The Consumer Response to the Mexican Peso Crisis*

David J. McKenzie†

Development Research Group, The World Bank

Revised March 2006

Abstract

Household expenditure surveys are used to examine the effects of the Mexican peso crisis on household consumption. The main smoothing mechanism was a change in the composition of consumption, with households reducing semi-durable spending to maintain basic food levels. This paper provides a method for disentangling income, price, demographic, and crisis adjustment effects and finds that households increased their expenditure share on certain basic food items even more than Engel's law and relative price changes would predict. I hypothesize that this reflects the use of semi-durables as an adjustment mechanism, and show this leads to changes in the shape and position of the Engel curves. However, the paper can not fully rule out the alternative explanation that the reduction in semi-durables reflects households reducing semi-durable stocks due to a perceived fall in permanent income from the crisis.

JEL Classifications: D12, O12, E32

Keywords: crisis adjustment; Engel effect; consumption composition; semi-durables

*I thank Christopher Udry, T. Paul Schultz, Jonathan Morduch, Dirk Krueger, the editor, two anonymous referees, and seminar participants at Yale University, the University of California, Berkeley, the University of Maryland, Stanford University, the NEUDC Conference and the IDB/IFPRI "Crises and Disasters" conference for their comments and suggestions. Support from a Sasakawa Fellowship and Cowles Foundation Prize is gratefully acknowleged.

†E-mail: dmckenzie@worldbank.org; Fax: (202) 522-3518; Mailing Address: The World Bank, MSN MC3-300, 1818 H Street N.W., Washington D.C. 20433.

1 Introduction

Following the forced devaluation of the peso on December 20, 1994, Mexico faced its worst economic crisis since the Great Depression. Real GNP per capita fell 9.2 percent in 1995 and mean manufacturing wages fell by 21 percent over the 1994-96 period. Household expenditure fell by 15 percent over this period, with households having little success in smoothing total consumption. This paper investigates the extent to which changes in the composition of consumption acted as an adjustment mechanism for households.

Mexican household income and expenditure surveys are used to investigate changes in consumption over the crisis period. The peso crisis is shown to have had an extremely widespread impact, lowering income and consumption for all age groups and education levels. The composition of consumption changed dramatically in response to the crisis, with households reducing expenditure on luxury goods, postponing durable and semi-durable consumption, and increasing expenditure shares on food staples. As a consequence, food expenditure fell by much less than overall expenditure.

This pattern of reallocation of expenditure towards food staples is a common experience during financial crises.[1] One explanation is Engel's law, which predicts an increase of expenditure shares on necessities, such as food, in response to a fall in income. Secondly, food inflation typically exceeds overall inflation during financial crises, due to the tradable nature of food. As demand for basic food may be relatively price inelastic, relative price changes may therefore also help account for the observed changes in expenditure shares. This paper uses pre-crisis data to fit an Engel curve for each consumption item and then employs the change in relative prices and total expenditure experienced by households during the Mexican peso crisis to predict crisis-period expenditure shares. I find that expenditure shares on food staples, such as cereals and grains, eggs and oils and fats, and education and leisure goods expenses increased by more than Engel's law and relative price changes would predict, whereas clothing, entertainment equipment, glassware and bedding, primary health care, and meals out all fell by more than predicted. That is, there was an additional crisis adjustment effect.

One explanation for this adjustment is that liquidity-constrained households are using their stocks of semi-durables, such as clothing, as an internal capital market, allowing them to further smooth non-durables (Browning and Crossley, 2001). I present a formal model of choice between semi-durables and non-durables

for a liquidity-constrained consumer, which enables determination of how expenditure shares and Engel curves can shift intertemporally in response to a large temporary income shock. The model shows how expenditure shares can change by more than relative price changes and intratemporal Engel's curves would predict, in accordance with my empirical results. This analysis also demonstrates that the use of semi-durables as an adjustment mechanism can change the shape of the intratemporal Engel curve, as well as its position, which I also find evidence for during the peso crisis. This adjustment mechanism is found to have enabled consumers to maintain quantities of tortillas, beans, rice, onions and pasta, although quantities of milk, meat, and fresh fruit fell. Together with a reduction in the expenditure share on health care, this suggests that consumers were also using their health stocks as a semi-durable with which to adjust to the crisis.

An alternative explanation for the fall in semi-durable expenditure is that households may have perceived the crisis as a permanent income shock, leading them to spend down their stock of semi-durables to the optimal post-crisis level. This would also result in a short-run decrease in semi-durable expenditure shares, but would not reflect a desire to lower semi-durables *below* equilibrium levels in order to smooth basic foods. Without data on stocks of semi-durables or on individual expectations I am unable to fully rule out such an explanation. However, suggestive evidence favoring the smoothing hypothesis is provided by finding that, conditional on income, households that were potentially less liquidity-constrained lowered semi-durables less.

In related work, Cunningham and Maloney (2003) use quantile analysis with a rotating panel to identify vulnerability during the peso crisis. They find that most families were unable to prevent large income shocks from being realized, but that less-educated households experienced more rapid income recovery after the crisis. Attanasio and Székely (2004) test whether Mexican households were able to insure idiosyncratic risk during the 1990s. They reject the full insurance hypothesis and find that relative consumption responds to relative wage changes. Together these two papers show that households were unable to prevent large changes in income or total consumption during the crisis. McKenzie (2003) examines other adjustment mechanisms to the crisis, including changes in household structure, fertility, labor supply, and interhousehold transfers, finding a decline in fertility during the crisis, but little change in household labor supply or household structure. In light of these results, the evidence provided in the current paper on adjustments in the

consumption basket appear to be one of the most important adjustment mechanisms for households during the Mexican crisis.

Macroeconomic crises appear to be a recurrent phenomena in much of the developing world, with Lustig (2000) counting over forty cases in Latin America along in which per capita GDP fell by four percent or more during the period 1990-98. Financial crises in recent years in East Asia, Brazil, Turkey, Russia and Argentina have all attracted widespread attention. The Mexican household survey data we use here are one of the most detailed consumption surveys available for developing countries, allowing a much more detailed analysis of changes in consumption patterns than is possible in many other afflicted countries. The results here therefore should also enhance our understanding of crises elsewhere in the developing world.

The remainder of the paper is organized as follows. Section 2 provides further detail on the macro effect of the crisis. Section 3 describes the household survey data, and shows the household level impact of the aggregate shock. Section 4 considers the differential impact of the crisis across groups and examines how the composition of consumption changed during the crisis. Section 5 attempts to disentangle income and price effects by fitting Engel curves over pre-crisis data and predicting crisis-period expenditure. Section 6 provides a model of consumer smoothing through semi-durables to explain these results. Section 7 examines an alternative explanation for the change in semi-durable expenditure shares, while Section 8 considers how successful consumers were at smoothing quantities of basic food. Section 9 concludes.

2 Mexico's Macroeconomy during the 1990s

The 1980s was a period of economic stagnation in Mexico, with the debt crisis and oil price shocks combining to leave real GDP per capita lower at the end of the decade than at the beginning. Mexico enjoyed some recovery and growth between 1990 and 1994, and in mid-1994, international observers forecasted high growth and stability for the coming year.[2] However, following a drain on its foreign exchange reserves, Mexico devalued its peso by 40% in December 1994, leading to capital flight, a stock market crash, the loss of 2 million jobs, and plummeting real incomes. Between the outbreak of the peso crisis in January 1995 and July 1997, average remuneration in manufacturing fell almost 40 percent (Lustig, 1998, p. 211). Figure 1 plots the annual growth rates in real GDP, real consumption, and real manufacturing and commerce wages[3]

over the period 1989-2002. The effect of the crisis is clearly seen, with large negative growth in 1995. Private consumption growth closely tracks GDP growth over time, and actually falls by more during the crisis, although by less than real wages. There is thus at most only limited aggregate smoothing of consumption. Real wages fell by more than real GDP during the crisis, and took longer to recover, falling in 1996 as well as in 1995. The last four years of the decade saw recovery, with GDP growing at an average of 5.1% per year between 1996 and 2000, and inflation falling below ten percent, before world events took the economy into a slight recession in 2001.

3 The ENIGH Survey data

Household surveys of income and expenditure in Mexico have been carried out at irregular intervals since 1950, however only the Encuesta Nacional de Ingreso-Gasto de los Hogares (ENIGH) surveys from 1984 onwards are comparable.[4] The ENIGH surveys are nationally representative, and were carried out during the third quarter of each survey year. I work with all available rounds of the ENIGH from 1989 to 2000. The size of the survey varies from year to year, with 11,535 households surveyed in 1989, 10,530 in 1992, 12,815 in 1994, 14,042 in 1996, 10,952 in 1998 and 10,108 households surveyed in 2000. The majority of the analysis uses the 1992-98 surveys. The surveys contain extremely detailed information about the expenditure of each household, together with information on income after taxes and social security contributions, capital expenditure, and demographic variables. A household is defined as a group of people who habitually reside in the same dwelling and who are sustained by common expenditure on food. Individuals who live together but who do not share expenditure on food with one another are defined as distinct households (INEGI, 1998). McKenzie (2003) finds that household composition remained fairly constant over the crisis period, with young adults no more likely to live with their parents, and the elderly no more likely to live with their children or other relations, in 1996 than in 1994.

Non-durable consumption is calculated by subtracting the following expenditures from total consumption: expenditures on furniture and household appliances, leisure and entertainment equipment including audiovisual and photographic equipment, vehicles and orthopedic and therapeutic items. This definition closely follows that used by Attanasio and Székely (1998) and Villagómez and Solís-Soberón (1999). Income

is net income from all sources excluding income from capital transactions, such as the sale of a house, vehicle, animal or jewellery, and money received in the form of loans, or from closing a bank account.[5] Income is net of taxes and contributions to social security. Following Villagómez and Solís-Soberón (1999), the data were deflated into 1994 pesos using the Banco de Mexico's consumer price index for the month of September in each survey year, the mid-point of the quarter-long survey period.

3.1 Consumption and Income Growth at the Household Level

To determine whether the aggregate shock shows up in the household survey data, I calculate real household consumption and income growth from the ENIGH surveys. I consider households with heads aged 25-65 years grouped by the education level of the household head: primary education or less (6 years schooling or less); junior high (7-9 years of schooling); high school (10-12 years of schooling); and college (more than 12 years of schooling). The ENIGH surveys are repeated cross-sections, and not a panel, so we cannot follow different income quintiles over time, but as education remains fixed for heads aged 25 years or older, we can look at different socioeconomic impacts of the crisis by comparing households with heads of different levels of education. Figure 2a plots annualized real household consumption and income growth rates over 1989-2000 for low-schooled households, and Figure 2b plots the same variables for more-educated households. Both figures show clearly the same pattern as the macroeconomic data, with consumption growth tracking income growth, and large negative growth between 1994 and 1996 as a result of the crisis, followed by some recovery. Consumption falls for all education groups during the crisis, but by slightly less than income. Real income falls by 26 percent between 1994 and 1996 for households with primary education or less, and by about 35 percent over the same period for each of the other three education levels. These income declines are of similar magnitude to the aggregate fall in real wages seen in Figure 1.

4 Response to the Peso Crisis

4.1 Differential Impacts of the Crisis

To examine further how widespread the peso crisis shock was, and the differential impact of the crisis across socio-economic classes in Mexico, households are classified further into groups according to the age and education of the household head and the population of the city, town or village where the household is located. The change in mean real log income and mean real log consumption per capita between 1994 and 1996 is then calculated for different groups of household characteristics in Table 1.

The peso crisis is seen to have had a widespread impact on incomes and consumption, with all age groups and educational levels experiencing declines. However, more highly educated heads and those living in metropolitan areas experienced much larger declines in income than unschooled heads and rural households. The differential impact is much less amongst age cohorts than educational cohorts and rural-urban groups, although younger workers as a group experienced a slightly greater decline in income, due to the higher average education level of the young.

Changes in overall consumption per capita are closely related to the changes in income. For all groups, total consumption falls slightly less than income. However, the declines in consumption expenditure are still large, showing that consumption was not shielded from the effects of the crisis. For the households sampled, durable consumption fell 27 percent compared to a 18 percent decline in non-durable expenditure and a 9 percent decline in food expenditure, suggesting that households reacted to the crisis by changing the composition of consumption.

4.2 Changes in the Composition of Consumption

Changes in the composition of monetary expenditure are examined further in Table 2. Mean expenditure shares are calculated separately for low-education and high-education households over the pre-crisis (1992-94), crisis (1994-96) and recovery (1996-98) periods. Welch tests reject equality of expenditure shares across pairs of years for most goods.[6] The most significant changes are seen during the crisis period, where food, cereals and grains, eggs, oils and fats, and clothing all have Welch t-statistics above nine, whereas no good

had a Welch statistic this high over the pre- or post-crisis periods.

Total food expenditure accounted for an additional 3.5 percent of total expenditure for low-education households in 1996 than in 1994 and an additional 2.4 percent of total expenditure for more-educated (richer) households. Within food, there was a shift towards basic staples, with significant increases in the expenditure shares devoted to cereals and grains (which includes tortillas, rice and bread), milk, eggs, oils and fats and vegetables. In contrast the share of expenditure on fruit and meals consumed outside of the home fell, while the share going to alcoholic beverages and desserts and sweets also declined significantly for households with less-educated heads.

Among other expenditure categories, we see a decline in the expenditure share allocated to durables and semi-durables such as clothing, household goods, glassware and bedding, furniture, and entertainment equipment. Expenditure shares of these goods then rise during the recovery period 1996-98, suggesting households were postponing semi-durable and durable purchases. The expenditure shares on leisure fell and house cleaning and care expenses also fell significantly for more-educated households.

Both low-education and high-education households are found to have increased their expenditure share on education during the crisis, although only significantly so for the less-educated households. This contrasts with the findings of Frankenberg et al. (1999) in Indonesia who find a reduction in education expenditure. However, as in Indonesia, the use of primary health services declined substantially among the less-educated.[7] Transfers to non-household members and donations also experienced relative declines amongst less-educated households, increasing again during the recovery period. McKenzie (2003) examines further the changes in transfers during the crisis, finding that while domestic transfers fell, households reported receiving more transfers from abroad, providing evidence that international risk-sharing was possible.

4.3 Changes in Relative Prices

One potential explanation for the changes in the composition of expenditure detailed above is that they represent relative price changes. Table 3 details inflation rates by expenditure category over the periods of interest. Food prices are found to have increased by more than the overall consumer price index and by more than any other category apart from entertainment equipment. Moreover, as will be shown in Table

5, relative prices for most staple food items increased during the crisis. The result is that official inflation for households earning less than the minimum wage was 10 percent higher over the 1994-96 period than for households earning six times the minimum wage or higher. Meals out showed the lowest increase in prices, reflecting the large non-traded component of this category, and similarly education and health prices increased less than the overall CPI. As demand for basic foods is likely to be relatively price inelastic, relative price changes may therefore also explain part of the observed increase in expenditure shares for staple food. The next section explores this possibility.

5 Disentangling price, income and crisis mitigation effects

The above analysis shows dramatic changes in the expenditure shares of certain commodities during the crisis period. The direct effect of the fall in income caused by the crisis is an Engel's law effect, whereby households reduce their expenditure shares on luxuries and consume relatively more of necessities. We now investigate whether Engel's law and relative price changes are sufficient to explain the changes in expenditure shares observed, or whether it appears that households made additional adjustments in expenditure shares in an attempt to mitigate the effects of the crisis. Price series are available for 1992 and 1994 for 25 out of the 32 states of Mexico[8], and so we restrict our sample to these 25 states for this analysis.

I begin by specifying a standard Engel curve linking household expenditures on individual goods to total expenditure and to the demographic composition of the household. The functional form used is the budget share form of the almost ideal demand system of Deaton and Muellbauer (1980, p. 313), extended by Deaton (1997, p.231) to incorporate demographics:

$$\begin{aligned} \omega_{i,j,t} &= \alpha_i + \beta_i \ln\left(\frac{x_{j,t}}{n_{j,t}}\right) + \phi_i \left[\ln\left(\frac{x_{j,t}}{n_{j,t}}\right)\right]^2 \\ &\quad + \eta_i \ln\left(n_{j,t}\right) + \sum_{k=1}^{K} \gamma_{i,k} \left(\frac{n_{k,j,t}}{n_{j,t}}\right) + \tau_i' z_{j,t} + u_{i,j,t} \ . \end{aligned} \tag{1}$$

Here $\omega_{i,j,t}$ is the budget share of good i for household j at time t, x is total household expenditure, n_l is the number of people in the household in age-sex class l, z is a vector consisting of dummy variables for the sex and employment status of the household head, which might exert a separate influence on expenditure patterns,

and $u_{i,j,t}$ is the error term. The demographic controls provide good-specific equivalence scales, allowing for household size and demographic composition to have different impacts across expenditure shares. Banks, Blundell and Lewbel (1997) find that while linearity in log expenditure appears to be sufficient to explain expenditure shares for food and fuel in the United Kingdom, quadratic terms are needed for clothing and alcohol. The inclusion of the quadratic term then allows goods to be necessities at some income levels and luxuries at others.

In standard formulations (e.g. Deaton, 1997), $x_{j,t}$ is current household expenditure.We can write current expenditure as equal to permanent income, $I_{j,t}$ plus any unsmoothed shock, $s_{j,t}$, which causes current expenditure to deviate from permanent income:

$$x_{j,t} = I_{j,t} + s_{j,t} \tag{2}$$

Then we can allow for the possibility that changes in the budget shares allocated to semi-durables are used to smooth temporary shocks by adding the term $\delta_i s_{j,t}$ to equation (1), giving:

$$\begin{aligned} \omega_{i,j,t} &= \alpha_i + \beta_i \ln\left(\frac{x_{j,t}}{n_{j,t}}\right) + \phi_i \left[\ln\left(\frac{x_{j,t}}{n_{j,t}}\right)\right]^2 \\ &\quad + \eta_i \ln\left(n_{j,t}\right) + \sum_{k=1}^{K} \gamma_{i,k} \left(\frac{n_{k,j,t}}{n_{j,t}}\right) + \tau_i' z_{j,t} + \delta_i s_{j,t} + u_{i,j,t} \ . \end{aligned} \tag{3}$$

We then hypothesize that $\delta_i > 0$ for semi-durables, and correspondingly, $\delta_i < 0$ for basic foods that semi-durables are used to smooth.[9]

One explanation for the large changes in expenditure shares seen in Table 2 is that they represent purely an Engel curve effect. The peso crisis caused current expenditure to fall, which leads households to reduce the expenditure shares of luxuries and increase the shares of necessities. To determine whether expenditure shares for some items changed by more than the income effect of Engel's law would suggest, we first fit (1) using the 1992 and 1994 cross-sections of household level data, deflating expenditure using the Consumer Price Index to real 1994 pesos. We assume that in this pre-crisis period any shocks are idiosyncratic, and uncorrelated with permanent income or household characteristics. Then estimation of (1) , omitting the

unobserved $s_{j,t}$ which appears in (3) still yields consistent estimates of the β_i.

Using the fitted coefficients, I then use (1) with the 1996 explanatory variables to obtain predicted 1996 expenditure shares, $\widehat{\omega}_{i,j,t+2}$, together with the accompanying prediction errors.[10] Aggregating over households, one can then compare the actual expenditure share to the predicted one for each expenditure category. Testing whether the actual and predicted expenditure shares differ significantly then allows one to determine whether income effects alone can account for the changes in the composition of consumption observed. At the aggregate level the difference

$$\widehat{\omega}_{i,t+2} - \omega_{i,t+2} \rightarrow \delta_i s_{t+2} \tag{4}$$

Testing whether this difference is zero is thus a joint test of no smoothing through semi-durables and/or no transitory shock. A finding that $\widehat{\omega}_{i,t+2} < \omega_{i,t+2}$ for semi-durables then implies that either $\delta_i > 0, s_{t+2} < 0$ or $\delta_i < 0, s_{t+2} > 0$. I use the former interpretation, since the latter would imply that current expenditure is higher than permanent income during a large negative shock and is therefore implausible. The sign of the difference in equation (4) will thus be interpreted as the sign of δ_i.

A potential concern in estimating equation (1) is that total expenditure may be jointly determined with expenditure shares, so that per capita expenditure is endogenous for individual commodity demands. To allow for this possibility I follow Banks, Blundell and Lewbel (1997) in using labor income and its square as instruments for log per capita expenditure and its square.[11] The use of this instrument will also deal with the possibility that measurement error in total expenditure causes a spurious correlation between the expenditure share $\omega_{i,j,t}$, which has expenditure in its denominator, and $\ln\left(\frac{x_{j,t}}{n_{j,t}}\right)$.

Table 4 reports the results of this exercise. The first two columns report the actual mean expenditure shares by item for 1994 and 1996, while columns three to five report the predicted mean in 1996, the prediction error in the mean, and the t-ratio for testing that the difference between the predicted and actual value is zero. A significantly negative t-ratio means that consumers increased their expenditure share on this item by more (or reduced it by less) than would simply be predicted from the cross-sectional Engel curves by the change in total expenditure. According to this analysis, we find that the expenditure shares for cereals and grains, milk, eggs, oils and fats, vehicle services, personal care, and education increased by more than

the direct income effect would predict, while leisure and housing expenses did not fall as much as predicted. In contrast, meat, fish, vegetables, fruits, desserts and sweets, alcoholic beverages, meals consumed outside the house, house cleaning, public transport, clothing, primary health care, entertainment equipment and glassware and bedding all fell by more (or increased by less) than the income effect predicted.

As detailed in Table 3, there were substantial movements in relative prices during the crisis, with prices for basic staples increasing by more on average than prices for durables and many luxuries. To determine whether income effects and relative price movements together can explain the changes in expenditure patterns, equation (1) is modified to include relative prices:

$$\begin{aligned}\omega_{i,j,t} &= \alpha_i + \beta_i \ln\left(\frac{x_{j,t}}{n_{j,t}}\right) + \phi_i \left[\ln\left(\frac{x_{j,t}}{n_{j,t}}\right)\right]^2 + \sum_{h=1}^{H} \lambda_{i,h} \log p_{i,h,t} \\ &\quad + \eta_i \ln\left(n_{j,t}\right) + \sum_{k=1}^{K} \gamma_{i,k} \left(\frac{n_{k,j,t}}{n_{j,t}}\right) + \tau_i' z_{j,t} + \delta_i s_{j,t} + u_{i,j,t} \ . \end{aligned} \tag{5}$$

where $p_{i,h,t}$ is the price of good h paid by household i at time t and again $s_{j,t}$ is unobserved and so forms part of the error term. Household-level prices are only available for food and suffer from the problem that price differences across households are likely to reflect differences in quality (see Deaton, 1997). Therefore I instead use state-level variation in prices, including state-level relative prices and state dummies in the regression.[12] It is then the variability across states in changes in prices relative to the overall CPI change between 1992 and 1994 that is used to identify the relative price effects. One can then use the estimated coefficients with the 1996 price and income data to predict the 1996 expenditure shares accounting for both relative price and income changes.

The last three columns of Table 4 present the results of controlling for both income and price effects. Controlling for relative price movements helps explain some of the deviations between actual and predicted expenditure shares based on only income effects. After controlling for both price and income effects we find that households have higher expenditure shares than predicted on the basic food staples of cereals and grains, eggs, oils and fats, and vegetables. Education and leisure expenditure shares are also higher than predicted. In contrast, they have lower shares than predicted for clothing, entertainment equipment, glassware and

bedding, primary health care, and meals consumed outside of the home.

The increase in education expenditure relative to predicted concurs with the finding of McKenzie (2003) that school attendance rates actually rose for 15-18 year olds during the crisis, which may be attributed to declining labor market opportunities and a decline in the opportunity cost of schooling. Leisure expenses fell during the crisis, but less than predicted, which also may reflect changes in the value of time. Similarly the larger than predicted fall in meals out may reflect households increasing home production due to changes in the opportunity cost of time.

Apart from these changes in consumption patterns due to changes in the value of time, the other results show consumers reducing semi-durables, perhaps including health stocks, by more than predicted in order to raise basic food expenditure shares. The next section explores this explanation further.

6 Intertemporal Shifts in the Engel Curves

The peso crisis was widespread in nature, having a negative impact on incomes of all education levels and age groups. Real inter-bank interest rates rose to almost 40 percent in 1995, with both formal and informal sources of credit drying up. Consumer credit fell 43 percent in real terms in 1995. The reduction in real credit to consumers continued in 1996, with credit card financing declining 43 percent and consumer credit issued for durable goods falling 23 percent (Banco de México, 1996, 1997). This reduction in consumer credit does not simply reflect lower demand for credit, but also a reduction in bank's willingness to grant credit. Haber (2004) shows how the characteristics of the bail-out procedure used in response to the crisis created incentives for banks to hold government securities and make loans to government entities rather than provide credit for private consumption and investment. As a result, private credit by deposit money banks and other financial institutions fell from 33 percent of GDP in 1994 to 20.8 percent of GDP in 1996 (Beck, Demirgüç-Kunt and Levine, 1999).

Liquidity constraints are therefore likely to have been an important factor preventing households from smoothing total household expenditures as much as they would like in response to the crisis. In the presence of liquidity constraints, Browning and Crossley (2001) suggest that households may adjust the timing of their purchases of clothing and other small durable goods in order to finance current non-durable consumption.

In their terminology, households may use their "internal capital market" of semi-durables to borrow from themselves. Empirically they find evidence for this substitution between clothing and food during periods of unemployment in Canada. The evidence that Mexican consumers shifted from clothing and other durables to basic foods, after controlling for Engel curve and price effects, also seems suggestive of this hypothesis. In this section we examine formally how the expenditure shares and Engel curves of liquidity-constrained consumers can shift intertemporally in response to a large temporary income shock.

To formally model how liquidity-constrained households may change their expenditure shares on semi-durables in response to a temporary income shock, I consider a two-good model in which households derive utility from both non-durable and from semi-durable consumption. To isolate the crisis-adjustment effect through semi-durables I shut down credit markets, hold the relative price of non-durables in terms of semi-durables constant at p, and use iso-elastic felicity to eliminate the income effect. Households receive exogenous income in each period and begin their lives with an endowment of semi-durables. Asset markets are assumed to be absent, so that households choose to consume their entire income in each period. The stock of semi-durables depreciates at rate δ each period, where a smaller δ indicates higher durability. Semi-durables, such as clothing, are assumed to be divisible, but the absence of rental markets or good second-hand markets means that they can not be resold. Let C_d denote the stock of semi-durables the household enters the period with, and Y be the current exogenous income. Given the state variables (C_d, Y), the household must choose C_n, its consumption of the non-durable good, I, its semi-durable expenditure in the current period, and thereby C'_d, its stock of semi-durables at the end of the current period. The household's problem in recursive formulation is then:

$$\begin{aligned} V(C_d, Y) &= \max_{I, C'_d, C_n} \frac{\left[C_n^{\alpha} + \gamma \left(C'_d\right)^{\alpha}\right]^{\frac{\rho}{\alpha}}}{\rho} + \beta V(C'_d, Y') \\ &\quad \text{s.t.} \\ C'_d &= (1-\delta)C_d + I \qquad (6) \\ pC_n + I &= Y \qquad (7) \\ I, C_n &\geq 0 \qquad (8) \end{aligned}$$

Utility is assumed to be non-separable in within-period consumption of non-durables and semi-durables, but is additive over time. The iso-elastic felicity function allows non-durables and semi-durables to be either complements ($\rho > \alpha$) or substitutes ($\rho < \alpha$). Equation (6) gives the law of motion for semi-durables given the rate of depreciation δ, (7) gives the within-period budget constraint, and the constraint $I \geq 0$ is due to the absence of rental or resale markets for the semi-durable good. Using (7), the household's problem can be reformulated as a choice problem simply in I

$$V(C_d, Y) = \max_{I \in [0,Y]} \frac{\left[\left(\frac{Y-I}{p}\right)^{\alpha} + \gamma\left((1-\delta)C_d + I\right)^{\alpha}\right]^{\frac{\rho}{\alpha}}}{\rho} + \beta V((1-\delta)C_d + I, Y')$$

subject to (6) and $0 \leq I \leq Y$. Attach Lagrange multiplier μ_1 to the constraint $I \geq 0$ and multiplier μ_2 to the constraint $I \leq Y$. We then look for a policy function $I(C_d, Y)$.[13]

The first order condition of the above maximization problem is

$$\begin{aligned}&\left[\left(\frac{Y-I}{p}\right)^{\alpha} + \gamma\left((1-\delta)C_d + I\right)^{\alpha}\right]^{\frac{\rho}{\alpha}-1} * \left[\frac{-1}{p}\left(\frac{Y-I}{p}\right)^{\alpha-1} + \gamma\left((1-\delta)C_d + I\right)^{\alpha-1}\right] \\ &+\beta V'((1-\delta)C_d + I, Y') + \mu_1 - \mu_2 = 0 \end{aligned} \tag{9}$$

The Envelope theorem implies

$$\begin{aligned} V'(C_d, Y) &= (1-\delta)\left[\left(\frac{Y-I}{p}\right)^{\alpha} + \gamma\left((1-\delta)C_d + I\right)^{\alpha}\right]^{\frac{\rho}{\alpha}-1} * \gamma\left((1-\delta)C_d + I\right)^{\alpha-1} \\ &\quad +(1-\delta)\beta V'((1-\delta)C_d + I, Y') \end{aligned} \tag{10}$$

These two equations will be used to compute the optimal policy $I(C_d, Y)$. Suppose we know the function $V'(.,.)$, which denotes the derivative of the value function with respect to its first argument. Then one can use (9) to solve for $I(C_d, Y)$. Three mutually exclusive cases can arise.

Case 1 *Suppose that at* $I = 0$

$$\begin{aligned} & \left[\left(\frac{Y-I}{p}\right)^{\alpha} + \gamma\left((1-\delta)C_d + I\right)^{\alpha}\right]^{\frac{\rho}{\alpha}-1} * \left[\frac{-1}{p}\left(\frac{Y-I}{p}\right)^{\alpha-1} + \gamma\left((1-\delta)C_d + I\right)^{\alpha-1}\right] \\ & +\beta V'((1-\delta)C_d + I, Y') \\ < \quad & 0 \end{aligned}$$

for some (C_d, Y)*. Then necessarily* $\mu_1 > 0$ *and* $I(C_d, Y) = 0$*.*

Case 2 *Suppose that at* $I = Y$

$$\begin{aligned} & \left[\left(\frac{Y-I}{p}\right)^{\alpha} + \gamma\left((1-\delta)C_d + I\right)^{\alpha}\right]^{\frac{\rho}{\alpha}-1} * \left[\frac{-1}{p}\left(\frac{Y-I}{p}\right)^{\alpha-1} + \gamma\left((1-\delta)C_d + I\right)^{\alpha-1}\right] \\ & +\beta V'((1-\delta)C_d + I, Y') \\ > \quad & 0 \end{aligned}$$

for some (C_d, Y)*. Then necessarily* $\mu_2 > 0$ *and* $I(C_d, Y) = Y$*. With the Inada condition on consumption this will not happen.*

Case 3 *If neither of the above two cases is relevant, then for a given* (C_d, Y)*, the function* $I = I(C_d, Y)$ *solves the nonlinear equation*

$$\begin{aligned} & \left[\left(\frac{Y-I}{p}\right)^{\alpha} + \gamma\left((1-\delta)C_d + I\right)^{\alpha}\right]^{\frac{\rho}{\alpha}-1} * \left[\frac{-1}{p}\left(\frac{Y-I}{p}\right)^{\alpha-1} + \gamma\left((1-\delta)C_d + I\right)^{\alpha-1}\right] \\ & +\beta V'((1-\delta)C_d + I, Y') \\ = \quad & 0 \end{aligned}$$

Exact analytic solutions to this system of equations do not exist, and so the path of optimal non-durable consumption must be solved numerically. However, if we assume that income is constant over the household's lifetime, then equations (10),(9), and (6) can be used to solve for the steady-state semi-durables expenditure

share:

$$\begin{aligned} \frac{I^*}{Y} &= \frac{\delta\kappa}{1+\delta\kappa} \\ \text{where } \kappa &= \left[\frac{1-\beta\left(1-\delta\right)}{p^{\alpha}\gamma}\right]^{\frac{1}{\alpha-1}}. \end{aligned} \tag{11}$$

With iso-elastic felicity, the steady-state expenditure shares are independent of the level of income, and so there are no Engel effects here. The main computational problem in solving numerically for the path of semi-durable purchases is that we do not know $V'(.,.)$. The algorithm for computing the function $I(C_d, Y)$ is to guess a function $V_0'(.,.)$, use (9) to determine $I_0(.,.)$, then use (10) to update the guess to $V_1'(.,.)$ and so on, until V_n' and I_n have converged. The state values are C_d and Y. We carry out the algorithm for different income processes of interest, and approximate the functions V' and I piecewise linearly on $[0, \bar{C}_d]$, that is, I solve for the function on a discrete grid and interpolate linearly in between grid points. Once I have solved for the optimal policy function $I(C_d, Y)$, from any initial values I can then trace out the dynamic paths of semi-durable purchases, semi-durable stock, and non-durable consumption.[14]

I use this apparatus to simulate the adjustment path of non-durable and semi-durable expenditure shares in response to a temporary fall in income. I begin by assuming that household income is constant over their lifetime, $Y = 1$, and solve for the steady-state level of semi-durables stock. Then, given that households are in this steady-state, I lower household income by 20 percent in the next period, raising back to the previous level of income for every period thereafter. Given this temporary income shock, we can then determine whether households adjust their expenditure shares in the absence of relative price and Engel effects. I set $\rho = -1$, $\gamma = 0.3$, $\alpha = 0.2$ and $\beta = 0.96$ and vary the how durable the semi-durable good is by adjusting δ.

Figure 3 shows the adjustment paths of the semi-durable expenditure share for different levels of durability.[15] When $\delta = 1$, the semi-durable is in fact non-durable, and so the expenditure share remains constant over time, since relative prices haven't changed. As the durability of the semi-durable good increases, the semi-durables expenditure share falls by more and more in the period of the shock, resulting in an increase in the non-durables expenditure share. For goods which are sufficiently durable (the case of $\delta = 0.1$ here), the constraint $I \geq 0$ binds and we are in Case 1 above - households would like to sell some semi-durables but can

not, so reduce their expenditure share to zero. In the period after the shock, the semi-durables expenditure share rises above its steady-state level, as they need to purchase more than their steady-state amount to get back to the steady-state stock of semi-durables. This is a numerical demonstration of what Browning and Crossley (2001) refer to as a microfoundation for "pent-up demand". This simulation shows that the more durable a good is, the more it can shield non-durable consumption during a crisis, but that the post-crisis adjustment phase is longer.

The amount of shift in the Engel curve for semi-durables will depend on how substitutable semi-durables are with non-durables, and the size and duration of the income shock. The reduction in semi-durables expenditure share is larger if semi-durables are a substitute for non-durables in within-period consumption, and smaller if they are a complement. The reduction is also larger the larger the size of the shock experienced. However, adjustment is less in the first period of the shock if the fall in income is expected to last for more periods. That is, the slower the expected recovery time from the shock, the less semi-durables adjust in the period that the shock occurs. The model assumes that the shock is known to be temporary in nature. The use of a deterministic model simplifies the computations needed to obtain the transition dynamics and enables us to illustrate the key adjustment mechanisms without having to specify the entire distribution of the shock. If consumers are uncertain as to the duration of the shock, this will lessen the magnitude of the adjustment in the first period, but the qualitative effects will remain the same.

The iso-elastic felicity function used here allows the crisis-adjustment mechanism to be clearly separated from standard income effects. However, as steady-state expenditure shares are independent of income, changes in the slope and shape of the Engel curve can not be examined with this felicity function. A slight moderation of the felicity function is to add a subsistence amount $\overline{C}$ of non-durable consumption, so that within-period utility is now:

$$\frac{\left[\left(C_n - \overline{C}\right)^{\alpha} + \gamma \left(C_d'\right)^{\alpha}\right]^{\frac{\rho}{\alpha}}}{\rho}$$

Under this specification, it can be shown that the semi-durables expenditure share is increasing in income, that is semi-durables are now a luxury good. Figure 4 shows the simulated shift in the semi-durables Engel curve in response to a one-period 20 percent fall in income under this specification of the felicity function.

Not only does the semi-durables expenditure share fall at every level of income above subsistence, but the shape of the Engel curve changes as well.[16] Of course other specifications of the within-period utility function can lead to different Engel curves, but this example illustrates the possibility that the use of semi-durables as an adjustment mechanism can cause the shape of the Engel curves to change.

Figure 5 plots smoothed fitted Engel curves from (1) for three basic staple food items (cereals and grains, eggs, and oils and fats) and three semi-durable goods (clothing, glassware and bedding, and entertainment equipment). The fitted Engel curves show both a change in the level and shapes of the Engel curve, in a manner consistent with the model of adjustment through semi-durables presented here. The Engel curves for basic foods shift upwards, with more movement for the poor, while the semi-durables curves shift down. The change in shape in the clothing Engel curve closely approximates that in Figure 4.

7 Were consumers just adjusting to a perceived fall in permanent income?

An alternative explanation for the reduction in the expenditure share allocated to semi-durables following the crisis could be that consumers perceived the crisis as a permanent reduction in income, rather than as a transitory shock. In this case, consumers would not want to smooth consumption, but would wish to permanently lower the level of consumption. Since their stock of semi-durables at the onset of the crisis would then be higher than the desired level they wish to maintain at their new lower level of permanent income, consumers would reduce spending on semi-durables to adjust their stock downward.

Although consumer expectations data are unavailable, a wide range of private sector forecasts provide evidence that recovery of GDP growth was expected after the decline in 1995. For example, a survey of 453 private firms in November 1995 showed an average forecasted GDP growth of 3.9 percent for 1996 (Tricks, 1996). Moreover, the mood was becoming more optimistic by the third quarter of 1996 when the 1996 round of the ENIGH survey was conducted. In February and March 1996, many experts were forecasting 2 to 2.5 percent growth for 1996, whereas by June through August, 1996 growth was forecast to be in the 3.7 to 4.3 percent range, with 1997 growth forecast to be 4 to 4.5 percent.[17] This expectations data thus suggests

that consumers did expect the crisis to be temporary, and did expect recovery.[18]

However, the expected post-crisis growth in income may have been insufficient to take consumers to the income level they would have expected had the crisis not occurred and the economy continued to grow. In this case, consumers would perceive the crisis as having a permanent effect on incomes, leading them to reduce semi-durable stocks to their new equilibrium levels. Without data on stocks of semi-durables or on individual expectations it is not possible to completely rule out this explanation. Nevertheless, some suggestive evidence can be obtained by looking at households subject to different degrees of liquidity constraints.

This paper claims that the reduction in the expenditure share allocated to semi-durables (and corresponding increase in the share allocated to food) represents the result of liquidity-constrained households using semi-durables as a smoothing mechanism. To help distinguish this explanation from the permanent income shock alternative, I examine whether, all else equal, households that have more access to credit have higher shares of semi-durables in the year of the crisis. This test is suggestive only, since the ENIGH data contain only rough measures of access to credit, and we do not have instruments available to explain why one household has access to credit while enough household with the same income and same educational level of the household head does not have access.[19] Nevertheless, with these caveats in mind we can at least examine the association present in the data.

A crude proxy for liquidity constraints and access to credit from the ENIGH data is whether or not a household made a deposit in a savings account, checking account, or *tanda* (a form of rotating credit association) during the past three months. Almost 31 percent of the sample are made such a deposit. While many individuals making deposits may still have been liquidity constrained, they may have had more access to liquid savings and credit and faced less liquidity constraints than individuals not making such deposits. I then regress the expenditure share of food and of semi-durable items (good i) for household j on a dummy variable for whether or not household j made a deposit, and the other control variables in the Engel regression:

$$\begin{aligned}\omega_{i,j} &= \alpha_i + \beta_i \ln\left(\frac{income_j}{n_j}\right) + \delta_i deposit_j \\ &\quad + \eta_i \ln(n_j) + \sum_{k=1}^{K} \gamma_{i,k}\left(\frac{n_{k,j}}{n_j}\right) + \tau_i' z_j + u_{i,j} \ . \end{aligned} \tag{12}$$

I use income rather than total expenditure as a regressor to control for the possibility that liquidity might affect the total amount spent as well as what it is spent on. The set of control variables z contains the age and education of the household head. These variables may also determine access to credit, but help control for differences in preferences which may be correlated with access to credit.

Table 5 presents the estimated coefficient δ_i for different goods. Households which are less likely to be credit-constrained are observed to have lower expenditure shares on food, and higher expenditure shares on semi-durables for a given level of income. This is consistent with such households having to rely less on semi-durables as a smoothing mechanism during the crisis, and thereby reducing expenditure shares on semi-durables by less than more liquidity-constrained households. This finding is less consistent with the alternative explanation that households are simply lowering semi-durable stocks to their new lower equilibrium level, since if the shock were permanent, both liquidity-constrained and non-liquidity-constrained households would wish to adjust spending patterns in similar ways.

8 How Successful were Consumers at Protecting Food Quantities?

Our analysis has found that consumers reduced the expenditure share allocated towards semi-durables and used this to increase their expenditure shares of basic staple foods. The result is that food expenditure did not fall as much as clothing and other durable expenditure. However, as seen in Table 1, food expenditure still did fall, and it is of interest to determine how successful consumers were at protecting the level of basic foods consumed. The ENIGH surveys contain data on quantities for food items, which Table 6 uses to look at changes in the mean per capita quantity purchased of the most commonly consumed food items in the pre-crisis period. I also present the change in the price of each food item relative to the change in the overall CPI, to see whether it is simply those foods which have the lowest price increases which fall least.

Table 6 finds that the quantity consumed of certain very basic staple foods - corn tortillas[20], beans, red tomatoes, potatoes, onions, rice, and pasta - actually increased during the crisis, with the most significant increases found among households with less-educated heads (who are poorer). In contrast, households experienced decreases in meat as a whole, and in poultry, beef and pork. Milk and fresh fruit also showed decreases. This suggests that households were able to maintain calorie levels much better than key nutrients.[21] Beer and soft drink consumption also fell, which is less of a concern. These changes do not seem to simply reflect relative price changes, as prices for many staples rose by more than the CPI. Falls in semi-durable expenditure therefore seem to be used by households to protect essential food consumption more than overall food expenditure.

9 Conclusions

Mexican households were unable (or unwilling) to shield the level of their consumption from falling during the peso crisis, but altered the composition of consumption by reducing expenditure on non-essentials and durable goods. Households reduced their expenditure on semi-durables such as clothing, glassware and bedding, and entertainment equipment, in order to allocate a relatively higher share of their budget to basic foods, such as cereals and grains, eggs, oils and fats, and vegetables. The use of this smoothing mechanism enabled households to maintain levels of basic staples while overall expenditure was falling.

This paper hypothesizes that this reduction in the expenditure share allocated to semi-durables is the result of liquidity-constrained households using semi-durables as a smoothing mechanism. A model based on this mechanism predicts that Engel curves can change shape and position during periods of shock, which is seen in the data. An alternate explanation is that households viewed the crisis as permanently lowering income, and as a result, lowered semi-durable stocks to their new equilibrium level. While I can not completely rule out this second explanation, suggestive support for the smoothing hypothesis is found in households with less access to credit lowering semi-durable expenditure more. Future surveys should collect data on semi-durable stocks and on individual expectations in order to explore this potential smoothing channel further.

References

Attanasio, Orazio P. and M. Székely (1998). "Household Savings and Income Distribution in Mexico". Inter-American Development Bank Working Paper 390.

—— (2004). "Wage Shocks and Consumption Variability in Mexico during the 1990s", *Journal of Development Economics* 73(1): 1-25.

Banco de México (various years) *Indicadores Economicos*, (Economic Indicators) Banco de Mexico, Mexico City.

—— (1997) *The Mexican Economy 1996*, www.banxico.org.mx/gPublicaciones/FSPublicaciones.html

—— (1998) *The Mexican Economy 1997*, www.banxico.org.mx/gPublicaciones/FSPublicaciones.html

Banks, James, Richard Blundell and Arthur Lewbel (1997). "Quadratic Engel Curves and Consumer Demand", *The Review of Economics and Statistics* 74(4): 527-539.

Beck, Thorsten. Asli Demirgüç-Kunt and Ross Levine (1999) "A New Database on Financial Development and Structure", *World Bank Policy Research Working Paper* No. 2146.

Browning, Martin and Thomas Crossley (2001) "Shocks, stocks and socks: consumption smoothing and the replacement of durables during an unemployment spell", mimeo. York University.

Browning, Martin and Costas Meghir (1991) "The Effects of Male and Female Labor Supply on Commodity Demands", *Econometrica* 59(4): 925-51.

Cunningham, Wendy and William F. Maloney (2000). "Measuring Vulnerability: Who Suffered in the 1995 Mexican Crisis", mimeo. The World Bank, Washington D.C.

Deaton, Angus (1997). *The Analysis of Household Surveys*. The Johns Hopkins University Press, Baltimore.

Deaton, Angus and John Muellbauer (1980). "An Almost Ideal Demand System", *American Economic Review*, 70(3): 312-26.

Emerging Markets Report (1996a) "Santander Ups Mexico 1996 GDP Forecast to 3.7% from 3.1%", 7 June 1996, Emerging Markets Report: Dow Jones and Company, Inc.

—— (1996b) "Morgan Stanley Raises Mexico GDP Growth Forecast to 4.2%", 21 August 1996, Emerging Markets Report: Dow Jones and Company, Inc.

Frankenberg, Elizabeth, Duncan Thomas and Kathleen Beegle (1999). "The Real Costs of Indonesia's Economic Crisis: Preliminary Findings from the Indonesia Family Life Surveys", *RAND Labor and Population Program Working Paper Series 99-04.*

Haber, Stephen (2004) "Mexico's Experiments with Bank Privatization and Liberalization, 1991-2003", Mimeo. Stanford University

Instituto Nacional de Estadística, Geografía e Informática (INEGI). (1998). *Encuesta Nacional de Ingresos y Gastos de los Hogares 1996: Tabulados y Base de Datos 1992, 1994 y 1996.* (National Survey of Household Income and Expenditure 1996: Tables and Databases 1992, 1994 and 1996) INEGI, Aguascalientes.

Lerner, George (1996) "Rebound may not leave Mexicans feeling better off", 23 February 1996, Reuters News.

Lustig, Nora .C. (1998). *Mexico: The Remaking of an Economy.* Second Edition. The Brookings Institution, Washington D.C.

—— (2000) "Crises and the Poor: Socially Responsible Macroeconomics", *Economia* 1(1): 1-30.

McKenzie, David J. (2002). "Are Tortillas a Giffen Good in Mexico?", *Economics Bulletin* 15(1): 1-7.

—— (2003). "How do Households Cope with Aggregate Shocks? Evidence from the Mexican Peso Crisis", *World Development*, 31(7): 1179-99.

Martin, Robert (2003) "Consumption, Durable Goods, and Transaction Costs", Board of Governors of the Federal Reserve System International Finance Discussion Paper No. 756.

Nacional Financiera (various years). *The Economía Mexicana en Cifras,* (The Mexican Economy in Numbers) Nacional Financiera, Aguascalientes.

Reuters News (1996a) "Bear Stearns lowers Mexico Inflation, GDP Outlook", 25 March 1996, Reuters News.

—— (1996b) "Analysts hail better-than-expected Mexico '95 GDP", 16 February 1996, Reuters News.

—— (1996c) "James Capel ups Mexico '96 GDP forecast to 3.7 pct", 24 June 1996, Reuters News.

—— (1996d) "JP Morgan ups 1996 Mexico GDP forecast to 3.7 pct", 24 June 1996, Reuters News.

—— (1996e) "Interacciones ups Mexico GDP forecast, lowers peso", 26 August 1996, Reuters News.

—— (1996f) "ING Barings raises estimate for Mexico GDP growth", 26 August 1996, Reuters News.

—— (1996g) "Mexico's Sidaoui sees growth above 3 pct in 1996", 13 August 1996, Reuters News.

Salinas de Gotari, Carlos (2002) *México: the Policy and Politics of Modernization.* Barcelona: Plaza and Janés.

Skoufias, Emmanuel (2003) "Consumption Smoothing in Russia: Evidence from the RLMS", *Economics of Transition* 11(1): 67-91.

Székely, Miguel (1998). *The Economics of Poverty, Inequality and Wealth Accumulation in Mexico.* St. Martins Press, New York.

Tricks, Henry (1996) "Mexican firms see growth up, inflation high in '96", Reuters News, January 18, 1996.

Villagómez, Alejandro and Fernando Solís-Soberón (1999). "Ahorro y Pensiones en Mexico: Un Estudio al Nivel de las Familias". *Economía Mexicana, Nueva Epoca*, 13(2): 339-66.

Wall Street Journal (1996) "Mexico's '95 GDP Fell 6.9% on Poor Domestic Demand", 20 February 1996, Page A14, The Wall Street Journal.

Welch, B. L. (1947) "The generalization of Student's problem when several different population variances are involved", *Biometrika* 34(1/2): 28-35.

Notes

[1]See also, for example, Frankenberg et al. (1999) for Indonesia and Skoufias (2003) for Russia.

[2]See the references in Salinas de Gotari (2002, p. 1005).

[3]The wage series for commerce is only available from 1994 onwards, but tracks manufacturing wages closely after this period.

[4]Earlier surveys were taken at different times of the year, by different government bodies, and used different sampling techniques. See Székely (1998) for further discussion of the earlier surveys.

[5]The category "other income - other" lumps together income from lottery winnings, dowries, inheritances and sale of authors rights with money received from loans from other people. In order to avoid counting loans received as income we exclude this category from income received.

[6]The Welch test is a t-test of equality of means allowing for the variance of the two samples to be different. See Welch

(1947).

[7]Note that while the share and level of health expenditures fell, we are unable to capture changes in usage of the Government health system, or the extent to which individuals substitute private for public expenditures on health.

[8]Changes in relative prices were not available for the states of Campeche, Durango, Morelos, Nayarit, Oaxaca, Queretaro and Tlaxcala.

[9]This interpretation continues to hold if the Engel equation is instead written in terms of permanent income and temporary shocks. For simplicity, ignore the quadratic term and demographic terms in equation (3). Then substituting (2) into (3) gives

$$\omega_{i,j,t} \simeq \alpha_i + \beta_i \ln(I_{j,t}) + (\delta_i + \beta_i / x_{j,t})\, s_{j,t}$$

Since $\beta_i > 0$ for luxuries like semi-durables, $\delta_i > 0$ will still imply a positive coefficient on $s_{j,t}$, showing lower semi-durable expenditure shares in response to negative shocks.

[10]The prediction errors were obtained by bootstrapping the estimation and prediction 100 times and taking the standard deviation of the mean predicted expenditure shares.

[11]I use the level of income rather than the log since some heads report zero labor income. Browning and Meghir (1991) use asset income to instrument expenditure, however less than 5 percent of households in the ENIGH surveys report income from rent, interest or patents, preventing asset income from being used here.

[12]See Table 3 for the source of this data.

[13]Note that given this policy, one can find the remaining policies as $C'_d(C_d, Y) = (1-\delta)C_d + I(C_d, Y)$ and $C_n(C_d, Y) = \frac{Y - I(C_d, Y)}{p}$.

[14]Estimation was carried out in Fortran based on code kindly provided by Dirk Krueger.

[15]Since we have only two goods, the non-durable goods expenditure share is one minus the semi-durable expenditure share, and will therefore move in the opposite direction to semi-durables.

[16]In this two-good model, a change in the shape of the semi-durables Engel curve automatically translates into a corresponding change in the non-durables Engel curve as well.

[17]February-March 1996 forecasts of 1996 growth were: Bear Stearns,1.96% (Reuters News, 1996a), Paribas Capital Markets 2.3% (Wall Street Journal, 1996), Jonathan Heath 2.1% (Reuters News, 1996b), Merrill Lynch 2.5% (Lerner, 1996); June-August Forecasts for 1996 were: Santander Investment 3.7% (Emerging Markets Report, 1996a), James Capel 3.7% (Reuters News, 1996c), JP Morgan 3.7% (Reuters News, 1996d), Morgan Stanley 4.2% (Emerging Markets Report, 1996b), Interacciones Brokerage 4.3% (Reuters, 1996e); June-August Forecasts for 1997 GDP growth were: Interaccioes Brokerage 4.5% (Reuters,

1996e), ING Barings 4% (Reuters, 1996f), CEESP 4.2% (Reuters, 1996g).

[18]Forecasts also show that the private sector expected inflation to fall from its 1995 level, but information is not available concerning expectations about relative price movements. However, given that most semi-durables prices increased by less than food prices, it seems unlikely that consumers were delaying semi-durable purchases solely in expectation of relative price declines in the future.

[19]Moreover, since access to credit may change over time, we are unable to construct pseudo-panels based on credit access and test whether the change in semi-durables share is different for those with and without credit access.

[20]More detail on changes in tortilla consumption during and after the crisis is available in McKenzie (2002).

[21]Along with the finding that primary health care fell, they also might suggest households are using their health stocks as a semi-durable with which to smooth.

Table 1: The Response of Income and Consumption to the Peso Crisis

Change in logs of per capita income and expenditures 1994-96 by Groups

		----------Total Consumption ---------			
	Total Monetary Income	Overall Consumption	Nondurable Consumption	Durable Consumption	Food Expenditure
All Heads aged 25-65	-0.23	-0.19	-0.18	-0.27	-0.09
	(0.013)	(0.012)	(0.012)	(0.013)	(0.010)
Education level of head:					
No Schooling	-0.14	-0.13	-0.12	-0.31	-0.03
	(0.028)	(0.027)	(0.027)	(0.029)	(0.025)
Incomplete Primary	-0.25	-0.20	-0.19	-0.20	-0.07
	(0.020)	(0.018)	(0.018)	(0.020)	(0.018)
Complete Primary	-0.33	-0.24	-0.24	-0.15	-0.14
	(0.023)	(0.021)	(0.021)	(0.023)	(0.020)
Junior High	-0.34	-0.31	-0.30	-0.41	-0.18
	(0.025)	(0.025)	(0.025)	(0.026)	(0.022)
High School	-0.42	-0.35	-0.33	-0.51	-0.20
	(0.037)	(0.037)	(0.036)	(0.038)	(0.033)
Higher Education	-0.39	-0.35	-0.34	-0.28	-0.27
	(0.036)	(0.034)	(0.034)	(0.036)	(0.031)
Location of Residence:					
Metropolitian Area	-0.44	-0.36	-0.35	-0.42	-0.23
locality of 100,000 + residents	-0.18	-0.15	-0.14	-0.33	-0.07
locality of 15,000-99,999	-0.29	-0.25	-0.25	-0.01	-0.17
locality of 2,500-14,999	-0.20	-0.13	-0.12	-0.20	-0.08
locality of 2,500 or less people	-0.18	-0.14	-0.13	-0.16	-0.03
Age of head in 1994:					
15-19	-0.30	-0.30	-0.29	0.25	-0.05
20-24	-0.30	-0.24	-0.23	-0.35	-0.14
25-29	-0.25	-0.20	-0.19	-0.33	-0.12
30-34	-0.31	-0.24	-0.23	-0.26	-0.12
35-39	-0.18	-0.13	-0.13	-0.20	-0.05
40-44	-0.27	-0.21	-0.20	-0.42	-0.14
45-49	-0.20	-0.17	-0.16	-0.16	-0.08
50-54	-0.19	-0.14	-0.14	-0.18	-0.06
55-59	-0.25	-0.21	-0.20	-0.48	-0.05
60-64	-0.19	-0.13	-0.14	-0.11	-0.06
65-69	-0.23	-0.24	-0.23	-0.50	-0.11
70-74	-0.26	-0.30	-0.31	0.20	-0.11

Notes: adapted from McKenzie (2003, Table 5).

Apart from age group comparisons, all other groupings are done for household heads aged 25-65 years

Standard errors in parentheses. Standard errors for location and age of head not shown for space reasons, but are approximately 0.02 to 0.03 for location and 0.03 to 0.05 for all age groups except 15-19, where the standard error is approximately 0.09

Table 2: Changes in the Composition of Expenditure in Response to the Peso Crisis

	Household Head's Education is Primary School or Less							*Household Head's Education is High School or above*						
	Share of Total Expenditure				Welch test of Equality			Share of Total Expenditure				Welch test of Equality		
Expenditure Category	1992	1994	1996	1998	1992=94	1994=96	1996=98	1992	1994	1996	1998	1992=94	1994=96	1996=98
Food	46.7	44.8	48.3	46.5	--	++	--	31.8	30.2	32.6	30.9	--	++	--
Cereals and Grains[1]	9.1	8.3	10.5	9.6	--	++	--	3.5	3.2	4.3	4.0	--	++	-
Meat	8.9	8.7	8.9	8.4			--	8.0	7.1	7.6	6.9	--	++	--
Fish and Seafood	0.8	0.8	0.8	0.6			--	0.8	0.7	0.8	0.6			--
Milk and Milk Products	3.5	3.5	3.6	3.9		+	++	3.9	3.5	4.2	4.1	--	++	
Eggs	2.2	1.9	2.7	2.2	--	++	--	0.9	0.7	1.2	0.8	--	++	--
Oils and Fats	1.7	1.7	2.1	1.6		++	--	0.4	0.4	0.6	0.4		++	--
Vegetables	8.2	7.4	8.1	7.9	--	++		3.2	2.8	2.9	2.9	--		
Fruits	1.3	1.3	1.1	1.1		--	+	1.6	1.5	1.4	1.3		-	
Desserts and Sweets	0.19	0.11	0.08	0.14	--	-	++	0.2	0.2	0.1	0.2	--		
Alcoholic Drinks	0.3	0.6	0.4	0.5	++	--	+	0.3	0.3	0.3	0.3			
Meals consumed outside home	3.2	2.7	2.0	2.3	--	--	+	4.9	5.5	4.2	4.5		--	
Tobacco	1.0	0.5	0.3	0.4	--	--		0.6	0.3	0.2	0.2	--	--	
Public Transport	6.0	6.5	6.1	5.8	++	--		4.0	3.9	4.4	4.1		++	
Vehicle and Transport Services	3.5	3.0	3.0	3.4	--		++	7.1	6.7	7.3	6.9		+	
Housing and Utilities	7.6	9.0	8.4	8.8	++	--	+	10.2	11.1	11.1	11.2	+		
House Cleaning and Care[2]	6.6	6.6	6.5	6.7				5.2	5.9	5.4	5.5	++	-	
Personal Care Services[3]	4.2	4.9	4.9	5.3	++		++	4.1	4.6	4.7	4.5	++		
Education	4.6	5.0	6.0	4.5	+	++	--	7.8	8.0	8.7	8.6			
Primary Health Care[5]	1.9	2.1	1.8	1.9	+	--		1.7	1.7	1.6	1.7			
Other medical expenses	1.2	1.1	1.1	1.1				1.1	0.9	1.1	1.0			
Leisure Expenses[4]	0.6	0.8	0.7	0.8	++	-	+	2.3	3.1	2.7	3.0	++	--	
Communication Expenses	0.8	1.1	1.3	1.5	++	++	++	2.4	2.8	2.9	3.6	++		++
Clothing	7.8	7.5	6.1	6.4	-	--	++	8.2	7.5	6.7	6.7	--	--	
Household Goods and Furniture	2.3	2.4	2.0	2.2		--		3.4	3.7	2.9	3.1		--	
Entertainment Equipment[6]	1.1	0.7	0.4	0.6	--	--	++	1.7	1.3	0.8	1.2	--	--	++
Glassware, Bedding	1.0	0.9	0.6	0.7	--	--	++	0.9	0.7	0.6	0.8	--	-	++
Vehicle Purchases	0.5	0.3	0.4	0.4	-			2.6	1.8	1.4	1.9	-		
Transfers to non-household members	0.7	0.9	0.7	0.9		--	+	1.5	1.8	1.8	1.8			
Donations (including to church)	0.18	0.13	0.09	0.13	--	--	++	0.15	0.10	0.11	0.10	-		
Miscellaneous Expenses[7]	1.5	1.7	1.4	1.8		--	++	2.9	3.5	2.8	3.1	+	--	
Total	100	100	100	100				100	100	100	100			

Notes:

+ and ++ (- and --) indicate that a Welch test of equality of means rejects the null at the 5% and 1% level respectively and the later period is larger (smaller)

1. Includes Tortillas, Corn, Rice, Bread, Oats and Wheat products
2. Includes Cleaning Products, Batteries, Lightbulbs, Gardening, Laundry and Drycleaning Services
3. Includes haircuts, massages, manicures, and other beautician services
4. Includes expenditure at the cinema, theatre, bars, sporting events, lotteries, club membership fees, cable service etc.
5. Medical expenses at primary health providers (does not include hospital costs nor medical costs during pregnancy)
6. Includes audiovisual equipment, photographic and video equipment, sporting goods, games, musical instruments, etc.
7. Includes many miscellaneous expenses such as ceremonies, professional fees, hotel and other tourism expenses, among others.

Table 3: Relative Price Changes

	two-year inflation rates			Δprice category/ΔCPI
	1992-94	*1994-96*	*1996-98*	*1994-96*
Overall Consumer Price Index	16.8	86.5	37.7	1.00
General Categories				
Food	11.6	104.8	36.3	1.21
Meals consumed outside the home	5.5	50.9	41.3	0.59
Clothing	12.9	79.4	39.8	0.92
Housing	20.0	71.2	36.3	0.82
Furniture and Domestic Appliances	10.3	91.6	29.5	1.06
Electronic Equipment	7.3	111.3	23.2	1.29
Health	26.9	78.2	42.0	0.90
Education	34.8	66.9	34.9	0.77
Leisure Goods and Services	26.2	63.8	33.0	0.74
Overall CPI by income class				
Less than minimum wage	17.7	92.0	36.6	1.06
1-3 minimum wages	17.7	90.3	37.8	1.04
3-6 minimum wages	16.6	86.7	37.6	1.00
6+ minimum wages	16.9	82.8	37.8	0.96

Source : September month National Consumer Price Index by month and expenditure item or income class, *Banco de Mexico* , available online at:http://www.banxico.gob.mx/eInfoFinanciera/FSinfoFinanciera.html

Table 4: Were Changes in Composition Just Income and Price Effects?

			Predicted Mean Expenditure Share in 1996 from 1992-94 Engel Curve					
	actual mean expenditure share		due to change in income only			due to change in income & change in relative prices		
Expenditure Category	1994	1996	predicted share	prediction error	T-ratio (predicted-actual)=0	predicted share	prediction error	T-ratio (predicted - actual) =0
Food	41.57	44.08	44.28	0.19	1.05	42.91	0.91	-1.29
Cereals and Grains[1]	7.07	8.74	7.75	0.07	-13.53	8.06	0.29	-2.37
Meat	8.55	8.78	9.22	0.09	4.83	9.98	0.93	1.29
Fish and Seafood	0.78	0.81	0.91	0.02	4.35	0.72	0.14	-0.61
Milk and Milk Products	3.60	3.95	3.51	0.05	-9.50	4.11	0.19	0.86
Eggs	1.59	2.34	1.79	0.02	-22.16	0.94	0.18	-7.89
Oils and Fats	1.32	1.66	1.49	0.02	-7.14	1.28	0.22	-1.71
Vegetables	6.22	6.54	7.01	0.07	6.84	6.14	0.24	-1.63
Fruits	1.37	1.18	1.38	0.02	8.57	1.25	0.15	0.47
Desserts and Sweets	0.12	0.10	0.15	0.01	5.65	0.24	0.04	3.27
Alcoholic Drinks	0.52	0.33	0.46	0.02	5.11	0.27	0.24	-0.28
Meals consumed outside home	3.35	2.62	3.32	0.08	8.65	3.19	0.26	2.18
Public Transport	5.94	5.77	6.08	0.09	3.63	4.79	0.30	-3.30
Vehicle and Transport Services	3.80	4.05	3.61	0.06	-7.05	4.55	0.54	0.93
Housing and Utilities	9.54	9.24	8.50	0.07	-9.91	9.47	0.48	0.48
House Cleaning and Care[2]	6.27	6.10	6.54	0.05	8.19	6.11	0.38	0.02
Personal Care Services[3]	4.85	4.94	4.67	0.04	-6.03	4.49	0.27	-1.66
Education	5.63	6.73	5.00	0.10	-17.83	4.56	0.64	-3.39
Primary Health Care[5]	2.00	1.69	1.98	0.05	6.12	1.85	0.06	2.68
Other medical expenses	1.08	1.05	1.12	0.04	1.98	1.08	0.05	0.78
Leisure Expenses[4]	1.32	1.24	1.00	0.03	-8.51	0.86	0.16	-2.34
Clothing	7.53	6.18	7.77	0.07	21.79	7.94	0.37	4.76
Household Goods and Furniture	2.78	2.32	2.34	0.07	0.32	1.99	0.38	-0.88
Entertainment Equipment[6]	0.87	0.50	0.98	0.04	13.40	1.10	0.30	1.98
Glassware, Bedding	0.82	0.58	0.89	0.02	15.43	1.06	0.11	4.53
Vehicle Purchases	0.68	0.64	0.58	0.07	-0.91	0.78	0.48	0.28

Notes:

* and ** denote significance at the 10% and 5% levels respectively.

Shares are for households with heads aged 25-65.

Predicted Shares are obtained by estimating an Engel Curve using the 1992 and 1994 ENIGH surveys and using the estimated coefficients to predict 1996 shares.

Fitted Engel Curves include a quadratic in log expenditure per capita instrumented with the labor income and squared income of the household head,

log of household size, controls for the proportion of the household aged 0-4, 5-9, 10-14, 15-54, and 55-65 by gender,

and sex and employment status of household head. State-level changes in the relative price of the expenditure item are also included when we consider income and price effects.

Table 5: Did Households with More Access to Credit have higher semi-durables expenditure shares during the crisis?
Coefficient on deposit dummy variable in Engel regression.

Expenditure Category	Coefficient	T-statistic
Food	-1.19	3.73
Semi-durables		
Clothing	0.45	3.59
Household Goods and Furniture	0.94	6.84
Entertainment Equipment	0.13	2.83
Glassware and Bedding	0.17	4.90
Vehicle Purchases	0.26	2.64
All Semi-durables	1.95	9.04

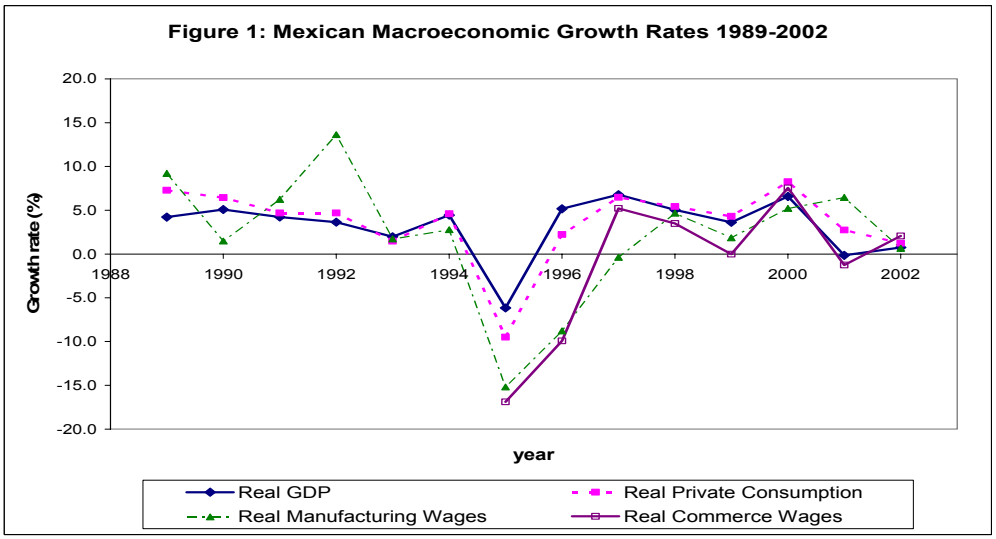
Table 6: Changes in Quantity of Different Foods Consumed by Education of Household Head

Food item	Change in price relative to change in overall CPI 1994-96	Mean per capita quantity consumed of different foods by Education of Head (in kilograms/week unless noted otherwise)											
		Primary Edn or less		%		Junior High		%		High School +		%	
		1994	1996	change		1994	1996	change		1994	1996	change	
Corn tortillas	0.99	1.086	1.257	15.7	**	1.144	1.223	6.9	*	0.903	0.992	9.9	**
Soft Drinks (litres)	1.02	0.593	0.510	-14.0	**	0.847	0.695	-18.0	**	1.046	0.916	-12.4	**
Pasteurized Milk (litres)	1.10	0.535	0.458	-14.4	**	1.101	0.922	-16.2	**	1.515	1.336	-11.8	**
Meat (poultry, beef, pork & fish)	0.97	0.429	0.420	-2.1		0.621	0.547	-12.0	**	0.770	0.720	-6.5	*
Fresh Fruit	1.22	0.376	0.322	-14.1	**	0.699	0.567	-18.9	**	1.074	0.928	-13.6	**
Beans	1.42	0.247	0.267	8.1	**	0.166	0.191	15.2	*	0.126	0.142	12.6	
Red Tomatoes	1.13	0.246	0.268	8.7	**	0.291	0.290	-0.6		0.300	0.290	-3.2	
Sugar	1.10	0.208	0.209	0.7		0.138	0.157	14.1	*	0.136	0.148	8.8	
Eggs	1.40	0.198	0.200	1.4		0.236	0.239	1.2		0.243	0.240	-1.0	
Poultry	1.00	0.175	0.169	-3.0		0.250	0.217	-13.2	**	0.270	0.267	-1.2	
Beef	0.94	0.157	0.152	-3.3		0.251	0.212	-15.5	**	0.340	0.293	-13.8	**
Potatoes	0.81	0.121	0.139	15.2	**	0.148	0.161	8.8		0.149	0.157	5.1	
Vegetable Oil (litres)	1.33	0.117	0.121	3.8		0.110	0.121	9.6		0.123	0.121	-1.8	
Sweet bread	1.25	0.090	0.077	-14.2	**	0.121	0.109	-9.9		0.123	0.122	-1.2	
Onions	1.44	0.087	0.096	9.8	**	0.105	0.107	2.8		0.118	0.127	8.1	
Rice	1.08	0.086	0.103	19.8	**	0.080	0.087	9.2		0.090	0.089	-0.9	
White bread	2.01	0.080	0.069	-13.9	**	0.110	0.099	-9.9		0.100	0.089	-10.9	
Beer (litres)	0.89	0.055	0.046	-16.4		0.113	0.064	-43.9		0.083	0.091	8.8	
Pork	1.00	0.054	0.049	-9.7	*	0.067	0.061	-9.0		0.077	0.070	-8.5	
Serrano and Jalapeno Chiles	0.81	0.050	0.043	-13.9	**	0.036	0.036	-1.1		0.034	0.028	-17.2	*
Pasta for Soup	1.22	0.046	0.047	2.8		0.038	0.043	14.8	*	0.041	0.042	3.4	
Fish	0.93	0.043	0.049	15.0	*	0.054	0.057	6.4		0.083	0.090	7.8	
Cheese	1.12	0.024	0.023	-4.9		0.032	0.031	-1.4		0.037	0.035	-5.7	
	Food prices relative to CPI	1994 pesos		%		1994 pesos		%		1994 pesos		%	
		1994	1996	change		1994	1996	change		1994	1996	change	
Three month Food Expenditure per capita	1.10	304.7	247.6	-18.7	**	469.1	342.9	-26.9	**	767.7	528.1	-31.2	**

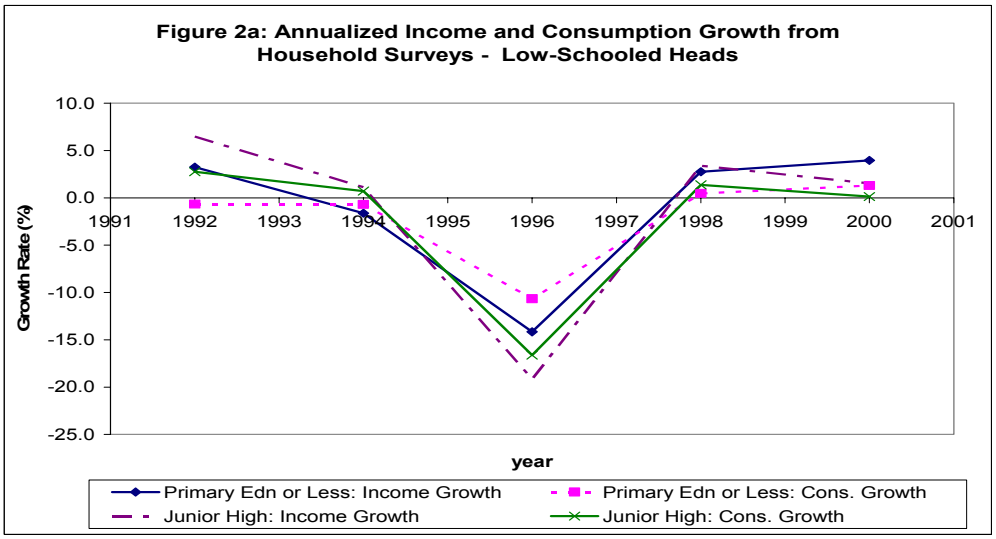
Source: own calculations from 1994 and 1996 ENIGH. Monetary Food expenditure deflated by September Food Consumer Price Index.

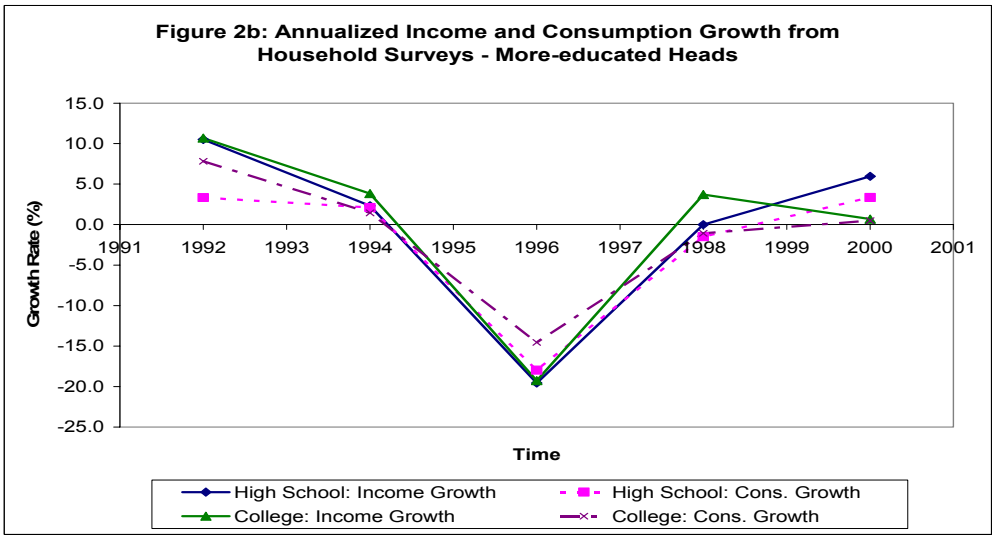
Results are for households with heads aged 25-65 only.

* and ** indicate the change is different from zero at the 5% and 1% levels of significance respectively



source: Banco de Mexico, *Indicadores Económicos y Financieras*, http://www.banxico.gob.mx/eInfoFinanciera/FSinfoFinanciera.html





source for Figure 2: own calculations from ENIGH 1989, 1992, 1994, 1996, 1998 and 2000, for households with heads aged 25-65 years. Growth is reported at the endpoints, so 1992 growth is average over 1989-92.

FIGURE 3: SIMULATED SEMI-DURABLE EXPENDITURE SHARE RESPONSE TO A TEMPORARY INCOME SHOCK

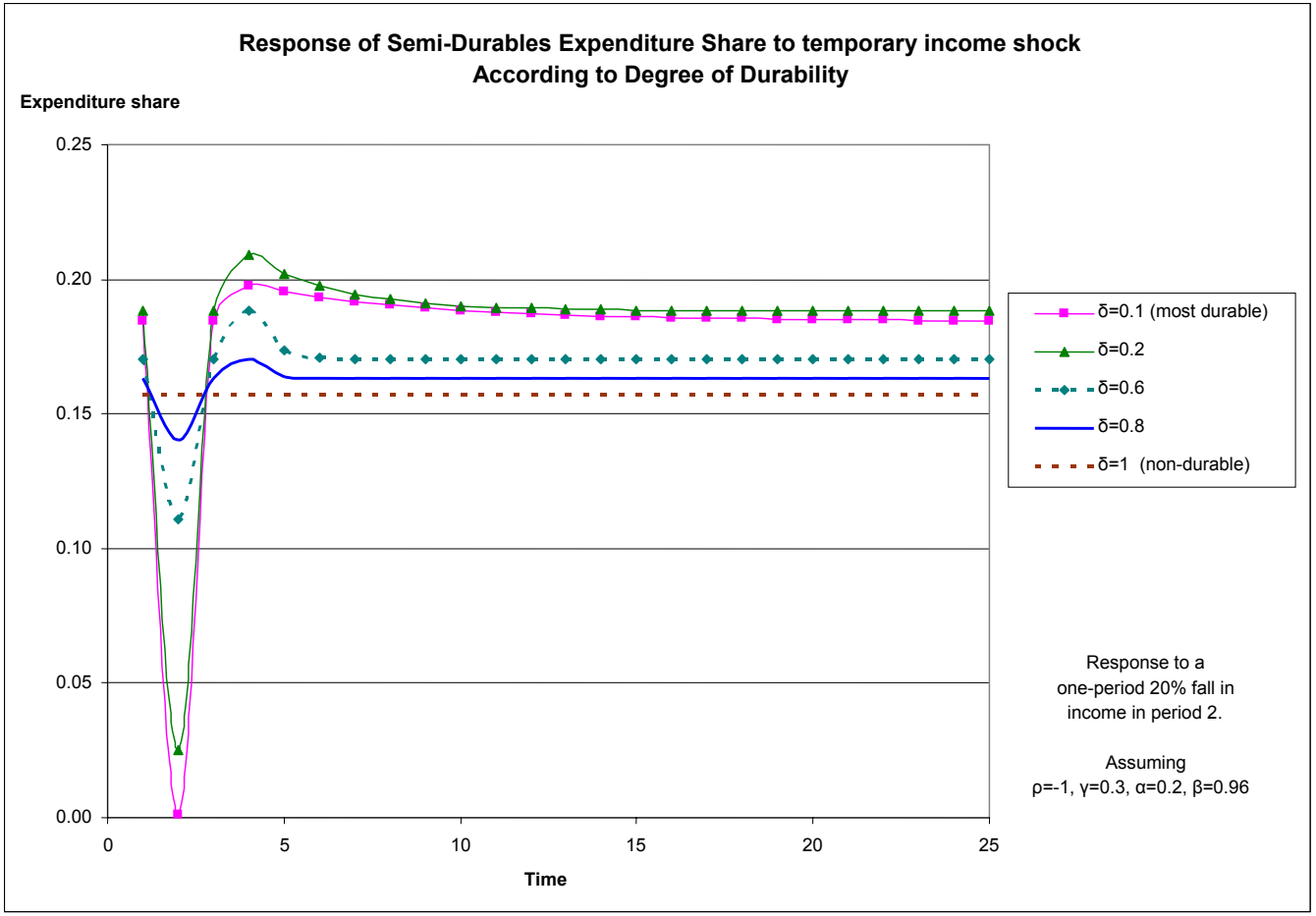
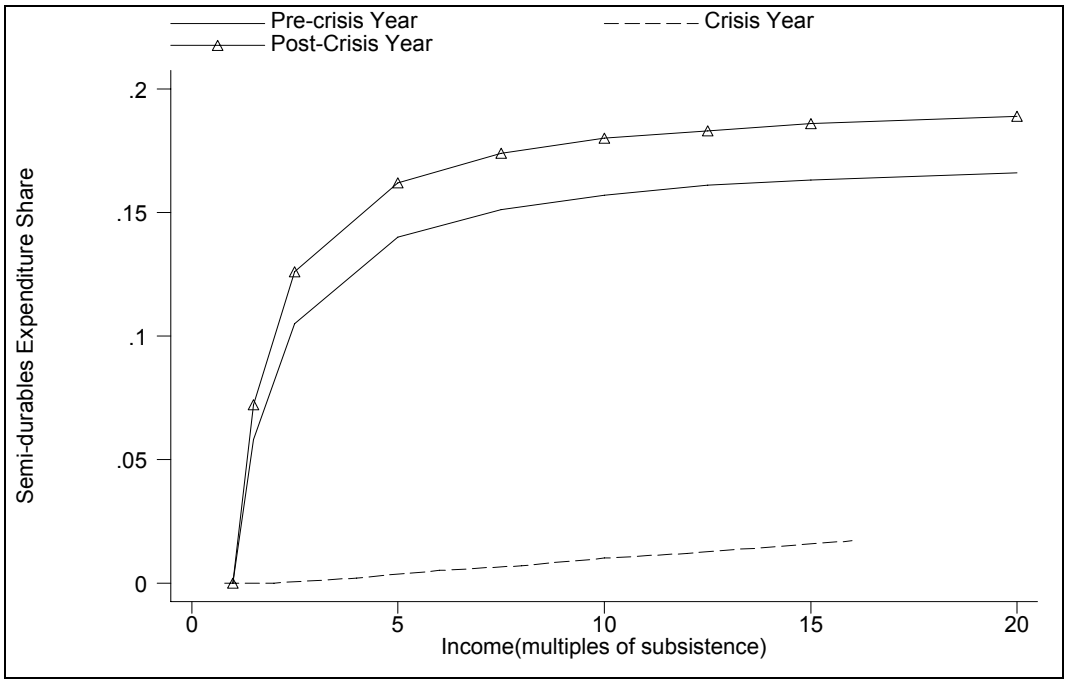


FIGURE 4: SIMULATED SHIFT IN THE SEMI-DURABLES ENGEL CURVE IN RESPONSE TO A TEMPORARY INCOME SHOCK



Note: Simulated response to one-period 20% fall in income, assuming ρ=-1, δ=0.5, γ=0.3, β=0.96, and α=0.2.

FIGURE 5: ENGEL CURVES FOR SELECTED GOODS - 1994 AND 1996