A Micro-Empirical Foundation for the Political Economy of Exchange Rate Populism

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Abstract: Latin American countries have experienced cycles of expansionary policies, currency appreciation and crises. The popularity of appreciations, through its effect on consumer's purchasing power has been an accepted assumption in the literature despite a dearth of studies on the distributional impact of exchange rate movements. This study computes the welfare effects of exchange rate movements at different points of the income distribution for Brazil and Mexico. It shows that the distributional effects of appreciations split both countries on a regional basis, instead of across income levels. In Brazil, appreciations are found to benefit less or harm more the rural areas; in Mexico, the border states.

A. Introduction

A discussion of the political economy of exchange rates can be guided by the following questions: (1) Do politicians actually use it? (2) Are the effects really there? (3) Does it actually buy support?[1]

For the first question, there is indeed evidence that politicians in Latin America have a bias towards appreciating their currencies. Dornbusch and Edwards (1990) refer to the ensemble of expansionary policies with distributive goals that have often generated real appreciation and periodic crisis in Latin America as "macroeconomic populism." Frieden and Stein (2001) identify a conflict between external balance and domestic purchasing power in the decision to set the level of exchange rates. In a large cross-section of Latin American countries, they show that the currency tends to appreciate before and depreciate after elections.[2] Bonomo and Terra (1999) base

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[1] We are grateful to Allen Drazen for providing this useful classification in his discussion of this paper.

[2] More recently, Aisen (2007) argued that political opportunism causes exchange rate based stabilizations to be more likely launched before elections, because they create an initial consumption boom, as the real exchange rate appreciates.

their discussion of the political economy of exchange rates in Brazil on the observation that real appreciations are politically popular.

While the "popularity" of appreciated currencies in the region can be reasonably taken for granted, there have been a dearth of studies of the distributional effects of appreciations. This paper skips the discussion on the specific channels through which a policy maker can affect the real exchange rate.[3] Instead, we focus on the second question: are the effects really there? The main contribution of this paper is analyzing whether distributional effects can amplify the scope for appreciation-prone policies. We use household-level data from Brazil and Mexico (which account for over half of Latin America's output and population) to examine how the exchange rate affects households at different points in the income distribution and with different characteristics. The goal is to uncover a compelling, economically significant, distributional effect that might serve as a foundation for a political economy theory of exchange rate populism, and to motivate further research on the third question: do appreciation policies buy political support?[4]

In a simplified general equilibrium model, this paper identifies two channels through which exchange rate movements can affect household welfare. For a given level of income, changes in exchange rates that are passed through to domestic prices affect the purchasing power of households differentially, depending on how the price of their consumption baskets respond to exchange rates. For instance, to the extent that poorer households spend a larger share of their consumption on tradable goods (food, a tradable good, tends to have a large weight on the poor's budget) than richer households, the pass-through or consumption effect of an appreciation tends to be pro-poor. Exchange rate movements will also affect household welfare through a factor income channel. As exchange rate movements affect the relative profitability of different sectors of the economy (e.g. manufacturing relative to services), it also shifts the relative demand for labor of

[3] It seems reasonable to assume that there are a number of "levers" at the disposal of policy makers to affect exchange rates at least in the short-term. One such option is through a tighter monetary policy. Other policy instruments include trade restrictions, fiscal policy (government spending tilted towards non-traded goods tend to appreciate the currency in the short-run), financial sector regulation, capital controls, among others.

[4] There is a related literature that explores individual survey data to inquire on determinants of individual attitudes towards trade policy. E.g. Balistreri (1997), Beaulieu (2002), Scheve and Slaughter (2001) and Mayda and Rodrik (2005).

different skills, locations and sector of employment, among other characteristics.[5] In addition to this labor market channel, an appreciation can also affect incomes through its impact on profits, and on public and private transfers. Once we have computed the effect of exchange rate movements through these different channels, we can compute its net effect at different points of the income distribution and for household with different characteristics. It is beyond the scope of this paper to estimate the effect of exchange rate movements on average income. Instead we will focus on its distributional effects on income (taking the average income as given) and will normalize the average effect on income to equal zero.

The focus on Brazil and Mexico is based on data availability, their large size and the substantial differences in their export structures. Mexico has more opportunities for exporting labor intensive manufactures due to NAFTA and its proximity to the U.S.. As such, we should expect that a larger share of its population would be negatively affected by a real appreciation through the factor income channel.

Our results indicate that the short-term effect of currency appreciation through the consumption channel benefits poorer households more than proportionately as expected. For Brazil, the consumption or pass-through effect of a 10 percent appreciation is equivalent in welfare terms to an increase in income of 1½ percent for the poorest households and only 1 percent for the richest ones. In Mexico, where the exchange rate pass-through is higher, the average of that effect is 4½ percent, and the difference between poorer and richer households is more muted (only about ¼ percent), with the effects peaking at middle income levels (but varying by less than ½ percent across the distribution). The evidence on income effects, however, shows sizeable differences that cut through regional and sectoral divides in both countries, but less so across the income distribution. Finally, when total effects are calculated through the sum of pass-through and income effects, the shape of the distribution of welfare effects is dominated by the factor income effects.

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[5] In the short-run, it is plausible that the impact of exchange rate appreciations, which are usually transitory, is dominated by their effects on current income, causing the political cleavages to be drawn on industry, instead of factor, lines.

The paper is organized as follows: in section B, we motivate it with regional comparisons between Latin American and East Asian countries; section C lays out the model underlying our discussion; section D discusses the estimation; section E describes the data; section F presents the results; finally section G concludes

B. Motivation: Some Regional Comparisons

This section briefly documents the tendency for overvaluation spells among Latin American emerging market countries, in contrast to the experience of emerging Asian countries.

The perception that some Asian countries, and in particular, China, have pursued active exchange rate policies has renewed interest on a debate about the merits of the neo-mercantilist view that an undervalued currency should provide protection to domestic industries in order to stimulate the tradable sector (e.g. Rodrik, 2006; Johnson, Ostry and Subramanian, 2006). The flip side of this debate is the observation that Latin American countries have often allowed their currencies to appreciate, or maintained artificially appreciated official exchange rates in the presence of large black market premia, and have achieved lower growth rates and been prone to periodic bouts of macroeconomic instability.

Figure 1 traces the evolution of the Real Effective Exchange Rate (henceforth, REER) and income in four Latin American and four East Asian countries. Two striking patterns emerge from these comparisons. Asian countries managed to grow steadily while preventing their currencies from appreciating substantially (most of the volatility in the East Asian REERs is concentrated around the time of the Asian Crisis). Latin American countries, on the other hand, have apparently experienced stagnating incomes, which has not prevented them from going through large swings in their REERs.[6]

[6] de Carvalho Filho and Chamon (2007) provide evidence that the apparent income stagnation in Brazil and Mexico is partly the result of measurement problems.

Table 1 reports a measure of the frequency of overvaluation episodes for different economies. These episodes were defined based on the number of years when the REER exceeded its linear time trend by different thresholds. During 1980-2006, an overvaluation of 15 percent or more took place during 12 years in Argentina, 7 in Brazil, 8 in Colombia, 5 in Chile and 4 in Mexico. There are far fewer/shorter episodes of overvaluation among Asian emerging markets. During that same period, the REER was above 15 percent of its trend during 7 years in Indonesia. But among the other East Asian emerging markets the spells were relatively short: 3 years in Hong Kong SAR, 2 years in the Philippines, 1 year in Korea, Malaysia and Thailand, and none in Taiwan Province of China.

Most of the overvaluation spells mentioned above were related to the presence of fixed exchange rate regimes. Frieden and Stein (2001) show that the choice of a fixed exchange rate is inversely related with the size of the manufacturing sector in a sample of Latin American countries. While differences in the choice of exchange rate regimes may be distorting the comparisons in Table 1, a similar point can be made by comparing black market premia. A large black market premium is perhaps a clear sign of an artificially appreciated currency. Table 1 also reports the percentage of time during which the black market premium exceeded 15 percent in 1980-1998, based on the Reinhart and Rogoff (2004) de facto exchange rate classification. Argentina and Brazil experience those large black market premia over half of the time in that sample: 52 and 62 percent respectively. Chile, Colombia and Mexico experienced large black market premia during 40, 29 and 28 percent of the time respectively. Among East Asian emerging markets, neither Thailand nor Malaysia experienced episodes of such large black market premia, while Korea and Indonesia experienced it 7 and 18 percent of the time respectively.

This tendency for Latin American countries to seek to appreciate their currencies has often been attributed to political economy considerations (Dornbusch and Edwards 1990; Kaufman and Stallings 1990). Latin America's large inequality is thought to provide the grounds for strong short-term political gains from policies that redistribute rents from the exporting sector, and exchange rate appreciation figures prominently among such policies. In the rest of this paper, we quantify the strength of these distributional effects to check whether they could account for Latin America's unusual exchange rate policies.

C. The Model

This section derives the theoretical distributional effects of exchange rate movements. It follows Porto (2006), which adapted the small open economy models of Dixit and Norman (1980) and Wooland (1982) to a multi-household context in order to analyze the distributional effects of trade liberalization.

We start from the expenditure function of a household *j,* which is the solution to the expenditure minimization problem for given prices and desired utility level. For the sake of simplicity, we assume it equals its income (which includes transfers).[7]

$$e^j\left(\mathbf{p},u^j\right)=x_0^j+\sum_m w_m^j+k^j+\psi^j \quad (1)$$

where the expenditure function $e^j(.)$ depends on the vector of prices of consumption goods and required utility u^j. Household income includes exogenous income x_0^j, the sum of labor income of each household member *m*, w_m^j, capital income, k^j, and government transfers, ψ^j.

The production side of the economy is assumed to be competitive and face constant returns to scale. Firms producing good *i* use local factors of production **N** that are remunerated at factor prices **w** and imported intermediate inputs **Z** that are purchased at international prices $\mathbf{p}^*$. Thus, the profit function can be calculated as the solution to the profit maximization problem of a representative firm producing all goods in the economy:

$$r\left(\mathbf{p},\mathbf{p}^*,E,\mathbf{v},\phi\right)=Max_{\{N_i,Z_i\}}\sum_i f_i\left(\mathrm{N_i},Z_i\right)p_i-\mathbf{wN}-E\,\mathbf{p}^*\mathbf{Z}$$

where **v** is a vector of local factor endowments.

[7] This simplifying assumption ignores the impact of exchange rate movements on savings.

The equilibrium in the goods market is determined by demand and supply equality. That is,

$$\sum_j \frac{\partial}{\partial p_i} e^j\left(\mathbf{p}, u^j\right) = \frac{\partial}{\partial p_i} r\left(\mathbf{p}, \mathbf{p}^*, E, \mathbf{v}, \phi\right)$$

where the demand for good *i* is given by the derivative of the expenditure function with respect to the price of that good (Shepard's Lemma), whereas its supply is given by the own-price derivative of the GDP function (Hotelling's Lemma). Given the nominal exchange rate, the international price of intermediate goods, the vector of utilities **u**, the equilibrium prices for the consumption goods is given by:

$$p_i = p_i\left(\mathbf{p}^*, E, \mathbf{v}, \phi, \mathbf{u}\right)$$

The assumption of perfect competition in this setting means that goods prices equal the unit costs:

$$p_i = c_i\left(\mathbf{w}, E, \mathbf{p}^*, \phi\right)$$

The equalization of goods prices to unit costs allows us to solve for equilibrium factor prices:

$$\mathbf{w} = w\left(\mathbf{p}^*, E, \mathbf{v}, \phi, \mathbf{u}\right)$$

The distributional effects of exchange rate movements can be divided in two steps: the effect of exchange rate movements on consumption goods prices and its resulting effect on household welfare; and the effect of exchange rate movements on factor incomes. The welfare effect caused by the changes in the consumption goods are referred to as *pass-through* or *consumption effects*. The welfare effect channeled through changes in factor prices are referred to as *factor income effects*.

The changes in household welfare are computed with measures of compensating variations, the income needed to compensate households for a change in the nominal exchange rate *E*. These compensations can be measured with the change in exogenous income, x_0^j, that would leave the household indifferent to the previous level of the exchange rate. Differentiating equation (1) and assuming public transfers and capital income away, the compensating variation for a change in the nominal exchange rate is:

$$\frac{\mathrm{d}x_0^j}{e^j} = \left(\sum_i s_i^j \frac{\partial \ln p_i}{\partial \ln E} - \sum_m \theta_m^j \frac{\partial \ln w_m^j}{\partial \ln E} \right) \mathrm{d} \ln E$$

where s_i^j is the budget share spent on consumption good *i* by household *j*, θ_m^j is the share of the factor income of household member *m* on household *j*, and the equation describes the negative of the compensating variation that would be a revenue for the central planner setting the change in the nominal exchange rate if households were to transfer their gains from that change to the planner.

The first term within the parenthesis captures the *consumption effect*. The budget shares of each consumption good are data to be drawn from a household expenditure survey. The elasticity of consumption goods prices with relation to nominal exchange rate changes are exchange rate pass-through measures and are customarily estimated by vector auto regressions (e.g. McCarthy, 2007 for industrialized economies, and Belaisch, 2003 for Brazil). The second term within the parenthesis reflects the effect of nominal exchange rate movements on household income (factor income effects). This effect can be estimated based on a panel of cross-sections of income and employment surveys. As mentioned in the introduction, it is beyond the scope of this paper to estimate the effect of exchange rate movements on average income. Instead we will focus on its distributional effects on income (taking the average income as given), and instead of computing the compensating variations we will compute their distribution around a given mean.

D. Estimation

Consumption or pass-through effects

The estimation of the consumption or pass-through effects requires data on budget shares across the income distribution (or for groups of households based on observable characteristics), which are available from household expenditure surveys.

To estimate the effect of exchange rate movements on consumer goods prices, we use the cumulative impulse response functions from a vector auto regression (VAR) with two endogenous variables, an individual CPI sub-index (e.g. clothing and apparel) and the INS/IMF trade-weighted nominal effective exchange rate (henceforth, NEER), while controlling for measures of international prices as exogenous variables. In this estimation, we restrict the sample to years with similar inflation levels, as the literature has shown that exchange rate pass-through tends to be higher in higher inflation environments (e.g. Goldfajn et alli (2000) and Ca' Zorzi et alli (2007)). Thus, we drop Brazilian inflation data prior to the 1994 stabilization (due to hyper-inflation in those years). We use Mexican inflation data beginning in 1990 (which includes some high inflation years following the 1995 Crisis, but nowhere near Brazilian hyper-inflation levels). The set of international prices enters the VAR as exogenous variables and comprises the non-fuel commodities index and the average of three spot crude oil prices, both from the IMF/WEO, and the U.S. consumer price index (all items, urban average). To account for seasonal effects, the VAR was estimated with 12 lags of the endogenous variables. To avoid over-fitting the model, each exogenous variable was used only as one- and twelve-month changes. All variables enter the VAR in monthly log changes.

Our preferred estimate of the nominal exchange rate pass-through is based on the cumulative impulse response function to shocks on the NEER. Since we are mainly concerned about short- and medium-term distributive effects, we focus on the pass-through over a 12-month horizon. We calculate the cumulative impulse response of prices and the NEER to shocks to the NEER. For the purposes of this paper, we define the 12-month pass-through as the ratio of the average cumulative impulse response of prices between 3 to 15 months after a shock to NEER to the 12-month average cumulative own impulse response of NEER.

Using the household expenditure survey, we compute the share s_i^j of each good i in the consumption basket of each household j. Based on these shares and the pass-through estimates, we can construct a household-specific of the *pass-through or consumption-effect* $\Gamma^{j} = \sum_{i} s_{i}^{j} \frac{\partial \ln p_{i}}{\partial \ln E}$ of a change in NEER. We estimate this effect at different points of the income distribution non-parametrically:

$$\Gamma^{j} = f(y^{j}) + \varepsilon^{j}$$

using a locally weighted regression with quartic kernel weights. To construct standard error bands for our estimates of the consumption effect, we bootstrap the sample of the household expenditure survey and our estimate of the pass-through to the price of each group of goods.

Factor income effects

The estimates of the income effects require time series data on income and employment for workers of different characteristics, which we construct by pooling different cross-sectional surveys. The equation estimated is:

$$y_{mt} = \beta_{m} y_{.t} + \alpha_{m} e_{t} + Z_{mt}\gamma + \mu_{m} + \varepsilon_{mt} \qquad (2)$$

where y_{mt} is the log of average household nominal income for group *m* in time *t*, $y_{.t}$ is the log of overall average nominal income in time *t*, e_{t} is a measure in logs of the exchange rate (about which we will elaborate soon!), Z_{mt} is a vector of group characteristics that vary over time (e.g. percent of households headed by a female; average family size) and μ_{m} is a group fixed effect. The coefficients β_{m} capture the relative income of group *m* relative to the average while the coefficients α_{m} captures the distributional effects of exchange rates (i.e. how group incomes vary with exchange rate movements, after controlling for overall average income). The latter is the main coefficient of interest.

The estimation of the effect of exchange rates poses a few challenges. In the case of Brazil, nominal variables pre-1995 generally follow a I(2) process. However, since 1994, when the *Plano*

Real brought average inflation rates to single digits, nominal variables are best characterized as a I(1) process. Because the estimation of factor income effects would benefit from a longer panel, our baseline specification spans from 1981 to 2006. For Brazil, we chose to use the log of the REER as our exchange rate variable in equation (2) because this choice allows us to use a longer span of data, while for Mexico, we used the log of the NEER.[8]

Note that in our strategy, by including overall average nominal income in the year ($y_{.t}$) as a regressor, we avoid the need to deflate incomes to constant price terms. This is useful, since de Carvalho Filho and Chamon (2007) estimate a sizeable bias in the Consumer Price Indices (CPIs) in Brazil and Mexico (more so for poorer households, and such bias could affect our distributional results). We do not intend to estimate the effect of exchange rate movements on the overall average income since the nominal exchange rate is endogenous to economy wide averages. It is arguable, however, that the nominal exchange rate is exogenous to the average income of specific groups of the population, once we control for overall average income. Hence all of our income estimates will focus on distributional effects, taking the average income as given.

The final step is to construct expenditure-specific distributional $\alpha(y)$ effects based on $\hat{\alpha}_m$. We estimate:

$$\hat{\alpha}_j = g(y^j) + \upsilon^j$$

using a locally weighted regression with quartic kernel weights, where $\hat{\alpha}_j = \hat{\alpha}_m$ for $j \in m$. We are then ready to obtain the combined distributional effect of an exchange rate change for a household of expenditure y^j: $f(y^j) + g(y^j)$.

E. Data

Brazil

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[8] Our results are robust to restricting the Brazilian sample only to the post-Plano Real period (1995-2006) and to the choice of NEER or REER to both Brazil and Mexico.

We use the *Pesquisa Nacional por Amostra de Domicílios* (PNAD) to estimate the effect of the exchange rate on household income, and the *Pesquisa de Orçamentos Familiares* (POF) to obtain the household consumption shares of different groups of goods.

The POF is a nationally representative expenditure survey. Its latest available round was the 2002/03 POF. It provides detailed income and expenditure data, used to construct the budget shares for 18 different groups of goods that match the groups of goods as reported in the *Índice de Preços ao Consumidor Ampliado* (IPCA), which is considered Brazil's official consumer price index. The groups considered are: food inside the household, food outside the household, home maintenance and fees, fuel and energy, furniture and appliances, repairs and maintenance, clothing, shoes and accessories, jewelry, fabrics, transportation, medicine and optical products, health services, personal hygiene, recreation, communication and education. The POF provides information on age and education of the head of household which, together with the household geographical location, is used to match the factor income effects estimated with data from the PNAD.[9]

The PNAD is a yearly household survey, with sample size equal to 1/500 of the Brazilian population (about 100,000 households per survey year), designed to produce a picture of the living conditions and economic life of the Brazilian population, rural and urban. It provides detailed information on demographic characteristics such as age and race, education attainment, school enrollment, income from different sources, housing and living arrangements, family structure, work, fertility, migration and other topics. It provides several measures of labor participation and income, including hours of work, labor income and income from sources other than labor.

In both surveys, households can be grouped in terms of the age and education of the household head, and their geographical location. We consider six different geographical locations, based on whether the household is in a metropolitan area, other urban setting or in a rural area; and whether the household is in the North/Northeast region or not. We consider five educational levels: less than one year, some primary (2-5 years), some middle (6-9 years), some secondary (10-12 years),

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[9] Ideally we would like to have information on sector of employment or activity at the POF, but that is not available.

and some college. We use three age categories: 30 or below, between 31 and 50, and 51 or older. These categories group households into 6·5·3=90 bins. For each of these bins we compute the average income in every survey from 1981 to 2005.

We use the Nominal Effective Exchange Rate (NEER) and Real Effective Exchange Rate (REER) constructed by the IMF (which are based on trade-weighted averages). Since there is no apparent trend in the REER over the 1981-2007 period, we use the level of the REER as the exchange rate variable for our baseline estimates of the factor income effects in Brazil.

Mexico

We use the *Encuesta Nacional de Ingresos y Gastos del Hogar* (ENIGH) to estimate both the distributional effects on income and on relative prices. The ENIGH has national coverage, and is available for every even year in 1992–2006 plus 2005 (9 surveys in total). It provides detailed income and expenditure data, as well as a host of demographic characteristics of household members and living conditions.

Our income estimates classify households based on region, education attainment and sector of employment. We consider five regions: Distrito Federal (DF), urban and rural areas in *entidades* bordering the United States, and urban and rural areas elsewhere. We use fewer regions than in Brazil due to the smaller size of the ENIGH. The particular focus on states bordering the U.S. is based on our prior that labor demand in those regions is more likely to be sensitive to movements in the exchange rate. We classify areas as urban or rural based on their *localidade* having more than 15,000 people.[10] We consider five classifications of educational attainment of the household head: no formal education, some primary (1-6 years), some secondary (7-9 years), some preparatory (10-12 years) and some college. We use the same 3 age categories as in Brazil. Finally, we classify the employment as tradable if it is related to agriculture, mining or manufacturing, and nontradable if it is anything else. This yields a total of 5·5·3·2=150 bins in which households can

[10] ENIGHs are also available for 1984 and 1989, but we chose not to use these surveys because they did not provide this information on the size of *localidades*.

be classified. The ENIGH provides information on income for each of the previous 6 months (so it has a panel component which is not present for example in the PNAD).

Consumption expenditure shares are obtained for 17 groups: food (at home), alcohol and tobacco, clothing, footwear, clothing accessories and care, rent (including of owner-occupied housing), fuel and energy, other services related to housing, furniture and household equipment, home accessories and cleaning products, health, personal care, public transportation, private transportation, education, leisure and other services (including food outside the home).

F. Results

Consumption effects

Table 2 presents the pass-through effects from the VARs for Brazil, estimated in a sample from July 1994 through December 2006. The elasticity of the consumer price index to changes in the nominal effective exchange rate is 14 percent over 12 months and 17 percent over 24 months. Those results are similar to previous literature, such as Belaisch (2003) that finds that the pass-through of the Brazilian bilateral exchange rate with the US dollar is 17 percent over 12 months and 23 percent in the long run. The results by groups of goods show higher pass-through for tradable goods (such as food at home, electronic appliances, personal care and hygiene) than for nontradable ones (e.g. personal services, communication). The only surprising pass-through coefficients are on clothing and shoes and accessories, which seem to behave as nontradable goods, likely due to high trade protection to that industry.[11] The three groups of goods most sensitive to the exchange rate are: food inside the home, electronic appliances and jewelry. All services-related groups exhibit very low pass-through (sometimes even slightly negative).

Table 3 presents the pass-through effect for Mexico in a sample from 1990 to the present. The pass-through to the general inflation index is larger than in the case of Brazil, which likely reflects Mexico's greater economic integration to the United States. The elasticity of the consumer price

[11] "Protection through higher-than-average tariffs is provided to activities such as beverages, transport equipment, clothing and footwear." WTO (2004).

index to changes in the nominal effective exchange rate is 46 percent over 12 months and 73 percent over 24 months. The results are also consistent with a dichotomy between tradable and nontradable goods. The three groups most sensitive to the exchange rate include: food, home accessories and cleaning products, and private transportation. Not surprisingly, education, a non-tradeable service, exhibits the lowest pass-through coefficients among all groups.

The large pass-through for food, the consumption group accounting for the biggest expenditure share for poorer households, suggests that all else equal, an appreciation (depreciation) will help (hurt) the poor through the consumption channel. Figure 2A plots the distributional effects through the consumption channel of a 10 percent nominal effective exchange rate appreciation in Brazil. As expected, the effect is stronger for poorer households, which experience a welfare improvement similar to a 1.6 percent increase in their expenditure. The strength of that effect steadily declines to about 1.3 percent as we move to the upper tail of expenditure distribution. Thus, the effects of a currency appreciation through the consumption channel are fairly evenly distributed across the expenditure distribution because of a combination of low exchange rate pass-through and limited discrepancies in the breakdown of consumption baskets between tradable and non-tradable components across the expenditure distribution. Figure 2B breaks down the consumption effects across type of location and shows that there are no relevant differences between households in metropolitan, other urban or rural areas, after controlling for total expenditure.

Figure 3A plots the distributional effects of the consumption channel for Mexico. The results confirm the conjecture of stronger gains for the poorer households. But the effect is fairly flat, with the distributional effects of a 10 percent appreciation varying by less then ½ percent across the distribution. The level of that effect though is quite large, with a 10 percent appreciation raising purchasing power by 4½ percent, reflecting the stronger pass through in Mexico. Figure 3B breaks down the consumption effects across type of location and shows that there are no relevant differences in those effects between households in the Distrito Federal, border states or other states, after controlling for total expenditure.

Factor income effects

First, we present results from a relatively parsimonious specification for equation (2). This specification estimates only the first-level interactions between age, education and location with the exchange rate variable. Hence the results can fit into a standard regression table and the unfolded patterns can be discussed.

We present different estimates using alternately NEER or REER as the exchange rate measure. In all specifications, we use interactions with the average nominal income in the period as controls. Those regressors act as an implicit deflator for the nominal income measures (again, we want to minimize the use of the CPIs in these countries since de Carvalho and Chamon (2007) have shown they are severely biased). To the extent that average nominal income plays the role of implicit deflator, the results should not depend on whether the exchange rate variable is REER or NEER.

Table 4 presents those results for Brazil. For each of the columns, the dependent variable is the log of the average total household income, measured in 90 cells (education x location x age) for each year and there are fixed effects for each cell.

In column (1), the exchange rate variable is the REER and the coefficient on aggregate average income is constrained to one, so the left hand side variable is the difference of group income to aggregate average income. The coefficients of interest are the interactions between the exchange rate variable and category characteristics. The base category are households whose head is under 30 years old, has 12 years or more of schooling and lives in a metropolitan area. The results show that the elasticity of total household income to REER appreciation is smaller for household whose heads have less than one year of schooling, at -0.148, significant at 99 confidence (i.e. a 10 percent real appreciation reduces the relative income of households at the lowest years of schooling category by 1½ percent relative to a household with similar age and location with 12 years of schooling). However, the interaction between the real exchange rate and educational levels is not monotonic. The relative incomes of households at the second highest education category, i.e. 9 to 11 years of schooling for the head, increase by 1.3 percent relative to the highest education category in response to a 10 percent real appreciation. Relative incomes of households whose head is over 50 tend to fall behind during appreciations (the coefficient is -0.074, marginally significant). Finally, a real appreciation is found to affect negatively the relative incomes of rural households (the coefficient is -0.074, statistically significant).

In column (2), we introduce interactions of log average income with the cell characteristics. The pattern of results do not change: real appreciations negatively affect the relative incomes of the rural, the least educated, and the older headed households, while significantly increasing the relative incomes of households whose head are in the middle range of education, from 5 to 11 years of schooling. The negative coefficient on rural households is -0.207, stronger than the previous specification, but the coefficient on the lowest education category narrowed to -0.045 and became insignificant. The introduction of the interaction terms with log average income lowers the standard errors of the coefficients and also reduces the root mean square error by about 50 percent.

In column (3), the sample is restricted to the period from 1995 to 2006, a period when inflation rates were lower. Perhaps reflecting lower measurement error, the root mean square error decreases further, but coefficient estimates are less precisely estimated since the sample size was reduced from 2068 to 990 observations. For this subsample, households in rural (coeff.: -0.134) and other urban (coeff.: -0.045) areas are estimated to have a significant negative correlation to real appreciations, and so are older-headed households. The coefficients of the interactions with education, however, show that in recent years appreciations have been associated with an equalizing effect: they have increased the relative incomes of all households whose heads have less than 12 years of schooling.

In column (4), we use the nominal effective exchange rate (NEER) as the exchange rate variable. The results are similar to the other columns (1) and (2) with sample spanning from 1981 to 2006, with appreciation hurting mainly the incomes of rural households, but the effect of appreciation on the interaction with the least educated household heads turned insignificant.

Then, we move to the estimation of equation (1) with interactions of each category with the exchange rate and the aggregate income variables (i.e. we interact each age*region*education combination with the exchange rate and aggregate income.) The results are in line with the parsimonious specification displayed in Table 4 and they are best summarized through snapshots of the estimated distributional effects through the factor income channel as in Figure 4A for Brazil. The relationship between the factor income effect of an appreciation and the household expenditure level has the opposite slope as the one for the consumption effect. A 10 percent appreciation has a distributional effect similar to that of lowering the income of the poorest households by 1 percent while raising that of the richest ones by about 0.25 percent. It is worth noting that the overall level of this effect is not estimated (only its shape along the expenditure distribution). The overall level is normalized to average to zero for the whole sample, but its average can be different from zero in the chart since the plot is conditional on the population composition as of the most recent expenditure survey. Figure 4B breaks down the sample by location: metropolitan, other urban and rural areas. It shows that whereas there is an inverted-U shaped curve relating the income factor effect to expenditure levels in metropolitan and other urban areas, factor income effects are uniformly negative in the rural areas (even though we do not estimate the aggregate level effect, our estimates do quantify this relative shift across regions).

The negative effect at the poor tail of the distribution and the uniformly negative effect on rural areas likely reflects the concentration of households in activities whose profitability is lowered by an appreciation, since households in rural locations are often net producers of food (a tradable good). This proposition can be taken to the data, as the PNAD provides information on sector of economic activity.[12]

Table 5 presents the estimates of the differential effect of the exchange rate variables on total household income across sectors of activity. As expected, households whose heads have been employed in agriculture in the last 12 months are the ones whose total income is more negatively related to appreciations. A 10 percent appreciation in REER is associated to a reduction in the relative income of those households by about 2.1 percent, and that was statistically significant for all specifications. On the other hand, the finance and business services and the construction sectors showed positive coefficients for all specifications, albeit less precisely estimated. That is also expected, as those two sectors are eminently non-tradable. Somewhat surprisingly, the relative

[12] For those currently not employed, the survey inquires about their sector of activity, if any, in the last 12 months before the week of reference.

incomes of households whose heads are in the public administration, health and education sector are negatively related to appreciations. It would be interesting to investigate further why this is so. Unfortunately, information on sector of activity is not available in the Brazilian expenditure survey (POF) hence those sectoral effects are not included in the discussion of the total effects (as in Figures 4 and 6).

Figure 5A plots the distributional effects through the income channel for Mexico (based on the regression reported in the first column of Table 6). Again, the income of poorer households fares worse following an appreciation. The distributional effects peak at the middle of the distribution, and then decline. All else equal, the effect of a 10 percent appreciation on the income of households will be about ½ percent lower for the poorest and ¼ lower for the richest households vis-à-vis those in the middle of the distribution. While income is a relevant dimension over which to separate households, as in the case of Brazil, additional insights can be gained by comparing households along other dimensions. . We regress the average income in each household age*region*sector*education group on dummies for each of those cells, and for the interactions of age, region, sector and education on the average income in the period and the exchange rate.[13] Table 6 reports the coefficients for the interactions with the exchange rate. Results are similar when we use the NEER or the REER as the exchange rate variable (the interaction of the dummies with aggregate income plays a role similar to that of a price deflator). All else equal, households working in the tradable sector (agriculture, mining and manufacturing) experience a 1.1 percent decline in their income relative to those in the nontradable sector following a 10 percent NEER appreciation (or a 2.8 percent decline for a 10 percent REER appreciation).[14] The regional dummies indicate that appreciations are associated to strong income declines in the northern border states. In our preferred specification (based on the NEER), the urban and rural areas near the U.S. border experience, respectively, a 3.0 and 1.5 percent decline in income relative to Mexico City. Note that this effect is in addition to the one related to working on the tradable sector. Incomes

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[13] We only interact one dimension at a time with the exchange rate and income in our estimates for Mexico, since the ENIGH sample is much smaller than the one in the PNAD, and we could not meaningfully estimate the interaction exchange rate and average income with each of the 150 combinations of age*education*region*sector.

[14] Chiquiar (2008) finds that Stolper-Samuelson effects of NAFTA are stronger in the Northern b order states of Mexico than elsewhere in that country.

decline in other urban and rural areas relatively to Mexico City during periods of more appreciation. The combined differences in the factor income effect across regions (including the other factors, such as tradable sector employment) can be seen at Figure 5B. The results for the other characteristics indicate that less educated households and those in the 30-50 age group tend to do better during periods of more appreciation than the more educated and older households (although caution should be used due to the wide standard errors around those estimates).

Aggregating consumption and factor income effects

The combined net effect can be quantified up to a constant, since whereas we estimate the level and the distribution of the consumption or pass through effect, only the relative distribution of factor income effects can be recovered (the average income effect is by construction zero for the entire sample).

Figure 6A aggregates the consumption (pass-through) and factor income effects for Brazil. It shows that whereas pass-through effects are estimated with more uncertainty than factor income effects, the bulk of the distributional effects we find across the expenditure distribution is caused by the incomes of the poor (households whose head have less years of schooling, and located in rural areas) falling behind the rich during appreciations. This is confirmed by robustness checks. Figure 6B shows that this effect is driven by rural households doing substantially worse than everybody else, with their total effect falling short by 1-2 percentage points relative to those residing in metropolitan areas.

In the case of Mexico (Figure 7A), the largest gains from appreciation remain in the lower middle classes, with a 10 percent appreciation improving their welfare relative to the very poor or very rich households by about ½ percent of expenditure. During appreciations, households in the Northern border area also do significantly worse than those elsewhere in Mexico (Figure 7B).

G. Conclusions

This paper uses household-level data to estimate the distributional effects of exchange rate movements in Brazil and Mexico. Its main result is that the bulk of distributional effects of nominal appreciations seem to work through factor incomes instead of the pass-through to consumption prices.

In the case of Brazil, the factor income effect generates a divide between metropolitan and rural areas. These differences are explained mostly by the sizeable negative effect of appreciations on the incomes of workers in the agricultural sector and their concentration in rural areas.

In Mexico, the divide is regional, with appreciation reducing the incomes of households located near the border to the United States relatively to the rest of the country, which likely reflects the concentration of Mexico's export sector in its Northern border. These findings confirm Kaufman and Stallings (1990) observation that the political divisions in Latin American countries responsible for populist policies are based on sectors of economic activity, instead of class conflict.

For both countries, appreciations, on average, tend to benefit households close to the median of the income distribution relatively to poorer or richer households. But overall, the distribution of the relative welfare gains or losses from an appreciation is fairly uniform across expenditure levels. It is plausible that if incomes take longer to adjust than consumption prices, the pass through effect to consumption could dominate voters' perceptions of the welfare effect of nominal appreciations, at least in the short-run. Or alternatively, income losses from appreciations could be concentrated on a few households experiencing unemployment. The combination of a limited distributional effect with a generous average pass-through effect can actually contribute to appreciation pressures - if a sizeable group of households stood to be particularly hit by an appreciation, that group might mobilize and voice its discontent over such policies.

In summary, the evidence for both Brazil and Mexico does not favor the view that Latin America's large inequality is the main culprit for their propensity to let their currencies appreciate, because the distribution of relative welfare gains and losses of appreciations across the expenditure distribution is fairly flat. In contrast, the paper found significant differences in the welfare effects of appreciations across economic sectors and regions. The question on whether appreciations indeed buys political support across sector and region divides is worthy pursuing by future research.

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Table 1. Overvaluation Episodes and Large Black Market Premia in Selected Emerging Markets Since 1980

REER data covers 1980-2006. Black market premium data from Reinhart and Rogoff (2004), covering 1980-1998. Transition Countries not reported due to concerns regarding pre-transition REER data.

Economy	Number of Years Overvalued Relative to Trend		Share of Time With Black Market Premium Above 15%
	15% or more	25% or more	
Argentina	12	10	0.52
Brazil	7	4	0.62
Chile	5	2	0.40
Hong Kong SAR	3	0	0.00
Colombia	8	2	0.29
Indonesia	7	5	0.18
Jamaica	6	3	0.62
Korea	1	0	0.07
Malaysia	1	0	0.00
Mexico	4	2	0.28
Paraguay	2	2	0.59
Peru	8	3	0.36
Philippines	3	0	0.09
Singapore	0	0	0.00
South Africa	3	0	0.14
Taiwan Province of China	0	0	n.a.
Thailand	1	0	0.00
Turkey	5	2	0.13
Uruguay	8	2	0.30
Venezuela	9	6	0.41

Table 2. Brazil: Exchange rate pass-through

Based on vector autoregression (VAR) model for log changes in prices and the nominal effective exchange rate (NEER), with monthly data from July 1994 to June 2006, including lags 1 to 12. The price data is from the Brazilian consumer price index (IPCA) and the exchange rate is the INS/IMF nominal effective exchange rate (NEER).

The regression controls for exogenous international prices: log changes in the non-fuel commodities index and the average of three spot crude oil prices, both from the IMF/WEO, and the U.S. consumer price index (all items, urban average; source: BLS) are included lagged 1 and 12 months.

%ΔP/ΔE is the ratio of the cumulative impulse response of log prices to a shock in the log exchange rates equation to the cumulative impulse response of log exchange rates to its own shock. %ΔP is the cumulative impulse response of log prices to a shock in the log exchange rates equation. The 12 (24) -month pass-through as the ratio of the average cumulative impulse response of prices between 3 to 15 (12 to 24) months after a shock to NEER to the 12-month average cumulative own impulse response of NEER.

Exchange rate pass-through (in percent)	**%DP/DE**		**%DP**	
	12 months	24 months	12 months	24 months
General Index	14.1	17.1	0.8	0.9
Food at home	26.6	27.1	1.4	1.4
Food outside the home	7.3	6.6	0.4	0.3
Home maintenance and fees	9.3	13.9	0.7	0.8
Fuel and energy	13.9	11.9	1.1	0.5
Furniture	13.7	15.0	0.8	0.8
Electronic appliances	24.1	22.3	1.2	1.0
Repairs and maintenance	3.8	2.0	0.2	0.1
Clothing	-1.5	-0.1	0.0	0.0
Shoes and accessories	0.0	-0.5	0.0	0.0
Jewelry	29.4	31.1	1.6	1.7
Fabrics	15.1	20.2	1.0	1.0
Transportation	20.7	19.7	0.9	0.8
Pharmaceutic and optical products	13.9	15.9	0.8	0.9
Health services	0.1	0.9	0.0	0.0
Personal care and hygiene	21.0	26.4	1.4	1.4
Personal services	-3.8	-6.4	-0.3	-0.3
Recreation and tobacco	6.6	5.7	0.3	0.3
Communication	-6.9	1.4	0.3	-0.2
Education and books	7.7	14.2	0.6	0.9

Table 3. Mexico: Exchange rate pass-through

Based on vector autoregression (VAR) model for log changes in prices and the nominal effective exchange rate (NEER), with monthly data from January 1990 to September 2007, including lags 1 to 12. The price data is from the consumer price index (INPC) and the exchange rate is the INS/IMF nominal effective exchange rate (NEER).

The regression controls for exogenous international prices: log changes in the non-fuel commodities index and the average of three spot crude oil prices, both from the IMF/WEO, and the U.S. consumer price index (all items, urban average; source: BLS) are included lagged 1 and 12 months. The food category only includes food consumed at home. Food consumed outside the home (e.g. restaurants) is included under the other services category.

%ΔP/ΔE is the ratio of the cumulative impulse response of log prices to a shock in the log exchange rates equation to the cumulative impulse response of log exchange rates to its own shock. %ΔP is the cumulative impulse response of log prices to a shock in the log exchange rates equation. The 12 (24) -month pass-through as the ratio of the average cumulative impulse response of prices between 3 to 15 (12 to 24) months after a shock to NEER to the 12-month average cumulative own impulse response of NEER.

Exchange rate pass-through (in percent)	**%DP/DE**		**%DP**	
	12 months	24 months	12 months	24 months
General index	45.6	72.6	2.5	3.9
Food	53.1	83.0	3.0	4.4
Alcohol and tobacco	34.2	53.7	1.9	2.9
Clothing	41.3	73.5	2.4	4.1
Footwear	38.7	63.5	2.2	3.4
Clothing accessories and care	30.8	44.1	1.7	2.3
User cost of housing	37.7	59.8	2.1	3.3
Fuel and energy	40.3	59.4	2.4	3.2
Other services related to housing	19.1	39.2	1.2	2.4
Furniture and household equipment	51.5	77.0	2.9	4.1
Home accessories and cleaning products	58.6	86.3	3.2	4.5
Health	36.4	58.0	2.0	3.2
Personal care	53.4	82.8	3.0	4.4
Public transportation	46.3	63.0	2.4	3.2
Private transportation	60.6	83.5	3.0	4.1
Education	21.8	42.7	1.3	2.6
Leisure	36.0	58.0	1.9	3.1
Other services	34.7	56.7	1.9	3.1

Table 4. Brazil: Regression of average income by household group on household characteristics.

Data comprises of log of annual average total household income by 3 categories of age (A), 6 of region of residence (R) and 5 of schooling (S) (3 x 6 x 5 = 90 groups) from the Brazilian PNAD household surveys from 1981 to 2006.

$$y_{mt} = \left(\sum_{s\in S}\beta_s y_{.t} + \sum_{a\in A}\beta_a y_{.t} + \sum_{r\in R}\beta_s y_{.t}\right) + \left(\sum_{s\in S}\alpha_s e_t + \sum_{a\in A}\alpha_a e_t + \sum_{r\in R}\alpha_r e_t\right) + Z_{mt}\gamma + \mu_m + \varepsilon_{mt}$$

where y_{mt} is the log of average household nominal income for group *m* in time *t*, $y_{.t}$ is the log of overall average nominal income in time *t*, e_t is a measure in logs of the exchange rate, Z_{mt} is a vector of group characteristics that vary over time (namely: percent of households headed by a female; average family size) and $\mu_m$is a group fixed effect. For presentational purposes, the β., the coefficients on the interactions to the log of average total household income, and the μ., the fixed effect for each of the 90 groups, are not report in this table. Standard errors in brackets. Coefficients significant at the 10 percent level in bold.

The exchange rate variable is Brazil's nominal and real effective exchange rates (NEER and REER) from the INS/IMF.

	Regression of log of Total household income			
	(1)	(2)	(3)	(4)
Exchange rate variable (E.R.)	Log(REER)	Log(REER)	Log(REER)	Log(NEER)
Sample	81-06	81-06	95-06	81-06
Schooling 0-1 yrs. X Exch. rate	**-0.148 [0.059]**	-0.045 [0.035]	**0.115 [0.038]**	-0.039 [0.029]
Schooling 2-4 yrs. X Exch. rate	-0.067 [0.059]	0.051 [0.033]	**0.134 [0.037]**	0.034 [0.028]
Schooling 5-8 yrs. X Exch. rate	0.004 [0.059]	**0.122 [0.034]**	**0.153 [0.037]**	**0.051 [0.029]**
Schooling 9-11 yrs. X Exch. rate	**0.133 [0.059]**	**0.191 [0.036]**	**0.133 [0.038]**	**0.060 [0.030]**
Other urban X Exch. rate	-0.045 [0.046]	**-0.074 [0.021]**	**-0.045 [0.024]**	-0.003 [0.018]
Rural X Exch. rate	**-0.074 [0.046]**	**-0.207 [0.027]**	**-0.134 [0.030]**	**-0.109 [0.022]**
South-SE-CW X Exch. rate	0.094 [0.059]	**0.086 [0.035]**	0.003 [0.038]	0.014 [0.029]
North-NE X Exch. rate	**0.137 [0.059]**	**0.092 [0.036]**	0.026 [0.039]	0.026 [0.030]
Age 30-50 X Exch. rate	-0.032 [0.046]	-0.018 [0.024]	-0.004 [0.027]	0.001 [0.020]
Age 51-up X Exch. rate	-0.074 [0.046]	**-0.093 [0.026]**	**-0.142 [0.029]**	**-0.088 [0.021]**
% of female heads	**-1.031 [0.079]**	**-0.859 [0.082]**	**-0.275 [0.118]**	**-1.030 [0.081]**
Average family size	**0.158 [0.013]**	**0.099 [0.014]**	**0.133 [0.028]**	**0.104 [0.014]**
Constant	**-0.619 [0.102]**	**-0.599 [0.071]**	**-0.472 [0.198]**	**-0.260 [0.105]**
Aggregate effect constrained to 1 for all groups	Yes	No	No	No
Observations	2068	2068	990	2068
R-squared	0.956	1.000	0.993	1.000
Root mean square error	0.178	0.089	0.066	0.092

Table 5. Brazil: Regression of average income by household group on household characteristics.

Data comprises of log of annual average total household income by 7 categories of occupation activity (O) and 5 of schooling (S) (7 x 5 = 35 groups) from the Brazilian PNAD household surveys from 1981 to 2006.

$$y_{mt} = \left(\sum_{s \in S} \beta_s y_{.t} + \sum_{o \in O} \beta_o y_{.t} \right) + \left(\sum_{s \in S} \alpha_s e_t + \sum_{o \in O} \alpha_o e_t \right) + Z_{mt}\gamma + \mu_m + \varepsilon_{mt}$$

where y_{mt} is the log of average household nominal income for group *m* in time *t*, $y_{.t}$ is the log of overall average nominal income in time *t*, e_t is a measure in logs of the exchange rate, Z_{mt} is a vector of group characteristics that vary over time (namely: percent of households headed by a female; average family size) and $\mu_m$is a group fixed effect. For presentational purposes, the β., the coefficients on the interactions to the log of average total household income, and the μ., the fixed effect for each of the 35 groups, are not report in this table. Standard errors in brackets. Coefficients significant at the 10 percent level in bold.

The exchange rate variable is Brazil's nominal and real effective exchange rates (NEER and REER) from the INS/IMF.

	Regression of log of Total household income			
	(1)	(2)	(3)	(4)
Exchange rate variable (E.R.)	Log(REER)	Log(REER)	Log(REER)	Log(NEER)
Sample	81-06	81-06	95-06	81-06
Agriculture * E.R.	**-0.211 [0.068]**	**-0.179 [0.048]**	**-0.190 [0.042]**	**-0.136 [0.040]**
Manufacturing * E.R.	-0.059 [0.064]	-0.006 [0.046]	-0.022 [0.040]	-0.011 [0.038]
Construction * E.R.	0.096 [0.071]	**0.115 [0.051]**	0.034 [0.044]	**0.156 [0.042]**
Commerce and services * E.R.	-0.026 [0.060]	0.023 [0.043]	-0.012 [0.036]	0.054 [0.035]
Public admin., health, education * E.R.	-0.065 [0.062]	-0.037 [0.044]	**-0.089 [0.038]**	**-0.068 [0.037]**
Finance, business services * E.R.	**0.133 [0.070]**	**0.163 [0.049]**	0.026 [0.042]	0.085 [0.041]
No activity * E.R.	-0.070 [0.065]	-0.060 [0.045]	**-0.166 [0.039]**	**-0.095 [0.038]**
0-1 yrs.schooling * E.R.	-0.019 [0.063]	-0.029 [0.044]	**0.092 [0.039]**	**-0.061 [0.037]**
2-4 yrs schooling * E.R.	0.068 [0.060]	0.068 [0.043]	**0.107 [0.037]**	0.008 [0.036]
5-8 yrs. schooling * E.R.	**0.139 [0.062]**	**0.138 [0.043]**	**0.132 [0.037]**	0.022 [0.036]
9-11 yrs. schooling * E.R.	**0.176 [0.063]**	**0.169 [0.044]**	**0.071 [0.038]**	0.026 [0.037]
% of female heads	**-1.047 [0.111]**	**-0.708 [0.155]**	0.024 [0.213]	**-0.848 [0.149]**
Average family size	**0.071 [0.017]**	0.017 [0.032]	**0.12 [0.058]**	**0.061 [0.030]**
Constant	**-0.256 [0.113]**	**-0.268 [0.134]**	-0.084 [0.370]	0.007 [0.160]
Aggregate effect constrained to 1 for all groups	Yes	No	No	No
Observations	805	805	385	805
R-squared	0.978	1.000	0.997	1.000
Joint significance, education * ER (p-value)	0.002	0.000	0.009	0.049
Joint significance, activity * ER (p-value)	0.000	0.000	0.000	0.000

Table 6. Mexico: Regression of average income by household group on household characteristics.
Data comprises of log of annual average total household income by 3 categories of age (A), 5 of region of residence (R), 5 of schooling (S), and 1 for tradable or nontradable sector of employment (T): (3 x 5 x 5 x 2= 150 groups) from the Mexican ENIGH household surveys from 1992 to 2006.

$$y_{mt} = \left(\sum_{s\in S}\beta_s y_{.t} + \sum_{a\in A}\beta_a y_{.t} + \sum_{r\in R}\beta_s y_{.t} + \beta_T y_t\right) + \left(\sum_{s\in S}\alpha_s e_t + \sum_{a\in A}\alpha_a e_t + \sum_{r\in R}\alpha_r e_t + \alpha_T e_t\right) + Z_{mt}\gamma + \mu_m + \varepsilon_{mt}$$

where y_{mt} is the log of average household nominal income for group m in time t, $y_{.t}$ is the log of overall average nominal income in time t, e_t is a measure in logs of the exchange rate, Z_{mt} is a vector of group characteristics that vary over time (namely: percent of households headed by a female; average family size) and $\mu_m$is a group fixed effect. For presentational purposes, the β., the coefficients on the interactions to the log of average total household income, and the μ., the fixed effect for each of the 150 groups, are not report in this table. Standard errors in brackets. Coefficients significant at the 10 percent level in bold.

The exchange rate variable is Mexico's nominal and real effective exchange rates (NEER and REER) from the INS/IMF.

Exchange rate variable (E.R.)	Log(NEER)	Log(REER)
Sample	92-06	92-06
Schooling 1-6 yrs. X Exch. Rate	0.065 [0.040]	0.047 [0.071]
Schooling 7-9 yrs. X Exch. Rate	0.024 [0.046]	0.047 [0.080]
Schooling 10-12 yrs. X Exch. Rate	**-0.100 [0.050]**	-0.011 [0.089]
College X Exch. Rate	-0.043 [0.050]	-0.082 [0.087]
Tradable X Exch. Rate	**-0.111 [0.027]**	**-0.279 [0.048]**
Border US Urban X Exch. rate	**-0.295 [0.060]**	**-0.395 [0.107]**
Border US Rural X Exch. rate	**-0.149 [0.048]**	-0.135 [0.085]
Other Urban X Exch. rate	**-0.094 [0.045]**	**-0.222 [0.079]**
Other Rural X Exch. rate	-0.020 [0.044]	**-0.138 [0.077]**
Age 30-50 X Exch. rate	0.006 [0.032]	0.067 [0.056]
Age 51-up X Exch. rate	**-0.066 [0.034]**	0.000 [0.060]
% of female heads	**-0.090 [0.026]**	**-0.100 [0.026]**
Average family size	**0.105 [0.005]**	**0.106 [0.005]**
Constant	**-2.397 [0.641]**	**-2.340 [0.446]**
Dummies for each cell, and for each group*aggregate income	Yes	No
Observations	11329	11329
R-squared	0.93	0.93

Figure 1. Evolution of Real Effective Exchange Rate and Income in Selected Latin American and Asian Emerging Markets in 1980-2003

Source: IMF (REER) and Penn World Table (PPP GDP Per Capita). REER equal to 100 in 2000. An increase in the REER indicates an appreciation of the currency.

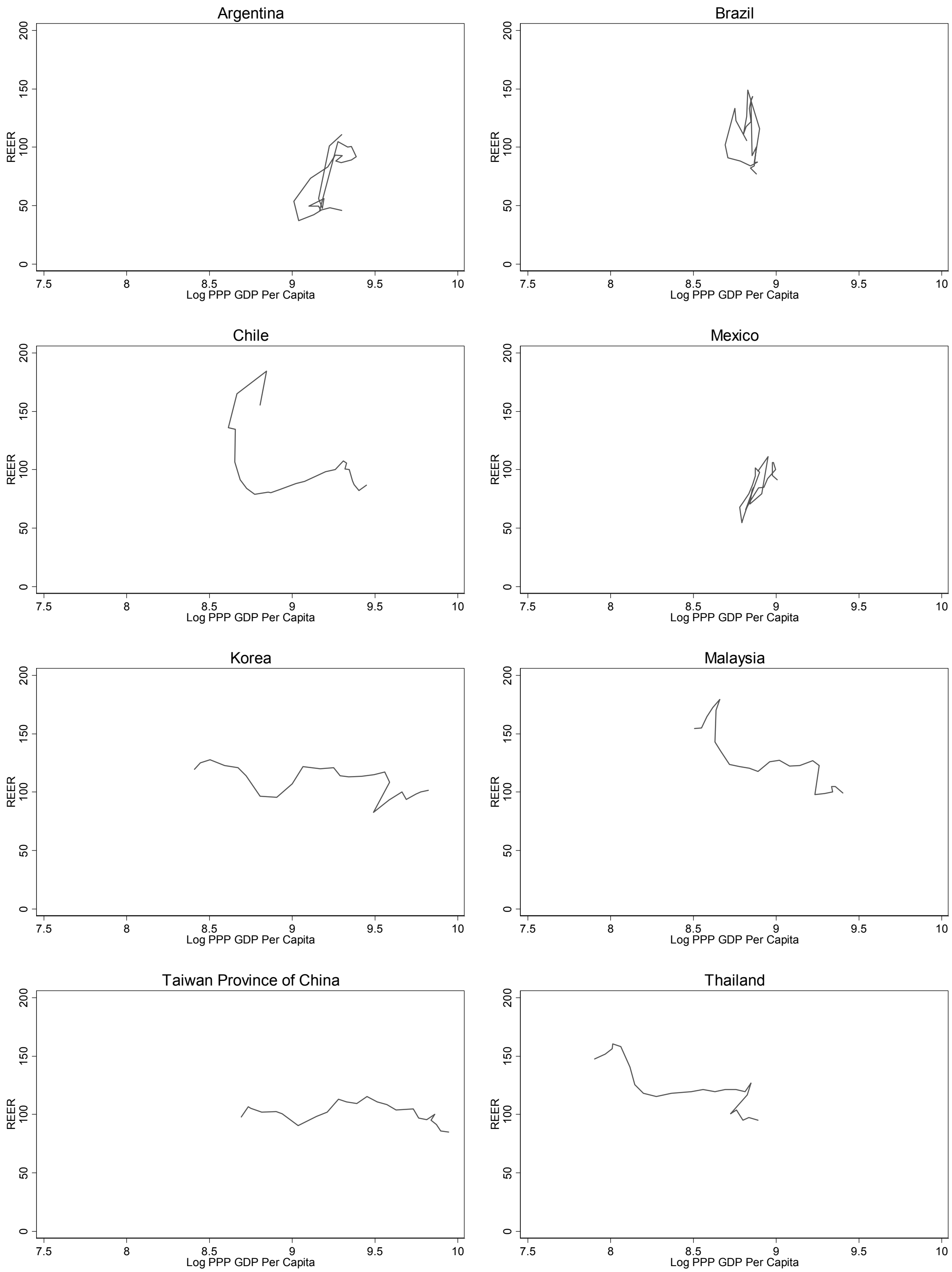

Figure 2A. Brazil: Pass-through effect of a 10 percent nominal effective exchange rate appreciation

Data comprises the estimated pass-through for each household specific consumption basket in the Brazilian POF household expenditure survey of 2002/03. Each household specific pass-through is based on its shares of expenditure in 19 categories of goods and the estimated pass-through of the nominal effective exchange rate (NEER) to each of those categories of goods for the 1994-2007 period, as reported in Table 2. The equation estimated is:

$$\Gamma^j = f(y^j) + \varepsilon^j$$

Where y^j is the log of expenditure of household j and Γ^j is its household-specific NEER pass-through. Non-parametric estimates were based on locally linear regressions with quartic kernel weights. Dashed lines are 95 percent bootstrap confidence intervals.

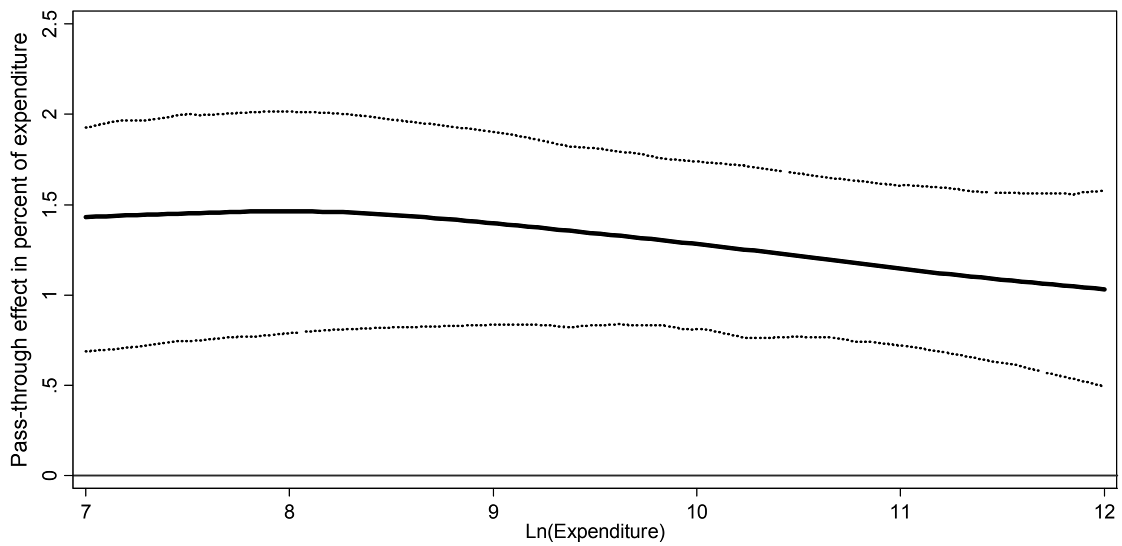

Figure 2B. Brazil: Pass-through effect of a 10 percent NEER appreciation, by location

Same as Figure 2A, by region of residence.

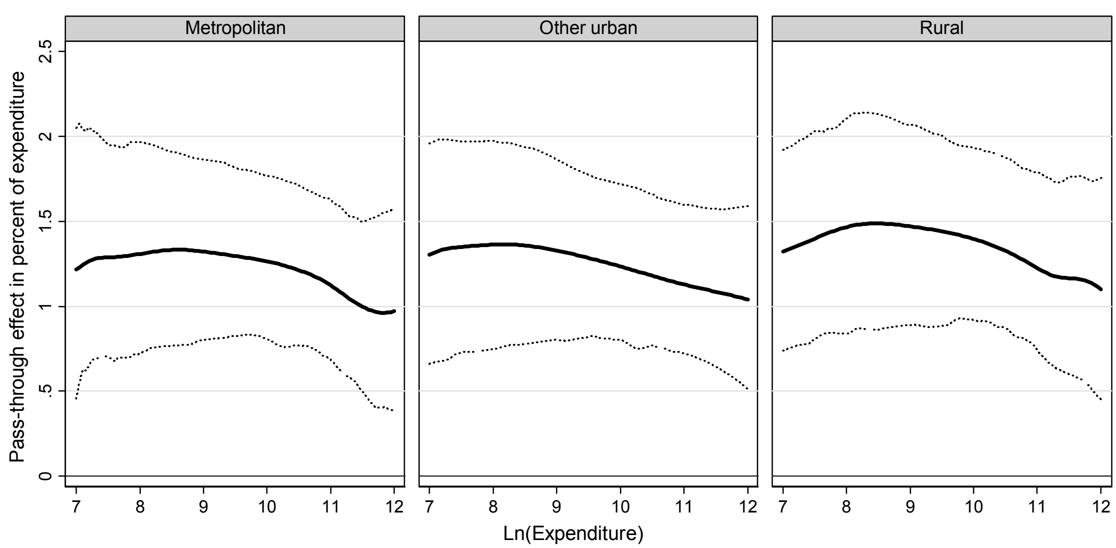

Figure 3A. Mexico: Pass-through effect of a 10 percent nominal effective exchange rate appreciation

Data comprises the estimated pass-through for each household specific consumption basket in the Mexican ENIGH household expenditure survey of 2006. Each household specific pass-through is based on its shares of expenditure in 17 categories of goods and the estimated pass-through of the nominal effective exchange rate (NEER) to each of those categories of goods for the 1990-2007 period, as reported in Table 2. The equation estimated is:

$$\Gamma^j = f(y^j) + \varepsilon^j$$

Where y^j is the log of expenditure of household j and Γ^j is its household-specific NEER pass-through. Non-parametric estimates were based on locally linear regressions with quartic kernel weights. Dashed lines are 95 percent bootstrap confidence intervals.

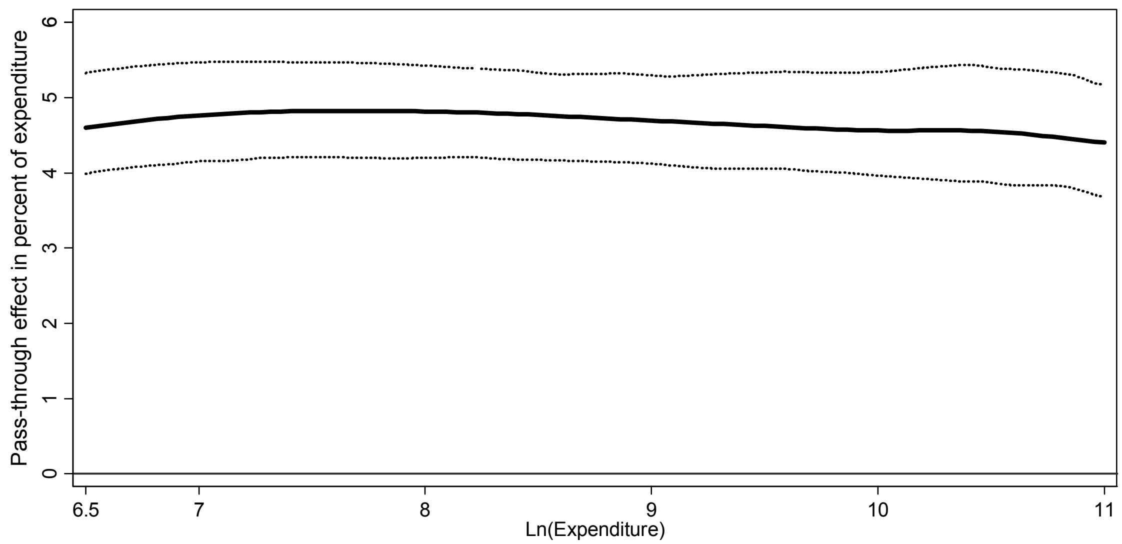

Figure 3B.Mexico: Pass-through effect of a 10 percent NEER appreciation, by location

Same as Figure 3A, by region of residence.

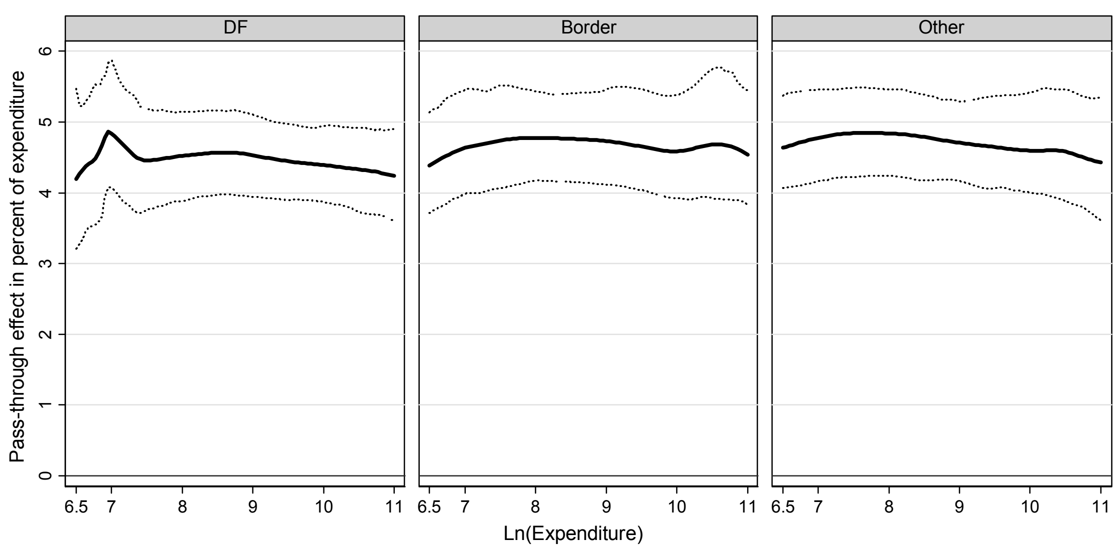

Figure 4A. Brazil: Factor income effect of a 10 percent nominal effective exchange rate appreciation

The equation estimated is: $\hat{\alpha}_j = g(y^j) + \upsilon^j$

where y^j is the log of expenditure of household *j* from the POF 2002/03 household expenditure survey and $\hat{\alpha}_j$ is household *j* group-specific factor income effect. Non-parametric estimates were based on locally linear regressions with quartic kernel weights. Dashed lines are 95 percent bootstrap confidence intervals.

Estimates of factor income effects α_m are based on estimation of equation (2) $y_{mt} = \beta_m y_{.t} + \alpha_m e_t + Z_{mt}\gamma + \mu_m + \varepsilon_{mt}$ where data comprises of log of annual average total household income by 3 categories of age (A), 6 of region of residence (R) and 5 of schooling (S) (3 x 6 x 5 = 90 groups) from the Brazilian PNAD household surveys from 1981 to 2006 and e_t is the log of the real effective exchange rate (REER) from INS/IMF. To map from a nominal effective exchange rate (NEER) to the REER, a VAR model for log changes in the NEER and REER was estimated as in Table 2. The average factor income effect over the whole estimation sample is equal to zero by construction, since we are only measuring distributional effects (taking the average income as given), but slightly different than zero for the POF 2002/03 sample.

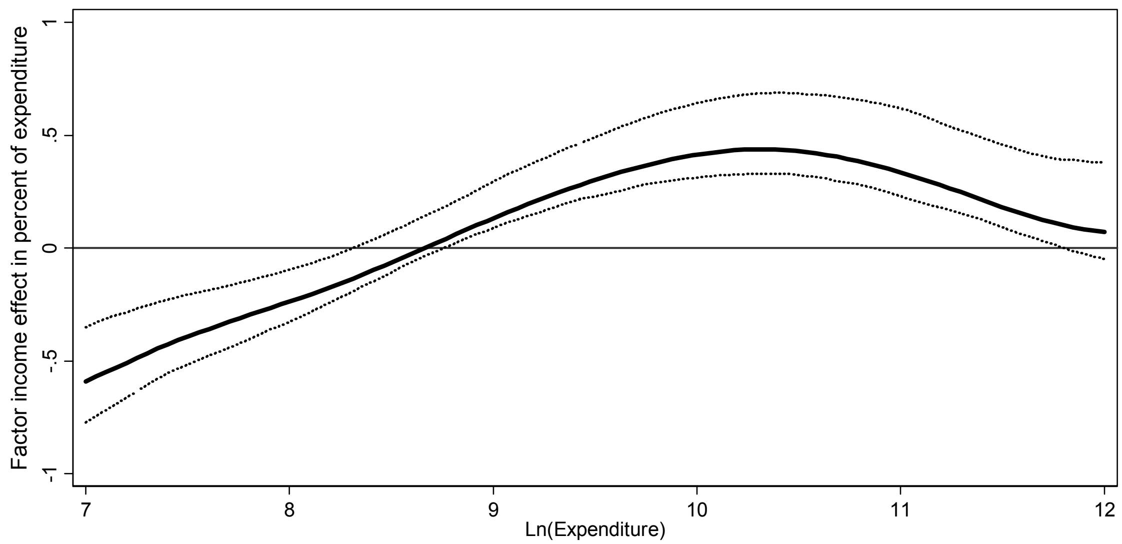

Figure 4B. Brazil: Factor income effect of a 10 percent NEER appreciation, by location

Same as Figure 4A, by region of residence.

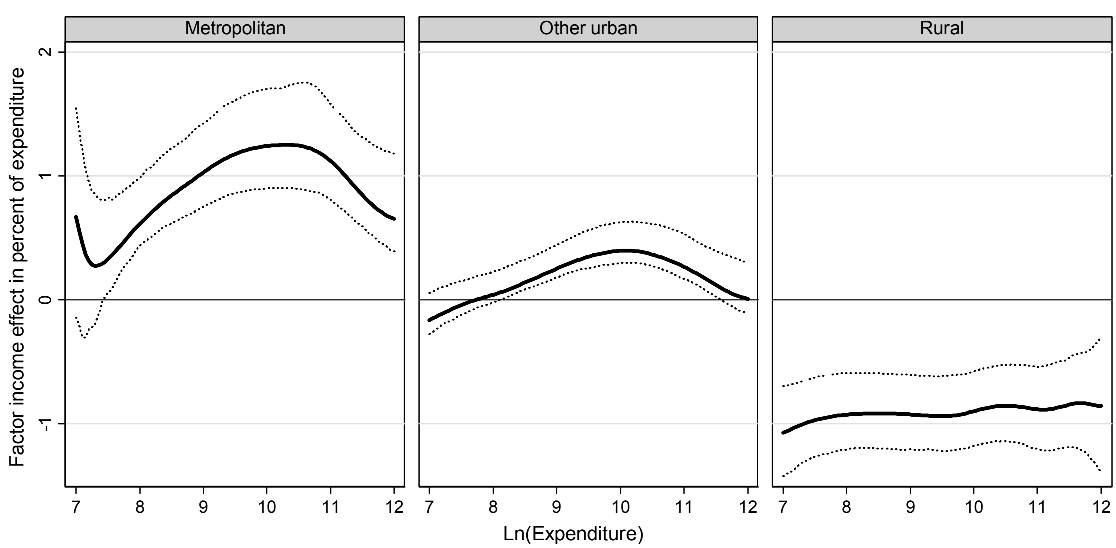

Figure 5A. Mexico: Factor income effect of a 10 percent nominal effective exchange rate appreciation

The equation estimated is: $\hat{\alpha}_j = g(y^j) + \upsilon^j$

where y^j is the log of expenditure of household j from the ENIGH 2006 household expenditure survey and $\hat{\alpha}_j$ is household j group-specific factor income effect. Non-parametric estimates were based on locally linear regressions with quartic kernel weights. Dashed lines are 95 percent bootstrap confidence intervals.

Estimates of factor income effects α_m based on the regression in Table 6 (first column) The average factor income effect over the whole estimation sample is equal to zero by construction, since we are only measuring distributional effects (taking the average income as given), but slightly different than zero for the 2006 sample.

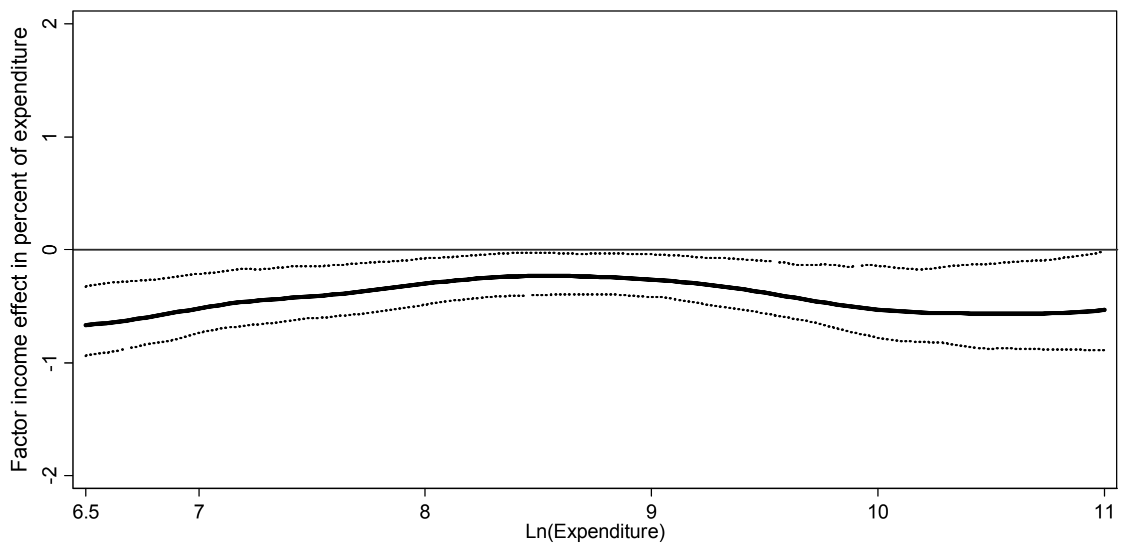

Figure 5B. Mexico : Factor income effect of a 10 percent NEER appreciation, by location

Same as Figure 5A, by region of residence.

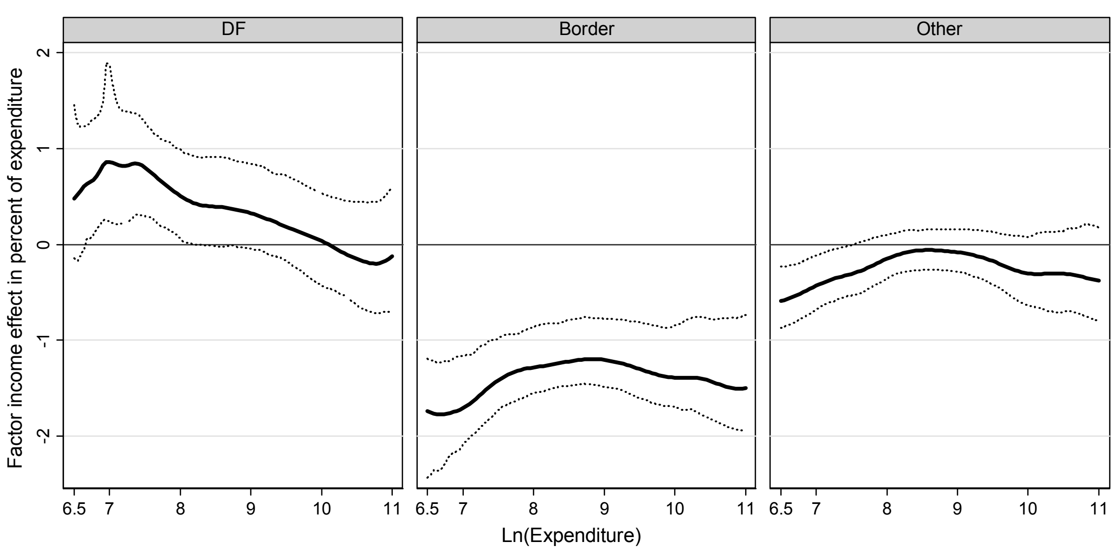

Figure 6A. Brazil: Total effect of a 10 percent nominal effective exchange rate appreciation

Pass-through and factor income estimates are as in Figures 4A and 6A. Total effects are equal to the sum of pass-through and factor income effects for each household. Average level of the combined effect is given by the average level of the consumption pass-through effect (since average factor income effect is equal to zero by construction). Thus, one should focus on the distributional patterns, not on the absolute levels. Dashed lines are 95 percent bootstrap confidence intervals.

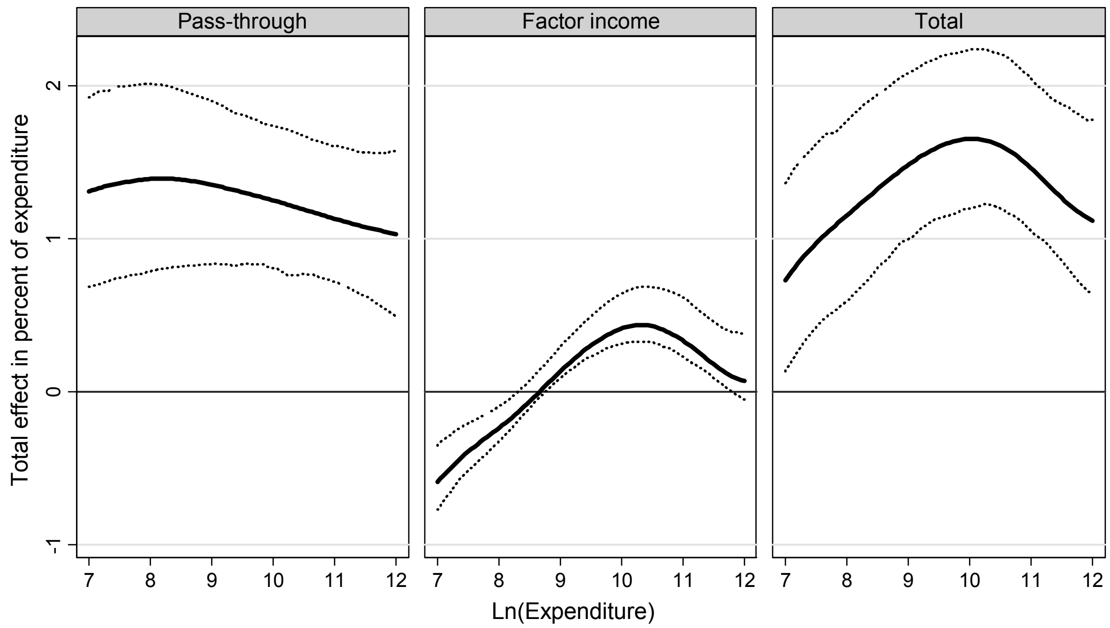

Figure 6B. Brazil: Total effect of a 10 percent NEER appreciation, by type of location

Same as Figure 6A, by region of residence

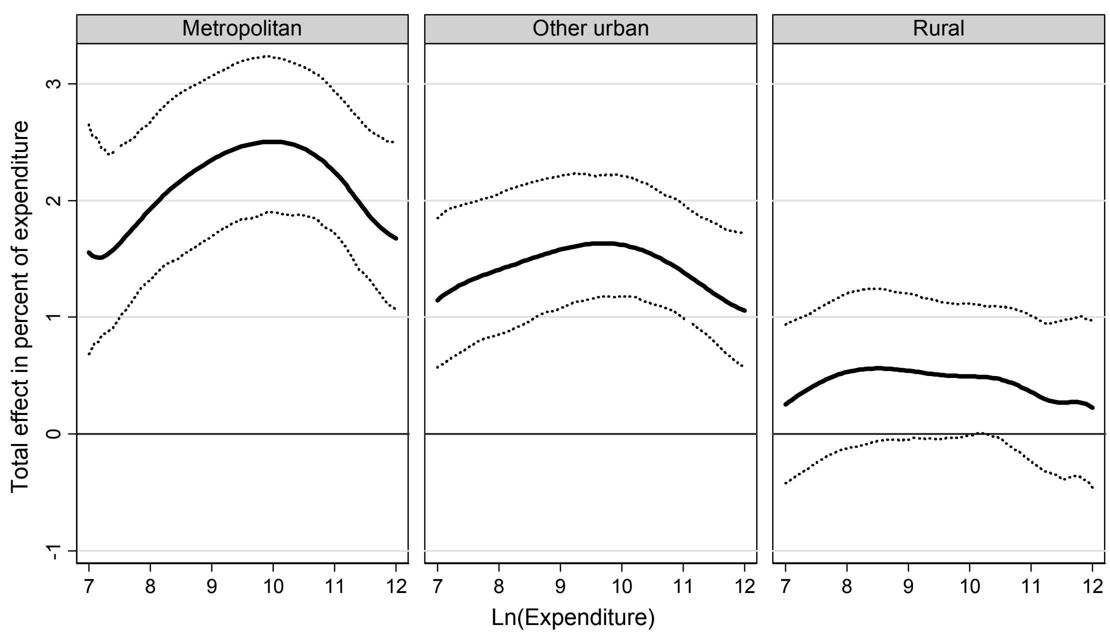

Figure 7A. Mexico: Total effect of a 10 percent nominal effective exchange rate appreciation

Pass-through and factor income estimates are as in Figures 5A and 7A. Total effects are equal to the sum of pass-through and factor income effects for each household. Average level of the combined effect is given by the average level of the consumption pass-through effect (since average factor income effect is equal to zero by construction). Thus, one should focus on the distributional patterns, not on the absolute levels. Dashed lines are 95 percent bootstrap confidence intervals.

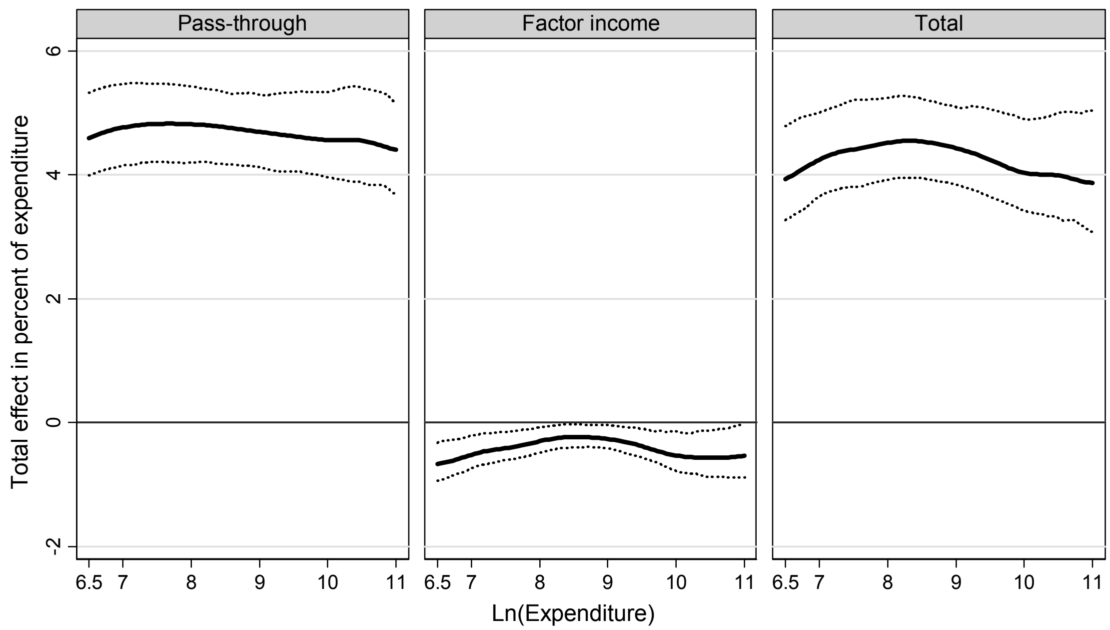

Figure 7B. Mexico: Total effect of a 10 percent NEER appreciation, by type of location

Same as Figure 7A, by region of residence