**

Price variable	(1)	(2)	(3)	(4)	(5)	(6)
First Component Score	0.017***	0.016***	0.016***	0.021	0.006	0.022*
	(0.002)	(0.002)	(0.002)	(0.014)	(0.006)	(0.014)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Standard errors clustered at the state-education group level in parentheses.

Significant at *** p<0.01, ** p<0.05, * p<0.1

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 14: **State-Income Quintile Pseudo-Panel for Households Without Children**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	-0.203^{***}	-0.208^{***}	-0.182^{***}	0.035	0.042	-0.157^{*}
	(0.046)	(0.045)	(0.049)	(0.066)	(0.088)	(0.088)
log(Real avg. price at tortillerías)	-0.232^{***}	-0.240^{***}	-0.206^{***}	0.025	0.030	-0.129
	(0.076)	(0.075)	(0.079)	(0.087)	(0.109)	(0.109)
log(Real avg. price at grocery stores)	-0.138^{***}	-0.141^{***}	-0.125^{***}	0.026	0.032	-0.109^{**}
	(0.030)	(0.029)	(0.032)	(0.042)	(0.053)	(0.053)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI of Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-income quintile level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 15: **State-Education Quintile Pseudo-Panel for Households Without Children**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	−0.035	−0.037	−0.024	0.001	0.006	−0.093**
	(0.024)	(0.024)	(0.024)	(0.036)	(0.043)	(0.043)
log(Real avg. price at tortillerías)	−0.028	−0.031	−0.015	0.021	0.025	−0.049
	(0.034)	(0.034)	(0.034)	(0.042)	(0.048)	(0.048)
log(Real avg. price at grocery stores)	−0.028*	−0.028*	−0.020	−0.012	−0.008	−0.085***
	(0.016)	(0.016)	(0.016)	(0.025)	(0.030)	(0.030)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI for Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-education group level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.
Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 16: **State-Income Quintile Pseudo-Panel for Households With Children**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	0.497***	0.501***	0.472***	−0.025	−0.031	0.259**
	(0.057)	(0.056)	(0.059)	(0.105)	(0.116)	(0.116)
log(Real avg. price at tortillerías)	0.584***	0.590***	0.548***	0.007	0.003	0.233**
	(0.098)	(0.097)	(0.101)	(0.113)	(0.108)	(0.108)
log(Real avg. price at grocery stores)	0.335***	0.337***	0.319***	−0.027	−0.033	0.171**
	(0.036)	(0.036)	(0.038)	(0.073)	(0.087)	(0.087)
Observations	638	638	638	638	638	638
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI of Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-income quintile level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 17: **State-Education Quintile Pseudo-Panel for Households With Children**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	0.580***	0.581***	0.539***	0.014	0.005	0.301***
	(0.040)	(0.040)	(0.041)	(0.076)	(0.079)	(0.079)
log(Real avg. price at tortillerías)	0.689***	0.691***	0.635***	0.052	0.047	0.283***
	(0.064)	(0.065)	(0.065)	(0.083)	(0.079)	(0.079)
log(Real avg. price at grocery stores)	0.389***	0.389***	0.362***	−0.004	−0.012	0.196***
	(0.025)	(0.025)	(0.026)	(0.052)	(0.056)	(0.056)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI of Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-education group level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 18: **State-Income Quintile Pseudo-Panel for Households Without Children (Number of Affirmative Answers)**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	-1.480^{***}	-1.506^{***}	-1.335^{***}	0.170	0.219	-1.155^{***}
	(0.215)	(0.212)	(0.253)	(0.323)	(0.407)	(0.407)
log(Real avg. price at tortillerías)	-1.695^{***}	-1.735^{***}	-1.510^{***}	0.117	0.148	-0.937^{*}
	(0.371)	(0.369)	(0.415)	(0.392)	(0.493)	(0.493)
log(Real avg. price at grocery stores)	-1.007^{***}	-1.020^{***}	-0.913^{***}	0.125	0.169	-0.816^{***}
	(0.139)	(0.138)	(0.162)	(0.237)	(0.252)	(0.252)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI of Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-income quintile level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 19: **State-Education Quintile Pseudo-Panel for Households Without Children (Number of Affirmative Answers)**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	−0.452***	−0.459***	−0.374***	0.085	0.118	−0.625***
	(0.113)	(0.113)	(0.116)	(0.173)	(0.202)	(0.202)
log(Real avg. price at tortillerías)	−0.432***	−0.444***	−0.335**	0.205	0.226	−0.330
	(0.162)	(0.162)	(0.167)	(0.196)	(0.227)	(0.227)
log(Real avg. price at grocery stores)	−0.332***	−0.334***	−0.281***	−0.016	0.014	−0.561***
	(0.073)	(0.073)	(0.074)	(0.125)	(0.137)	(0.137)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI of Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-education group level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 20: **State-Income Quintile Pseudo-Panel for Households With Children (Number of Affirmative Answers)**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	2.931***	2.949***	2.784***	0.236	0.189	1.966***
	(0.233)	(0.232)	(0.248)	(0.432)	(0.437)	(0.437)
log(Real avg. price at tortillerías)	3.507***	3.534***	3.299***	0.415	0.390	1.748***
	(0.426)	(0.423)	(0.451)	(0.483)	(0.424)	(0.424)
log(Real avg. price at grocery stores)	1.954***	1.963***	1.861***	0.088	0.046	1.303***
	(0.163)	(0.163)	(0.170)	(0.303)	(0.339)	(0.339)
Observations	638	638	638	638	638	638
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI of Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-income quintile level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

Table 21: **State-Education Quintile Pseudo-Panel for Households With Children (Number of Affirmative Answers)**

Price Variable	(1)	(2)	(3)	(4)	(5)	(6)
log(Real avg. tortilla price)	3.314***	3.321***	3.060***	0.441	0.382	2.039***
	(0.179)	(0.180)	(0.184)	(0.341)	(0.344)	(0.344)
log(Real avg. price at tortillerías)	4.003***	4.017***	3.672***	0.661*	0.630*	1.923***
	(0.296)	(0.300)	(0.301)	(0.364)	(0.331)	(0.331)
log(Real avg. price at grocery stores)	2.198***	2.201***	2.033***	0.208	0.156	1.299***
	(0.114)	(0.113)	(0.117)	(0.236)	(0.249)	(0.249)
Observations	640	640	640	640	640	640
Transfers/Donations Var.		Yes				Yes
Violence Var.			Yes			Yes
CPI of Food				Yes		Yes
Linear Time Trend					Yes	Yes

Note: Each panel contains the parameter estimate and standard error for the corresponding price measure from the regression model that also includes the controls that are listed at the bottom of this table. Standard errors clustered at the state-education group level in parentheses. Significant at *** p<0.01, ** p<0.05, * p<0.1.

Own calculations. Source: 2008, 2010, 2012, and 2014 Mexican ENIGH.

8 Appendix

Interview with the manager of a tortillería located in the Minneapolis-Saint Paul area

The following interview was made on December 11 2017 via email with the manager of a tortillería to understand the tortilla manufacturing process and the differences between tortillas from tortillerías and grocery stores.

Question 1. Which ingredients do you use to produce a tortilla? Is it more labor intensive than machine based?

Answer: We use a combination of corn flours to produce a tortilla that can be used in both retail and restaurant settings. Making tortillas is usually a labor intensive process, because we use heavy duty machinery we would not consider our product fully hand-made. However, we're not fully automated, and hands-on interaction is involved throughout the entire process.

Question 2. Based on your knowledge, how do they differ from tortillas sold in grocery stores and supermarkets?

Answer: Normally you'll find two types of tortillas, Retail tortillas and commercial kitchen tortillas. Retail tortillas are usually made with higher quality ingredients. At our tortillería we make one tortilla that is used in both retail and commercial kitchens. Our tortilla out performs the competition.

Question 3. We understand that tortillas made in tortillerías are more expensive than those sold in grocery stores. Is that right? What is our opinion about the situation?

Answer: Yes, Tortillas made in tortillerías are more expensive because of the volume. Su-

permarkets and grocery stores buy products in bulk, high volume. Tortillerías are usually on a much smaller scale and therefore have a better price based on volume and consistency. When you buy tortillas directly form the tortillería, you get the freshest tortillas made on that same day. Our distributors work closely with us in creating a program that allows companies to resupply every other day, with this method we're able to stock only the freshest tortillas at local stores.

Question 4. Do you think that tortillas sold at grocery stores and supermarkets represent a threat for tortillas sold at tortillerías? Why?

Answer: There is a definite threat from larger corporations with much higher resources than smaller companies. Large corporations cloud and clog the market wile pushing smaller companies out of the competition. This is why customers tend to find shelves upon shelves stocked with only one brand.

Question 5. Do you think customers are able to tell the difference between hand-made and commercially produced?

Answer: Yes, of course. Hand-made tortillas are usually made to order, and brought directly to the table. It is impossible to produce hand-made quality tortillas in a factory setting. The product volume would not be enough to supply tortillas in bulk. Here at our tortillería we use a hybrid system where we can be hands-on, but with the help of machinery.

Question 6. Based on your understanding, are tortillas an affordable product for all Mexican households? Is it possible that some households are not able to buy them?

Answer: Tortillas are a staple in the Mexican diet. Tortillas have been apart of Mexican culture and Native American history for centuries, and in Mexico, it is seen as one of the most widely available and easily accessible foods around.

References

Antman, F. and McKenzie, D. (2007). Poverty traps and nonlinear income dynamics with measurement error and individual heterogeneity. *The Journal of Development Studies*, 43(6):1057–1083.

Balderas, O. (2016). Tortillas y crteles: cómo el narco se metió hasta las tortillerías en méxico. `https://goo.gl/BQdYPK`. Online; accessed 20 December 2017.

Behrman, J. R., Gaviria, A., Székely, M., Birdsall, N., and Galiani, S. (2001). Intergenerational mobility in latin america [with comments]. *Economia*, 2(1):1–44.

Bellemare, M. F., Fajardo-Gonzalez, J., and Gitter, S. R. (2018). Foods and fads: The welfare impacts of rising quinoa prices in peru. *World Development*, 112:163–179.

Brinkman, H.-J., de Pee, S., Sanogo, I., Subran, L., and Bloem, M. W. (2010). High food prices and the global financial crisis have reduced access to nutritious food and worsened nutritional status and health. *The Journal of Nutrition*, 140(1):153S–161S.

Comité Científico de la ELCSA (2012). Escala latinoamericana de seguridad alimentaria (elcsa): manual de uso y aplicaciones. Technical report.

Corona, S. (2016). Esas medias hermanas mexicanas llamadas tortillas. `https://www.historiacocina.com/paises/articulos/mexico/tortillas.htm`. Online; accessed 20 December 2017.

Cuesta, J., Ñopo, H., and Pizzolitto, G. (2011). Using pseudo-panels to measure income mobility in latin america. *Review of Income and Wealth*, 57(2):224–246.

Deaton, A. (1985). Panel data from time series of cross-sections. *Journal of Econometrics*, 30:109–126.

EcuRed (2008). Tortilla mexicana. https://www.ecured.cu/Tortilla_mexicana. Online; accessed 20 December 2017.

Empresarial, C. C. (2012). Tiendas de autoservicio firman convenio en materia de seguridad. http://www.cce.org.mx/tiendas-de-autoservicio-firman-convenio-en-materia-de-seguridad/. Online; accessed 20 December 2017.

FAO (2017). Fao food price index database. http://www.fao.org/worldfoodsituation/foodpricesindex/en/. Online; accessed 20 December 2017.

González Dávila, O. (2010). Food security and poverty in mexico: the impact of higher global food prices. *Food Security*, 2(4):383–393.

Green, R., Cornelsen, L., Dangour, A. D., Turner, R., Shankar, B., Mazzocchi, M., and Smith, R. D. (2013). The effect of rising food prices on food consumption: systematic review with meta-regression. *BMJ*, 346.

Gundersen, C., Kreider, B., and Pepper, J. (2011). The economics of food insecurity in the united states. *Applied Economic Perspectives and Policy*, 33(3):281–303.

Hadley, C., Stevenson, E. G. J., Tadesse, Y., and Belachew, T. (2012). Rapidly rising food prices and the experience of food insecurity in urban ethiopia: Impacts on health and well-being. *Social Science & Medicine*, 75(12):2412 – 2419. Part Special Issue: Place, migration & health.

Headey, D. and Fan, S. (2008). Anatomy of a crisis: the causes and consequences of surging food prices. *Agricultural Economics*, 39:375–391.

Just, D. R. et al. (2011). Behavioral economics and the food consumer. *The Oxford Handbook of the Economics of Food Consumption and Policy*, pages 99–118.

Melgar-Quinonez, H. R., Zubieta, A. C., MkNelly, B., Nteziyaremye, A., Gerardo, M. F. D., and Dunford, C. (2006). Household food insecurity and food expenditure in bolivia, burkina faso, and the philippines. *The Journal of Nutrition*, 136(5):1431S–1437S.

Mundo-Rosas, V., Méndez-Gómez, H. I., and Shamah-Levy, T. (2014). Characterization of mexican households with food insecurity. *Salud publica de Mexico*, 56:s12.

Paredes Lopez, O., Guevara Lara, F., and Bello Perez, L. (2009). La nixtamalización y el valor nutritivo del maíz. *Ciencias*, 92:60–70.

Ruel, M. T., Garrett, J. L., Hawkes, C., and Cohen, M. J. (2010). The food, fuel, and financial crises affect the urban and rural poor disproportionately: A review of the evidence. *The Journal of Nutrition*, 140(1):170S–176S.

Schmitz, A. and Kennedy, P. L. (2015). *Food Security: Starvation in the Midst of Plenty', Food Security in an Uncertain World (Frontiers of Economics and Globalization, Volume 15)*. Emerald Group Publishing Limited.

Vazquez Carrillo, M., Avila Uribe, G., Hernandez Montes, A., Castillo Merino, J., and Angulo Guerrero, O. (2011). Sensory evaluation of freshly made and packed maize tortillas. *Revista Mexicana de Ciencias Agrícolas*, 2:161–167.

Vega-Macedo, M., Shamah-Levy, T., Peinador-Roldan, R., Méndez-Gómez, I. H., and Melgar-Quinonez, H. (2014). Food insecurity and variety of food in mexican households with children under five years. *Salud publica de Mexico*, 56:s21–30.

Wilde, P. E. (2004). Differential response patterns affect food-security prevalence estimates for households with and without children. *The Journal of nutrition*, 134(8):1910–1915.

Zezza, A., Davis, B., Azzarri, C., Covarrubias, K., Tasciotti, L., and Anriquez, G. (2008). The Impact of Rising Food Prices on the Poor. Working Papers 08-07, Agricultural and

Development Economics Division of the Food and Agriculture Organization of the United Nations (FAO - ESA).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