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IFPRI Discussion Paper 00696
April 2007

Supermarket Purchases and the Dietary Patterns of Households in Guatemala

Abay Asfaw

Food Consumption and Nutrition Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE.

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org

www.ifpri.org

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Acknowledgments

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Any remaining shortcomings are mine.

Abay Asfaw
Food Consumption and Nutrition Division (FCND)
International Food Policy Research Institute (IFPRI)

Abstract

Very limited empirical analyses are done on evaluating how changes in the retail environment affect diet and health status of consumers, especially in developing countries. The major objective of this study is to shed some light on some of these neglected but crucial issues. The study examines the impact of supermarket purchases on dietary practices (defined as the calorie share of different food groups) of Guatemalan households using the 2000 Guatemalan household survey. I use an instrumental variable method to take into account the potential endogeneity of the supermarket-purchase variable in the calorie share equations. The identification strategy relies on two variables: the wife's occupation (working or housewife) and the overall socioeconomic development of the community. These variables are highly correlated with the supermarket-purchase variable but are not correlated with the dietary preferences of households after controlling for income, education, location, price, and other related variables. The results of the study reveal that supermarket purchases increase the share that highly and partially processed food items, such as pastries, cookies, crackers, chocolate, ice cream, and so forth, make of total calories, at the expense of staple food items such as corn and beans. Since most processed foods contain disproportionately high amounts of added fat, sugar, and salt, and since supermarkets are expanding rapidly, different policy measures should be developed to ensure that supermarkets have a "healthier" impact on diets.

Keywords: supermarket, diet instrumental variable, Guatemala

1. Introduction

The dietary patterns of households in developing countries have been changing rapidly toward diets high in carbohydrates, added fat, added sugar, and processed food items. These food items are identified by the World Health Organization (WHO) as risk factors for obesity and diet-related noncommunicable chronic diseases (NCD) such as cardiovascular diseases, type-2 diabetes, and some types of cancer. WHO shows that 66 percent of the total deaths related to NCDs now occur in developing countries (WHO 2004).

Rapid economic growth, urbanization, and technological progress are often cited as the primary driving forces of such a "nutrition-transition." However, the impacts of other potentially obsogenic environments, such as the location of food purchase and the expansion of supermarkets on nutrition-transition are not well investigated. Several studies have analyzed the evolution, expansion, and diffusion of supermarkets and their impact on food retailing and small farmers (Kaufman 1998; Belik and Rocha dos Santos 2002; Ghezan, Mateos, and Viteri 2002; Gutman 2002; Reardon and Berdegué 2002; Rodriguez et al. 2002; Schwentesius and Gómez 2002; Weatherspoon and Reardon 2003; Codron et al. 2004; Dries, Reardon, and Swinnen 2004; Hu et al. 2004; Neven and Reardon 2004; Dries, Reardon, and Swinnen 2004; Reardon, Timmer, and Berdegué 2004; Berdegué et al. 2005; Hawkes 2005; Farina, Nunes, and Monteiro 2005; Traill 2006). Some studies have also examined the link between expansion of supermarkets and consumer preferences and food safety (Rodríguez et al. 2002; Balsevich et al. 2003; Berdegué et al. 2003a, 2003b). However, there is a big research gap on the implication of supermarket expansion on the diet and health status of consumers.

Supermarkets have been flourishing in developing countries, especially throughout Latin America (Reardon et al. 2003; Codron et al. 2004; Traill 2006). While it took supermarkets more than five decades to dominate the U.S. retail food market, supermarkets have dominated the Latin American retail sector only in one decade (Reardon, Timmer, and Berdegué 2004; Dugger 2004). Now, supermarkets control 50-75 percent of the retail food industry in countries such as Brazil and Costa Rica (Reardon, Timmer, and Berdegué 2004). Supermarkets have also been spreading from metropolitan areas to semi-urban and urban-slum areas and have evolved from providing high-price luxury food items to supplying massively produced cheap canned and processed foods (Hu et al. 2004; Neven and Reardon 2004; D'Haese and van Huylenbroeck 2005; Reardon, Berdegué, and Timmer 2005; Neven et al. 2006). Currently, supermarkets are no longer shopping

places for only upper and middle class households but also for relatively poor households (Hu et al. 2004; Traill 2006).

Supermarkets have been also expanding rapidly in relatively poor Central American countries such as Guatemala. The number of supermarkets in Guatemala has doubled since the 1990s and their retail food market share has exhibited an average (least square) growth rate of 10 percent per annum between 1994 and 2002, reaching 32 percent in 2002 (Dugger 2004). Multinational giant companies such as Ahold, La Fragua, Wal-Mart, Carrefour, and the like dominate the supermarket in Guatemala. For instance, La Fragua, Guatemala's largest retail supermarket chain, had 68 stores across the country in 1998, and was planning to open 48 new stores by 2001 (IFC 1998). Generally, the share of supermarkets in the retail food market is expected to grow in the coming years. At the current growth rate, the share of supermarkets will represent more than 60 percent of the total food retail market by 2010. As the experience of other Latin American countries shows, most of the supermarkets in Guatemala will concentrate on food items for which they have comparative advantage over traditional retailers.

This rapid spread of supermarkets in developing countries has brought numerous challenges and opportunities not only to producers but also to consumers. The rapid spread of supermarkets affects the price and availability of a variety of foods. Supermarkets usually provide cheap, processed, and junk foodstuffs. These food items are known for their disproportionately high content of added fat, sugar, and salt. Due to advances in storage and transportation, supermarkets have also the potential to provide fresh fruits and vegetables throughout the year.

There is no systematic evidence of the impact of supermarkets on the diet of consumers, especially in developing countries, and even the existing few studies conducted in developed countries could not provide conclusive empirical evidence (for instance, see the results of Mooney 1990; Cheadle et al. 1991; Sooman, Macintyre, and Anderson 1993; Piachaud and Webb 1996; Cooper and Nelson 2003; Wrigley, Warm, and Margetts 2003; and Laraia et al. 2004). Therefore, it is not clear whether the growing presence of supermarkets in developing countries will improve or worsen the effects of dietary-transition.

The main objective of this study is to empirically examine the relationship between supermarket purchase and dietary patterns of households in Guatemala. A key concern is that supermarkets will concentrate on providing food items in which they have a comparative advantage such as processed and canned foods (against fresh fruits and vegetables) and consequently alter the consumption patterns of households toward more added fat, sugar, and carbohydrate. The paper proceeds as follows. Section 2 presents a short overview of the

development of supermarkets in Guatemala. Sections 3 and 4 discuss the analytical framework and the data sources of the study, respectively. Section 5 presents the results of the study and their implications. Finally, section 6 concludes with policy options.

2. Theoretical Framework

Our main interest is examining the effect of supermarket purchases on the dietary practices of households. I start with a simple model in which the presence of different marketing outlets in a certain area will affect the location of food purchase and this, in turn, influences the dietary practices of households. This can be specified as

$$D = X\alpha + S\beta + \varepsilon. \tag{1}$$

In the structural equation (1), D is a $T \times q$ vector of q dietary indicators of T households, X is a $T \times n$ vector of independent variables that determines dietary patterns of T households, S is a $T \times 1$ vector of supermarket purchase indicator of T households, and ε is a $T \times 1$ vector of *i.i.d.* $N(0, \sigma_\varepsilon)$ error terms, serially uncorrelated, and homoscedastic, and α and β are $n \times 1$ and 1×1 unknown parameters to be estimated.

In Equation (1), the principal item of interest is β, the coefficient of the supermarket purchase variable. If all the assumptions of OLS are met, it measures the impact of supermarket purchase on the dietary patterns of households. However, the supermarket purchase variable may not be exogenous, since households are likely to choose where to buy, especially whether to buy from supermarkets or from other traditional retail channels. In other words, households that purchase from supermarkets may differ systematically from households that do not purchase at supermarkets but live in the same area. If this is the case, observed differences in dietary practices may not be attributed to the location of purchase. Hence, the OLS estimates of β can be biased and inconsistent.

If there had been time series data, this problem could be addressed by allowing for household fixed effects through differencing out household heterogeneity in levels. In the absence of time series data, one standard technique to circumvent this problem is to estimate the supermarket purchase indicator simultaneously with the diet outcome equation in an instrumental variable (IV) framework. A widely used method for creating an IV is to formulate a reduced-form equation that predicts the value of the supermarket purchase variable from a set of purely exogenous variables. Therefore, I formulate a reduced-form equation for the supermarket purchase variable as

$$S = X\gamma + Z\lambda + \mu, \tag{2}$$

where Z is a $T \times r$ number of exogenous instrumental variables, λ is a $r \times 1$ coefficient vector, and μ is a $T \times 1$ vector of i.i.d. $N(0,\sigma_\mu)$ error terms where the corr(ε_i μ_i) = ρ (where ε_i denotes the i^{th} observation on ε, and so forth).

I assume that μ and ε are not correlated with Z and X variables and therefore equations (1) and (2) can be estimated in a two-stage least square framework. Two crucial conditions should be fulfilled, however, for the Z variables to be valid instruments. First, the instruments should be relevant, that is, $corr(Z_i,X_i) \neq 0$ (where i denotes the i^{th} observation on Z and X). In other words, Z_i should be highly correlated with the supermarket purchase variable. Second, the instruments should be exogenous, that is, $corr(Z_i,X_i) = 0$. This means that Z_i should not be correlated with any unobserved factors that affect the nutritional patterns of households.

Our identification strategy relies on two variables that are highly related to the supermarket purchase variable but not directly related to the dietary practices of households. I use wife's occupation (working or housewife) and the overall socioeconomic development of the community (at a municipio level) as valid instruments for supermarket purchase. I argue that the occupation of wives is correlated with the probability of buying at supermarkets. Working mothers do not have enough time to prepare food at home and are more likely to buy at supermarkets than housewives. I also argue that this time constraint variable has very little direct effect on the share of different food groups from the total calories. One theoretical argument against the validity of this instrument is the idea that working wives are more likely to be educated or wealthy. Then, the observed difference in calorie share of different food items between house-and working-wives could be due to educational or income differences. I address this problem by including fathers' and mothers' education in the analysis.

The socioeconomic index of each community is used as the second instrument. The community survey of the Guatemala data set gives several community-level characteristics that help to measure the socioeconomic situation of each community. I use factor analysis to develop a socioeconomic index (see below). I hypothesize that supermarkets are more likely to be located in well developed areas so the socioeconomic index variable is expected to capture the location of supermarkets. However, one may argue that supermarkets can be located in richer areas or that the index may capture price differences across communities and therefore consumption patterns could differ even in the absence of supermarkets. I partially address these concerns by including the income status of each household (poor/nonpoor) and the price of each food group in each community as explanatory variables. In addition to these theoretical arguments, the relevance

and validity of the two instruments are also examined using various statistical methods. However, given the interaction between supermarket location and various socioeconomic variables, some of the unobserved location characteristics could be correlated with the households' dietary practices.

3. Data and Measurement of Variable

The data source for this study is the 2000 Living Standard Measurement Survey (LSMS) of Guatemala (ENCOVI 2000). The data were collected by the National Institute for Statistics (INE) between 1999 and 2000. The survey covered 38 *municipios* in 22 departments and eight regions of Guatemala and 7,276 households (3,852 rural and 3,424 urban) were included. The data set is statistically representative at the national level. The survey provides a wide range and detailed information on consumption, location of purchase, anthropometry, health, education, and social capital of households. Different from other LSMS data, ENCOVI 2000 includes rich information on household supermarket purchases. A community-level questionnaire was also administered in clusters where the household survey was carried out and information on price, infrastructure, community organization, and so forth, was collected.

I measured dietary practices by determining the share that eight different food groups make of the total calorie availability. These food groups include corn and corn products; beans; meats, fish, eggs, dairy, and dairy products; fruits; vegetables; pastries, cookies and crackers; added fats (animal and vegetable); and other highly processed foods (see the Appendix for details). I focus on these eight food groups because the first two are staple food items in Guatemala, fruits and vegetables are generally considered "healthy" food items, and the last four groups have been identified as potential risk factors for obesity and chronic diseases (WHO 2004). These food groups also constitute 94.7 percent of the total calorie availability in Guatemala.

Supermarket food purchase is measured by the amount of money spent on food at supermarkets per month. For the descriptive analysis, it is also measured as a dichotomous variable (whether the household shopped at supermarkets or not). Various household-, community-, and regional-level variables are also generated from the household and the community surveys (see Table 1). Income is approximated by the poverty status of households. Households whose income is below the poverty line are considered poor and households whose income is above the poverty line are considered nonpoor. Factor analysis is used to create a socioeconomic index for 35 different communities (*municipio*) from the following variables:

electricity, piped water, drainage/sewers services, telephone, number of primary schools, and number of secondary schools. I select only one factor with the number of Eigen values greater than 1.

Table 1. Description of Variables

Variable	Mean
Dependent variables (see Appendix)	2.402
Price of corn and corn products per pound	2.656
Price of beans per pound	2.943
Price of fruits per pound	1.917
Price of vegetables per pound	8.469
Price of meat, fish, eggs, dairy, and dairy products per pound	4.149
Price of pastries, cookies, and crackers per pound	7.070
Price of oil (animal and vegetable) per pound	1.255
Price of other highly processed food per pound	7.970
Household-level variable	
Native: 1 if the head is native	0.391
Sex of the head of the household (1 if female, 0 otherwise)	0.182
Age of the household head in years	44.505
Fathers' education (1 if literate, 0 otherwise)	0.397
Mothers' education (1 if literate, 0 otherwise)	0.263
Employment status of the mother (1 if housewife)	0.876
Family size	5.212
Per capita monthly expenditure (GTQ)	87.199
Poverty status	
Poor (percent)	45.89
Not poor (percent)	54.11
Value of food purchased from supermarkets pre month (GTQ)	22.07
Supermarket purchase (1 if purchased food from supermarkets)	0.155
Community-level variables	
Electricity (1 if 24 hours electricity is available, 0 otherwise)	0.779
Telephone service (1 if available, 0 otherwise)	0.335
Piped water (1 if available, 0 otherwise)	0.768
Drainage/sewers services (1 if available, 0 otherwise)	0.341
Primary school (1 if available, 0 otherwise)	0.722
Secondary school (1 if available, 0 otherwise)	0.705
Urban (1 if urban, 0 otherwise)	0.471

Source: Computed from ENCOVI 2000 survey.

4. Results and Discussion

Descriptive Results

The average per capita per day calorie availability in Guatemala is 3,219 (with a standard deviation of 2,866) and it is dominated by basic staple crops such as corn. Corn and corn products alone constitute 40 percent of the total calorie availability in Guatemala. Partially processed and highly processed foods have also an average share of 20 percent each. However, there is a big variation across households as shown by the high standard deviations (see last column of the Appendix). In addition to income and other socioeconomic variables, location of

purchases is expected to explain some of the variations in the calorie share of different food groups across households.

In this section, I use some descriptive statistics to get some preliminary idea about the relationship between supermarket purchases and diet. Supermarket purchase is measured as a dichotomous variable. Household diet is measured by the shares of calories that each of the eight different food groups make of total calorie availability. Table 2 presents the shares of different food groups by supermarket purchase status of households. Households that do not purchase from supermarkets tend to have more calories from corn and corn products and beans, while households who purchase from supermarkets tend to have more calories from partially and highly processed food items and the differences were statistically significant. Figure 1 depicts the shares that calories from the eight different food groups make of the total calorie availability, by supermarket purchase and expenditure quartile. The results are the same as in Table 2 and all the differences were statistically significant except in the case of vegetables. These results indicate that supermarket purchases could be one of the drivers of dietary changes in Guatemala.

Table 2. Calorie shares of different food groups, by supermarket purchase status

	Supermarket purchase status		
	Zero supermarket purchase	Positive super-market purchase	ANOVA F (Prob > F)
Corn and corn products	43.59	20.28	841.67 (0.000)
Other grains	9.51	19.60	1,124.14 (0.000)
Beans	5.32	3.46	98.54 (0.000)
Vegetables	3.27	4.89	5.93 (0.014)
Fruits	2.66	2.94	81.36 (0.000)
Meat, fish, eggs, dairy, dairy products	5.60	10.11	511.48 (0.000)
Sugar and sweeteners	10.13	8.39	37.49 (0.000)
Pastries, cookies, and crackers	13.70	19.66	166.60 (0.000)
Added fats (animal and vegetable)	4.55	6.79	124.20 (0.000)
Other highly processed foods	1.67	3.88	265.06 (0.000)

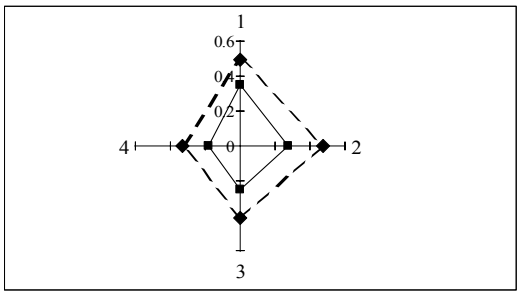
Source: Computed from ENCOVI 2000 survey.

Regression Results

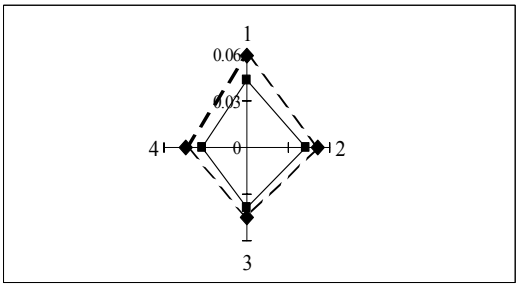
I used an Instrumental Variable (IV) model following equations (1) and (2). Eight different equations were estimated for the eight different food groups. Eight price variables were also added. In the first-stage regression, the value of supermarket food purchases is the dependent variable, and excluded variables are wives' working status and socioeconomic development index of the community. All equations are estimated using heteroskedastic-efficient two-step generalized method of moments (GMM) estimator (available in STATA software). This method generates "coefficient estimates that are efficient in the presence of arbitrary

Figure 1. Calorie shares from the total calorie availability, by income quartile and supermarket purchase status

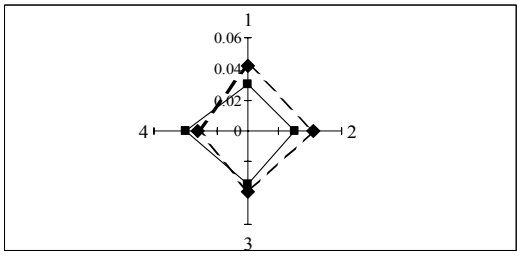
Corn and corn products***



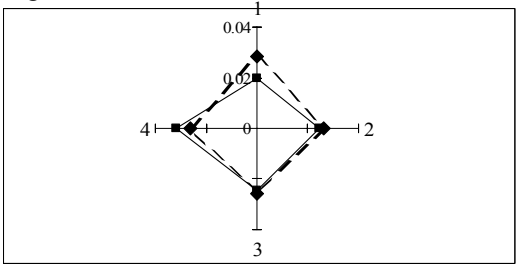
Beans***



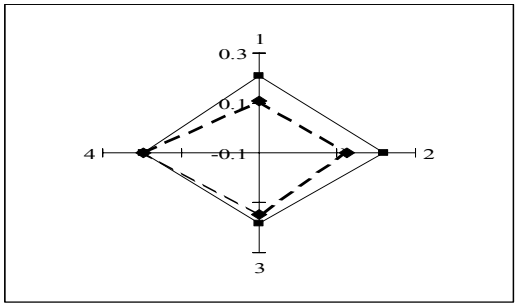
Fruit*



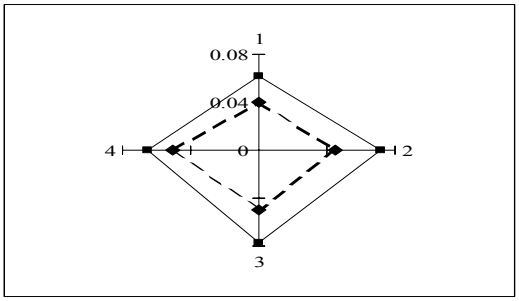
Vegetables



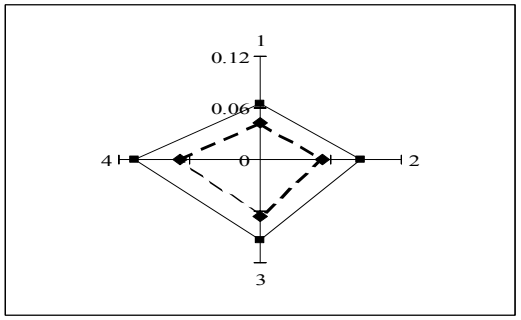
Pastries, cookies and crackers***



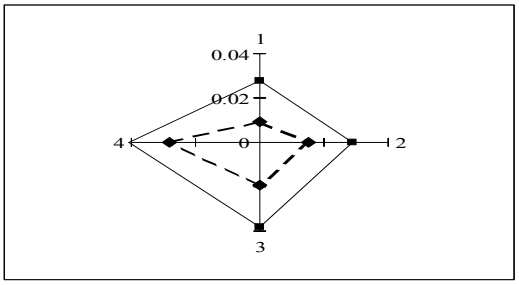
Added fats (animal and vegetable)***



Meat, fish, eggs, dairy and dairy products***



Other highly processed food items***



- - - - Zero supermarket purchase
—— Positive supermarket purchase

Source: Computed from ENCOVI 2000 survey.

Notes: *** significant at 0.5 percent, ** significant at 1 percent level.

heteroskedasticity and arbitrary intra-group group correlation" (Baum, Schaffer, and Stillman 2003).

Before presenting the results, I examine the validity of the instruments using various testing techniques (see, for instance, Baum, Schaffer, and Stillman 2003; Bound, Jaeger, and Baker 1995; Staiger and Stock 1997). First, I examine the results of the first-stage regression that are presented in Table 3. From these results, we are interested in the coefficients of the excluded variables: wives' working status and socioeconomic development index. These variables perform well in explaining the value of food purchased at supermarkets and take the expected negative and positive signs, respectively. Second, I test whether the instrumental variable wives' working status would be endogenous in the system using a modified Hausman test. The Chi-square statistic (presented in the last row of Table 3) could not reject the exogeneity/orthogonality of the variable in most cases. Third, the Anderson canonical correlations likelihood-ratio statistic is used to test whether the excluded instruments are relevant or the equation is identified. Under the null hypothesis, the model is under-identified. The relevant test statistic is distributed as χ^2 with $L - K + 1$), where K is the number of regressors and L is the number of instruments included and excluded. In all models, the computed Anderson LR statistics are much higher than the critical values at the 1 percent significance level indicating that the models are identified and the instruments used are relevant to the model.

Table 3. First-stage regression results

Dependent variable: Ln value of supermarket food purchase (first-stage regression)

Variable	Coefficients	Robust standard error
Head native	-0.054***	0.020
Ln family size	-0.003	0.005
Father education (1 if can read and write, 0 otherwise)	0.075***	0.028
Mother education (1 if can read and write, 0 otherwise)	0.133***	0.038
Sex of the household head	0.049	0.038
Age of the household head	0.007	0.005
Age square of the household head	0.000	0.000
Urban (1 if the areas is urban, 0 otherwise)	0.007	0.028
Income (1 if poor, 0 otherwise)	-0.114***	0.024
Ln price of corn and corn products	0.037	0.180
Ln price of beans	0.774***	0.203
Ln price of vegetables	-0.872**	0.350
Ln price of fruits	1.113***	0.223
Ln price of meat, fish, eggs and milk	-3.108***	0.759
Ln price of pastries, cookies, and crackers	2.151***	0.549
Ln price of added fats (animal and vegetable)	0.770***	0.254
Ln price of other highly processed foods	-3.277***	0.955
Housewife (1 if wife is not working, 0 otherwise)	***-0.101****	***0.051***
Infrastructure index	***0.320*****	***0.077***
Constant	8.328***	1.626
Number of observations	6,984	
Test of excluded instruments: F(2, 6964)	10.67 (0.000)	
Anderson cannon. corr. LR Statistics (IV relevance test)	22.588 (0.000)	

Source: Computed from ENCOVI 2000 survey.

Notes: *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

The estimated coefficients of the main equation are presented in Table 3. The share of corn and corn products of total calorie availability is higher, and the shares of meat (including fish, eggs, dairy, and dairy products), pastries (including cookies and crackers), and added fats (animal and vegetable) are lower for native Guatemalans compared to nonnatives. Big-family-size households tend to consume more corn and less of all other food groups (except beans). Households with educated mothers consume less processed foods and added fats and more fruits and meat. Urban households, on the other hand, tend to consume more processed foods and less corn and beans than rural households. For instance, living in urban areas increases the shares that meat, pastries, added fats, and other highly processed foods make of the total calorie availability by 1.2, 4.8, 1.0, and 0.4 percent, ceteris paribus. As expected, poor households are more likely to consume more corn and beans and less of all other food groups compared to their rich counterparts. The price variables are also significant in most of the equations.

The main regressor of interest in this model is the supermarket purchase variable. The supermarket purchase variable has a positive but statistically insignificant coefficient in the calorie share of vegetable and fruit equations (Table 4). Though insignificant, these results can be taken as a contribution of supermarkets to improving dietary practices of Guatemalan households.

However, the coefficients of the other food groups indicate the risks associated with supermarket purchases. All other things remaining constant, a one percent increase in the value of supermarket food purchase increases the share of pastries and other highly processed food items (sweets, chocolate, ice cream, etc.) by 14.4 percent and 6.0 percent, respectively. This result is in line with the current practice of supermarkets in developing countries. Most supermarkets provide a wide range of highly and partially processed food items at relatively low prices compared to traditional retailers, since they have a comparative scale advantage. For instance, Reardon et al. (2003) indicate that in Latin America the share of packed and processed food sales for supermarkets is roughly two to three times higher than the share of fresh foods. The results also indicate that the shares of these food groups increase at the expense of other staple food crops such as corn and corn products and pulses. All other things remaining constant, a one percent increase in the value of supermarket food purchases decreases the calorie share of corn and corn products by 41.6 percent and the calorie share of beans by 6.5 percent.

The impact of supermarket purchase on the dietary patterns of households may vary by income. I hypothesize that supermarkets expansion can have more negative impact on the poor since they are more likely to buy cheap, filling, and tasty processed food items than the rich. To test this hypothesis, I estimate the whole model separately for poor (below the poverty line) and.

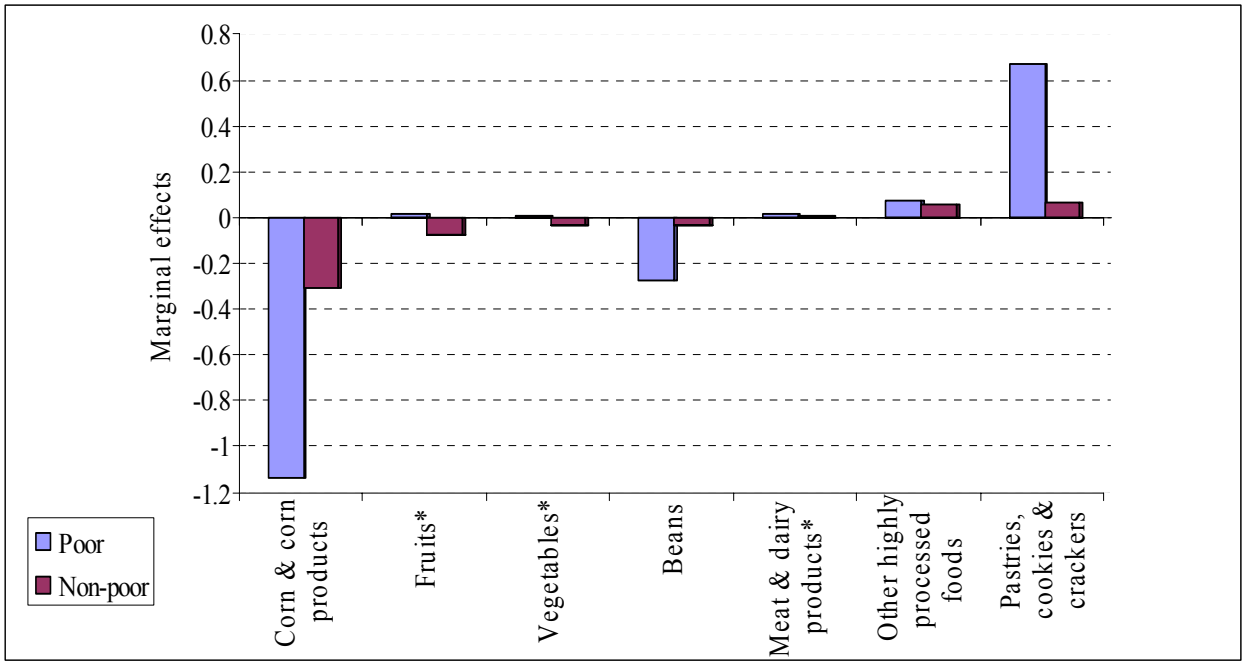
Table 4. IV Regression: Two-step feasible GMM estimation results

	Dependent variable: Calorie share of							
Variable	**Corn and corn products**	**Beans**	**Vegetables**	**Fruits**	**Meat, fish, eggs, dairy and dairy products**	**Pastries, cookies, and crackers**	**Added fats (animal and vegetable)**	**Other processed foods**
Ln value of SM food purchase	-0.416***	-0.065***	0.002	0.003	0.016	0.144***	-0.009	0.060***
	(0.092)	(0.017)	(0.008)	(0.012)	(0.013)	(0.038)	(0.014)	(0.017)
Head native	0.067***	-0.012***	0.005***	0.002	-0.011***	-0.047***	-0.011***	0.001
	(0.011)	(0.002)	(0.001)	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)
Ln family size	0.006***	0.000	-0.001***	-0.002***	-0.001**	-0.000	-0.000	-0.000
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Father education (1 if can read and write)	-0.005	0.003	0.002	0.002	0.005***	-0.004	0.003	-0.001
	(0.014)	(0.003)	(0.001)	(0.002)	(0.002)	(0.006)	(0.002)	(0.002)
Mother education (1 if can read and write)	0.012	0.006*	0.003	0.006**	0.011***	-0.028***	0.009***	-0.004
	(0.020)	(0.004)	(0.002)	(0.003)	(0.003)	(0.008)	(0.003)	(0.004)
Sex of the household head	-0.001	0.006**	0.004**	0.001	0.005**	-0.007	0.004	-0.006**
	(0.016)	(0.003)	(0.002)	(0.002)	(0.002)	(0.006)	(0.002)	(0.003)
Age of the household head	0.004**	0.000	0.000	0.000	-0.000	-0.002**	0.000	-0.001*
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Age square of the household head	-0.000	-0.000	0.000	0.000	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Urban	-0.087***	-0.005**	-0.001	0.000	0.012***	0.048***	0.009***	0.004**
	(0.012)	(0.002)	(0.001)	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)
Income (1 if poor)	0.041***	0.007**	-0.000	-0.009***	-0.023***	-0.013**	-0.012***	-0.005*
	(0.015)	(0.003)	(0.001)	(0.002)	(0.002)	(0.007)	(0.002)	(0.003)
Ln price of corn and corn products	-0.219**	0.022	0.008	-0.005	-0.026*	0.163***	0.005	-0.021
	(0.090)	(0.018)	(0.008)	(0.016)	(0.015)	(0.041)	(0.018)	(0.020)
Ln price of beans	0.277**	0.044*	0.005	0.033**	0.007	-0.061	0.005	-0.026
	(0.126)	(0.024)	(0.012)	(0.017)	(0.020)	(0.052)	(0.021)	(0.024)
Ln price of vegetables	-0.144	-0.050	-0.040**	-0.022	0.007	0.005	0.075**	0.000
	(0.187)	(0.037)	(0.019)	(0.026)	(0.032)	(0.077)	(0.031)	(0.030)
Ln price of fruits	0.134	0.133***	0.007	0.021	-0.035	0.003	0.051**	-0.056**
	(0.154)	(0.028)	(0.014)	(0.022)	(0.025)	(0.066)	(0.026)	(0.027)
Ln price of meat, fish, eggs, and milk	-0.346	-0.294***	-0.015	-0.125**	0.078	0.096	-0.201***	0.060
	(0.427)	(0.078)	(0.038)	(0.059)	(0.073)	(0.184)	(0.067)	(0.074)
Ln price of pastries, cookies, and crackers	0.509*	0.066	-0.024	0.047	-0.009	-0.298**	0.161***	-0.027
	(0.285)	(0.051)	(0.024)	(0.048)	(0.046)	(0.119)	(0.041)	(0.057)
Ln price of added fats (animal and vegetable)	0.222*	0.031	-0.022**	0.021	0.021	-0.146***	0.049**	-0.001
	(0.120)	(0.023)	(0.011)	(0.021)	(0.022)	(0.054)	(0.021)	(0.023)
Ln price of other highly processed foods	-1.238**	-0.079	0.080*	0.041	-0.044	0.809***	-0.263***	0.091
	(0.520)	(0.102)	(0.046)	(0.083)	(0.100)	(0.231)	(0.094)	(0.104)
Constant	2.547***	0.608***	-0.002	0.109	-0.004	-1.042***	0.544***	-0.170
	(0.907)	(0.168)	(0.076)	(0.138)	(0.153)	(0.391)	(0.131)	(0.163)
C statistic (exogeneity of housewife)	3.139	1.934	1.735	7.521***	2.093	15.864***	0.411	0.003

Notes: *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

nonpoor (above the poverty line) households. The marginal effects of the supermarket purchases variable in these estimations are presented in Figure 2. Marginal effects are computed only for food groups on which supermarket purchase has statistically significant impact.

Figure 2. Impact of a one percent increase in the value of supermarket purchase on the share of different food groups, by income group



Source: Computed from ENCOVI 2000 survey.

* Coefficients are statistically insignificant.

As the figure clearly shows, the marginal effect of supermarket purchase on the shares of pastries, cookies, and crackers and other highly processed foods (from the total calorie availability) are much higher for poor than for nonpoor households, respectively. The marginal effect of the supermarket purchases variable on the share of corn and corn products and beans is also very high (in absolute terms) for poor compared to nonpoor households.

These results have important implications. As supermarket purchases increase, the shares of pastries, cookies, crackers, and other highly processed foods increase while the shares of staple food items decrease. Given that most of the food items in the highly and partially processed category are high in added fat, sugar, and sodium, these results indicate that supermarket expansion poses a potential risk to the diet quality of households. The statistically insignificant relationship between supermarket purchase and the calorie share of vegetables and fruits may also strengthen this concern.

All these results reveal that, unless supermarkets alter their current practices and promote "healthy" food items, the risks associated with their expansion may outweigh the benefits they provide. Furthermore, these risks may affect the poor disproportionately more than the nonpoor. The availability of cheap, convenient, and diverse processed foods at supermarkets coupled with the lack of relatively bulk food items (such as fresh fruits and vegetables) may pose a serious challenge to consumers. This is particularly true for poor households, who usually decide what to buy when they are in stores and whose primary concern is not the nutritional content of food but merely having enough to be full (Winson 2004).[1]

5. Conclusion

Latin American countries have been experiencing a rapid expansion of supermarkets in semi-urban and urban neighborhoods, and even in poor neighborhoods of urban areas. This expansion has had clear effects, including changing the relative distance of other stores to consumers and changing the prices and diversity of available food items. Various studies have examined the underpinning factors for trend and its impact on the retail sector, food safety, small farmers, and agri-food market. However, there has been very limited empirical analysis of how such changes in the retail environment affect food choices, diet, and health status of households, especially in developing countries. The aim of this study is to shed some light on some of these neglected but crucial issues.

As in other Latin American countries the rapid expansion of supermarkets in Guatemala is likely to continue and even accelerate. This trend may bring new opportunities to consumers, but may also bring greater risks. Supermarkets in developing countries focus on processed, dry, and packed foods because they enable economies of scale and have long shelf lives. Various studies indicate that supermarkets have a comparative advantage in these food groups over traditional sale outlets. However, most of these food items tend to contain a disproportionately high amount of added fat, sugar, and salt, which are identified as potential risk factors for obesity and noncommunicable chronic diseases. On the other hand, the use of up-to-date transportation and storage facilities by supermarkets may increase the availability of fresh fruits and vegetables. Policymakers therefore should be aware that the diet and consequently the health status of the population can be significantly affected by the policies and practices of supermarkets.

[1] Due to low and instable income, poor households are less likely to have a structured menu and are therefore more likely to eat what they can get for a relatively low price.

The empirical results of this study reveal that in Guatemala the current practices of supermarkets have negative impacts on dietary patterns of households that appear to outweigh their positive contributions. A one percent increase in the value of supermarket purchases increases the share that pastries (including cookies and crackers) and other highly processed foods (sweets, chocolate, sausages, ice creams, etc.) make of total calorie availability by 14.4 and 6.0 percent, respectively. Although the coefficients are positive, the value of supermarket purchase does not have statistically significant impact on the share that vegetables and fruits make of total calorie availability. Supermarket purchases also have a negative and statistically significant impact on the share of staple foods such as corn and pulses. These results indicate that, unless necessary policy measures are taken, the expansion of supermarkets is likely to have negative repercussions on the dietary practices of Guatemalan households.

Policymakers should therefore design effective and appropriate measures to decrease the negative impacts and to exploit the opportunities of supermarket expansion. Supermarkets should be encouraged to supply more healthy scale-neutral food items such as fresh fruits and vegetables at affordable prices. They should also be encouraged to provide time-saving but healthy food items such as "pre-washed salads and vegetables" that are ready for direct use (Dolan and Humphrey 2000). Nutrition education, compulsory labeling, and other related measures may also help to improve the dietary practices of households. Since supermarkets are more likely to expand in the future, these measures will help to redirect the "diet transition" toward improved nutrition and health outcomes. Finally, as mentioned earlier, there is little empirical evidence on the impact of supermarkets expansion on the rising level of obesity and chronic diseases in developing countries, and therefore this topic needs further investigation.

Appendix: Food Grouping

Group	Item			
Corn and corn products	*Atole* of corn	Corn flour	Corn meal flour	Tortillas--corn
	Corn	Corn product		
Other grains	Mosh, oats	Rice	Noodles and the like	Other *atoles*
	Wheat flour	French bread	Sliced bread	
Beans	All types			
Fruits	Watermelon	Lemons	Papaya	Pineapple
	Avocado	Mangoes	Melons	Plantains
	Dried fruit	Guineos/bananas	Oranges/mandarins	Apples, grapes, peaches
Vegetables	*Anacate*	Cucumber	Other mushrooms	Pumpkin
	Beets	Garlic	Peas	Tomatoes
	Cabbage	*Guisquil*	Potatoes	Yucca
	Carrots	Herbs	Lettuce	
	Celery	Chiles	Onions	
Sugars and sweeteners	Sugar granulated	Brown sugar	Honeys	Molasses and syrups
Meat, fish, eggs, dairy, dairy products	Beef	Chicken meat	Milk	Yogurt
	Fresh fish	Beef meat on bone	Evaporated condensed milk	Powdered milk
	Pork	Canned fish	Fresh cheese/hard	Chicken organ meat
	Beef organ meat	Pork with bone	Chicken eggs	
Pastries, cookies, and crackers	Sweet bread	Pastries	Cookies	
Added fats (animal and vegetable)	Butter	Margarine	Edible oils	Vegetable shortening
	Lard	Fresh cream		
Other highly processed foods	Sweets	Sausages	Ice creams	Packed juices
	Chocolate sauce	Other pastas	Icy drinks	Soup mix packets

Source: Computed from ENCOVI 2000 survey.

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IFPRI HEADQUARTERS
2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1202-862-5600
Fax: +1202-467-4439
Email: ifpri@cgiar.org

IFPRI ADDIS ABABA
P. O. Box 5689
Addis Ababa, Ethiopia
Tel.: +251 11 6463215
Fax: +251 11 6462927
Email: ifpri-addisababa@cgiar.org

IFPRI NEW DELHI
CG Block, NASC Complex, PUSA
New Delhi 110-012 India
Tel.: 91 11 2584-6565
Fax: 91 11 2584-8008 / 2584-6572
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