Consumption Volatility, Marketization, and Expenditure in an Emerging Market Economy[†]

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In response to income fluctuations, households smooth consumption by substituting between market expenditure and time inputs. This paper provides evidence of this substitution in the context of food consumption over transitory and permanent income fluctuations in Mexico. Household time investments drive a wedge between consumption and expenditure, amplifying measured expenditure volatility. Volatility decompositions for Mexico and the United States suggest that the extent of bias in expenditure-based measures induced by changes in marketization is relatively larger in the Mexican setting. These findings imply that volatility comparisons between commodities or across countries are misleading when consumption measures ignore home production. (*JEL* D12, D91, E21, E32, O11, O12)

Recent research in the United States has documented that expenditure is a poor proxy for consumption when the opportunity cost of engaging with the market changes over the lifecycle (Aguiar and Hurst 2005; 2007; 2013) and over the business cycle (Aguiar, Hurst, and Karabarbounis 2013). In this paper, I employ household survey data from Mexico to confirm that the wedge between consumption and measured expenditure extends to the setting of a developing economy.[1] I then argue that substitution between home and market inputs leads to overstated aggregate volatility when consumption is measured by expenditure alone, and present evidence suggesting that the extent of this marketization bias may be larger in Mexico than in the United States.

This paper uses a series of empirical exercises examining changes in marketization to provide evidence on the validity and macroeconomic implications of existing theories of home production. In models based on Becker (1965), the final consumption of commodities entails both market expenditure and time as inputs. Individuals

[1] Mexico is an ideal setting to examine consumption volatility with a standard deviation of quarterly consumption expenditure two-and-a-half times greater than the developed country average over the last two decades. A higher volatility of investment, output, and consumption expenditure has been documented in emerging market economies in general (Backus and Kehoe 1992; Agénor, McDermott, and Prasad 2000; Neumeyer and Perri 2004; Aguiar and Gopinath 2007; Raffo 2008).

can substitute between these inputs in response to rising incomes or to shocks. I examine two mechanisms through which households accomplish this substitution. First, I show that households undertake a large amount of substitution *across commodities* that commonly require different levels of time inputs in consumption. For instance, raw food ingredients typically require a higher time investment in consumption than prepared foods or restaurant meals. Households are shown to substitute expenditure away from these highly marketized commodities in response to both permanent and transitory income fluctuations.

Next, the analysis examines substitution between market expenditure and time inputs *within a commodity*. I focus on tortillas, a staple of the Mexican diet and a commodity for which it is possible to identify expenditure at specific levels of marketization. This exercise reveals a high degree of substitution between time inputs and market expenditure in response to differences in permanent income across households and to the shock of the 1995 Mexican Peso Crisis. This result is consistent with McKenzie and Schargrodsky (2011), who show that during the 2002 Argentine crisis, households devoted more time to searching for lower prices and substitute goods, achieving higher quantities of commodity purchases for a given level of expenditure. Interestingly, I find little evidence of substitution of time inputs within the consumption of tortillas in response to idiosyncratic unemployment shocks, suggesting that the expenditure response to the Peso Crisis is more consistent with a reduction in permanent rather than transitory income.

The idea that marketization can lead the rate of economic growth to be overstated is not new. Deaton (2005) describes how during periods of expansion, households shift resources from informal to formal market activities, pushing a greater share of economic behavior within the production boundary and inflating growth in expenditure-based national accounts. The present study extends this line of reasoning to volatility. While Mexico has become increasingly marketized in recent expansions, during economic contractions, households realized substantial declines in expenditure in patterns consistent with demarketization. Together, marketization and demarketization shifts over the economic cycle combine to exaggerate overall consumption volatility when measured by expenditure.

There are two ways in which the extent of marketization bias could vary across countries. First, because nonmarket labor is only a viable input for some commodities, marketization bias may vary through structural differences in the composition of expenditure.[2] Second, the elasticity of substitution between home and market inputs may differ, owing, for example, to differences in preferences or in the technology of production (for either the home or the market). I examine both of these possibilities in the context of food expenditure. I find (i) that differences in expenditure shares alone imply that the corresponding level of marketization bias associated with food expenditure in Mexico would be two to three times larger than in the United States and (ii) that households in both settings exhibit a similar elasticity of

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[2]Patterns of time use suggest that most household substitution occurs within a specific set of activities, such as cleaning, food preparation, caregiving, and product search. These activities satisfy the third-party rule of Reid (1934), in which market expenditures are a viable alternative to home production in the consumption of a final commodity. If these expenditures comprise a larger share of output in one country than in another, then the extent of marketization bias may differ for this reason.

substitution between own time and market time when reallocating across restaurant and home produced meals.

General estimates of the elasticity of substitution between home and market production exist for the United States, with the most relevant being Aguiar, Hurst, and Karabarbounis (2013), which finds a value of 2.5 in the context of business cycle fluctuations.[3] A number of studies have modeled substitution in the allocation of household resources during economic fluctuations (Benhabib, Rogerson, and Wright 1991; Greenwood and Herkowitz 1991; Greenwood, Rogerson, and Wright 1993; and Baxter and Jermann 1999), although this literature has generally not explored the extent to which this elasticity may vary across countries or across commodities specifically.[4] If there is heterogeneity in this elasticity across commodities, it means that even within a country, relative consumption expenditure comparisons will be misleading as measured expenditure changes will appear more volatile for commodities where it is easier to substitute own time for expenditure during consumption.

Finally, I quantify the impact of changes in marketization on aggregate consumption expenditure volatility in both Mexico and the United States by performing a volatility decomposition using more than two decades of household-level expenditure data from each country. The results suggest that the much higher level of volatility observed in Mexico is disproportionately influenced by expenditure reallocations in food expenditure, which alone account for 27 percent of total consumption expenditure variance. I then contrast consumption expenditure fluctuations associated with the Peso Crisis with those occurring in the United States over the Great Recession. Both shocks produce changes in consumption expenditure consistent with de-marketization, with the Peso Crisis inducing a larger such reallocation. The findings of this analysis may generalize beyond the two country example if determinants of marketization bias vary systematically across countries. For instance, I show that Engel's Law suggests that developing economies have on average disproportionately larger food budget shares. A promising avenue of future research may then be to investigate cross-country variation in the level of marketization bias generated by the wedge between consumption and expenditure.

I. Final Consumption, Market Expenditure, and Marketization

This section outlines the major exercises of the paper and presents a simplified static framework, based on Becker's (1965) model of consumption, and following Aguiar, Hurst, and Karabarbounis (2012) to conceptualize the role of marketization in driving a wedge between the final consumption of commodities and the measured

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[3] Estimates for this elasticity can also be found in Rupert, Rogerson, and Wright (1995); McGrattan, Rogerson, and Wright (1997); and Aguiar and Hurst (2007). See Aguiar, Hurst, and Karabarbounis (2013) for a summary of the literature.

[4] An exception is Cardoso-Lecourtois (2002), which estimates a significantly higher elasticity of substitution between home and market goods in Mexico than in the United States, and finds that the inclusion of country specific values into an RBC model of Mexico results in home production explaining over two-thirds of observed consumption volatility.

level of market expenditure. Let households derive utility from the consumption of N commodities, each denoted by C_i:

$$U(C_1, \ldots, C_N),$$
(1)

where the consumption of each commodity entails some quantity of market input X_i, and household time investment H_i such that:

$$C_i = F_i(X_i, H_i).$$
(2)

Assume also that households face both a time and a budget constraint:

$$\sum_{i=1}^{N} H_i + L = 1$$
(3)

$$L \geq 0$$
(4)

$$\sum_{i=1}^{N} p_i X_i = wL + T,$$
(5)

where p_i is the market price of input X_i, w is the wage rate, L is labor time in the market, and T is exogenous income.

The key intuition is that individuals can purchase commodities that necessitate different levels of own time and market expenditure or substitute directly between these inputs when consuming a specific commodity. Aguiar, Hurst, and Karabarbounis (2012) shows that under reasonable conditions, and holding constant the marginal utility of wealth, when wages are growing, agents shift toward market expenditures, and, conversely, when wage shocks lower the opportunity cost of time, agents reallocate time to nonmarket production.[5] This study examines the possibility that households adjust H_i during income shocks so that the path of final consumption C_i is smoother than that of expenditure on market inputs, X_i.

Section II provides empirical evidence consistent with household use of this consumption smoothing mechanism through a set of related exercises. First, I examine how, in response to economic fluctuations, households reallocate X_i across a range of substitute C_i, which vary in their typical level of H_i required for final consumption, shifting expenditure between food for the home, prepared foods, and restaurant meals. Next, I examine how in Mexico for a specific C_i, tortillas, households substitute between H_i and X_i by varying the level of marketization in their expenditures. Current household income, $wL + T$, has both a permanent and a transitory component, and the household response may vary across these sources of income and

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[5] Aguiar, Hurst, and Karabarbounis (2012) makes clear that the issue is complicated by the household's ability to substitute across time as well. Formally, what is required for households to devote more time to producing commodities during negative shocks and less time during booms is for the elasticity of substitution between market inputs and time to be greater than the intertemporal elasticity of substitution. For this reason, the analysis here focuses on commodities for which the possibility of substitution of time for expenditure is large, as is likely the case for food.

across idiosyncratic and aggregate shocks. I thus examine household substitution in three settings: as a function of permanent income, across idiosyncratic shocks to transitory income in the form of unemployment spells, and in response to the aggregate shock of the Peso Crisis.

Section III examines the possibility that the discrepancy between final consumption and measured expenditure may vary in degree across countries. I investigate two possible sources of variation in the level of marketization bias across countries. First, the elasticity of substitution between H_i and X_i may vary across settings. I explore this in the context of food using a sample of both Mexican and US households. Second, variation may occur because the share of total expenditure devoted to goods with a high elasticity of substitution between H_i and X_i differs across countries. I perform a decomposition of consumption expenditure volatility to examine whether the scope for marketization bias generally differs between Mexico and the United States, and undertake a comparison of expenditure changes in Mexico during the Peso Crisis and the United States during the Great Recession as a case study. Section IV concludes.

II. Marketization and Household Production in Food Consumption

A. *Household Income and Expenditure Data in Mexico*

Mexico's *Encuesta Nacional de Ingresos y Gastos de los Hogares* (ENIGH) is a nationally representative survey of income and expenditure carried out by the *Instituto Nacional de Estadística Geografía e Informática* (INEGI). The ENIGH surveys are highly detailed household-level questionnaires that record both monetary and nonmonetary transactions for over 500 distinct goods and services, as well as detailed income information by source. Additionally, information is collected on a range of household member characteristics, such as age, occupation, employment status, hours worked, and educational attainment, as well as detailed records on characteristics of the residence and on household asset ownership. There is no panel component, and enumeration occurs around the third quarter of each survey year.

Comparable ENIGH surveys have been carried out at irregular intervals for the past two decades. This study employs data from the 1984, 1989, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2005, and 2006 survey rounds, which provides 11 rich cross-sectional snapshots of the Mexican economy. Demographic and economic statistics for the ENIGH sample are presented in Table 1.[6] With the exception of the 1984 survey, which includes just over 4,700 households, the surveys range in coverage from 10,100 to 22,600 households.

Several trends are evident over the two-decade survey period. The majority of households are headed by males, although this fraction declines over time. Household heads work longer, earn and spend more, and are on average older and better educated as time passes. Questions on literacy were dropped from surveys in the latter

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[6]The years 2005 and 2006 are excluded from this table and from some portions of the subsequent analysis because of a lack of consistency in the coding of several demographic variables. The subset of surveys from 1992–2004 is particularly comparable in this regard.

Table 1—Summary Statistics for Mexico's ENIGH, 1984–2004

	1984	1989	1992	1994	1996
Panel A. Household head characteristics					
Male indicator	0.85	0.86	0.86	0.85	0.84
Age	44.5	44.7	44.0	44.8	44.6
	(15.5)	(15.2)	(15.3)	(15.5)	(15.3)
Education level indicator					
None	0.20	0.20	0.18	0.19	0.16
Partial/complete primary school	0.58	0.48	0.49	0.46	0.46
Partial/complete junior high	0.11	0.14	0.16	0.16	0.17
Partial/complete vocational/high school	0.04	0.07	0.07	0.08	0.09
Partial/complete college/university/graduate	0.07	0.11	0.10	0.11	0.11
Worked for pay in last week indicator	0.971	0.972	0.975	0.982	0.981
Worked less than 40 hours per week indicator	0.373	0.344	0.356	0.367	0.367
Hours worked in last week	36.9	38.0	38.0	38.6	38.4
	(21.6)	(22.2)	(22.6)	(23.1)	(23.0)
Retired indicator	0.021	0.040	0.041	0.042	0.044
Panel B. Household characteristics					
Household size (adult equivalent)	3.97	3.96	3.81	3.75	3.70
	(1.88)	(1.81)	(1.74)	(1.72)	(1.71)
Number of child dependents	2.03	1.79	1.67	1.57	1.53
	(1.87)	(1.70)	(1.60)	(1.57)	(1.53)
Number of elderly dependents	0.21	0.23	0.21	0.22	0.21
	(0.51)	(0.53)	(0.51)	(0.52)	(0.51)
Located in an urban area indicator	0.65	0.64	0.62	0.61	0.63
Total quarterly income	16,340	18,370	20,486	21,217	15,778
	(15,237)	(16,888)	(19,752)	(19,839)	(15,472)
Total quarterly expenditure	15,574	17,450	19,904	19,583	15,722
	(13,085)	(14,763)	(17,145)	(16,669)	(13,653)
Number of households	4,735	11,531	10,530	12,815	14,042

(*Continued*)

Notes: Means and standard deviations (where informative) are reported. Household income and expenditure include both monetary and nonmonetary flows with the top 1 percent of values trimmed, and are reported in December 1999 pesos. Results are survey weighted.

Source: ENIGH surveys for the years listed.

half of the sample, but for the years during which the information was collected, rates were consistently above 85 percent and rising (not shown). The majority of households are nuclear, with a steady downward trend in adult equivalent household size over time, falling from roughly 4 to 3.4 over the period.

High levels of both consumption and income volatility can clearly be seen in Figure 1, which depicts annualized changes in income and expenditure. Slowdowns are evident particularly from 1994–1996, but also between the 2000–2002 and 2004–2005 survey waves. The 1994 and 1996 ENIGH surveys bracket the 1995 Peso Crisis, a severe shock to the Mexican economy. The crisis was the latest in a series of exchange rate shocks for Mexico, and the aftermath included a large decline in stock market valuation, a more than 5 percentage point rise in the official unemployment rate, a 24 percent decline in consumption expenditure, and rapid inflation.

TABLE 1—SUMMARY STATISTICS FOR MEXICO'S ENIGH, 1984–2004 (*Continued*)

	1998	2000	2002	2004
Panel A. Household head characteristics				
Male indicator	0.82	0.82	0.80	0.77
Age	45.6	46.3	47.1	46.9
	(15.5)	(15.4)	(15.3)	(15.7)
Education level indicator				
None	0.16	0.15	0.15	0.12
Partial/complete primary school	0.45	0.43	0.41	0.42
Partial/complete junior high	0.18	0.20	0.21	0.24
Partial/complete vocational/high school	0.09	0.09	0.10	0.10
Partial/complete college/university/grad	0.11	0.13	0.13	0.13
Worked for pay in last week indicator	0.986	0.990	0.985	0.983
Worked less than 40 hours per week indicator	0.365	0.362	0.364	0.330
Hours worked in last week	37.9	37.8	37.8	40.0
	(22.9)	(22.7)	(23.0)	(24.5)
Retired indicator	0.045	0.054	0.053	0.057
Panel B. Household characteristics				
Household size (adult equivalent)	3.54	3.45	3.44	3.36
	(1.61)	(1.55)	(1.53)	(1.54)
Number of child dependents	1.41	1.30	1.23	1.18
	(1.46)	(1.40)	(1.33)	(1.29)
Number of elderly dependents	0.22	0.23	0.25	0.25
	(0.52)	(0.53)	(0.56)	(0.54)
Located in an urban area indicator	0.62	0.64	0.63	0.64
Total quarterly income	15,920	18,469	18,423	19,053
	(16,140)	(18,904)	(17,714)	(17,484)
Total quarterly expenditure	15,426	17,205	17,527	18,371
	(13,848)	(15,567)	(15,669)	(15,480)
Number of households	10,952	10,108	17,167	22,598

Notes: Means and standard deviations (where informative) are reported. Household income and expenditure include both monetary and nonmonetary flows with the top 1 percent of values trimmed, and are reported in December 1999 pesos. Results are survey weighted.

Source: ENIGH surveys for the years listed

In calculating consumption and income, I correct for the introduction of the new peso in 1993 and deflate income and expenditure using the monthly National CPI corresponding to the survey enumeration date for each household. Based on the model presented in Section I, changes in the relative prices of specific market inputs should impact household decision making regarding how much time to invest in order to achieve a given level of consumption. To mitigate this issue, the subsequent analysis predominantly focuses on a narrow range of commodities for which relative price differences are not likely to be large. Most of the analysis focuses on food expenditures, while some of the exercises confine themselves to even more homogenous expenditure sets, such as across corn-based commodities.[7]

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[7] The analysis presented here focuses primarily on an examination of the impact of income fluctuations on marketization, while online Appendix A discusses the potential role of price changes in more depth.
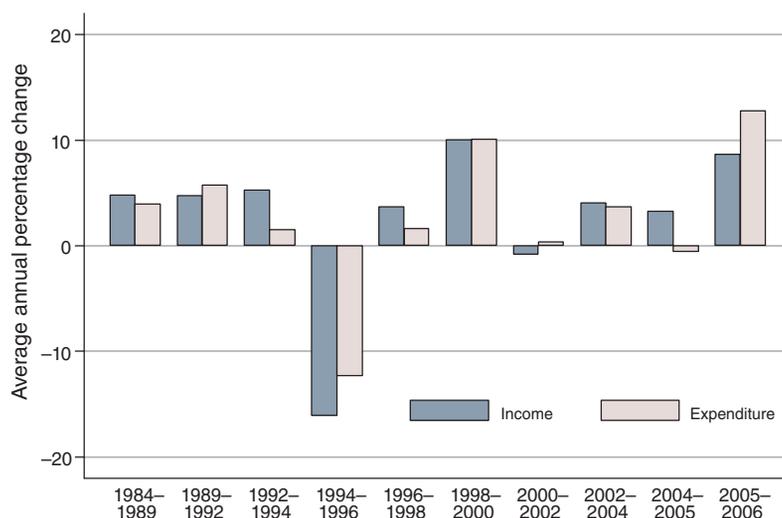
FIGURE 1. PER CAPITA INCOME AND EXPENDITURE IN MEXICO

Notes: The data for this figure were drawn from ENIGH surveys for 1984–2006. Income and expenditure include both monetary and nonmonetary flows, and are reported in constant pesos. Results are survey-weighted.

B. *Substitution between Market and Household Inputs by Permanent Income*

The remainder of Section II utilizes the ENIGH survey data to analyze the mechanisms through which Mexican households alter the relative level of market expenditures and household inputs in food consumption. I focus first on examining differences in consumption expenditure by permanent income, then turn to transitory income, and then examine the expenditure response to the aggregate shock of the Peso Crisis. As it is possible for households to substitute time for market inputs both within a specific commodity and across commodities with different levels of marketization, I examine each of these behaviors separately.

The challenge in examining within-commodity substitution is to identify expenditure on market inputs for which there is both a clear differentiation in the level of time input required and a sizeable degree of quality homogeneity. Fortunately, the richness of the ENIGH surveys allows for such an exercise. Tortillas, particularly those made of corn, are a common component of the typical Mexican diet. They are also ubiquitously available and can be purchased in various stages of production.

The production of tortillas from scratch is time intensive. In order to make a corn tortilla at the lowest level of processing, a household must first obtain corn grains and steep them in an alkaline solution in a process known as *Nixtamalization*.[8] Households then typically rinse (and sometimes hull) the processed grains. These kernels, sometimes referred to as *Nixtamal*, are then ground to produce either corn

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[8] Typically, the alkaline solution is created through the addition of lime to water.

meal or dough, which must be shaped and cooked to produce finished tortillas. Because it is possible to purchase tortillas at each of these stages of processing (raw corn grains, *Nixtamal* services, cornmeal and dough, or finished tortillas), households essentially face a menu of products that vary in their level of marketization. Each increase in the level of preparation reflects fewer household time inputs, but also entails increasing market expenditure. In the weekly ENIGH diaries of household food expenditure, 78 percent of households report positive expenditure on corn tortillas, 12 percent report positive expenditure on corn grains, and 11 percent report positive expenditure on corn meal or dough.[9]

It is possible that households substitute across the level of market expenditure in food consumption with respect to fluctuations in permanent or transitory income. To explore the relationship between the level of market expenditures and permanent income, I estimate a regression of the following form:

$$(6) \qquad E_{ijt} = \alpha + \beta \ln(\hat{Y}_{Perm,jt}) + \delta \mathbf{X}_{jt} + \varepsilon_{ijt},$$

where E is an indicator for positive expenditure in category i by household j during year t. Recognizing that current household income, Y, has both a permanent and a transitory component, I instrument for current income with indicators for household head education in order to isolate the permanent component of income. Educational attainment should serve as a valid instrument in this context as incomes vary strongly with education in Mexico. Furthermore, tortillas are such a common staple in Mexican households that individuals at every level of educational attainment should have access to the knowledge of how to produce them, even the illiterate. This means that the decision to purchase tortillas at various levels of marketization is plausibly unrelated to education other than through education's impact on income.[10]

$\mathbf{X}$ is a vector of household level controls including gender of household head, number of young and old age dependents, number of men and women, adult equivalent household size, as well as an indicator for urban households, and for each survey year. Analysis is constrained to the period 1992–2004 because the surveys are most consistent over this period. The sample is further restricted to households with household heads of prime working age, to be consistent with subsequent analysis examining employment shocks and because the context for retired heads may differ as suggested by the analysis of Aguiar and Hurst (2005).

Panel A of Table 2 compares general food expenditure for the home with highly marketized food expenditures such as food spending for consumption away from the home and expenditure on prepared foods. Column 1 details the proportion of households with positive expenditure at each level of marketization, while column 2 presents the estimated semi-elasticities obtained from the regression described in equation (6). As would be expected, richer households are significantly more likely

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[9] Because this is a snapshot of expenditure for a given week, these numbers likely understate the total number of households with positive expenditure on these various components during a given year.

[10] Online Appendix Table B1 shows that the qualitative results from this exercise are robust to a range of alternative estimation strategies.

TABLE 2—PERMANENT INCOME AND FOOD CONSUMPTION EXPENDITURE IN MEXICO

Degree of marketization	Market expenditure	Dependent variable: indicator for positive expenditure		Dependent variable: expenditure	
		Mean (1)	2SLS results (2)	Mean (SD) (3)	Tobit results (4)
Panel A. Substitution across broad food commodity categories, by level of marketization					
Low	Food in	0.98	−0.012*** (0.004)	4,471 (2,552)	47.6*** (2.4)
Medium	Prepared foods	0.33	0.061*** (0.011)	215 (443)	7.2*** (0.8)
High	Food out	0.49	0.148*** (0.010)	1,333 (2,286)	72.6*** (2.8)
Panel B. Substitution within a food commodity (tortillas), by level of marketization					
Low	Corn grain	0.12	−0.072*** (0.005)	49 (170)	−11.0*** (1.5)
Medium	Nixtamal services	0.07	−0.041*** (0.003)	6 (28)	−4.6*** (0.8)
	Corn meal & dough	0.11	−0.039*** (0.006)	14 (56)	−2.0*** (0.3)
High	Tortillas	0.80	0.030*** (0.009)	290 (260)	−1.6*** (0.2)

Notes: The sample is restricted to households with heads aged 35–50. Coefficients reported in column 2 are from separate 2SLS regressions of an indicator for positive quarterly expenditure in the expenditure category listed on log quarterly household income, where income is instrumented using a full set of household head education indicators. Coefficients reported in column 4 are from separate Tobit regressions of quarterly expenditure in the expenditure category listed on quarterly household income (in thousands of pesos). The number of observations ranges from 36,603 to 37,153 depending on the specification. All regressions include controls for household head gender; adult equivalent household size; numbers of men, women, young age dependents, and old age dependents in the household; an indicator for whether the household is urban; and indicators for survey year. Income and expenditure include both monetary and nonmonetary flows with the top 1 percent of values trimmed, and are converted to December 1999 pesos. Regressions are survey weighted and robust standard errors are reported.

 ***Significant at the 1 percent level.
 **Significant at the 5 percent level.
 *Significant at the 10 percent level.

Source: Data for this table were drawn from biennial ENIGH surveys between 1992 and 2004.

to consume meals out and purchase prepared foods than poorer households. These effects are sizeable, with a doubling of income associated with a 14.8 percentage point increase in the likelihood of consuming meals out and a 6.1 percentage point increase in the likelihood of purchasing prepared meals. These results suggest that higher income households purchase more marketized versions of foods and outsource more of the labor required in food production.

To study substitution within a commodity, panel B of Table 2 examines tortilla expenditures at varying levels of marketization. Again, column 1 presents the proportion of households with positive expenditure at each level of marketization, while column 2 presents the estimated semi-elasticities. Poorer households are significantly more likely to purchase raw corn grain, *Nixtamalization* services, or corn meal and dough. Specifically, the estimates suggest that a doubling in household permanent income is associated with a 7.2 percentage point decline in the likelihood

of purchasing corn grain, a 4.1 percentage point decline in the likelihood of purchasing *Nixtamalization* services, a 3.9 percentage point decline in the likelihood of corn meal purchases, and a 3 percentage point *increase* in the likelihood of buying corn tortillas. This pattern indicates that lower income households invest more of their own time in the consumption of tortillas.

An exploration of the relationship between income and the *level* of expenditure, rather than just an indicator for positive expenditure, can be informative as well. Column 3 presents the mean level of expenditure, while column 4 presents the results of running a Tobit regression of the following form:

$$(7) \qquad E_{ijt} = \alpha + \beta(Y_{jt}) + \delta\mathbf{X}_{jt} + \varepsilon_{ijt},$$

where $\mathbf{X}$ is the same vector of controls as in the previous exercise, Y is income (scaled to thousands of pesos for interpretation), and E_{ijt} is defined to equal household expenditure for each marketized input whenever such expenditure is nonzero, and zero otherwise.

The results presented in column 4 generally mirror those of column 2, in that as income rises, individuals reduce purchases of food inputs at low levels of marketization in favor of more marketized expenditures. From panel A, we can see that, as expected, higher incomes are associated with a proportionately higher level of expenditure on restaurant dining. The results of panel B suggest a similar pattern for expenditure on tortillas at all levels of preparation. Taking into account the initial differences in means, the Tobit results suggest the largest proportional declines in expenditure as incomes rise occur for corn grains and *Nixtamalization* services, consistent with lower income household having higher inputs of own time in food consumption.

C. *Substitution between Market and Household Inputs in Response to Transitory Shocks*

Households with different income levels may vary along a number of dimensions, including their preferences and access to marketized commodities. It is thus not immediately clear from the previous evidence that households would be willing or able to substitute between own time and market expenditure inputs to achieve a given level of consumption when faced with shocks. Stated differently, the behavioral response to changes in transitory income may differ from the response to permanent income fluctuations. In order to examine the response to a transitory shock, I examine household food consumption expenditure over idiosyncratic household income shocks, such as spells of unemployment and underemployment. Because the ENIGH data lacks a panel component, selection concerns are first order and I attempt to mitigate their impact by employing cohort fixed effects.

An advantage of cohort fixed effects in this setting is that they restrict identification to variation across households that vary in their labor market status, but are otherwise quite similar. At the same time, this strategy allows the analysis to take full advantage of the rich microeconomic detail of the ENIGH sample. I construct cohorts based on year of birth and educational attainment of household head, again

utilizing the data collected over the period 1992–2004, when the surveys were particularly comparable and available biannually. The resulting sample of more than 75,000 households is sufficient to construct 8 five-year of birth cohorts across the 5 educational groups (or 40 cohorts per survey year) with an average cell size of 277 households per cohort.

I assess the impact of labor market shocks on expenditure by estimating the following regression equation:

$$(8) \qquad \ln(E_{ijt}) = \alpha + \beta unemp_{jt} + \delta \mathbf{X}_{jt} + \gamma \mathbf{D}_j + \varepsilon_{ijt},$$

where, as before, j indexes households, i indexes commodities, and t indexes survey years. E represents household consumption expenditure. The independent variable of interest is the labor market shock, defined in terms of the employment status of the household head. $\mathbf{X}$ is a vector of socioeconomic and demographic controls including the gender and age of the household head, as well as adult equivalent household size, numbers of men, women, young age dependents, and old age dependents in the household, an indicator for whether the household is urban, and survey year dummies. $\mathbf{D}$ is a set of cohort fixed effects based upon year of birth and educational attainment of the household head.

Table 3 presents the results of these regressions. In column 2, an individual is defined as unemployed if they lacked work for any number of reasons (including job loss or temporary lack of employment due to strikes, supply shortages, necessary equipment repair, and sickness) and had actively searched for work. Households may view such a bout of unemployment, particularly one due to a strike or seasonal factors, as transitory. Since many employment changes occur at the margin, column 3 examines changes in expenditure occurring when the household head works less than full time.

Panel A presents the results across broad categories of expenditure that vary in their level of market inputs. Unemployment of the household head in column 2 is associated with significant reductions in expenditure. Total expenditure declines 23.5 percent when the household head becomes unemployed, while expenditure on food declines by 15 percent. The reduction in food consumed at home is smaller than the reduction in expenditure on food consumed out and on prepared meals, although this difference is statistically significant only for column 3. As one would expect, results in column 3, where the dependent variable is an indicator for less than full-time employment, are generally smaller in magnitude, but are otherwise substantively similar to the results in column 2 for all expenditure categories except prepared foods. These findings are suggestive of a household reallocation away from marketized expenditures during negative income shocks.

Panel B replicates these regressions for the components of tortilla expenditure examined in Table 2. The results are noticeably different from those explored for differences in permanent income. Specifically, unemployment and less than full employment of a household head produce no significant change in the pattern of tortilla consumption expenditures. This raises the possibility that the household marketization response to differences in permanent income differ in meaningful ways from the response to transitory income shocks. In this setting, transitory shocks

TABLE 3—INCOME SHOCKS AND FOOD CONSUMPTION EXPENDITURE IN MEXICO

| | Dependent variable: log of expenditure | | | |
	Mean (SD) (1)	Unemployment (2)	Less than full time (< 40 hrs) (3)	Expenditure change over peso crisis (4)
Panel A. Substitution across expenditure categories, by level of marketization				
Total expenditure	9.19	−0.235***	−0.071***	−0.26
	(0.84)	(0.048)	(0.009)	
Food expenditure	8.23	−0.150***	−0.066***	−0.19
	(0.74)	(0.040)	(0.009)	
Food in	8.09	−0.102***	−0.042***	−0.11
	(0.74)	(0.038)	(0.009)	
Prepared foods	6.10	−0.205***	−0.013	−0.16
	(0.88)	(0.067)	(0.021)	
Food out	7.04	−0.227**	−0.180***	−0.37
	(1.18)	(0.096)	(0.024)	
*Panel B. Substitution within a food commodity (*tortillas*), by level of marketization*				
Corn grain	5.59	−0.021	−0.030	0.18
	(1.00)	(0.265)	(0.040)	
Nixtamal services	4.72	0.082	−0.010	0.09
	(0.80)	(0.224)	(0.032)	
Corn meal & dough	4.74	−0.099	0.031	0.02
	(0.93)	(0.118)	(−0.035)	
Tortillas	5.55	0.041	−0.013	0.02
	(0.80)	(0.041)	(0.011)	

Notes: The sample in columns 1–3 is restricted to households with heads aged 20-59 in 1992. Regression results reported in columns 2 and 3 are from separate regressions of log quarterly expenditure in the category listed on the employment measure specified at the top of the column. The number of observations varies by specification. All regressions include controls for household head gender and age, as well as adult equivalent household size; the numbers of men, women, young age dependents, and old age dependents; an indicator for whether the household is urban; as well as survey round and age-education cohort fixed effects. Expenditures include monetary flows with the top 1 percent of values trimmed, and are converted to December 1999 pesos. Regressions are survey weighted and robust standard errors are reported. Column 4 calculates changes in adult equivalent total expenditure between 1994 and 1996, among households with heads aged 35–50 who work at least 40 hours per week, and thus differs from estimates for all households in Table 9.
    ***Significant at the 1 percent level.
    **Significant at the 5 percent level.
    *Significant at the 10 percent level.

Source: Data for this table were drawn from biennial ENIGH surveys between 1992 and 2004.

appear to elicit only substitution across commodities with varied levels of marketization, as opposed to the within-commodity time reallocation seen across differences in permanent income.

D. *Substitution between Market and Household Inputs during the Peso Crisis*

The large shock generated by the 1995 Peso Crisis provides an opportunity for studying changes in marketization by examining household expenditure patterns at the aggregate level. As previously discussed, the crisis dramatically reduced labor market opportunities and real purchasing power for Mexican households. If households chose to substitute additional time inputs in the consumption of tortillas in

response to the crisis then this should be visible in household expenditure data over the crisis period from 1994–1996.

Column 4 of Table 3 presents changes in expenditure over the crisis period. Focusing first on panel A, we see that expenditure changes during the Peso Crisis were sizeable. While total food expenditure during the crisis fell by 19 percent, the decline in food for the home was more modest at 11 percent, and the decline for restaurant food consumption was nearly 40 percent. Similarly, the decline in expenditure on prepared foods exceeded that of groceries in general. These results suggest a large degree of substitution away from marketized inputs and toward commodities requiring more household time investment in food consumption.

Panel B presents household expenditure responses for tortillas and their components, broken down by level of marketization in response to the Peso Crisis. Despite the sizeable decline in total household food expenditure, expenditures on corn grain, *Nixtamal* services, corn meal and dough, and tortillas rise over the crisis period, in ways that are indicative of households increasing their time investment in food consumption. This is most clearly seen by recognizing that expenditure on prepared tortillas rises to a much more modest degree than that of corn grains and *Nixtamal* services.[11] This evidence suggests that the crisis forced a reallocation of household expenditures into versions of the commodity which are significantly less marketized. In this regard, the household expenditure response to the Peso Crisis is more consistent with the response to a change in permanent income than to a change in transitory income.

III. Marketization Bias across Countries

This section establishes that the extent of marketization bias varies with the economic cycle and across countries. Rigorously comparing marketization bias across countries requires multiple pieces of evidence. Section IIIA describes expenditure and time use for households in Mexico and the United States, and documents that household production in both countries is predominantly restricted to a similar group of activities for which there is a corresponding set of identifiable market expenditure substitutes. Marketization bias may then vary between the two countries because of differences in the elasticity of substitution between home and market inputs or through structural differences in the composition of expenditure with respect to these market inputs. To explore this, Section IIIB compares the elasticity of substitution between household time investments and market expenditures for the case of food consumption in Mexico and the United States, while Section IIIC compares expenditure shares between the two countries for the set of commodities where substitution of time for expenditure is feasible. Section IIID decomposes volatility over the period 1984–2006 in Mexico and the United States and shows that food expenditure and other substitutable commodities are important sources of consumption expenditure volatility. Section IIIE compares the household expenditure response to the Peso Crisis and the Great Recession, revealing evidence of demarketization

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[11] Increased corn grain expenditure alone would not necessarily imply that these purchases are used for tortillas, but the concomitant substantial rise in expenditure on *Nixtamal* services does.

during these shocks. Section IIIF combines these results to show that the extent of marketization bias may vary in systematic ways.

A. *Paired Expenditure and Time Use Data in Mexico and the United States*

The 1996 and 2002 Mexican ENIGH survey rounds collected information on the time use of all household members over the age of 12 in a companion survey known as the *Encuesta Nacional sobre Uso del Tiempo* (ENUT). This module was administered to one-third of households who completed the income and expenditure survey, for a total of roughly 4,500 households in each survey round. A remarkable feature of this data is that because of its inclusion in the larger survey, it is possible to directly link individual time use information with household data on income, expenditure, and socioeconomic and demographic characteristics.[12]

Household data containing information on both food expenditure and time use can be constructed for the United States as well. The American Time Use Survey (ATUS) is a well known time use study that has conducted comparable annual cross-sectional surveys over the period 2003–2011. The ATUS records time use on a wide variety of activities for a single respondent in a household.[13] The respondents of the ATUS are a nationally representative stratified random sample selected from within the population of Current Population Survey (CPS) respondents who have completed their eighth and final wave of CPS enumeration. The CPS collects a wide range of individual socioeconomic, labor market, and demographic information for approximately 54,000 households each month in the United States. The CPS is a rotating panel in which households are surveyed each month for four months, leave the sample for eight months, and are surveyed again for four months.

Neither the CPS nor the ATUS collects information on food expenditures. However, household-level food expenditure data is collected in a supplement to the CPS, the Food Security Supplement (FSS)—a survey given to all eligible CPS households on an annual basis since 1995. As the ATUS sample is drawn from CPS households as well, it is thus possible to match respondent households in the ATUS to those who have participated in FSS surveys. Technically, the rotating panel structure of the CPS and the practice of enumerating the FSS as a December supplement means that approximately one-third of CPS households (the respondents who complete their final CPS in December, January, February, or March of a given year) are in the universe of both ATUS and FSS respondents. The 4–8–4 structure of the CPS also means that this subset of households will have been surveyed by the FSS in

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[12] A short period of time elapsed between enumeration of the income and expenditure module and the time use module. There is a similar timing gap for the corresponding US data. This gap is unlikely to affect the analysis other than by introducing measurement error, which may attenuate the results. Tasks are not mutually exclusive, and for instance, household members who simultaneously care for an elderly parent and a child would report this concurrent time use separately for both activities. The ability to undertake simultaneous activities is a factor that individuals take into account when deciding how much time to devote to housework, inflates measured hours of housework, and raises questions about the effort devoted to these tasks. These questions are beyond the scope of this analysis.

[13] Like the ENUT, tasks are not mutually exclusive and individuals can record time in multiple activities simultaneously.

TABLE 4—DEMOGRAPHIC STATISTICS FOR TIME USE SUBSAMPLES

	Mexico			US
	1996	2002		2003–2011
Household head characteristics			*Respondent characteristics*	
Indicator for male	0.83	0.80	Indicator for male	0.34
Age	45.5	47.0	Age	50.1
	(13.9)	(13.7)		(15.4)
Indicator for education level[a]			Indicator for education level	
None	0.17	0.18	Less than high school	0.12
Primary school	0.49	0.44	Completed high school	0.32
Junior high	0.16	0.19	Partial college or associate	0.26
Vocational/high school	0.09	0.08	Bachelor's degree	0.19
College/university/graduate	0.10	0.11	Graduate degree	0.11
Hours worked	37.7	38.1	Hours worked	21.9
	(22.9)	(22.8)		(21.2)
Household characteristics			*Household characteristics*	
Household size	3.70	3.48	Household size	2.47
(adult equivalent)	(1.60)	(1.45)	(adult equivalent)	(1.06)
Number of child dependents	1.59	1.38	Number of child dependents	0.91
	(1.51)	(1.37)		(1.15)
Number of elderly dependents	0.20	0.23	Number of elderly dependents	0.37
	(0.50)	(0.54)		(0.66)
Indicator for urban area	0.62	0.60	Indicator for urban area	0.81
Number of households	4,492	4,271	Number of households	16,965

Notes: Means and standard deviations (where informative) are reported. Both samples are restricted to households where the household head (Mexico) or respondent (United States) is aged 25–80. All results are survey weighted.
  [a]Education levels include individuals with either partial or complete attainment.

Source: Data for Mexico were drawn from a merged ENIGH-ENUT database for 1996 and 2002. Data for the United States were drawn from a merged ATUS-CPS-FSS database for the period 2003–2011.

each of the two Decembers prior to their ATUS survey. Where possible, I use information collected on food expenditure from the most recent FSS survey.

Table 4 presents statistics on the demographics of households included in the time use samples in Mexico and the United States. Households in Mexico are on average larger with more children, while those in the United States are more likely to be located in urban areas and to have old age dependents. Sizeable differences in hours worked between the two samples are evident, but these differences primarily reflect a discrepancy in the definition of respondent and household head across the two samples. Reported household heads in Mexico are more likely to have been male, while respondents in the United States were more commonly female. These differences are controlled for in the regression analysis, and Section IIIB details steps taken to adjust these samples to arrive at comparable estimates of the relationship between household time use and food expenditure.

Panel A of Table 5 presents summary statistics on income and expenditure for households in the time use samples. To facilitate comparison, these figures have been deflated to December 1999, when the exchange rate averaged roughly 10 pesos to the dollar. Household earnings in Mexico averaged 1,340 pesos per week, and expenditures on food comprise close to one-third of this at 420 pesos per week. In a given week, roughly half of households had positive expenditure on food away from

TABLE 5—SUMMARY STATISTICS FOR TIME USE SUBSAMPLES

	Mexico		United States	
	Mean	SD	Mean	SD
Panel A. Income and expenditure (*per household/week*)				
Total income ('000s of 1999 pesos), ('00s of 1999 USD)	1.34	(1.29)	4.36	(4.88)
Total food expenditure ('000s of 1999 pesos), ('00s of 1999 USD)	0.42	(0.25)	1.23	(0.80)
Food expenditure away from home ('000s of 1999 pesos), ('00s of 1999 USD)	0.09	(0.16)	0.41	(0.43)
Panel B. Time use in home production (*min/week/adult equivalent*)				
Total home production time	1,520	(869)	1,306	(1,449)
Food prep and cleanup	484	(322)	260	(397)
Cleaning, laundry, sewing, management	504	(334)	285	(617)
Repair and maintenance tasks	19	(112)	87	(332)
Shopping	102	(101)	296	(557)
Caregiving	411	(611)	234	(540)
Care for children	378	(568)	172	(435)
Care for the elderly	16	(140)	31	(160)
Care for the sick	17	(140)	1	(9)

Notes: All results are survey weighted. The top 1 percent of values are trimmed. Mexico: The sample is restricted to households with heads aged 25–80. There are 9,078 observations. Expenditure and income information include both monetary and nonmonetary flows and are converted to December 1999 pesos. Time use information is recorded for all household members over the age of 12 for a given week, and total weekly household time use per adult equivalent household member is presented here. All results are survey weighted. United States: The sample is restricted to households where the ATUS respondent is aged 25–80. There are 31,955 observations. Expenditure and income information are converted to December 1999 dollars. Time use information in the ATUS is recorded for a single respondent per household per day, and has been scaled up to the weekly adult equivalent household level for comparison with the Mexican data.

Source: Data for Mexico were drawn from a merged ENIGH-ENUT database for 1996 and 2002. Data for the United States were drawn from a merged ATUS-CPS-FSS database for the period 2003–2011.

the home, spending roughly 90 pesos eating out. Respondents in the United States earn an average of US$436 per week and mean weekly household food expenditure totaled US$123. Eighty-one percent of households reported positive food expenditure on dining out during the week, with a mean spending of US$41.

Panel B of Table 5 presents summary statistics on time use behavior among Mexican and American households. These measures have been scaled to report minutes per week per adult equivalent, to allow for comparisons of individual time investments in household production across the two contexts. On average, individuals in Mexican households spend more time on food preparation, cleaning, and caregiving activities, while those in US households spend slightly more time on repair and maintenance activities and on shopping. In both countries, these activities comprise the vast majority of time, which can be classified as household production time based on each survey's lexicon of activities.[14] Some of the differences in household production behavior between Mexico and the United States simply reflect the fact

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[14] This implies that the extent of substitution between market expenditures and time for commodities other than those that correspond to these activities is generally lower and likely limited to product search, as in McKenzie and Schargrodsky (2011). For instance, patterns of time use behavior suggest substitution of own time is more common for expenditures on food, infant care, and household operations than for expenditures on lawyer services or cell phones.

that respondents in the ATUS were more likely to be female. In the regression analysis, I control for a range of household head and respondent characteristics to account for these differences.

B. *Expenditure and Time Inputs into Food Consumption in Mexico and the United States*

The analysis has shown that Mexican households adjust market expenditures across commodities which typically vary in their required labor investments for final consumption in response to shocks. If this readjustment involves changes in marketization, then behavioral changes should also be visible in household time allocations. Just how large is the requisite time reallocation associated with the use of nonmarket labor in consumption? Research in the United States has documented that households reallocate nearly one third of foregone market labor hours to home production in response to a decline in market work owing to fluctuations in the business cycle (Aguiar, Hurst, and Karabarbounis 2013). The results of Section II suggest that similar household production responses should be expected among Mexican households during shocks.

I explore time reallocations in greater detail for both the United States and Mexico by comparing household level decisions to alter expenditure relative to time in the context of food consumption. Specifically, the analysis focuses on how time allocated to food preparation and related activities varies as a function of household expenditure on food for the home versus food consumed away from home. In the context of the model presented in Section I, one can conceptualize grocery purchases as an expenditure requiring a larger input of own time to achieve a given level of final consumption, while restaurant meals achieve the same level of consumption with a lower proportional investment of own time relative to market expenditure.

There are several advantages to focusing on food expenditure to examine this association. First, in so doing, the results are consistent and comparable with those in each of the previous exercises presented in this paper. Second, food is a necessity, is commonly studied within economics, and is an expenditure that can easily be paired to corresponding time use activities in both countries. Third, food is a commodity that is commonly considered to have a reasonably high potential for nonmarket substitution in place of market expenditures in consumption. Finally, food expenditure is a sizeable component of aggregate expenditure, and as will be demonstrated in Section IIID, a key driver of overall expenditure volatility in Mexico.

In order to arrive at comparable household estimates of time use and expenditure in both the United States and Mexico, several data adjustments are necessary. The ENUT data provides time use for all household members, while the ATUS provides time use information for only a single respondent per household. To account for this, I control for respondent demographics and scale the ATUS estimates up to the household level. In both surveys, I construct a comparable measure of time spent on activities related to food preparation and cleanup, tasks for which the questions were quite similar in both surveys. Next, because the CPS-FSS reports weekly expenditures, the ENIGH data must be scaled down from standardized quarterly estimates to arrive at comparable values.

For both countries, I calculate an OLS regression of household time spent in food preparation and cleanup activities as a function of food expenditures:

$$(11) \qquad \ln(T_{jt}) = \alpha + \beta \ln(\mathbf{F}_{jt}) + \delta \mathbf{X}_{jt} + \varepsilon_{jt},$$

where j indexes households and t indexes survey years. T is time spent in food production related activities. $\mathbf{F}$ is a vector of household food consumption expenditures (including either expenditure on food for the home or food away from the home, or both). $\mathbf{X}$ is a vector of socioeconomic and demographic controls.[15]

Estimates obtained from equation (11) are displayed in Table 6. Columns 1–3 present estimates for Mexico, while columns 4–6 present US estimates. In all cases, higher household expenditure on groceries produces a positive coefficient, while expenditure on food for consumption away from home yields a negative coefficient. The qualitative pattern of higher own time investment in food purchased for consumption at home and a lower level of own time investment on restaurant purchases is consistent with households facing a marketization tradeoff when allocating expenditure across these commodities in food consumption. In other words, shifting expenditure from restaurants to groceries, as observed in Mexican households during shocks is associated with higher levels of household time investments.

Of particular interest are specifications (3) and (6), which include spending on food for the home and on food away from home simultaneously. The estimated coefficients in these regressions imply that a 10 percent increase in expenditure on food consumption away from home is associated with a 0.49 percent fall in time spent in home production of food among Mexican households, and a 0.31 percent decline among US households. Although the two elasticity estimates are not significantly different from one another (p-value of 0.383), they nonetheless imply very different responses in the different settings. In particular, the coefficients suggest that a doubling in mean food expenditure away from the home is associated with a decrease in weekly household time spent on food preparation and related tasks each week by 80 minutes in Mexico and by 17 minutes in the United States.[16] Differences in the size of the time use reallocation could reflect a range of factors, such as a lower technology of production in food preparation and cleanup in Mexico or higher levels of marketization (preparation) in US grocery products.[17]

These findings provide evidence that households in Mexico and the United States reallocate in similar ways between time and expenditure, at least in the narrow context of food consumption, through purchases of meals out or food for the home. At the same time, the requisite own time investment appears larger in Mexico for a given expenditure change, suggesting that more dramatic changes in marketization may occur in this setting when faced with shocks. Given the welfare implications

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[15] The full set of controls used for each sample is described in the notes to Table 6. An effort was made to be as consistent as possible across the samples, while accounting for particularities of each dataset.

[16] The implied responses differ because mean expenditure on meals away from the home is much lower and household time spent on food preparation is larger in Mexico. For example, mean weekly time allocated to these activities at the household level is 1,622 minutes in Mexico and 556 minutes in the United States.

[17] Online Appendix Table B2 shows that similar results are produced from specifications that also include the subset of households lacking expenditure on food away from the home in a given week.

TABLE 6—EXPENDITURE AND TIME INPUTS IN FOOD CONSUMPTION IN MEXICO AND THE US

	Dependent variable: log household time in food preparation and cleanup					
	Mexico			United States		
	(1)	(2)	(3)	(4)	(5)	(6)
log of food expenditure for the home	0.055*** (0.019)		0.041 (0.030)	0.022 (0.016)		0.021 (0.021)
log of food expenditure away from home		−0.064*** (0.015)	−0.049*** (0.016)		−0.028** (0.013)	−0.031** (0.013)
Observations	8,624	3,868	3,774	16,965	11,545	11,545
R^2	0.265	0.286	0.280	0.117	0.124	0.124
Mean (SD) of dependent variable	7.20 (0.65)	7.11 (0.71)	7.12 (0.70)	6.53 (0.99)	6.48 (0.98)	6.48 (0.98)

Notes: Regressions are survey weighted, and robust standard errors are reported. The top 1 percent of values for the time use data are trimmed. Mexico: The sample is restricted to households with heads aged 25–80. Coefficients reported are from OLS regressions of log household time spent in food preparation and cleanup on log weekly expenditures listed in the table; and controls for log weekly household income, household head gender and age; a set of indicators for household head education level; adult equivalent household size; the numbers of men, women, young age dependents, and old age dependents in the household; an indicator for whether the household is urban; and an indicator for survey year. Expenditure and income include both monetary and nonmonetary flows with the top 1 percent of values trimmed, and are converted to weekly December 1999 pesos. United States: The sample is restricted to households where the ATUS respondent was aged 25–80. Coefficients reported are from OLS regressions of log household time spent in food preparation and cleanup on log weekly expenditures listed in the table. Controls were chosen for consistency with the Mexican data. Controls include indicators for ATUS respondent gender, education level, student status, employment status, presence of a spouse and employment status of that spouse, as well as respondent age, weekly income, weekly hours worked, and spouse's weekly hours worked. Household level controls include adult equivalent household size; the numbers of men, women, young age dependents, and old age dependents in the household; and indicators for whether the household is urban, state of residence, and month and year of survey, whether the survey was conducted on a weekend or holiday, and whether the ATUS survey was conducted within a year of the CPS survey. Expenditure and income information are converted to December 1999 dollars. Time use has been scaled to the weekly household level for comparison with the ENIGH estimates.

   ***Significant at the 1 percent level.
   **Significant at the 5 percent level.
   *Significant at the 10 percent level.

Source: Data for Mexico were drawn from a merged ENIGH-ENUT database for 1996 and 2002. Data for the United States were drawn from a merged ATUS-CPS-FSS database for the period 2003–2011.

of shifting individuals' time towards household tasks, pinning down this elasticity more precisely, for a larger range of commodities and across a larger set of countries, is likely a valuable avenue for future research.

C. *Economic Development and Marketization Bias in Mexico and the United States*

Even if the elasticity of substitution between time investments and market expenditure inputs for specific commodities were similar across countries, the extent of marketization bias could still vary across countries. This is because the expenditure share devoted to commodities with higher elasticities may be larger in one economy than in another. This section contrasts the pattern of expenditure in Mexico with that in the United States. Examining recent growth in Mexico, I consider the possibility that the process of economic development exacerbates the wedge between consumption and measured expenditure in rapidly growing economies.

TABLE 7—EXPENDITURE SHARES, MARKETIZATION, AND DEVELOPMENT IN MEXICO AND THE US

| | Average annual growth | | Expenditure share | | |
| | Unconditional | Conditional | Mexico | | United States |
	1984–2006 (1)	1984–2006 (2)	1984 (3)	2006 (4)	2006 (5)
Panel A. Aggregate economy					
Household expenditure	0.026	0.029			
Household income	0.026	0.032			
Panel B. Sectors of the economy					
Durable goods	0.023	0.024	0.072	0.066	0.166
Non-durable goods	0.010	0.015	0.601	0.434	0.302
Services	0.047	0.046	0.327	0.501	0.533
Panel C. Expenditures with potential for nonmarket substitution					
Food and alcohol	0.005	0.010	0.416	0.273	0.160
Food consumed at home	−0.003	−0.005	0.334	0.181	0.083
Food consumed out	0.022	0.045	0.079	0.088	0.065
Domestic service	0.049	0.036	0.006	0.011	0.003
Household operation	0.013	0.017	0.005	0.004	0.012
Primary/infant care	0.084	0.071	0.001	0.006	0.008
Personal care services	0.034	0.044	0.004	0.005	0.007
Recreational services	0.038	0.061	0.015	0.020	0.025
All 5 (non-food) categories	0.040	0.048	0.031	0.045	0.055

Notes: Growth rates are calculated using per capita income and expenditure figures in constant pesos. Conditional growth rates and expenditure shares are calculated using household level data, conditioned among households where the head is male and aged 35–50 and the household is urban. All results are survey weighted.

Source: Estimates in columns 1–4 are based on author's calculations using ENIGH surveys for 1984 and 2006, and in column 5 using 2006 CEX data.

Table 7 presents expenditure shares for commodities such as food, childcare, and domestic service, for which there are commonly associated household production substitutes (i.e., household activities which would satisfy Reid's (1934) "third party criterion"). Stark differences are immediately evident in comparing expenditure shares for Mexico and the United States for 2006 in columns 4 and 5, respectively. As can be seen from the broad sectoral breakdown, services comprise a similar share of the economy in both countries. At the same time, consumer expenditure in the United States is more heavily weighted toward durables and expenditure in Mexico is more heavily weighted toward nondurables. This difference appears attributable in part to the relatively larger expenditure share on food among Mexican households. To the extent that food consumption is smoother than expenditure on food, this implies excessive volatility in a commodity that alone comprises more than one quarter of total consumption expenditure in the Mexican economy, a much larger share than for the United States.

Table 7 also presents statistics on growth and expenditure shares for the Mexican economy over the sample period. Changes in the pattern of income and consumption among ENIGH households over the period 1984–2006 are suggestive of a growing economy becoming increasingly marketized over time. Column 1 reports

that consumption expenditure grows over this period, with households experiencing an unconditional average annual growth rate of 2.6 percent for real consumption expenditure and of 2.6 percent for real income. As Mexican households become more affluent, the composition of the typical consumption bundle shifts from nondurable goods to services, as seen in columns 3 and 4. This shift is in large part due to declines in the expenditure share on food, which falls from 42 percent to 27 percent of the average household budget over the sample period.

Market expenditure on many commodities traditionally considered to have a high potential for substitution between home and market inputs such as domestic service, personal care, child care, and meals consumed outside the home is presented in panel C. These expenditures increased over the period, both in terms of total consumption and in terms of expenditure share (as evidenced by the faster average annual growth rate for these consumption categories than for overall consumption). This trend suggests increasing marketization as the Mexican economy develops and is consistent with theory in that as incomes increase, the tradeoff between home and market inputs in consumption shifts more in favor of market goods.

The ENIGH sample statistics presented in Table 1 showed that a number of demographic variables evolve over the survey period. Column 2 of Table 7 explicitly conditions the growth rate on demographics to examine the implications of a changing sample. I constrain the sample to a subset of households who report having a male household head between the ages of 35 to 50, and who live in urban areas.[18] While demographic patterns are able to explain some of the total growth we observe, the key finding, that highly marketized sectors grow faster than average consumption expenditure and gain in expenditure share, remains clear (and actually becomes more evident) even after restricting the demographic sample to be similar over time. These patterns suggest that during recent growth, Mexico has become increasingly marketized, but when faced with a contraction, households realized substantial declines in a set of expenditures consistent with demarketization. To the extent that a marketization wedge exists between consumption and expenditure, these patterns should overstate both expansions and contractions in measured expenditure.

D. *Decomposing Volatility in Consumption Expenditure in Mexico and the United States from 1984–2006*

This section employs household expenditure data in Mexico and the United States to identify the fraction of overall volatility in each country that can be attributed to food expenditure and to the expanded set of substitutable commodities examined in Section IIIC. I decompose total expenditure changes into component fluctuations, recognizing that the impact one particular commodity has on aggregate volatility depends not only on the commodity's expenditure share, but also on the extent to which the commodity moves with the rest of the economy.

One way to decompose variance in consumption expenditure is to employ fundamentals from portfolio theory, in which individual assets each contribute to an

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[18] This subset was chosen to be consistent with the other empirical exercises in the paper, but the results were consistent even when conditioning on household size, marital status, and education level.

overall portfolio's volatility. Koenig and Ball (2007) show that for a random variable, such as aggregate consumption expenditure E, $E = \sum_i^I \alpha_i E_i$ is the weighted sum of individual components E_i, where each component has a constant weight α_i and a covariance given by $\mathrm{Cov}(E, E_i) = \rho_{E,E_i} \sigma_E \sigma_{E_i}$.[19] Overall volatility is then given by $\sigma_E = \sum_i^I \alpha_i \rho_{E,E_i} \sigma_{E_i}$. Assuming expenditure shares are relatively stable, we can calculate how much of aggregate volatility is attributable to each individual component of consumption by looking at the product of three factors: individual expenditure shares, correlation with aggregate consumption, and individual volatility.[20]

I undertake the above decomposition for Mexico using the ENIGH expenditure data (previously described), and for the United States using estimates from the Consumer Expenditure Survey (CEX) for the period 1984–2006. The CEX is a highly detailed, nationally representative household income and expenditure survey in the United States, collecting information on approximately 7,000 households on a quarterly basis. I have matched expenditure categories across the ENIGH and CEX surveys, and focus the exercise predominantly on expenditures that have corresponding household production activities, such as food expenditure out, childcare, and domestic service. I also examine the results for broader sectors of the economy for comparison.

Table 8 presents decompositions of consumption expenditure volatility for both Mexico and the United States. Looking first at the broad sectoral breakdown at the top of panel B, it is clear that consumption volatility in both countries is primarily driven by expenditures on services and nondurable goods. It is important to note, however, that durables play a relatively more important role in driving aggregate volatility in the United States. This is consistent with Cecchetti, Flores-Lagunes, and Krause (2006), who note that durable goods are frequently cited as an important factor driving consumption volatility in developed nations. This disparity can be attributed in part to expenditure share differences between the two economies, as shown in Table 7. Throughout the survey period, durables only comprise about 7 percent of total consumption expenditure in Mexico. Thus, even though they are often much more volatile than nondurables and services, they still have only a small impact on overall changes in this setting.

The decomposition of Table 8 shows that expenditure on food and alcohol alone accounts for more than a quarter of total consumption volatility in Mexico—suggesting that a sizeable portion of aggregate expenditure volatility is directly attributable to expenditure in a sector for which the household can easily substitute between own and market inputs during consumption. Extending the exercise to include a range of other expenditures with high potential for nonmarket substitution increases the fraction of volatility accounted for in Mexico to nearly one-third. Over the same period in the United States, food expenditure accounts for only about one-eighth of total volatility. Including the subset of other commodities with a high potential for nonmarket substitution, this proportion rises to roughly one-fifth of total variance. In

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[19] Where ρ represents the correlation coefficient and σ represents the standard deviation.
[20] Expenditure shares are in fact slowly changing over time. As an approximation, I employ the average expenditure share over the entire period for both Mexico and the United States.

TABLE 8—VARIANCE ACCOUNTING IN MEXICO AND THE U.S.

	Mexico	United States
Panel A. Aggregate consumption volatility		
Standard deviation of the growth rate of consumption expenditure 1984–2006	0.062	0.017
Panel B. Share of expenditure volatility by sector and by commodity		
Durable goods	0.102	0.277
Nondurable goods	0.375	0.294
Services	0.530	0.434
Panel C. Expenditures with potential for nonmarket substitution		
Food and alcohol	0.256	0.127
Food consumed at home	0.108	0.022
Food consumed out	0.135	0.095
Domestic service	0.010	0.001
Household operation services	0.007	0.017
Primary/infant care	0.006	0.018
Personal care services	0.003	0.014
Recreational services	0.019	0.026
All 5 (nonfood) expenditure categories	0.044	0.076

Notes: The covariance decomposition method is an approximation, and aggregating shares of total volatility across individual components will not sum perfectly to 100 percent. Cash and pension contributions are excluded from consumption expenditures. See text for additional details.

Source: Estimates are based on author's calculations using ENIGH and CEX data over the period 1984–2006.

sum, the decomposition reveals that expenditure fluctuations in Mexico, in comparison to the United States, are more heavily driven by a range of sectors with a high potential for nonmarket substitution. In addition to proportionally higher variance, the set of commodities examined also contribute a significantly larger amount of variance in absolute terms in Mexico, as implied by the higher level of aggregate consumption volatility (panel A).[21]

E. *A Comparison of Consumption Expenditure Fluctuations during the Peso Crisis and the Great Recession*

During the study period, both Mexico and the United States experienced rather large aggregate shocks. Table 9 provides a comparison of expenditure fluctuations during Mexico's Peso Crisis with that of the US's Great Recession, using household survey data on expenditure in both countries. Columns 1 and 3 present the percentage change in each expenditure category during these crises, while columns 2 and 4 present the share of the overall expenditure fluctuation attributable to each individual category. This is done simply by calculating the change in household expenditure on a particular commodity and dividing by the overall decline in household

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[21] The period examined in Table 8 is one of rather high consumption volatility for Mexico and rather low volatility for the United States. As a check that the results are not driven by specifics of this time period, online Appendix B3 documents that these qualitative patterns are robust to examining alternative sample periods and survey frequencies.

TABLE 9—EXPENDITURE FLUCTUATIONS OVER THE PESO CRISIS AND THE GREAT RECESSION

	Mexico's Peso Crisis 1994–1996		US Great Recession 2007–2010	
	Percent change in expenditure (1)	Share of fluctuation (2)	Percent change in expenditure (3)	Share of fluctuation (4)
Panel A. Aggregate economy				
Household expenditure	−0.244		−0.080	
Panel B. Sectors and components of expenditure				
Durable goods	−0.306	0.082	−0.209	0.423
Nondurable goods	−0.189	0.358	−0.085	0.314
Services	−0.288	0.561	−0.039	0.263
Panel C. Expenditures with potential for nonmarket substitution				
Food and alcohol	−0.182	0.226	−0.056	0.109
Food consumed at home	−0.123	0.107	−0.005	0.006
Food consumed out	−0.320	0.114	−0.108	0.084
Domestic service	−0.404	0.021	−0.102	0.004
Household operation	−0.413	0.007	0.072	−0.011
Primary/infant care	−0.271	0.005	−0.145	0.015
Personal care services	−0.398	0.009	−0.068	0.006
Recreational services	−0.332	0.019	−0.057	0.020
All 5 (nonfood) categories	−0.364	0.060	−0.046	0.034

Notes: Share of fluctuation in columns 2 and 4 are calculated as change in consumption expenditure in a given category divided by overall change in consumption expenditure. All expenditures are deflated. Cash and pension contributions are excluded from consumption expenditures.

Source: Estimates are based on author's calculations from the ENIGH surveys for the period 1994–1996 and CEX surveys from 2007–2010.

expenditure over these crises. Panel A examines overall expenditure, while panel B examines both sectors and specific commodities.

Focusing first on Mexico, we see in column 1 that from 1994 to 1996 expenditure on durables and services declined dramatically.[22] However, the small expenditure share households devoted to durables means that over half of the aggregate change in expenditure can be explained by declining expenditure on services, as seen in column 2. In terms of expenditures with a high potential for nonmarket substitution, we see that expenditure on food out and all five nonfood substitutable commodities fell much more rapidly than overall spending, contributing significantly to the overall size of the downturn.[23] These patterns are indicative of households reallocating away from highly marketized expenditures during the crisis, and with the reallo-

[22] This is consistent with McKenzie (2006), which documents that consumers altered the timing and composition of consumption over the Peso Crisis, and shows that one method Mexican consumers used to respond to the crisis was to postpone purchases of durables. Note that estimates presented for total consumption expenditure and food consumption expenditure differ from those of Table 3 since the present table includes the full sample. Because of its analysis of employment shocks, Table 3 focuses on the working age population in Mexico.

[23] Some of these declines may have been offset by increases in the expenditure share of substitutes requiring higher levels of home time inputs. For example, while spending on domestic services declined by 39 percent from 1994–1996, the budget share devoted to purchasing household cleaning products increased (not shown), suggesting that households may be substituting their own labor for what was previously a service purchased in the market.

cations contributing substantially to the overall size of the downturn in measured consumption expenditure.

Columns 3 and 4 replicate this exercise for the Great Recession in the United States, examining the period 2007–2010.[24] While the overall shock in the United States was smaller than the Peso Crisis, there are a number of interesting comparisons to be made. First, expenditure on durable goods falls to a much larger degree relative to the overall size of the expenditure shock in the US case. A comparison of panel B in columns 2 and 4 suggests that consistent with the volatility decomposition of Table 8, durables drive a much larger share of expenditure volatility during the Great Recession than during the Peso Crisis. Second, unlike during the Peso Crisis in Mexico, many of the substitutable expenditures either decline to a smaller degree relative to total expenditure or actually rise (i.e., household operation expenditures) over the crisis in the United States. In fact, of the selected commodities, only expenditures on food away from the home, domestic service, and child care fall by more than total consumption expenditure. Column 4, which incorporates differences in the expenditure share devoted to these commodities, paints a clearer picture of the role of these commodities in driving the crisis. As can be seen from the table, while the Great Recession induced some demarketization in the United States, the overall impact of this behavior on consumption volatility is much smaller than during the Peso Crisis.

F. Marketization Bias across Countries

To what extent could marketization bias vary across countries more broadly? The analysis so far has shown that households substitute between food expenditure for the home and food expenditure away from the home in response to shocks, and that food expenditure is a significant source of volatility for both the United States and Mexico. This result suggests that comparing expenditure shares on food across countries should be a reasonable place to start answering this question. Research by Regmi et al. (2001) has shown that lower income economies spend significantly more of their budgets on food (47 percent) than both middle-income (29 percent) and high-income economies (13 percent).[25] Figure 2 presents food expenditure shares by income for a range of developed and less-developed countries. These shares are declining in income, and the clear downward slope illustrates Engel's Law. Because food is a larger share of the economy, and a commodity for which the scope of household substitution in consumption has been shown to be sizeable, expenditure measures should be more misleading in these economies.

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[24] In the CEX surveys, 2010 captures the trough in annual estimates of consumption expenditure.

[25] In their study, low-income economies are defined to have less than 15 percent of US GDP, middle-income economies to have 15–50 percent, and high-income economies to have over 50 percent. If households in less developed countries are more likely to substitute own time for market time in the production of food in response to changing wages, then we might expect to observe larger expenditure responses to changes in income and thus higher income elasticity of food expenditure in these settings. This is indeed the case, as low-income economies additionally have much higher income elasticity for food expenditure (0.73) compared to middle- (0.58) and high-income economies (0.29). Most emerging market economies fall into the middle-income category and have income elasticities roughly five to six times that of the United States (Seale, Regmi, and Bernstein 2003).
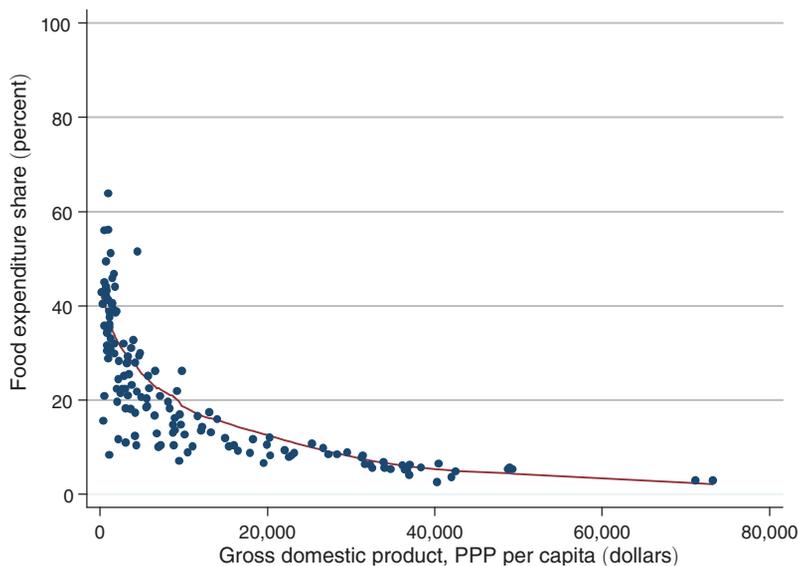
FIGURE 2. ENGEL'S LAW

Notes: Food expenditure data was drawn from the 2005 International Comparisons Program. GDP data was drawn from the Penn World Tables 7.1. A locally weighted regression line has been added.

This paper has presented evidence that Mexico has become increasingly marketized during the process of economic growth over the past two decades, and that the economy rapidly demarketized during the large, permanent shock of the Peso Crisis. Together with the evidence on food expenditure shares, this suggests that marketization bias has the potential to be a larger structural issue for emerging markets, as these economies are characterized by both rapid growth and a higher than average frequency of large shocks. While further research is still needed to precisely pin down the elasticity of substitution between home and market inputs in consumption across countries and to do so for a broader range of commodities, it is clear that the composition of aggregate consumption expenditure varies both across countries and over time with development in ways that could cause the extent of marketization bias to vary across countries.

IV. Conclusion

Changes in marketization complicate the issue of identifying the impact of economic fluctuations using expenditure measures. Consistent with recent research on the United States, this paper presents evidence that Mexican households substitute own time in place of market expenditure in food consumption in response to income fluctuations. Mexican households make this substitution both within and across commodities based on permanent income, but only across commodities in response to transitory income shocks. An examination of expenditure over the course of the Peso Crisis reveals a behavioral response more consistent with a shock to permanent

income than one to transitory income, as the shock forced households to substitute both within and across commodities.

Household time investments drive a wedge between the final level of commodities consumed and the observed level of expenditure. Expenditures with a high potential for substitution with nonmarket inputs have a large impact on volatility in Mexico, and a variance decomposition over the period 1984–2006 confirms that nearly one-third of overall consumption expenditure volatility can be attributed to these expenditures. During the Peso Crisis, food expenditure alone accounted for nearly one-quarter of the fall in total expenditure, with half of this fraction representing household decisions to refrain from consuming meals away from home. A comparative analysis of food expenditure and time use in Mexico and the United States demonstrates that the wedge between expenditure volatility and consumption volatility is greater in Mexico than in the United States and may vary across developed and developing economies more generally.

The extreme volatility of emerging market consumption is an active topic in the study of aggregate fluctuations, and the high level of volatility observed in national account statistics are present in household surveys as well. Nevertheless, a case can be made for using surveys to supplement GDP statistics in ways that may potentially reduce marketization bias. For example, when statistical agencies are faced with a methodological decision on how to treat nonexchanged commodities outside the traditional production boundary, rather than calculating consumption as a residual derived from production estimates, a more appropriate treatment might be to derive updated estimates from surveys when they are available. Similarly, household surveys could be used to more frequently update estimates of the level of intermediate consumption, which should be affected by household substitution in consumption. Researchers in general can look for ways to move beyond or supplement expenditure-based measures of economic activity.

This study provides an alternative explanation for the extremely high level of observed consumption volatility in emerging markets—bias induced through marketization during growth and demarketization during large shocks. The severity of marketization bias appears to vary in a systematic way with the level of development of an economy, exacerbating cross-country volatility differences and distorting commodity-specific comparisons of volatility. This work highlights the fact that inaccuracies in the measurement of the level of economic activity can be muted or amplified over the course of the economic cycle, leading to misleading estimates of volatility. Recognizing that expenditure is more volatile than the final consumption of commodities is important for accurately understanding the welfare implications of shocks, for producing relevant policy, and for undertaking cross-country analysis.

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