How do Borrowers Adjust in a Household Foreign Currency Debt Crisis?*

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Abstract

This paper studies how households adjust to a large revaluation of foreign currency-denominated household debt. Our analysis uses detailed household-level data during Hungary's large depreciation in 2008. Relative to similar local currency debtors, foreign currency debtors reduce consumption expenditures approximately one-for-one with increased debt service, suggesting binding liquidity constraints. Foreign currency debtors reduce both the quantity and quality of expenditures, consistent with nonhomothetic preferences and a "flight from quality." Debt revaluation has no effect on labor market status, hours, or earnings, but there is a small adjustment toward foreign income streams and a substantial increase in home production.

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1 Introduction

Foreign currency debt often plays a central role in emerging market financial crises. From crises in Asia and Latin America in the 1990s to emerging Europe in 2008, widespread exposure to foreign currency debt combined with a sharp exchange rate depreciation weakened private-sector balance sheets, depressing consumption and investment. While its impact on firm outcomes is well-documented, less is known about how households respond to foreign currency debt revaluations. Nevertheless, household foreign currency debt has represented an important vulnerability in several financial crises, as shown in Figure 1.[1] Moreover, household balance sheets are an important transmission channel in models of international financial crises (Lorenzoni, 2014) and recent heterogeneous agent open economy macro models (de Ferra et al., 2019; Auclert et al., 2021; Zhou, 2022).

In this paper, we study how households adjust to a large revaluation of foreign currency debt burdens during a currency crisis. Our focus is the case of Hungary around the depreciation of the Hungarian forint starting in late 2008. Prior to the crisis, two-thirds of household debt was denominated in foreign currency, primarily Swiss franc. The sharp and unexpected depreciation of the forint relative to the Swiss franc starting in October 2008 increased household debt burdens for foreign currency (FC) borrowers, but not local currency (LC) borrowers. We examine how households adjust to this balance sheet shock using detailed survey data that follows households for four years and, crucially, contains information on the currency composition of housing debt.

Our empirical approach compares the outcomes of foreign currency borrowers to similar local currency borrowers. Four facts support our identifying assumption of parallel trends. First, variation in households' debt currency denomination comes largely from the timing of borrowing due to changes in the availability of a government subsidy for local currency loans. As a result, FC and LC debtors are broadly similar on observable characteristics. Second, FC and LC debtors have parallel pre-trends in consumption before

[1] Appendix C provides additional examples of household foreign currency lending and resulting balance sheet effects during depreciations.

the large depreciation. Third, our estimates are essentially unchanged when including a rich set of household controls, including contemporaneous household income. Fourth, as a placebo test, we show that non-borrowers do not reduce consumption relative to LC debtors in the crisis.

We find that households with FC debt significantly and persistently reduce consumption after the depreciation, relative to households with LC debt. The consumption response translates into a marginal propensity to consume (MPC) on nondurable consumption out of higher debt service of approximately one. This implies that nondurable consumption falls one-for-one with the increase in debt payments, indicating that foreign currency borrowers were unhedged against the depreciation. When we consider total household spending including durables, we estimate a marginal propensity to spend of 1.23. This large decline in consumption for foreign currency debtors is most consistent with binding liquidity constraints and "wealthy hand-to-mouth" behavior (Kaplan and Violante, 2014). While the increase in debt service is persistent, taking into account that debt obligations have a finite maturity, we calibrate that the permanent income hypothesis would predict a lower MPC of about 0.6.

We document a variety of margins of adjustment to the balance sheet shock that are relevant for models of business cycles and international financial crises. We start by decomposing the fall in expenditures to understand the structure of the demand response to the foreign currency debt shock. We use detailed product-level information on expenditures to decompose the change in spending induced by the shock into reductions in spending on the intensive and extensive margins. Reduction in spending along the intensive margin accounts for 71 percent of the overall decline in spending. The remaining 29 percent driven by the extensive margin. The extensive margin reduction, in turn, is primarily driven by reduced entry into new product categories, while exit from product categories matters less.

Focusing on the intensive margin of adjustment, 71 percent of the decline in spending is explained by a reduction in quantities purchased, and the remaining 29 percent is explained by a reduction in average prices paid. The decline in prices paid within detailed consumption categories suggests that FC debtors substitute away from more expensive to cheaper varieties following the balance sheet shock, which can be interpreted as a "flight from quality" (Burstein et al., 2005). The reduction in prices is consistent with nonhomothetic preferences following a shock to household balance sheets. The finding that an adverse balance sheet shock reduces the quality composition of demand has implications for measurement of consumer price inflation (Burstein et al., 2005), balance-of-payments adjustment (Bems and di Giovanni, 2016), and labor demand (Jaimovich et al., 2019).

We also examine household adjustment through labor supply. We find no effect of the shock on labor market status, hours, or household income, pointing to a weak wealth effect on labor supply. Our data also contain information about sources of income, including foreign income. While overall labor supply does not increase, a small but significant subset of households adjust their labor supply toward foreign income streams by working abroad. Finally, FC debtor households increase home production, suggesting a shift in consumption from money-intensive to time-intensive goods.

Our paper contributes to the literature on large devaluations and emerging market crises. There is a vast literature studying the consequences of *firm's* FC debt exposure around devaluations (see, for example, Galindo et al., 2003; Aguiar, 2005; Endrész and Harasztosi, 2014; Kim et al., 2015; Salomao and Varela, 2021; Vonnák, 2018; Niepmann and Schmidt-Eisenlohr, 2019). Most studies find that FC debt depresses firm investment and increases bankruptcy risk. Nevertheless, there is also evidence that firms with a natural hedge select into FC debt financing and that these firms' investment is not differentially sensitive to a depreciation (Bleakley and Cowan, 2008). More recently, Adams and Verdelhan (2021) shows that Japanese firms have large unhedged exchange rate exposures and reduce investment in response to exchange rate shocks.

In contrast, there is less evidence on the transmission of exchange rate shock through household balance sheet exposures, despite awareness that household FC debt represented a vulnerability in crises such as Mexico in 1994 (Corsetti et al., 1999), Argentina in 2002 (IMF, 2003a), and especially several emerging European economies in the 2008 Global Financial Crisis (Ranciere et al., 2010). Verner and Gyöngyösi (2020) also focused on Hungary's 2008 crisis and found that sub-regional exposure to household FC debt led to a worse local recession.[2] This paper builds on Verner and Gyöngyösi (2020) by estimating the consumption and labor supply response to the debt revaluation at the *household level*, comparing similar households within regions. To our knowledge, this is the first paper with household-level evidence on the transmission of an exchange rate shock to consumption and other household-level outcomes through household balance sheets. Credit frictions and balance sheet shocks may help understand the high volatility of consumption in emerging markets and its sharp decline during many crises (Aguiar and Gopinath, 2007; Mendoza, 2010).[3] Our estimates can therefore be used by researchers calibrating recently-developed open-economy heterogeneous models with a "foreign currency Fisher channel" in which households have exchange rate exposure through nominal foreign currency assets and liabilities (de Ferra et al., 2019; Auclert et al., 2021; Zhou, 2022). Furthermore, we provide new evidence on households' margins of adjustment, including the "flight from quality" and the limited labor supply response. We discuss the implication of this evidence for the literature when presenting these results in section 6.

Finally, we contribute to the literature on the role of household debt in consumption decisions. Dynan (2012) studies household deleveraging in the Great Recession and shows that households with higher debt reduced their spending to a larger extent between 2007-2009. Mian et al. (2013) show that housing net worth shocks depressed consumption in the Great Recession. Di Maggio et al. (2017) find that a decline in debt burdens due to changes in interest rate has a positive effect on durable spending. Ganong and Noel

[2]Verner and Gyöngyösi (2020) also analyzed individual-level defaults and found individual and local spillover effects of FC debt on default. That paper, however, did not examine household-level data on consumption or labor supply.

[3]Guntin et al. (2020) present evidence based on household survey data from five crisis episodes that high income households display the largest decline in consumption and have larger than average consumption-income-elasticities, pointing to an important role for permanent income shocks. In contrast, we trace the adjustment to a specific identified balance-sheet shock and relate the estimates to theories of household behavior.

(2020) study mortgage modification policies for distressed debtors in the United States and find that increased liquidity boosts consumption, whereas changes in wealth that do not increase liquidity have no effect on consumption. Our data and research design allow us to estimate the consumption response to a large and sudden increase in debt for a broad cross-section of debtors, compute the marginal propensity to consume out of higher debt service, and shed light on numerous channels of adjustment that have received little attention in previous work. Our large MPC estimates are consistent with the importance of liquidity in household spending emphasized by Ganong and Noel (2020) and the models of Kaplan and Violante (2014) and Boar et al. (2021).

The rest of the paper is structured as follows. The next section provides background on foreign currency lending in Hungary. Sections 3 and 4 present the data and empirical framework. Section 5 presents the main results, section 6 explores the margins of adjustment, and section 7 concludes.

2 Household foreign currency lending in Hungary

This section provides context for Hungary's foreign currency lending boom and crisis. Credit to the retail sector in Hungary was low in the 1990s, but lending increased rapidly in 2000 after the government introduced a mortgage subsidy program. Through the program, households could borrow in local currency (LC) at nominal interest rates similar to the rates on euro-denominated mortgages and significantly below LC market lending rates. Figure 2 panel (a) shows household indebtedness in LC increased rapidly following the introduction of the subsidy program.

However, by early 2004 the subsidy program was cut back, leading to an increase in interest rates on new LC loans. Foreign banks responded by entering the retail lending market and competing with domestic banks by offering foreign currency (FC) denominated housing loans with lower interest rates (Banai et al., 2011). Several factors contributed to the spread of foreign currency loans including: the large interest rate differential between local and foreign currency loans and the persistent deviation from uncovered interest parity (Csajbók et al., 2010), expectations of joining the euro (Fidrmuc et al., 2013), banks seeking to match the currency composition of their assets and liabilities, and expansive foreign monetary policy (Gyöngyösi et al., 2019). By 2008, household debt increased to more than 30 percent of GDP from around 5 percent in 2000. In September 2008, 66 percent of total household debt was denominated in FC, with 97 percent of FC debt denominated in Swiss franc and the rest mostly in euro.

The exchange rate was stable before 2008, as shown in Figure 2, which further contributed to the rapid spread of lending in FC. The Hungarian National Bank maintained an ± 15 percent exchange rate band to the euro in the 2000s, which Ilzetzki et al. (2019) classify as a *de facto* ± 5 percent band. Meanwhile, the Swiss franc was maintained within a *de facto* ± 2 percent band around the euro.

The Hungarian National Bank abolished the exchange rate band in February 2008. The outbreak of the crisis in September 2008 was followed by a large depreciation of the forint alongside an appreciation of the Swiss franc. The forint depreciated by 27.5 percent against the euro and 32.3 percent against the Swiss franc between September 2008 and March 2009. By 2012, the forint depreciated by more than 50 percent against the Swiss franc compared to the pre-crisis period.

While market participants may have appreciated some risk of depreciation, a significant depreciation of the domestic currency was not the baseline expectation among households or professional forecasters. Consensus Economics forecasts show that professional forecasters anticipated a stable HUF/EUR exchange rate over one- and two-year horizons in the months before October 2008 (Figure A.1). Based on a household survey from November 2008, Pellényi and Bilek (2009) find that most FC borrowers did not expect large exchange rate movements.[4]

Most households had limited foreign currency income or wealth and were thus not

[4]Pellényi and Bilek (2009) present survey evidence that 87.2 percent of borrowers did not expect the level of exchange rate volatility that materialized in the 2008 crisis.

hedged against the depreciation.[5] Although Hungary joined the EU in 2004, working abroad and hence foreign currency income was negligible before the crisis.[6] As Hungarian households had limited savings or income in foreign currency, the unexpected debt revaluation placed a significant burden on households through rising monthly installments. With the depreciation of the forint, default rates increased to nearly 15 percent of FC mortgage loans and 22 percent for FC home equity loans by 2012 (Figure A.2). Since household debt in Hungary is full recourse and there was no provision for personal bankruptcy, the rise in default rates largely reflects the limited ability to service rising installments.

In addition to the exchange rate shock, rising interest rates on variable rate housing loans also increased debt service costs for FC debtors. Szigel (2012) quantifies the effect of the exchange rate depreciation and interest rate increases on debt service using aggregate data. He finds that exchange rate movements contributed 75 percent of the increase in debt service for FC borrowers, while interest rate increases contributed the remaining 25 percent. The crisis led to a sharp fall in aggregate consumption, which declined by 10 percent from 2008 to 2012 (Figure 2 panel (c)).

Although foreign currency loans were banned in 2010, no major policies were implemented to address increased debt burdens of existing debtors until the end of 2011. The Early Repayment Program (ERP) of 2011 allowed households to prepay their foreign currency housing debt at a preferential exchange rate.[7] Because the program required households to repay the entire outstanding debt, wealthier households were more likely to participate. Some households took out new domestic currency loans to participate in the

[5]Backé et al. (2007) documents using repeated cross-sectional survey data that less than 10 percent of households had foreign currency holdings between 2002 and 2006, and the median holding was around 100 EUR. Pellényi and Bilek (2009) report survey evidence that only 1.6 percent of FC borrowers had FC income or savings in 2008.

[6]The major destination countries for Hungarians working abroad were Austria, Germany, and the UK. Although the UK opened its labor market to Hungarian workers in 2004, only 40,000 Hungarians migrated to the UK officially between 2004 and 2011 (Moreh, 2016). Austria and Germany only opened their labor markets completely to Hungarian citizens in 2011. Hárs (2016) uses census data and shows that less than 2 percent of Hungarian households had emigrated by 2011, and emigration only accelerated after 2010.

[7]Gyöngyösi and Verner (2020) analyze the political economy of the crisis and provide further details on the policy response in the FC loan market.

program. Approximately 23 percent of FC debt was prepaid through the ERP. In 2012, the government also introduced the Exchange Rate Cap program, which allowed FC debtors to repay their debt at a preferential exchange rate for a grace period of five years.[8] These policies were implemented after the period from 2008 to 2011, which is the central focus in our analysis.

3 Data and measurement

3.1 Survey data

Our source for household-level data is the Household Budget and Living Conditions Survey (HKÉF), administered by the Hungarian Central Statistical Office (KSH). This is a representative survey of 8 to 10 thousand households residing in Hungary. The data has a rotating panel structure, and households are followed for four consecutive years. This provides a long within-household panel dimension relative to most consumption surveys. Our sample period is between 2005 and 2012, which provides four years of data in both the pre-depreciation period (2005-2008) and the post-depreciation period (2009-2012).[9]

The survey consists of two parts, a consumption diary and an interview. In the consumption diary, participants write a detailed diary tracking all expenditures for two weeks.[10] The interview part of the survey takes place in the first quarter of the following year. In the interview, KSH surveys households about their major expenditures in the previous year. The interview is also used to collect detailed information on the household and each members' socioeconomic background, including age, education, and region (county and settlement type).[11] Household members are also surveyed about their labor

[8]Participation in this program was lower than expected. In August 2012, only 16 percent of eligible borrowers had applied. MNB (2012) speculate the low participation may be explained by the fact that the program was relatively complicated.

[9]Our sample period ends in 2012, as KSH started data collection with a completely new set of households in 2013 for the EU-SILC survey.

[10]An example of the diary is presented in Figure A.3.

[11]Information on the county and settlement type (Budapest, county capital, town, village) allows us to partition the country into 58 "regions."

market status, income, and transfers in the previous year. To ensure representativeness, our analysis uses the household weights provided by KSH.

Measures of consumption Our primary outcome variable for household consumption is real nondurable consumption expenditures. Nondurable consumption comprises strict nondurable goods, semi-durable goods, and services. We exclude expenditures on durables and on home improvement from this main measure of consumption, but we present results for these categories separately.[12] We adjust consumption for family composition by dividing by the Oxford scale.[13] To ensure that our results are not driven by outliers, we winsorize consumption at the top 97.5 percent. Consumption expenditures are deflated by 3-digit price indices to 2007 levels.

We also utilize the survey's detailed information on purchases by product categories. Consumption expenditures are classified at the five-digit level using the UN's Classification of Individual Consumption by Purpose (COICOP). In addition, households report *quantities* purchased for three consumption categories (food and non-alcoholic beverages, alcohol and tobacco, and clothing and footwear). These three groups account for 34.3 percent of nondurable expenditure in 2008. This allows us to calculate the average price (unit value) a household pays for the purchased items within five-digit COICOP categories. The survey also asks about home production of food and non-alcoholic beverages. While we exclude home production from our main measure of nondurable consumption, we analyze it separately.

Foreign currency debt exposure To classify households as FC debtors, LC debtors, and non-borrowers, we use various pieces of information on household debt. The survey

[12] Home improvement expenditure includes spending on materials for the maintenance and repair of the dwelling (COICOP 04.3.1) and services for the maintenance and repair of the dwelling (COICOP 04.3.2). Households undertaking major renovations report expenditures in these categories, which represents investment rather than consumption. Benmelech et al. (2017) show that home purchase is followed by an increase in home-related durable consumption and home improvements.

[13] The Oxford scale is given by: $1 + 0.7(n-1) + 0.5k$, where n is the number of persons age 14 and over in the household and k is the number of children under 14. In the appendix we report results using alternative consumption equivalence scales.

includes loan-specific information on the year of origination, maturity, total amount borrowed, and the monthly payment. From 2009 onward, KSH also collects information on the currency denomination of the loan, the type of the housing loan, as well and the total debt service paid in the last year. We thus see debt currency denomination for households entering the survey before 2009 as long as households are present in or after 2009. As a result, we have a direct measure of debt currency denomination for all households who are in the survey in both the pre (before 2009) and post period.

To reduce measurement error in FC debt status, we determine whether households have FC or LC debt by combining the reported loan currency denomination with various other pieces of information. These are the year of origination (essentially all loans originated before 2004 are LC, while 79.3 percent of loans originated in 2004 or after are FC), the type of the loan (home equity loans are essentially all in FC as they were not subsidized), and participation in the Exchange Rate Cap or the Early Repayment Program (which only applied to FC loans). With this information, we count the number of indications of whether a household has an FC or LC loan and classify FC status based on the majority indication (for details see Appendix B). Moreover, since monthly debt payment is not reported every year, we use an annuity model to reconstruct payments and outstanding debt by combining the information on loan terms with currency-specific average interest and exchange rate data from the Hungarian National Bank (for details see Appendix B).

We validate our approach in two ways. First, we compare the estimated annuity payment with the reported payment in years when the survey asks about the latter. Appendix Figure B.11 shows that there is a tight, positive, and roughly one-for-one relation between the two. This supports our classification, as payments of FC and LC debtors diverge with the significant depreciation of the forint. Second, we compare the regional average foreign currency loan share calculated from the survey with administrative credit registry aggregates from the Hungarian National Bank in Appendix Figure B.12. The positive correlation indicates that our approach correctly distinguishes between FC and LC debtor households.

4 Empirical framework and identification

4.1 Empirical specification

We measure the effect of the foreign currency household debt shock on consumption and other household-level outcomes by comparing households with FC debt to households with LC debt. We also examine non-borrowers as a placebo group. Our basic specification is the following difference-in-differences regression:

$$\ln C_{it} = \alpha_i + \delta_t + \beta FC_i \times Post_t + \gamma NoDebt_i \times Post_t + \Gamma X_{it} + \varepsilon_{it}, \tag{1}$$

where $\ln C_{it}$ denotes a measure of household i's log consumption expenditure, α_i is a household fixed effect, δ_t is a year fixed effect, and $Post_t$ is an indicator variable that equals one after 2008. FC_i and $NoDebt_i$ are household-level indicator variables for households with FC debt and households without debt, respectively. The omitted group is LC borrowers. X_{it} is a set of household level control variables measured in the household's first sampling period, interacted with $Post_t$. The controls include age, gender, and education of the household head, household size, and fixed effects for 58 regional units.

4.2 Identification

The identifying assumption for consistent estimation of β is that consumption would have evolved similarly for FC and LC debtors in the absence of exposure to FC debt. The threat to identification is thus time-varying household-level shocks that affect consumption and are correlated with debt currency denomination. This raises two important questions. First, why do some households enter the crisis with FC debt, while other households have LC debt? Second, what are the observable characteristics of these households and are they comparable?

Variation in households' debt currency denomination in this context is driven by the *timing* of borrowing. As discussed in Section 2, households who borrowed during the phase of subsidized LC loans from 2000 to early 2004 have LC loans. The majority (79.3 percent) of households who borrowed from 2004 onward have FC debt.

The importance of government policy in explaining variation in currency denomination mitigates concerns about self-selection into FC loans based on financial literacy, risk preferences, or other factors. Nevertheless, given that FC debtors and LC debtors borrowed at different points in time, they could still be meaningfully different in observables, raising concerns that their consumption would have evolved differently during the crisis in the absence of FC exposure.

Table 1 presents evidence against this concern. Specifically, the table compares the average characteristics of households in HKÉF by the currency denomination of their debt in 2008. The first three columns present the average characteristics of FC borrowers, LC borrowers, and non-borrowers, respectively. Column 4 reports the difference between FC and LC borrowers, and column 5 reports the difference between borrowers and non-borrowers. We also plot the distribution of key variables by currency denomination of debt in Figure 3.[14]

Table 1 reveals that FC borrowers and LC borrowers are broadly similar along several observable dimensions. For example, there are no clear differences in household size, total consumption-to-income, food consumption-to-income, debt service-to-income in 2008, and liquid assets. The distributions of these variables across the two groups are also similar (Figure 3). There is some difference in income and educational attainment, with LC debtors being more likely to have a college education, but the distributions have considerable overlap.[15] We also find that FC and LC households' consumption basket have similar inflation exposure (Figure A.10). The broad similarity between FC and LC debtors along these characteristics is consistent with the fact that the variation in exposure

[14] Appendix Figure A.4 shows the distribution by borrower status.

[15] Verner and Gyöngyösi (2020) find similar patterns using two other household survey datasets with information on foreign currency debt status, the Euro Survey Project and the Tárki Household Monitor. One difference is that in these other survey datasets, FC debtors have higher education than LC debtors. Nevertheless, taken together, the evidence suggests that FC and LC borrowers do not differ substantially in terms of key observables. These findings are consistent with existing studies on household FC borrowing in emerging European countries, which find that FC and LC debtors are reasonably similar (Pellényi and Bilek, 2009; Fidrmuc et al., 2013).

is driven primarily by the timing of borrowing, rather than self-selection into loan currency denomination within a given point in time.[16] This mitigates the concern that FC debt exposure is correlated with other unobserved shocks to household consumption.

One difference between FC and LC borrowers that is worth noting is that FC borrowers are significantly less likely to live in a main city and more likely to live in a village. This is explained by the fact that smaller towns had a lower density of domestic banks, implying that borrowers living in these areas were less likely to borrow in LC while these loans were subsidized. During the lending boom, foreign banks expanded their footprint, opening branches in previously underserved areas. This meant that households in smaller towns were more likely to take on FC denominated debt (Verner and Gyöngyösi, 2020). Given that we are interested in household-level responses, in this study, we control for these differences using region-by-time fixed effects.

In contrast to the differences between FC and LC debtors, the differences between borrowers and non-borrowers are more substantial. Households with debt are significantly younger and larger, have higher overall household income (but lower income per equivalence unit), and spend a lower share of income on food. Debtors are also less likely to live in the capital (Budapest) and more likely to live in other towns.

Finally, it is worth noting that FC debt exposure rises across the income distribution, as lower income households are less likely to have debt.[17] The positive covariance between income and FC debt exposure implies that the depreciation *reduces* inequality through FC debt exposure, as higher income households are more likely to experience adverse debt revaluations. This contrasts with previous work documenting channels through which depreciations increase inequality through differential increases in the cost of living or differential exposure to foreign assets (Cravino and Levchenko, Cravino and Levchenko; Drenik et al., 2018).

[16]We find similar results when focusing only on households who borrowed after 2003, for whom there was no subsidy available. Table A.1 shows that FC and LC borrowers in this subsample are very similar on observables.

[17]Figure A.5 shows more explicitly that FC debt exposure rises across the income distribution. This result also holds in a broader sample of nine economies in Emerging Europe, as show in Figure A.6a. The result is also robust to adjusting for foreign currency savings.

5 Effect of foreign currency debt revaluation on consumption

5.1 Main result

Table 2 presents the results from the estimation of equation (1) for log household non-durable consumption as the outcome variable. We estimate the regression by using Poisson pseudo-maximum likelihood (PPML), which avoids the potential bias introduced by heteroskedasticity (Silva and Tenreyro, 2006).[18] Standard errors are clustered at the household level. The estimation period is 2005-2012.

The first column in Table 2 presents the estimates without controls. FC debtors reduce consumption by 4.6 percent, relative to LC debtors, following the large depreciation of the forint. The estimate is statistically significant at the one percent level. In contrast, the effect for non-borrowers is close to zero and is not significant. In the second column of Table 2, we control for household characteristics and region fixed effects. All controls are interacted with the $Post_t$ dummy. These controls absorb differential shocks affecting households that are correlated with observable characteristics such as education and preference-driven differences in the evolution of consumption. The coefficient is essentially unchanged.

A concrete threat to identification is that FC debtor households experienced different income shocks in the crisis. For example, this could happen if FC debtors were more likely to be employed in sectors severely hit by the crisis. To address this concern, in column 3 we control for *contemporaneous* household income to account for any other income shocks that might affect consumption. Because households can adjust their labor supply in response to balance sheet shocks, this specification may over-control for income, so our preferred specification excludes this control. Nevertheless, the estimate remains statistically significant and similar in magnitude, falling modestly to -4.1 percent.[19]

Finally, in column 4 we control for log consumption in 2008. This effectively compares

[18]PPML also naturally deals with zero values in the dependent variable, which can arise for subcategories of spending. We find similar results using OLS.

[19]In section 6.2, we document that a small but significant subset of households increase their foreign income share, suggesting a positive labor supply effect toward foreign income streams. However, we also show that there is no evidence that FC debtors experience a differential change in overall income (see Table 7), which further allays the concern that FC debtors are hit by differential income shocks.

households that have the same pre-crisis consumption level. While the number of observations falls by approximately half because it requires households to be in the survey in 2008, the point estimate is again quantitatively similar. The stability of the coefficient to the inclusion of this rich set of controls supports our identifying assumption that FC debt exposure is orthogonal to time-varying shocks to consumption.

5.2 Dynamic impact of foreign currency debt on consumption

To understand the dynamic impact of foreign currency debt on consumption and assess the validity of the parallel trends assumption, we estimate the following dynamic difference-in-differences regression:

$$\begin{aligned}\ln C_{it} =& \alpha_i + \delta_t + \sum_{k\neq 2008} \beta_k^{FC} FC_i \times \mathbb{1}_{t=k} + \sum_{k\neq 2008} \beta_k^{ND} NoDebt_i \times \mathbb{1}_{t=k} \\ &+ \sum_{k\neq 2008} \Gamma_k X_{it} \times \mathbb{1}_{t=k} + \varepsilon_{it}.\end{aligned} \tag{2}$$

Figure 4 plots the sequence the coefficient estimates $\{\hat{\beta}^{FC}\}$ comparing the effect of FC debt exposure on consumption over time relative to the omitted LC group. The baseline year is 2008 based on the fact that the depreciation started in October 2008 and that the decline in aggregate consumption in annual data occurs between 2008 and 2009 (Figure 2 panel (c)).

The point estimates on FC_i in the years preceding the crisis (2005-2007) are generally close to zero and insignificant, in line with the parallel trends assumption. There is some evidence of elevated nondurable consumption in 2006, which could be driven by new housing borrowing financing higher nondurable consumption for FC borrowers, although this estimate is not statistically significant. With the start of the crisis in late 2008, FC debtors sharply reduce consumption in 2009. The effect continuously builds throughout the crisis, reducing FC debtor's consumption by 7 percent in 2012. The coefficient is significantly different from zero in all years after the onset of the depreciation.

Figure 4 also plots the consumption response of non-borrowers, again relative to LC debtors. For non-borrowers, there is a positive but insignificant upward trend before 2008. After 2008, non-borrowers' consumption evolves similarly to LC debtors. While non-borrowers may have been differentially affected by the crisis through other channels, the absence of an effect for these households nevertheless provides a useful placebo check supporting a causal interpretation of the estimated effect of FC debt exposure on consumption.

5.3 Marginal propensity to consume out of the debt service shock

Theory To understand the magnitude of the consumption response to the FC debt revaluation, we estimate the marginal propensity to consume out of the increase in debt service by relating the consumption change to the increase in debt service. Before presenting the estimates, we outline the consumption response to this shock for two polar models of consumption: a permanent income (PI) consumer, who can smooth her consumption over the life cycle, and a hand-to-mouth (HtM) consumer, who has liquidity constraints and cannot smooth her consumption. In both cases, we consider a consumer with unhedged foreign currency debt of d. Suppose the initial exchange rate is one and the exchange rate unexpectedly depreciates to $\mathcal{E} > 1$. The change in the LC value of debt is $\mathcal{E}d - d = (\mathcal{E} - 1)d \equiv \Delta d$.

Consider first the adjustment of permanent income consumer. A quadratic utility permanent income consumer (Hall, 1978) smooths the increase in debt and reduces spending by $\Delta c^{PI} = -r\Delta d$, where r is the interest rate faced by the household.

Next, consider the HtM consumer. In line with the data, assume debt is an annuity with payments before the depreciation given by

$$P = d\frac{r}{1-(1+r)^{-m}}.$$

Given that consumption of the HtM consumer responds one-for-one with the increase in payments, the change in consumption due to the depreciation is

$$\Delta c^{HtM} = -\Delta d \frac{r}{1-(1+r)^{-m}}.$$

As an example, suppose that the debt is perpetual, so that $m \to \infty$. In that case, $\Delta c^{HtM} = -r\Delta d$, so the PI and the HtM consumer have the same response. The infinite maturity allows the HtM consumer to smooth as if she were a PI consumer. At the other extreme, if debt must be rolled over every period $(m = 1)$, then consumption declines by the full increase in debt and interest payment, $\Delta c^{HtM} = -(1+r)\Delta d$.

Given these responses, it is straightforward to calculate the marginal propensity to consume (MPC) out of increased debt service, ΔP. The MPC of the HtM consumer is one, $MPC^{HtM} = 1$. In contrast, the MPC of the PI consumer is given by $MPC^{PI} = \Delta c^{PI}/\Delta P = 1-(1+r)^{-m}$. In our sample, the average remaining maturity is $m = 18$, and the average interest rate is $r = 5\%$. These values imply an MPC for the PI consumer of $MPC^{PI} \approx 0.6$. Given the finite maturity of the contract, the HtM consumer displays a significantly larger MPC compared to the PI consumer.

Households' expectations about the persistence of the exchange rate depreciation also play an important role for the PI consumer. By anticipating that the exchange rate shock is only temporary, the fall in lifetime wealth is smaller than Δd and the implied MPC is smaller than 0.6. However, expecting further depreciation implies bigger decline in wealth than Δd and higher MPC than 0.6. Our assumption that households expect that the depreciation is permanent is consistent with the notion that it is difficult to beat a random walk forecast of exchange rates (Meese and Rogoff, 1983), and, more broadly, that crises in emerging economies are perceived to be permanent shocks (Aguiar and Gopinath, 2007).

Estimates We estimate the MPC out of the increase in annual debt service by instrumenting household debt service with FC debt exposure. In the first stage, we estimate

$$P_{it} = \alpha_i^{FS} + \delta_t^{FS} + \beta^{FS} FC_i \times Post_t + \Gamma^{FS} X_{it} + \varepsilon_{it}^{FS},$$

where P_{it} is the "payment surprise," defined as the unanticipated level of debt service induced by the crisis. Motivated by our simple theoretical framework, the payment surprise for household i in year t is calculated as the difference between the actual annual debt service at the prevailing prices (exchange rates and interest rates) minus the counterfactual debt service holding prices fixed at the time of origination. This difference captures changes in payment induced by plausibly unexpected shocks, but it is not affected by predictable changes in debt service caused by new borrowing or pre-prepayment.[20]

Using the predicted payment surprise, $\widehat{P}_{it}$, in the second stage, we then estimate

$$C_{it} = \alpha_i^{SS} + \delta_t^{SS} + \beta^{SS} \widehat{P}_{it} + \Gamma^{SS} X_{it} + \varepsilon_{it}^{SS}, \tag{3}$$

where C_{it} is the level of consumption in Hungarian forints. This specification measures the impact of the change in debt service induced by foreign currency exposure on household consumption. The exclusion restriction requires that the currency denomination of the loan affects consumption only through the increase in debt service.

Table 3 presents the estimates. Columns 1-3 present the reduced form effect of FC exposure on the level of consumption. FC debt exposure reduces annual nondurable consumption by 33-35 thousand HUF. Based on our preferred specification in column 2, this corresponds to an average decline in the level of overall household nondurable consumption of 85 thousand HUF ($652 PPP).

[20] Instrumenting the payment surprise also mitigates the attenuation bias stemming from measurement error in the payment surprise. As we construct the loan payment of households using an annuity model, measurement error in the borrowed amount or maturity can lead to measurement error in the loan payment and therefore in the payment surprise. The instrument essentially normalizes the change in consumption by the average increase in FC payment surprise relative to the average increase in LC payment surprise. As a classical measurement error in payment surprise does not change the average payment surprise much, the instrument lowers the attenuation bias.

Table 3 columns 4-6 present the instrumental variables estimates, effectively relating the forint decline in spending to the forint increase in debt service from FC exposure. The first stage F-statistic is above 110 in all specifications, indicating that FC exposure results in a significant increase in household debt service. The estimates imply a marginal propensity to consume on nondurable consumption of 0.92 to 0.99. Based on these estimates, spending on nondurable consumption declines approximately one-for-one with the increase in debt service in the years following the depreciation.

How does the marginal propensity to consume evolve over time? Figure 5a presents a year-by-year visualization of the MPC estimate. Specifically, we plot estimates from equation (2) for the level of consumption and debt service as dependent variables. We multiply the coefficient on debt service by negative one to show it on the same scale as the coefficient on consumption. We only estimate the impact on debt service following the depreciation in 2008, as FC exposure only induces a significant unanticipated change in debt service after the depreciation. The estimates imply that consumption of FC debtor households declines by 50 thousand forints ($382 PPP) per adult equivalent by 2012, relative to 2008. This corresponds to a decline in total household nondurable consumption of about 122 thousand forints ($931 PPP).

Figure 5b reports the cumulative MPC at horizons from 2009 to year k, calculated as:

$$MPC(k) = -\frac{\sum_{j=2009}^{k} \hat{\beta}_j^C}{\sum_{j=2009}^{k} \hat{\beta}_j^P}, \tag{4}$$

where $\hat{\beta}_j^C$ and $\hat{\beta}_j^P$ are the estimated effects of FC exposure on consumption and annual debt service, respectively, in year j relative to 2008. Since the increase in debt service is a negative cash-flow shock, we multiply this ratio by negative one to obtain a positive MPC.

The MPC in 2009 is 1.16, so nondurable consumption initially declines more than one-for-one with the increase in debt service after 2008. Once the exchange rate became unanchored, households may have expected further depreciation, leading to a larger initial consumption response. As the Swiss franc appreciated further, FC debt exposure further depressed consumption. However, the decline in consumption is smaller than the additional increase the debt service in 2011 and 2012. This coincides with the large increase in household default rates (Figure A.2), which suggests that some households conserved liquidity by defaulting. Hence, by 2012, the estimated cumulative MPC falls to 0.81.

The point estimates of the MPC are most consistent with hand-to-mouth behavior.[21] Based on our preferred estimate in Table 3 column 5, we can reject an MPC of lower than 0.41 at the 10 percent level. Therefore, strictly speaking, we cannot reject an MPC of 0.6, our calibrated MPC for a permanent income consumer, at the 10 percent level. However, the point estimates are most consistent with hand-to-mouth behavior, suggesting a role for liquidity constraints. Furthermore, the estimates indicate that persistent shocks to cash flows lead to larger responses than transitory shocks, which are usually estimated to generate MPCs of around 0.25 (Johnson et al., 2006; Parker et al., 2013; Kaplan and Violante, 2014).

MPC heterogeneity Table A.3 explores the heterogeneity in the MPC. The MPC is nearly twice as high for low-income households compared to high-income households. Households with a low liquidity buffer also exhibit a higher MPC than households with higher liquidity.[22] These differences, however, are not statistically significant, so they should be interpreted as suggestive. Nevertheless, these results also points to the importance of liquid wealth in explaining the high MPC of foreign currency borrowers. We also find that the MPC is larger for households with lower levels of education, while MPC is similar for younger and older households.

[21] The initially high MPC, followed by a fall over time is also consistent with consumption commitment models, e.g. Chetty and Szeidl (2007).

[22] Households with a low liquidity buffer assets are those who report in the survey that they cannot cover an unanticipated expenditure shock.

5.4 Effect on consumption sub-categories and the marginal propensity to spend on nondurables and durables

How do FC debtor households adjust different sub-categories of consumption? Table 4 presents estimates of equation (1) for major expenditure categories. Panel A shows that the FC debt shock lowered spending in all categories.[23] The smallest reductions are for spending on strict nondurable goods and semi-durable goods (columns 1-2). Both estimates are negative, but neither is statistically significant. The reduction in spending on services of 10 percent is larger and highly significant (column 3). The reduction in spending on durable goods of 16 percent is the most pronounced (column 4), consistent with a higher intertemporal elasticity of substitution for durable goods.[24]

Our baseline analysis in Table 2 considered total nondurable expenditures, which comprise the categories in columns 1-3 of Table 4. Columns 1 and 2 in Panel B of Table 4 examine total spending on nondurables and durables (the sum of the items in columns 1 through 4 of Panel A). Column 1 shows that FC debt exposure reduced total consumption on nondurables and durables by 5.3 percent. This estimate is slightly higher than the 4.6 percent estimate on nondurables from Table 2. Using the IV setting from equation (4) in column 2, we estimate a marginal propensity to spend (MPS) on nondurable and durable consumption expenditures of 1.23.

Finally, we consider housing investment, defined as spending on home maintenance and repair (COICOP 04.3.1 and 04.3.2). Column 3 in Table 4B shows that FC debtors reduce housing investment expenditures by 25 percent. This suggests that these households reduce or postpone home improvement. There are two potential explanations for this strong response. The first is that households cut back on housing investment when becoming liquidity constrained. The second is debt overhang. Highly indebted households would fear not reaping the full benefits of this investment from the increased risk that their home might be foreclosed (Melzer, 2017). Finally, in column 4 we aggregate total nondurable

[23] The effect of FC debt on finer categories of consumption by purpose is summarized in Table A.2.

[24] The lower number of observation in this regression is due to fact that we use maximum likelihood for estimation and therefore households with no variation in the dependent variable (e.g. all zeros) are dropped.

and durable expenditures and spending on housing investment. For this broad measure of household spending, we estimate a marginal propensity to spend of 1.30 out of the FC debt service shock.

5.5 Difficulties making debt payments

As additional evidence supporting the adverse balance sheet effect of FC debt exposure in the crisis, we analyze survey questions about households' difficulties making payments on their obligations. Table 5 presents the results of estimating equation (1) with indicator variables for whether households have difficulties making payments on items such as their mortgage and other credit. FC debtors are significantly more likely to report having difficulties making their mortgage payments, common cost payments, and payments on other credit after the onset of the crisis. For example, FC debtors see an 8.7 percentage point increase in the likelihood of reporting difficulties making their mortgage payments, compared to similar LC debtors.

5.6 Robustness checks

Alternative scaling In the analysis presented thus far, we use the Oxford scale to adjust total consumption for differences in household composition. Table A.4 presents estimates of equation (1) and (3) for various alternative equivalence scales. In column 1, we report the effect of FC debt on total nondurable household consumption, without adjusting for household composition. We find a substantial drop in consumption, although the decline is smaller than in our baseline specification. Column 2 shows that controlling for contemporaneous household size increases the estimates for total household consumption, yielding an MPC of 0.79. In columns 3-5, we use the "per capita," "OECD", and "square-root" equivalence scales, respectively.[25] The estimates are slightly larger than our baseline

[25] The per capita scale simply divides by total number of household members. The OECD scale attaches a weight of 1 to the first adult, but gives a weight of 0.5 for all the consecutive adults, while children get a weight of 0.3. The square root equivalence scale divides consumption expenditures by the square root of household size.

when using the per-capita scale and slightly smaller when using the OECD and square-root scale. Nevertheless, the MPC estimates remain large for all scales. These results suggest that some FC debtors react to the shock by adjusting household size, perhaps to take advantage of economies of scale. We explore this further in section 6.4 below.

Propensity score matching Although FC and LC debtor households are broadly similar on observables, there are significant differences between the two groups in terms of educational attainment and income (Table 1). While the estimates are robust to controlling for these differences, we further ensure that our results are not driven by these differences by matching FC debtor households to control households using propensity score matching. We select two groups of control households: only LC debtors, or both LC debtors and non-debtors. We match households within waves and use the baseline household control variables for calculating the propensity score: age of the household head, gender of the household head, educational attainment of the household head, household size, and the location of the household.

The balance test for the two matched samples are presented in Table A.6 and Table A.7. For all observables, the differences between treatment and control groups are small and not statistically different from zero. Moreover, the Imbens and Wooldridge (2009) normalized differences are also small. Table A.5 presents the results from estimating equation (1) on the matched sample. For both sets of control groups, the estimates are essentially indistinguishable from the baseline estimates in Table 2.

House prices To further support the identifying assumption that FC borrowers were not exposed to other differential shocks, we show that the value of housing assets evolved similarly for FC and LC debtor households at the individual level.[26] We use self-reported house price data from the survey to test whether FC debtor households perceived their

[26] Although the HKÉF survey does not contain information on financial assets, households report the self-assessed value of their homes. As real estate constitutes the most important asset class for households and homeownership rate is almost 91 percent in the 2011 census in Hungary, house prices capture a large part of households' illiquid assets.

house price differently from LC borrower households by estimating equation (2) for house prices. Figure A.7 plots the dynamic impact of FC debt status, which shows that perceived house prices evolved similarly for FC and LC borrower households.

6 Margins of adjustment

This section analyzes the margins of adjustment to the increase in debt burdens. We examine how households adjust to the shock by changing the quality composition of their spending, household size, labor supply and income streams, and home production.

6.1 Quantity and quality of expenditures

Models of household consumption with homothetic demand predict that households should adjust the quantities consumed but not the average quality of their consumption bundles. In contrast, models with non-homethetic demand predict that households hit by an adverse balance sheet shock may also reduce the average quality of their consumption and enter or exit certain product categories. This distinction is important for understanding the change in the composition of demand during a severe crisis, which has implications for measurement of inflation (Burstein et al., 2005), balance-of-payments adjustment (Bems and di Giovanni, 2016), and labor demand (Jaimovich et al., 2019).[27]

Extensive vs intensive margin We begin by decomposing the change in household expenditures into the extensive margin – entry and exit from specific product categories – and the intensive margin – changes in spending within product categories. Our approach follows Bems and di Giovanni (2016).

[27] Burstein et al. (2005) document that during Argentina's 2002 devaluation, consumers substituted toward lower quality goods. Ignoring this substitution overstates CPI inflation during large devaluations. Bems and di Giovanni (2016) use scanner data from a retailer Latvia to show that a balance of payments crisis without a devaluation but with a large decline in aggregate income led to substitution from expensive imported items to cheaper domestic alternatives. Jaimovich et al. (2019) use firm level data to show that the largest employment declines in the Great Recession in the U.S. occurred for firms producing higher quality products. They argue that this channel amplified the employment downturn in the Great Recession, as lower quality goods are less labor-intensive.

For ease of notation, we omit the household index. The change in total household expenditures between periods $t-k$ and t, $\Delta_k E_t$, can be written as

$$
\begin{aligned}
\Delta_k E_t = E_t - E_{t-k} &= \sum_{j \in J_t} e_{jt} - \sum_{j \in J_{t-k}} e_{j,t-k} \\
&= \underbrace{\sum_{j \in J_{t/t-k}} e_{jt} - \sum_{j \in J_{t/t-k}} e_{j,t-k}}_{\text{Intensive margin}} + \underbrace{\underbrace{\sum_{j \in J_{t/t-k}} e_{j,t-k} - \sum_{j \in J_{t-k}} e_{jt-k}}_{\text{Exit}} + \underbrace{\sum_{j \in J_t} e_{jt} - \sum_{j \in J_{t/t-k}} e_{jt}}_{\text{Entry}}}_{\text{Extensive margin}},
\end{aligned} \tag{5}
$$

where E_t is total expenditure in period t, e_{jt} is the expenditure on item j in period t. J_t is the set of consumption categories that have positive expenditure in period t, J_{t-k} is the set with positive expenditure in period $t-k$, and $J_{t/t-k}$ is the set of categories that are purchased in both periods.

The first term in equation (5) captures the intensive margin of adjustment. This is the change in expenditure on items purchased in both periods. The second term is the extensive margin, which covers consumption goods that are purchased in only one period. The extensive margin is the sum of the "entry" and "exit" of goods in a household's consumption basket. For example, if a household switches from buying beef to buying chicken, this translates into a decline in spending driven by exit from beef and an increase in spending driven by entry into chicken.

Price and quantity adjustment on the intensive margin The intensive margin can be decomposed into the contribution of changes in quantities purchased and average prices paid. Expenditure on consumption category j may decrease between two periods for two reasons. First, a household may purchase a cheaper variety of the same category, but purchase the same amount. Second, the household may purchase a lower quantity of the same variety.

To do this, we calculate the Marshall-Edgeworth decomposition for the change in spending on the intensive margin, given by

$$\underbrace{\sum_{j\in J_{t/t-k}} e_{jt} - \sum_{j\in J_{t/t-k}} e_{j,t-k}}_{\text{Intensive margin}} = \sum_{j\in J_{t/t-k}} p_{jt}q_{jt} - \sum_{j\in J_{t/t-k}} p_{j,t-k}q_{j,t-k}$$

$$= \underbrace{\sum_{j\in J_{t/t-k}} \Delta_k p_{jt}\frac{q_{jt}+q_{j,t-k}}{2}}_{\text{Price change}} + \underbrace{\sum_{j\in J_{t/t-k}} \Delta_k q_{jt}\frac{p_{jt}+p_{j,t-k}}{2}}_{\text{Quantity change}} \tag{6}$$

where p_{jt} denotes the average price paid for good j in period t, and q_{jt} denotes the purchased quantity of good j in period t. The Marshall-Edgeworth decomposition weights the price change, $\Delta_k p_{jt}$, by the average quantity purchased in the two periods. Similarly, it weights the quantity change, $\Delta_k q_{jt}$, by the average price paid in the two periods. In this decomposition, there is no composite effect. That is, there is no cross-term that depends on both the price change and the quantity change.[28]

Estimation and results Since these margins of adjustment are defined for the change in consumption expenditures, we estimate the impact of FC debt exposure on each margin using a regression in differences:

$$\Delta_k y_{it} = \delta_k + \beta_k FC_i + \gamma_k NoDebt_i + \Gamma_k X_{it} + u_{it}^k, \tag{7}$$

where $\Delta_k y_{it}$ is a margin of adjustment of household i between year $t-k$ and t. Note that taking differences sweeps away the household fixed effect. To ease the interpretation, we compute the change in the relevant margins relative to 2008. This transformation makes the estimates directly comparable to the main results.[29]

Table 6 presents the results of the decomposition of the intensive and extensive margins. The intensive margin contributes approximately 71% of the decline in FC debtors' spending,

[28] Appendix B.2 discusses alternative decompositions of the intensive margin. In Table A.8, we show that these these yield similar results.

[29] Specifically, we estimate equation (7) with the change in each margin between consecutive years. We then calculate the levels for each years and average them in the pre-period (2005-2007) and post-period (2009-2012) and report the difference in this average.

while the extensive margin contributes the remaining 29% of the decline. Within the extensive margin, most of the effect is driven by reduced entry into new product categories. Households experiencing a debt shock were less likely to experiment by entering new product categories. In contrast, exit plays a negligible role.[30]

Table 6 also shows that the effect of FC debt on the intensive margin of consumption is driven by both a decline in quantities purchased and a decline in average prices paid. The reduction in quantities accounts for approximately 71 percent of the reduction in spending on the intensive margin, while the reduction in prices accounts for the remaining 29 percent. Both margins are statistically significant at the 5 percent level.

The reduction in quantities is consistent with standard models in which a negative cash flow shock reduces quantities consumed. The reduction in average prices paid, however, is not consistent with standard models of homothetic preferences, such as CES preferences. Instead, it suggests that households have nonhomothetic preferences and substitute away from higher quality and toward lower quality products within tightly-defined five-digit COICOP categories. Households affected by the FC debt shock move down an upward sloping relation between household resources and average prices paid, referred to as a *quality Engel curve* (Bils and Klenow, 2001).[31] This evidence is consistent with the "flight from quality" hypothesis (Burstein et al., 2005).[32] Relative to previous work, we provide direct, within household-level evidence that balance sheet distress leads to changes in consumption baskets toward lower quality goods.[33]

The reduction in the quality of consumption has several important implications. First, as noted by Burstein et al. (2005), failing to adjust for changes in the quality composition

[30]Michelacci et al. (2021) find similar results studying the response to tax rebates shocks in the U.S. Specifically, they find that the extensive margin accounts for one-third of the increase in spending and that entry accounts for most of the extensive margin response.

[31] Bils and Klenow (2001) estimate average prices paid for durables, whereas our data allow us to measure unit prices for both nondurables and semi-durables (e.g., apparel). Jaravel (2019) and Jaimovich et al. (2020) also find that higher income households consume higher quality goods.

[32]Popular accounts also suggest that consumers substituted toward lower quality products during the Great Recession and the COVID-19 recession (see, e.g., The Economist, 2010; The Wall Street Journal, 2021).

[33]Stroebel and Vavra (2019) find that local house price shocks lead to increases in retail prices, as positive shocks to wealth lead homeowners to become less price sensitive.

of goods within broadly defined consumption categories leads to a downward bias in CPI inflation during crises. Second, Jaimovich et al. (2019) document that lower quality goods are less labor intensive. Hence, shifting spending toward lower quality goods amplifies the decline in labor demand following adverse shocks. Third, lower quality goods are less likely to be imported, a phenomenon known as the Alchian-Allen conjecture. Reducing the quality of consumption increases import compression during debt crises, which reinforces expenditure switching from changes in relative prices (Bems and di Giovanni, 2016).

Finally, while proxying for quality with average prices is a common assumption, a related but alternative interpretation of the reduction in average prices paid is that the shock leads households to search more intensively for lower prices of the *same* good (e.g., Aguiar and Hurst, 2005, 2007). Research based on scanner data documents that prices for identical goods vary within markets (Kaplan and Menzio, 2015). A negative balance sheet shock could induce households to increase their product search effort and consume less leisure. Our estimates reveal that a shock to household balance sheets implies adjustment on average prices paid by affected households, but without barcode level data, we cannot disentangle these two channels.

6.2 Wealth effect on labor supply

Do households adjust to the shock by increasing labor supply to service higher debt payments? The impact of wealth shocks on labor supply is a longstanding question with important implications for macroeconomic and finance models. Models with separable preferences over consumption and labor predict that a negative wealth shock from an increase in debt leads households to increase labor supply (e.g., Chari et al., 2005; Devereux and Smith, 2007; Lorenzoni, 2014). Obstfeld and Rogoff (1995) show that a reduction in net foreign assets in a small open economy leads to an increase in labor and output through a wealth effect on labor supply. However, other macroeconomic models assume non-separable preferences to remove the wealth effect on labor supply (Greenwood et al., 1988).[34] Furthermore, in models with household debt overhang, a large increase in debt leads households to *reduce* work effort, as higher debt service acts as a tax on labor effort (Krugman, 1988; Bernstein, 2017; Donaldson et al., 2019).

These contrasting theoretical predictions motivate a micro-level analysis of how households buffeted by a large debt revaluation shock adjust their labor supply. In Table 7, we estimate equation (1) with various labor market outcomes, including labor market participation, unemployment, hours worked, and household income, as dependent variables. Except for household income, these labor market outcomes are available at the individual level, so we employ two different sets of fixed effects in the estimation, household fixed effects and individual level fixed effects.[35]

Panel A in Table 7 reveals that there is a small and statistically insignificant effect of FC debt exposure on individual labor market status or the likelihood of being unemployed. Panel B in Table 7 focuses on hours worked in the primary job and across all jobs. Hours worked is only available from 2008, so the sample size declines for this specification. FC debt exposure has a negligible effect on hours. For example, the specification in column 4 of Table 7B implies that FC debtors increased weakly labor supply by an insignificant 0.2 hours.

Panel C in Table 7 examines the effect on various measures of household income. Columns 1 and 2 reveal that FC and LC borrowers' total net income evolved similarly following the depreciation. Columns 3 and 4 report results for wage income and social transfers and other income. Work-related income decreases, while social transfers and other incomes increases, but neither estimate is significant. These suggest that, although

[34] Greenwood et al. (1988) (GHH) preferences, $U(c - G(l))$, imply that the marginal rate of substitution between consumption (c) and labor (l) depends only on labor: $-\frac{U_l}{U_c} = G'(l)$. This eliminates the wealth effect on labor supply. Non-separable preferences are commonly used in closed and open-economy macroeconomic models for this reason (e.g., Mendoza, 1991; Monacelli and Perotti, 2008; Jaimovich and Rebelo, 2009; Schmitt-Grohé and Uribe, 2012). For example, the model of Jaimovich and Rebelo (2009) requires a negligible wealth effect on labor supply for positive news about future productivity to generate an expansion and positive comovement between consumption, labor, and output.

[35] The individual-level data has no panel identifier. Therefore, we create these identifiers by matching individuals within households across waves using date of birth (year, month), gender, and educational attainment.

FC debtor households saw minor losses in earned income relative to LC debtors, transfers compensated for this loss.

The small, negative, and insignificant effect of the FC debt shock on labor supply and income at the household level is most consistent with models with a weak wealth effect on labor supply. It also suggests that a debt overhang effect on labor supply is not first order for the average FC debtor. Previous work by Imbens et al. (2001) and Cesarini et al. (2017) find significant but modest wealth effects on labor supply based on an analysis of lottery prize winners. Our evidence of a null effect may stem from the fact that we consider a negative wealth shock. It could be easier to reduce labor supply following a positive wealth shock than to increase it after a negative shock, especially in a crisis with a substantial (3 percentage point) increase in the unemployment rate. Finally, it is worth noting that the similar evolution of income across FC and LC debtors at the household level supports the assumption that our baseline consumption effects are not biased by contemporaneous adverse income shocks for FC debtors.

Foreign currency income as a hedge against depreciation While households did not increase overall labor supply in response to the FC debt shock, some households may have adjusted to the crisis by seeking income from abroad. Having a household member work abroad provides access to FC income to service rising FC debt burdens. We estimate equation (1) with outcome variables for whether the household receives income from abroad. Although we do not directly observe the currency denomination of foreign income, the UK, Germany, and Austria were the popular destinations for Hungarian households migrating abroad (Hárs, 2016). Because the euro and British pound depreciated less against the Swiss franc than did the forint, income in these currencies would have provided some hedge against the debt revaluation.

Columns 1 and 2 in Table 8 show that FC debt exposure increased the probability of having income from abroad by 1.2 percentage points following the depreciation. While this is a modest effect in absolute terms, it is economically large compared to the negligible

0.45 percent baseline probability of having income from abroad in 2008. Results on the foreign income share in total net income are presented in columns 3 and 4. These reveal that FC debt exposure increased the foreign income share by 0.5-0.6 percentage points in the post-crisis period. This effect is also large relative to the low base rate of 0.23 percent in 2008. These results point to a significant labor supply adjustment of a small subset of households by seeking income from abroad.

6.3 Home production

Another potential margin of adjustment is the substitution of money for time through home production. Standard models equate consumption with expenditures. However, a more elaborate model takes into account that households can use their time in combination with market goods to derive utility (Becker, 1965).[36] Households may respond to the debt revaluation by increasing their allocation of time towards home production and decreasing the consumption of money-intensive goods. In a recession when jobs are scarce, it is likely that households can more easily adjust home production than market hours.

Based on the information in our data, we examine adjustment through home production by focusing on food production. In 2008, 31 percent of households engaged in some form of home production of food. Home production of food is an especially relevant alternative to purchasing food for rural households.[37] Note that the definition of home production in HKÉF that we use is more stringent than the definition commonly used in the macroeconomics literature, which defines activities such as cooking, cleaning, and laundry as home production (e.g., Aguiar et al., 2013).[38] Therefore, our results can be seen as a lower bound on overall home production activity.

[36] Macroeconomic business cycle models find that introducing a home production sector whose output is substitutable with market consumption increases the volatility of market labor and consumption (Benhabib et al., 1991; Greenwood and Hercowitz, 1991). Home production can also help explain the "excess sensitivity" of consumption to predictable income shocks driven by changes in wages and prices (Baxter and Jermann, 1999).

[37] Frankenberg et al. (2003) find that households were more likely to increase home production during Indonesia's financial crisis.

[38] Time spent cooking or on other home production activities is not captured by the questionnaire.

Columns 1 and 2 in Table 9 present estimates of equation (1) with an indicator for whether a household engages in home production of food as the dependent variable. The estimate shows that, during the crisis, the probability of engaging in home production increased by 5.5 percentage points for FC debtors, relative to LC debtors. Columns 3-6 examine the substitution from money to time-intensive consumption by focusing on the value of different types of food consumption. For the value of home production, we use the imputed value provided in the survey by KSH, which assigns a market price to the reported home production. Since many households do not engage in home production or buy food services, we again estimate equation (1) by PPML, which accommodates this corner solution.

Table 9 column 3 shows that FC debtors' total food consumption declines in the aftermath of the crisis by a modest 2.4 percent. This estimate is not statistically significant. On the other hand, FC borrowers cut back on food service spending by 13 percent and increased home production by 20 percent. Thus, there is a large relative substitution away from expensive food away from home and toward home production. While the share of home production in total consumption is relatively small for most households, these results indicate that a subset of households attempt to smooth consumption in response to the shock by boosting home production. The increase in home production implies that the decline in expenditures overstates the decline in household consumption (Aguiar and Hurst, 2005).

6.4 Household size and composition

Household size and composition are choice variables that families can use to smooth the marginal utility of consumption following a large balance sheet shock. Adding an additional member, such as a parent or other extended family member, can allow households to exploit economies of scale in the presence of fixed costs or public goods. This allows the household to use additional funds to service higher debt payments and smooth consumption. Families trade off this benefit against the utility cost of decreased subfamily privacy (Frankenberg et al., 2003).[39] A large, unanticipated increase in household debt may lead households to intertemporally substitute privacy over time to benefit from economies of scale of increasing household size and thereby reduce the fall in per capita consumption.[40]

To examine the extent to which households adjust the number of members in response to the increase in debt burdens, we estimate equation (2) with measures of household size as dependent variables. Appendix Figure A.9 reports the results. FC debtors see an 0.06 member increase in household size after the depreciation, relative to LC debtors, and a similar increase relative to non-borrowers.[41] The increase in household size is modest in magnitude and not statistically significant. When distinguishing between household members by age, it shows that this increase is driven by an increase in the number of *adults* in the household, which is significant. The number of children evolves similarly in FC and LC debtor households. This suggests that consolidating extended family within the household to save on housing costs and exploit economies of scale allows FC debtor households adjust to the increasing debt burdens. It also highlights the importance of adjusting for household size when estimating the impact of the FC debt shock on consumption.

7 Conclusion

This paper studies the transmission of a large exchange rate shock to household consumption through the revaluation of foreign currency-denominated debt. Using household-level panel survey data around Hungary's 2008 currency crisis, we document that FC debtors

[39]Frankenberg et al. (2003) analyze households' adjustment to Indonesia's 1997 financial crisis and find that households adjust by increasing household size to benefit from economies of scale.

[40]Adjusting household living arrangements is rarely considered in studies of consumption smoothing. Rosenzweig and Wolpin (1993) present evidence that parents provide shared residence with their adult sons to help sons smooth consumption. Kaplan (2012) provides related evidence that young individuals use the option to move in and out of the parental home as insurance against labor market risk.

[41]There is a substantial negative pretrend in household size for non-borrowers, as these households are older and are more likely to have children move away from home. In contrast, LC and FC borrowers have similar trends in household size and composition in the years before the exchange rate depreciation.

reduce nondurable consumption by 7 percent relative to LC debtors following the exchange rate depreciation. This corresponds to a marginal propensity to consume on nondurable consumption of approximately one out of increased debt service. Examining a broader measure of spending that includes durables, we find an even higher MPC of 1.23. These estimates are most consistent with the importance of liquidity constraints for foreign currency debtors.

The significant pass-through of the depreciation to consumption through household balance sheets had a sizable impact on aggregate consumption. Abstracting from general equilibrium effects, the foreign currency debt revaluation reduced annual nondurable consumption by 0.77 percent of GDP on average over 2009-2012. We calculate this by applying the estimated MPC from Table 3 to the increase in aggregate debt service induced by the depreciation from 2009 to 2012. Focusing on total spending including durables, the debt revaluation directly reduced annual spending by 0.97 percent of GDP over 2009-12. This is a large effect, especially considering that this calculation only captures the direct effect of the increase in debt service for households with FC debt. In particular, it abstracts from general equilibrium channels of the shock such as its effect on aggregate income, house prices, and the banking sector.

Households employ a variety of mechanisms to adjust to the balance sheet shock, many of which have received limited consideration in prior research. Households adjust the composition of their expenditures along both the intensive and extensive margins of product categories. On the intensive margin, FC debtors reduce expenditures both by purchasing lower quantities and lower quality goods. This is consistent with a balance-sheet-induced "flight from quality." Exposed households also adjust household size and composition, likely to exploit economies of scale. We find no evidence of an increase in labor supply to offset the effect of the debt revaluation. However, a small subset of households do respond by working abroad to access foreign currency income. Finally, there is an increase in home production, as households substitute time-intensive for money-intensive consumption.

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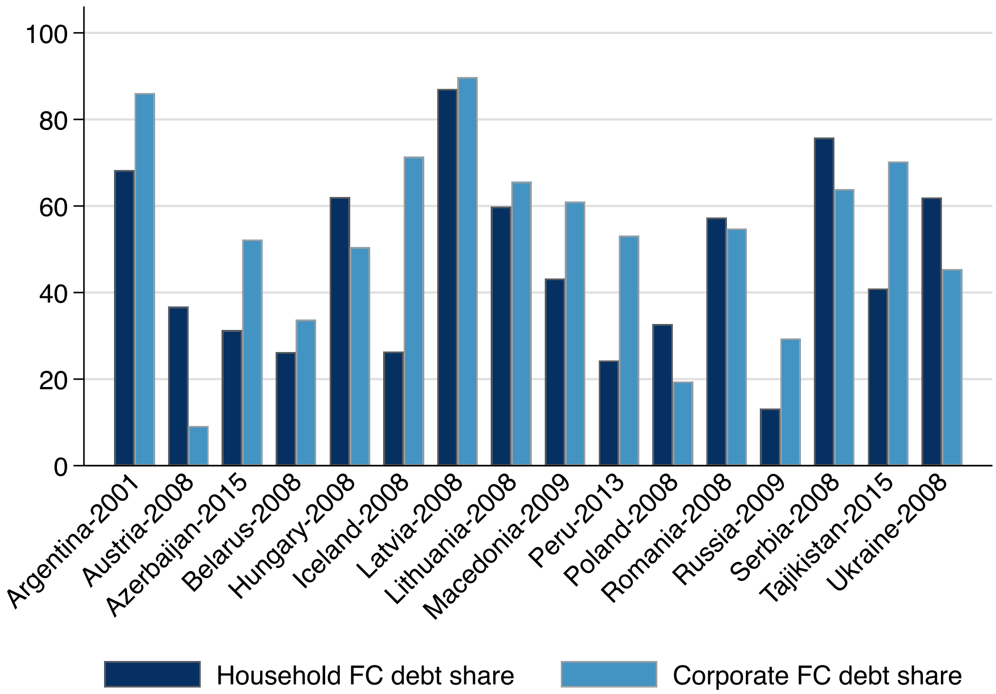
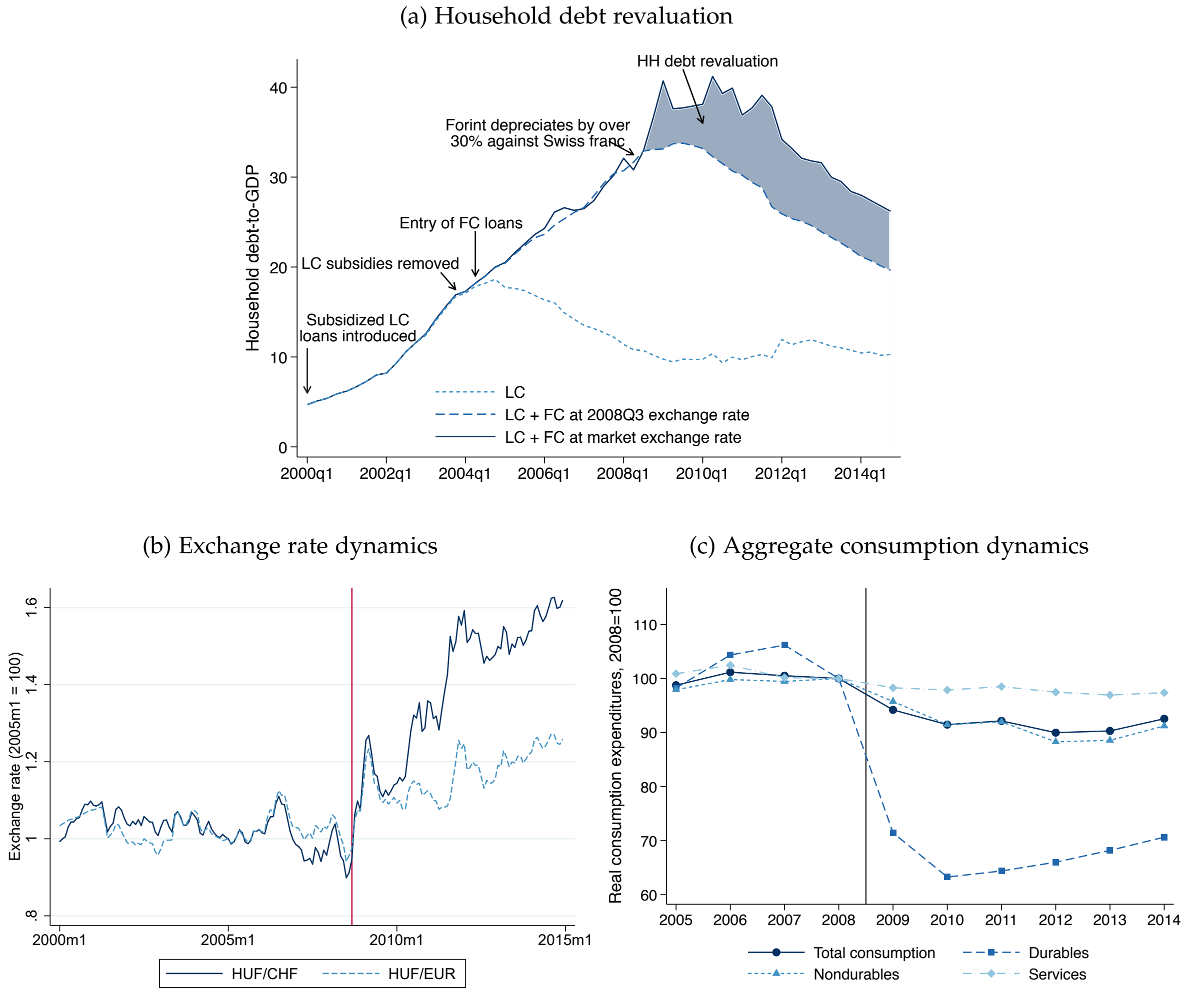
Figure 1: Household and corporate foreign currency loan exposure during selected crises



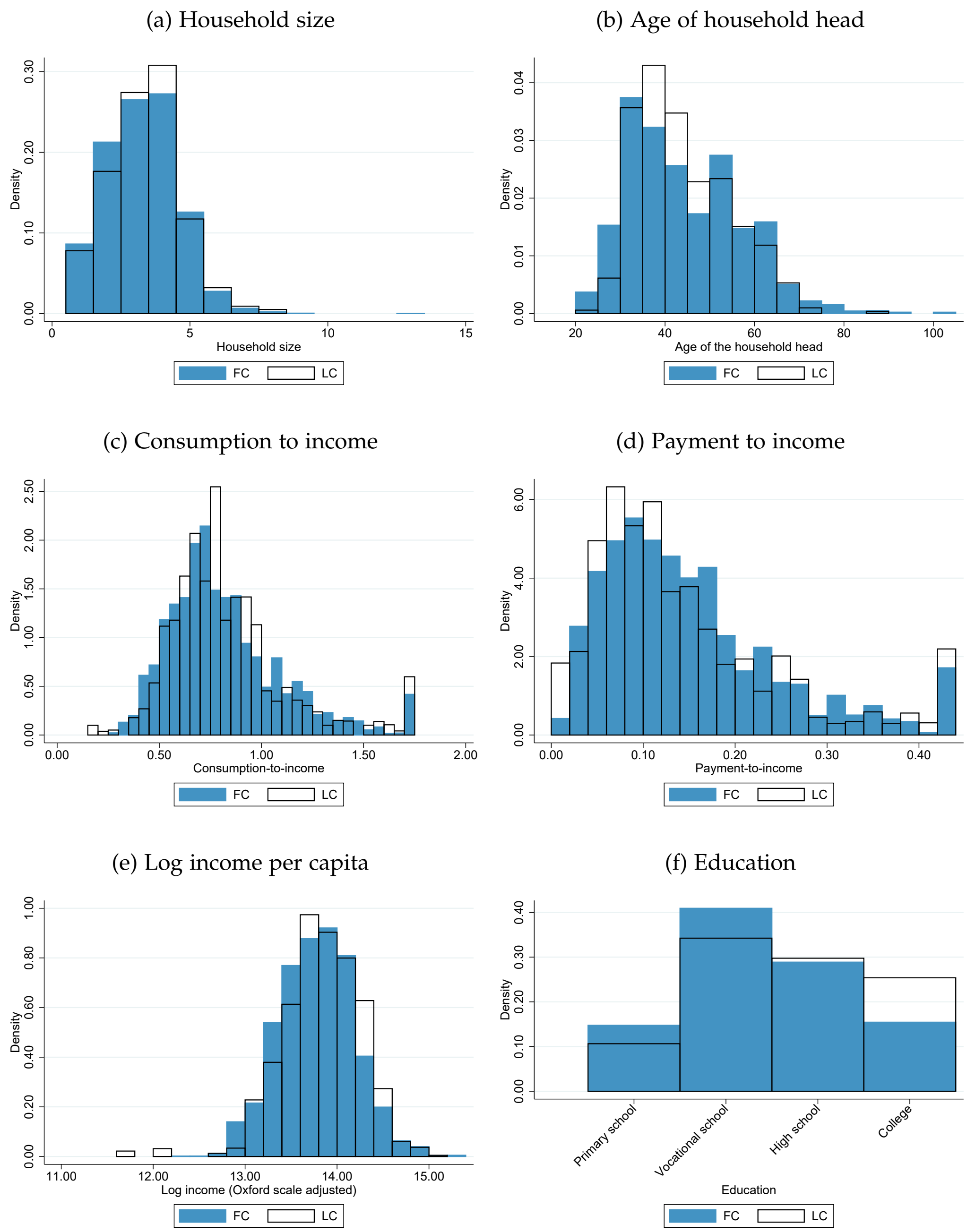
Notes: This figure plots the share of foreign currency loans in total household and non-financial corporate loans during selected episodes. The figure shows that foreign currency debt comprised an important share of household and corporate debt during these episodes. The episodes are chosen based on data availability, and most episodes involved major currency and/or banking crises. Data are collected from individual country central banks and the ECB. See Appendix C for additional details on these cases and other episodes for which data is not available.

Figure 2: Household debt, exchange rate dynamics, and consumption around the currency crisis



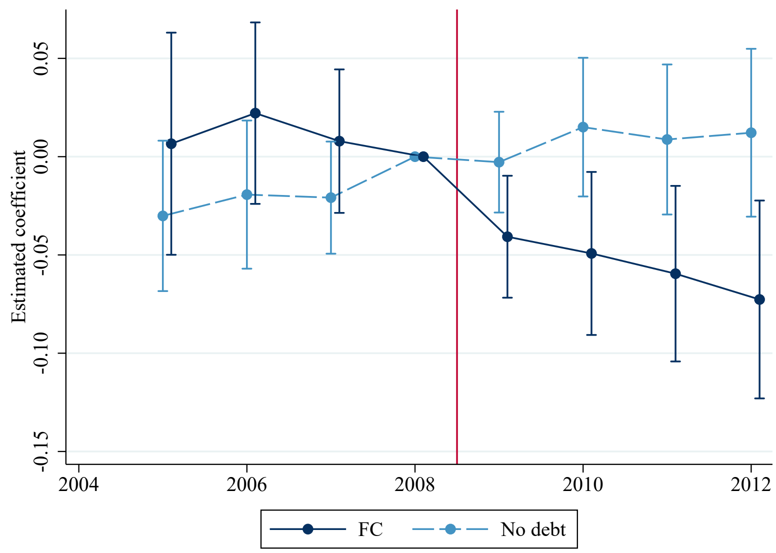
Notes: Panel (a) figure shows the evolution of household debt relative to GDP. The shaded area is the revaluation of household debt triggered by the depreciation of the Hungarian forint and appreciation of the Swiss franc. Panel (b) plots the HUF-CHF and HUF-EUR exchange rates, normalized to 100 in January 2005. An increase in the exchange rate represents a depreciation of the HUF. Panel (c) shows the dynamics of aggregate real consumption expenditures by broad consumption categories from OECD Statistics. Series are indexed to 100 in 2008.

Figure 3: Distribution of household characteristics in 2008 by debt currency denomination



Notes: This figure shows the distribution of household characteristics by currency denomination of household debt for households in the HKÉF survey in 2008. See section 3 for details on how households are classified into foreign currency debtors and local currency debtors.

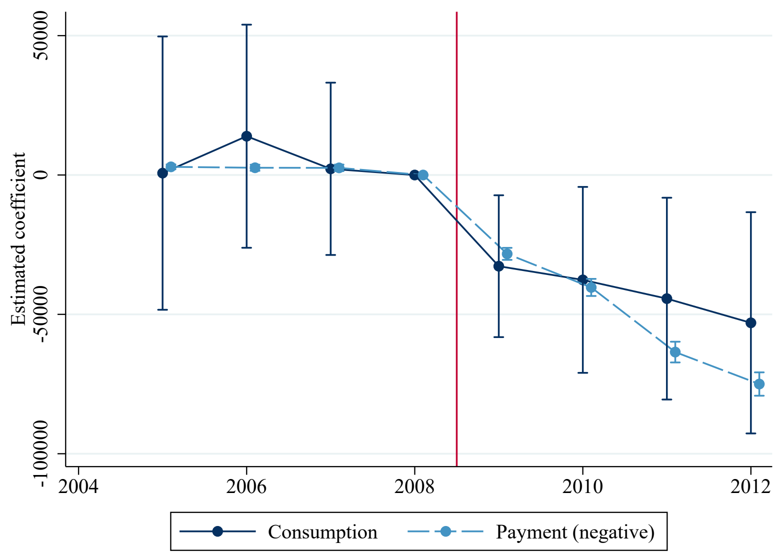
Figure 4: Dynamic impact of foreign currency debt exposure on consumption



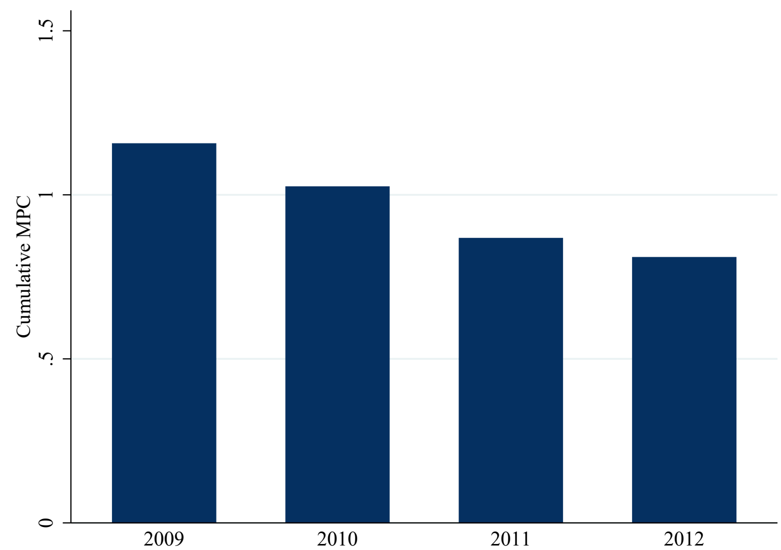
Notes: This figure plots the coefficients of interest from estimating equation (2) with log nondurable consumption as the dependent variable. The omitted category is LC debtors. The specification controls for age of the household head, gender of the household head, educational attainment of the household head, household size, and region (58 units) fixed effect. All control variables are interacted with year fixed effects. Standard errors are clustered at the household level. Error bars represent 95 percent confidence intervals.

Figure 5: Dynamic marginal propensity to consume

(a) Consumption and payment surprise response to the debt revaluation



(b) Cumulative MPC out of debt service



Notes: Figure (a) plots the coefficients of interest from estimating equation (2) with the level (HUF value) of nondurable consumption and the (negative) annual payment surprise as the dependent variables. Controls in both specifications include age of the household head, gender of the household head, educational attainment of the household head, household size, and region (58 units) fixed effect. All control variables are interacted with year fixed effects. Standard errors are clustered at the household level. Error bars represent 95 percent confidence intervals. Figure (b) plots the cumulative MPC defined in equation (4) using the estimates in panel (a).

Table 1: Descriptive statistics by household loan currency denomination in 2008

	FC mean/sd	LC mean/sd	Non-borr. mean/sd	FC-LC difference b/t	Borrower-non-borr. difference b/t
Primary school	0.15	0.11	0.26	0.04*	-0.13**
	0.35	0.31	0.44	2.07	-11.29
Vocational school	0.41	0.34	0.30	0.07*	0.09**
	0.49	0.47	0.46	2.25	5.85
High school	0.29	0.30	0.28	-0.00	0.02
	0.45	0.46	0.45	-0.32	1.06
College	0.15	0.25	0.16	-0.10**	0.03*
	0.36	0.44	0.37	-4.18	2.35
Household size	3.27	3.37	2.43	-0.10	0.87**
	1.31	1.30	1.34	-1.34	21.68
Age	43.87	43.65	56.11	0.22	-12.31**
	12.50	10.35	15.27	0.33	-30.88
Female	0.17	0.14	0.30	0.03	-0.14**
	0.37	0.35	0.46	1.52	-12.70
Income (1000 HUF)	1049.15	1109.73	1062.83	-60.58*	7.07
	459.40	455.80	454.21	-2.28	0.50
Consumption to income	0.82	0.84	0.85	-0.02	-0.02
	0.30	0.33	0.33	-0.90	-1.61
Food exp. to income	0.20	0.20	0.22	0.00	-0.02**
	0.10	0.11	0.11	0.07	-6.16
Payment to income	0.15	0.15	0.00	0.00	
	0.09	0.10	0.00	0.45	
Have liquid assets	0.08	0.10	0.18	-0.02	-0.09**
	0.27	0.30	0.39	-1.39	-9.89
Capital	0.16	0.16	0.20	0.00	-0.04**
	0.37	0.37	0.40	0.20	-3.42
County capital	0.24	0.29	0.23	-0.05+	0.02
	0.43	0.45	0.42	-1.89	1.41
Town	0.30	0.30	0.25	-0.00	0.05**
	0.46	0.46	0.43	-0.16	3.57
Village	0.30	0.25	0.31	0.05*	-0.03*
	0.46	0.43	0.46	2.02	-2.06
Observations	982	512	6156	1494	7650

Notes: The table presents descriptive statistics by loan currency denomination for households in the HKÉF in 2008. The first three columns show the average characteristics of foreign currency borrower households, local currency borrowers, and households without debt. The fourth column reports the difference between the average characteristics of foreign and local currency borrowers. The first seven rows report the characteristics of the household head, and the remaining rows show household-level characteristics. Consumption and income are scaled by the Oxford equivalence scale.

Table 2: Effect of foreign currency debt shock on nondurable consumption

	ln(Nondurable consumption)			
	(1)	(2)	(3)	(4)
NoDebt × POST	0.0118	0.0105	0.00984	0.00760
	(0.0124)	(0.0128)	(0.0125)	(0.0127)
FC × POST	-0.0461**	-0.0461**	-0.0414**	-0.0446**
	(0.0158)	(0.0156)	(0.0152)	(0.0151)
Household & year FE	Yes	Yes	Yes	Yes
Household controls		Yes	Yes	Yes
Contemporaneous inc.			Yes	Yes
Dep. var. 2008				Yes
N	59373	59321	59310	24951

Notes: This table reports results from estimating equation (1) by Poisson pseudo-maximum likelihood (PPML). The dependent variable is log nondurable consumption, adjusted for family composition by dividing by the Oxford equivalence scale. Nondurable consumption comprises expenditures on strict nondurable goods, semi-durable goods, and services. *FC* and *NoDebt* are indicator variables for households with FC debt and without debt, respectively. *POST* is an indicator variable that equals one after 2008. Household controls are age of the household head, gender of the household head, educational attainment of the household head, household size, and region (58 units) fixed effects. Contemporaneous income controls for household income in each period. Dep. var. 2008 refers to specifications that control for log household nondurable consumption in 2008. All control variables, except for contemporaneous income, are interacted with the *POST* indicator. Standard errors are clustered at the household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table 3: Marginal propensity to consume out of the foreign currency debt service shock

	Non-durable consumption					
	Reduced form			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
FC × POST	-33949.7**	-35230.5**	-32555.9**			
	(12724.4)	(12620.2)	(12242.5)			
Loan payment surprise				-0.957**	-0.986**	-0.920**
				(0.359)	(0.354)	(0.345)
Household & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls		Yes	Yes		Yes	Yes
Contemporaneous inc.			Yes			Yes
First stage F-statistic				807.2	863.4	863.1
R^2	0.878	0.879	0.883			
N	59373	59321	59321	59373	59321	59321

Notes: This table presents estimates of the marginal propensity to consume out of an increase in annual debt service induced by the foreign currency debt revaluation. Columns 1-3 present the reduced form estimates of the effect of FC exposure on the level (in forints) of household nondurable consumption. Columns 4-6 present the instrumental variable estimates of the MPC based on equation (3). Annual debt payment surprise is instrumented by FC exposure interacted with $Post_t$. See Table 2 for a definition of the control variables. All control variables are interacted with the $Post_t$ indicator. Standard errors are clustered at the household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table 4: Foreign currency debt exposure and spending on different categories of consumption

	Panel A: By durability			
	Strict non-durables	Semi durables	Services	Durables
	(1) PPML	(2) PPML	(3) PPML	(4) PPML
FC × Post	-0.0134	-0.0568	-0.0981**	-0.159+
	(0.0173)	(0.0425)	(0.0236)	(0.0930)
Household and year FE	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
N	59321	58986	59319	53539

	Panel B: Broad spending response			
	Total consumption		Housing investment	Total spending
	(1) PPML	(2) IV	(3) PPML	(4) IV
FC × Post	-0.0535**		-0.248	
	(0.0164)		(0.217)	
Loan payment surprise		-1.232**		-1.303**
		(0.398)		(0.413)
Household and year FE	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
First stage F-statistics		863.4		863.4
N	59321	59321	43202	59321

Notes: Panel A presents results from estimating equation (1) by PPML for various categories of consumption. The outcome variables in columns 1-3 are the components of total nondurable consumption used in Table 2. Column 4 reports the estimates for log durable spending as the dependent variable. Panel B column 1 present the PPML estimates of (1) for total consumption expenditures, defined as the sum of the measures in panel A columns 1-4. Column 2 reports the instrumental variable estimate of the MPC with total consumption expenditures as the dependent variable. Column 3 reports the PPML estimates of equation (1) for housing investment as the dependent variable. Column 4 presents the MPC estimate with total spending (total consumption plus housing investment) as the dependent variable. See Table 2 for a definition of the control variables. All control variables are interacted with the $Post_t$ indicator. Standard errors are clustered at the household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table 5: Effect of foreign currency debt exposure on payment difficulties

	Mortgage	Common cost	Utilities	Bank credit	Private credit
	(1)	(2)	(3)	(4)	(5)
FC $\times$ *Post*	0.0872**	0.0710*	0.0155	0.0527	0.159*
	(0.0320)	(0.0355)	(0.0247)	(0.0571)	(0.0659)
Household and Year FE	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
Mean outcome in 2008	0.107	0.0891	0.160	0.0937	0.193
R^2	0.663	0.687	0.698	0.650	0.702
N	7579	18833	56904	7901	7145

Notes: This table presents estimates of equation (1) with various measures of payment difficulties as the dependent variable. Household controls are defined in Table 2. All control variables are interacted with the $Post_t$ indicator. Standard errors are clustered at household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table 6: Margins of adjustment to the household foreign currency debt shock: Quality vs. quantity

	Total expenditures	Intensive		Extensive	
		Price	Quantity	Entry	Exit
FC $\times$ Post	-24705.7*	-5727.22*	-14559.68*	-9267.63	964.18
	(9860.08)	(2687.53)	(5860.49)	(5900.66)	(6189.76)
Household and Year FE	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	39689	39689	39689	39689	39689
Percent of total	–	20.03%	50.92%	32.41%	-3.38%

Notes: This table reports the estimated effect of FC debt exposure on various measures of household spending in forints (HUF) based on the decomposition of equation (5) and equation (6). The decomposition is based on three categories of goods for which quantities and total spending are reported (food and non-alcoholic beverages, alcohol and tobacco, and clothing and footwear). These three groups account for 34.3 percent of nondurable expenditure in 2008. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table 7: Foreign currency debt exposure and labor supply

	Panel A: Labor market status			
	(1)	(2)	(3)	(4)
	Labor market participation		Unemployment	
FC × Post	-0.00726	-0.00185	0.00630	0.00520
	(0.0135)	(0.0136)	(0.0150)	(0.0144)
Household & Year FE	Yes		Yes	
Individual & Year FE		Yes		Yes
Individual controls	Yes	Yes	Yes	Yes
R^2	0.689	0.899	0.517	0.723
N	154083	125953	74513	61299

	Panel B: Hours			
	Primary job		Total	
FC × Post	0.201	-0.0131	0.433	0.192
	(0.374)	(0.380)	(0.426)	(0.431)
Household & Year FE	Yes		Yes	
Individual & Year FE		Yes		Yes
Individual controls	Yes	Yes	Yes	Yes
R^2	0.518	0.731	0.504	0.707
N	36481	29579	36481	29579

	Panel C: Income			
	Net income		Income components	
	Total	Oxford adjusted	Wage income	Social and other income
FC × Post	-0.00884	-0.0238	-0.0366	0.0307
	(0.0174)	(0.0183)	(0.0283)	(0.0362)
Household & Year FE	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
N	59321	59321	52999	55338

Notes: This table presents estimates of equation (1) with various labor market outcomes as the outcome variable. Panel A uses indicator variables for whether an individual is in the labor market (columns 1-2) or unemployed columns (3-4). Panel B examines average weekly hours worked in the primary job (columns 1-2) and in all jobs (columns 3-4). Panel C examines various measures of household income. The specifications in Panels A and B are estimated at the individual level, while the specification in Panel C is estimated at the household level. Individual-level controls are gender, age, education dummies, and location fixed effects. Household controls are defined in Table 2. All control variables are interacted with the $Post_t$ indicator. Standard errors are clustered at household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table 8: Foreign currency debt exposure and foreign income

	Pr(Income from abroad)		Foreign income share	
	(1)	(2)	(3)	(4)
FC × Post	0.0127*	0.0121*	0.00603**	0.00543**
	(0.00547)	(0.00562)	(0.00211)	(0.00205)
Household & year FE	Yes	Yes	Yes	Yes
Household controls		Yes		Yes
Average value of outcome in 2008	0.00456	0.00456	0.00229	0.00229
N	59373	59321	59369	59317

Notes: This table presents estimates of equation (1) with measures of working abroad as the outcome variable. Column 1-2 use an indicator variables for whether a household receives income from abroad as the dependent variable. Column 3-4 use the foreign income share in total net income as the dependent variable. Household controls are defined in Table 2. All control variables are interacted with the $Post_t$ indicator. Standard errors are clustered at household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

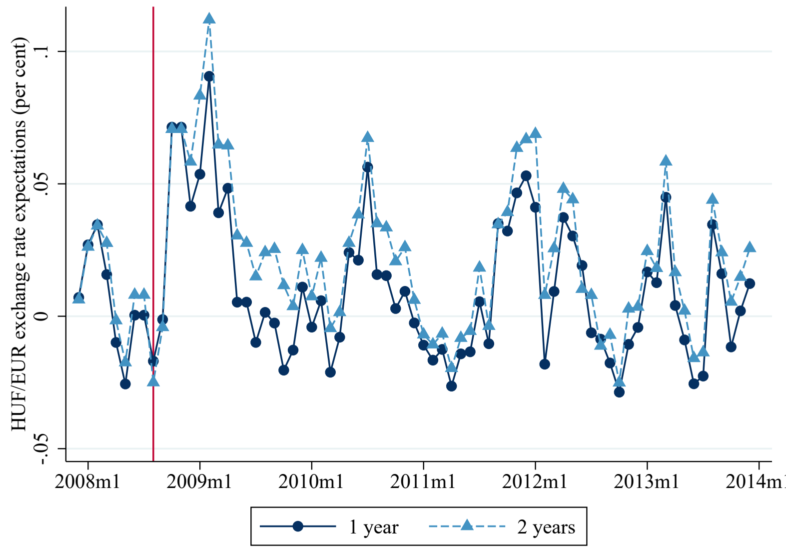
Table 9: Foreign currency debt exposure, home production, and food consumption

	Pr(Home production)		Food consumption			
			Total	Services	Home production	Supermarket
	(1)	(2)	(3)	(4)	(5)	(6)
FC × Post	0.0473+	0.0552*	-0.0239	-0.131	0.200+	-0.0169
	(0.0279)	(0.0269)	(0.0269)	(0.0815)	(0.119)	(0.0259)
Household and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls		Yes	Yes	Yes	Yes	Yes
Home production prob. in 2008	0.307	0.307				
R^2	0.767	0.769				
N	59373	59321	59321	38392	28899	59321

Notes: This table presents estimates of equation (1) with outcome variables related to whether a household engaged in home production as the dependent variable. Columns 1 and 2 use an indicator for whether the household engages in home production of food as the dependent variable. Columns 3-6 use the estimated value of various components of food consumption as the dependent variable. Household controls are defined in Table 2. All control variables are interacted with the $Post_t$ indicator. Standard errors are clustered at household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

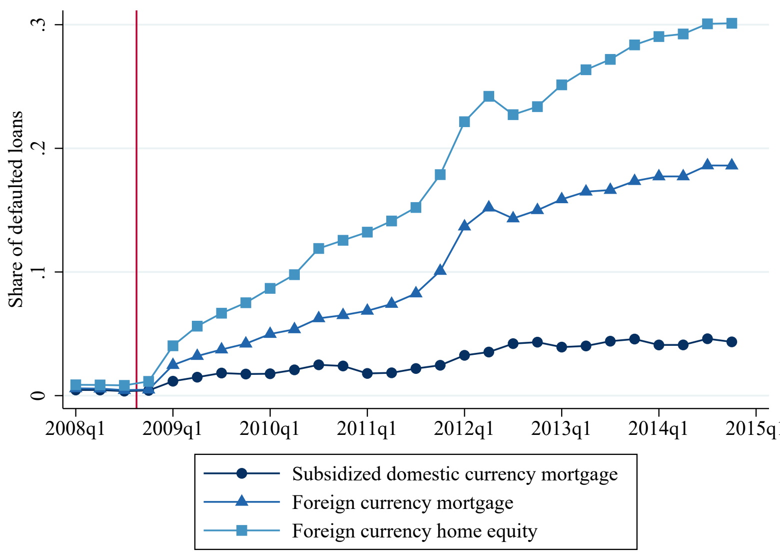
A Appendix figures and tables

Figure A.1: Exchange rate expectations from Consensus Economics



Notes: The figure plots the HUF/EUR exchange rate expectations on a 1 year and 2 years horizon from Consensus Economics forecasts. An increase in the series represents an expected depreciation of the HUF relative to the EUR. The vertical line represents September 2008.

Figure A.2: Default rate on housing loans by currency denomination and loan type



Notes: This figure shows the aggregate default rate on housing loans by currency denomination and loan type. The vertical line represents September 2008.

Figure A.3: Example of the consumption diary from HKÉF

(a) Original

Példa a kiadások tételenként történő beírásához

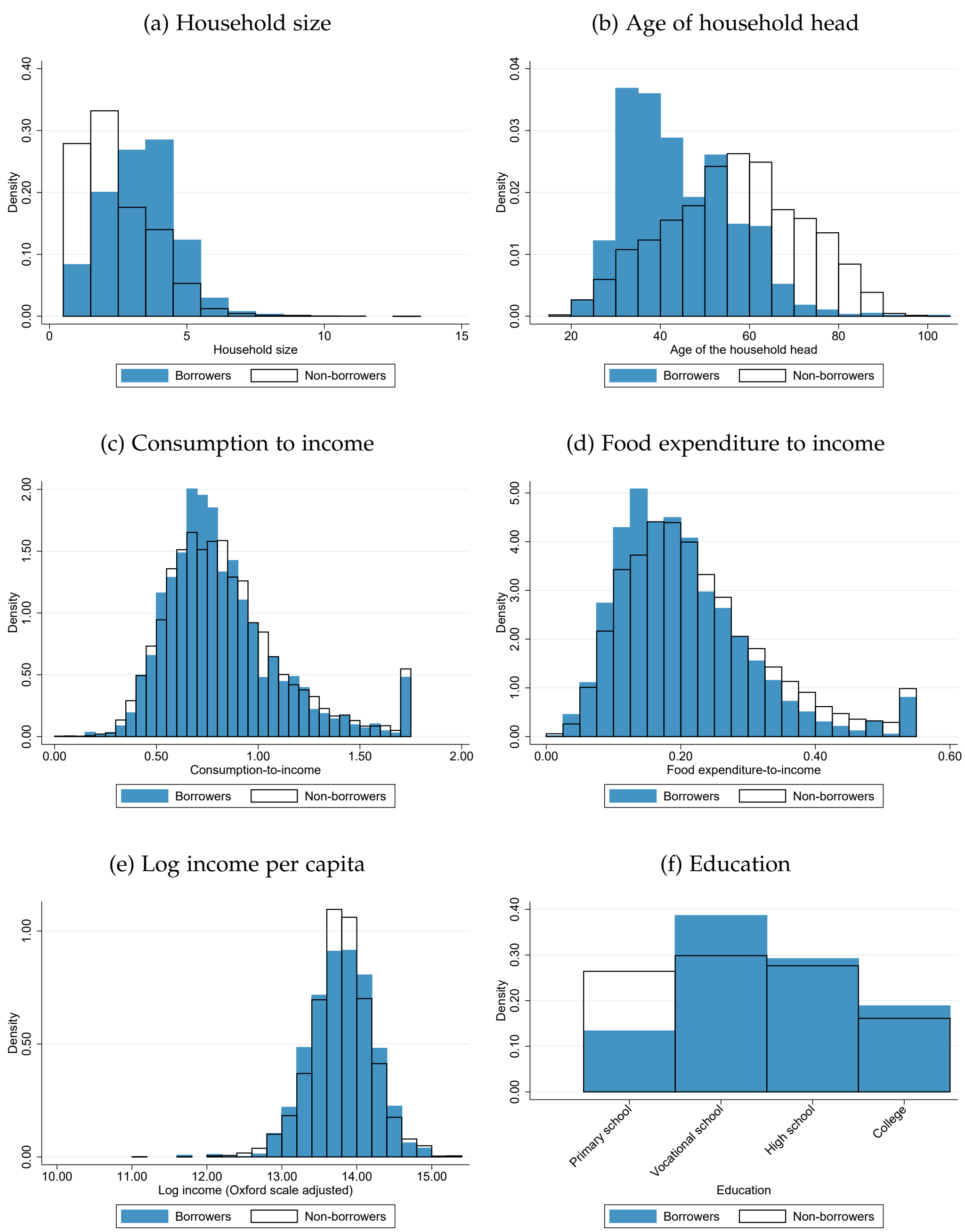
Sorszám	Nap	Mire mennyit költött? (Kérjük, hogy a ruházat és a lábbeli vásárlása esetén a személyt is nevezzék meg)	Kiadási kód	Mennyiség	Forint	Személy-sorszám
01	1	2,8%-os tartós tej, 1 liter	011410	100	200	
02	1	1 kg fehér kenyér	011121	100	250	
03	1	25 dkg baromfipárizsi	011253	25	225	
04	1	1 doboz cigaretta	022110		500	
05	2	1 csomag kávé, 25 dkg	012111	25	530	
06	2	2 korsó sör (sörözőben)	111128		800	
07	2	munkahelyi étterem, 1 ebéd	111211		550	
08	2	10 db tojás	011470	10	300	
09	3	tornacipő Petinek, 1 pár	032132	1	850	05

(b) Translated

Example of the detailed registration of consumption expenditures						
Num.	Day	Item and quantity purchased (Please indicate the member of the household for whom the item was bought, if clothing or shoes)	Expenditure item code	Quantity	Forint	Num. of household member
01	1	Milk, UHT, 2.5 percent fat	011410	1	200	
02	1	1 kg bread	011121	1	250	
03	1	250g cold cuts	011253	250	225	
04	1	1 pack of cigarettes	022110		500	
05	2	1 pack of coffee	012111	25	530	
06	2	2 pints of beer (in pub)	111128	2	800	
07	2	Workplace cafeteria, 1 lunch	111211	1	550	
08	2	10 eggs	011470	10	300	
09	3	Sport shoes for Peter, 1 pair	032132	1	850	05

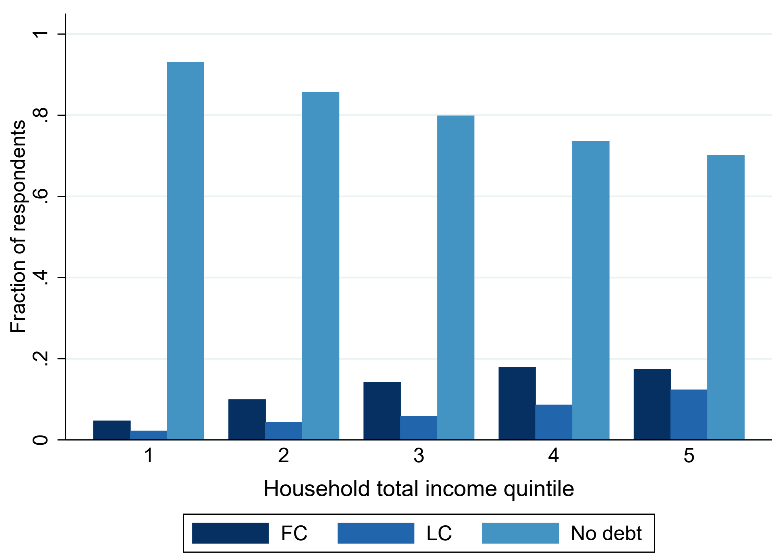
Notes: This figure shows an example from HKÉF of the consumption diary from 2010, with our translation in panel (b).

Figure A.4: Distribution of household characteristics in 2008 by borrower status



Notes: This figure shows the distribution of household characteristics for borrowers and non-borrowers in 2008.

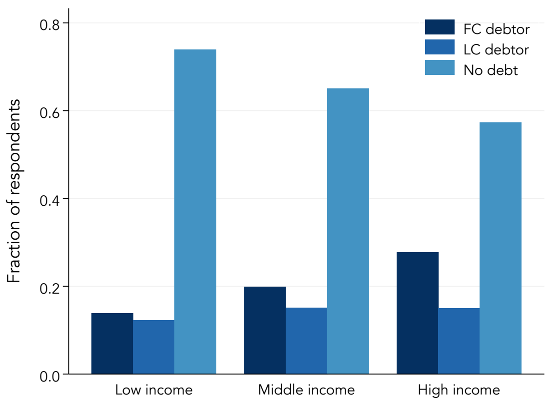
Figure A.5: Distributional implications: Exposure to depreciation through FC debt positions across the income distribution



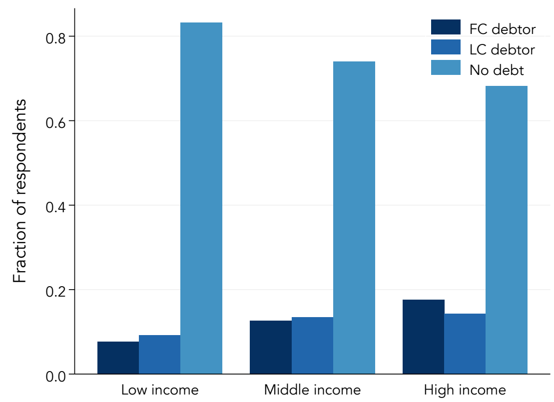
Notes: This figure plots the share of debtors by currency denomination across income quintiles in the HKÉF survey in 2008. Overall debt and FC debt exposure rise across the household income distribution. Columns add up to one within each quintile of the income distribution.

Figure A.6: Distributional implications of FC debt exposure: Evidence from Nine Additional Countries and Accounting for FC Savings

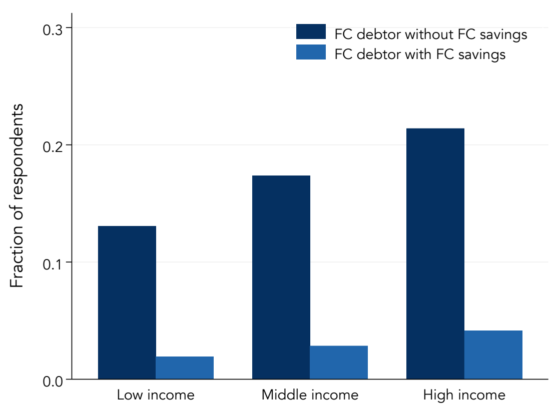
(a) FC debt exposure across the income distribution: Hungary



(b) FC debt exposure across the income distribution: 9 countries



(c) FC debt exposure across the income distribution for households with and without FC savings: Hungary

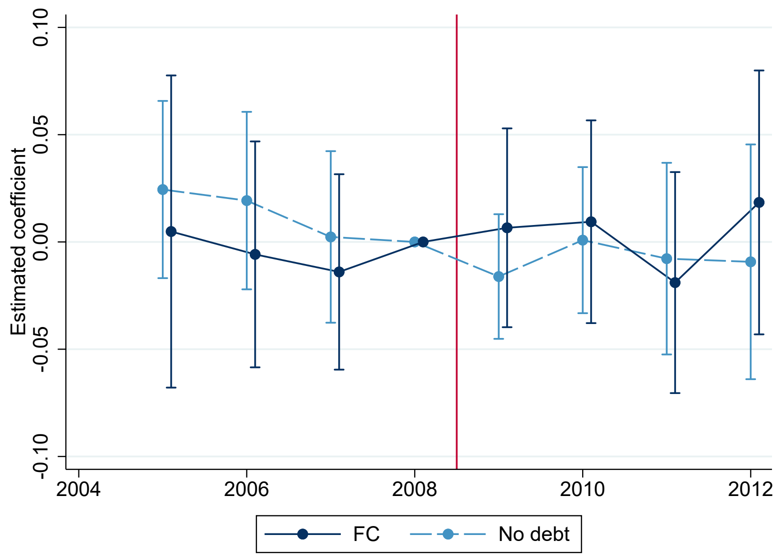


Notes: Panel (a) uses data from the Euro Survey Project and presents the fraction of respondents reporting having an FC loan, LC loan, or no debt by income terciles. The figures shows that FC debt exposure rises across income terciles.

Panel (b) in this figure reports the same statistics as panel (a) but for a sample of 9 countries in the Euro Survey Project (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Macedonia, Poland, Romania, and Serbia). The figure shows that for FC debt exposure (and overall debt) is higher for higher levels of income in this broader sample.

Panel (c) plots the fraction of households with FC debt across the income distribution, differentiating between households that report holding FC savings and households without FC savings. The figure uses the sample of Hungarian households in the Euro Survey. The figure shows that most FC debtors do not have FC savings and therefore the rising exposure to depreciation risk across the income distribution is robust to accounting for FC savings.

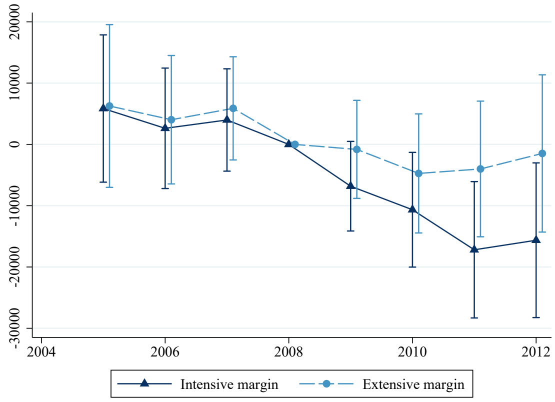
Figure A.7: Foreign currency debt exposure and house prices



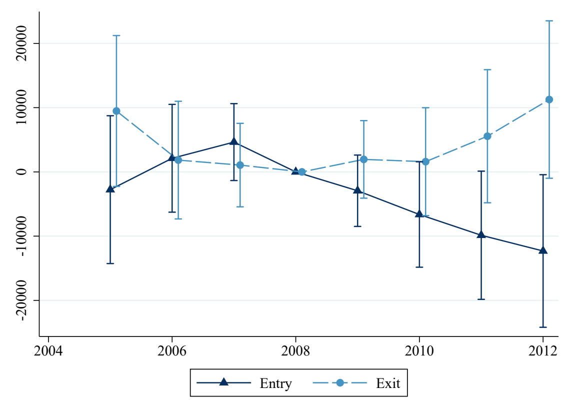
Notes: This figure plots the coefficients of interest from estimating equation (2) with the log of self-reported house price as the dependent variables. Controls in both specifications include age of the household head, gender of the household head, educational attainment of the household head, household size, and region (58 units) fixed effect. All control variables are interacted with year fixed effects. Standard errors are clustered at the household level. Error bars represent 95 percent confidence intervals.

Figure A.8: Intensive and extensive margins of adjustment

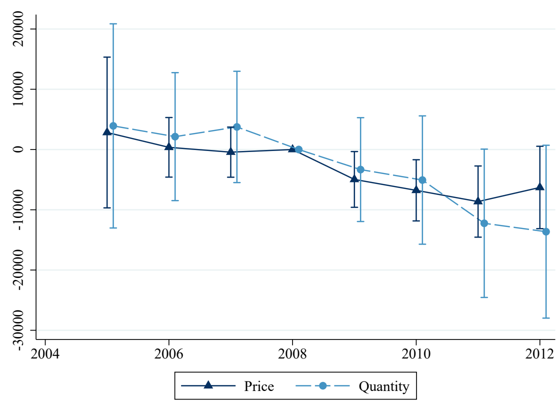
(a) Intensive vs. extensive margin



(b) Extensive margin: Entry vs exit



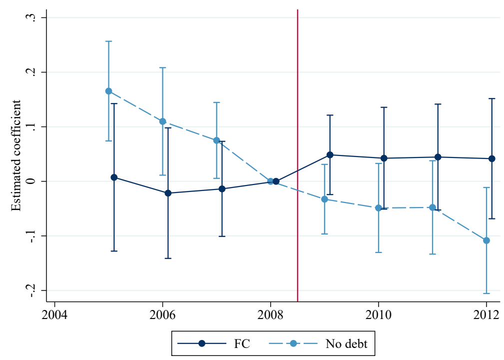
(c) Intensive margin: Price vs quantity



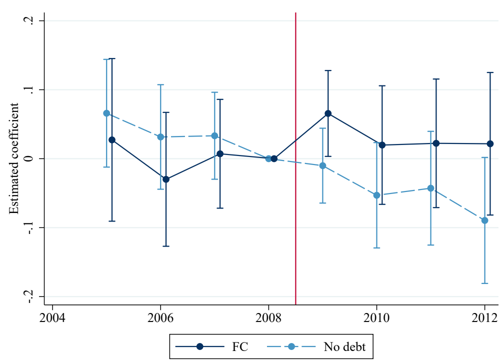
Notes: This figure plots the coefficients of interest from equation (7) using the different margins of adjustment as outcomes. Controls include age of the household head, gender of the household head, educational attainment of the household head, household size, and region (58 units) fixed effect. All control variables are interacted with year dummies. Standard errors are clustered at the household level. Error bars represent 95 percent confidence intervals.

Figure A.9: Dynamic impact of foreign currency debt on measures of equivalence scales and household size

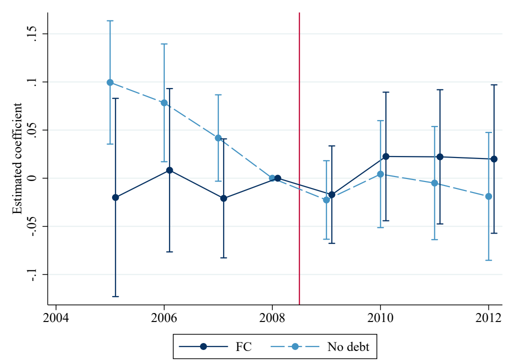
(a) Household size



(b) Number of adults

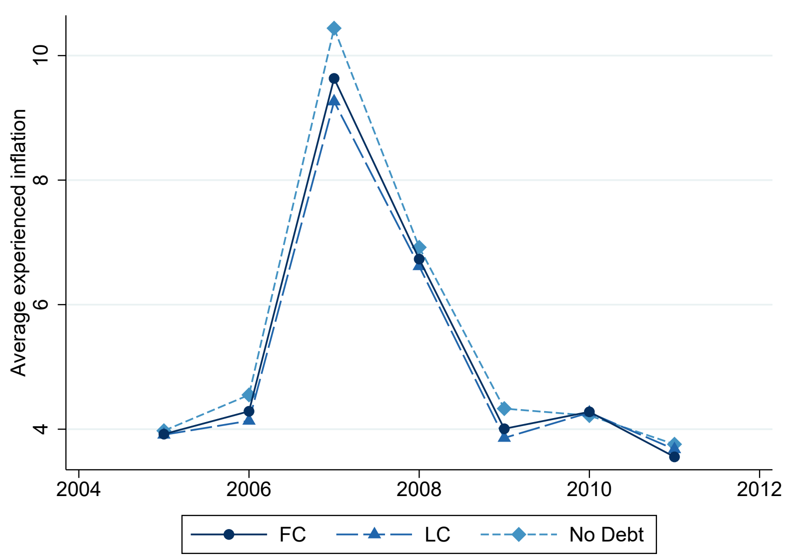


(c) Number of children below age 14



Notes: This figure plots the coefficients of interest from estimating the effect of foreign currency debt on various measures of equivalence scales and household size. The coefficients are estimated using equation (2). To avoid compositional changes driven by aging, we define an adult to be a person who was born in 1990 or earlier, while children are defined as a person to be born after 1990. Error bars represent 95 percent confidence intervals.

Figure A.10: Inflation exposure across foreign and local currency debtors



Notes: This figure plots the experienced inflation by FC debt status. We use the two digit COICOP level inflation, weighted by the 2008 consumption basket of households.

Table A.1: Descriptive statistics by household loan currency denomination in 2008 for households borrowing after 2003

	FC mean/sd	LC mean/sd	FC-LC difference b/t
Primary school	0.15	0.14	0.01
	0.36	0.35	0.14
Vocational school	0.41	0.36	0.04
	0.49	0.48	0.55
High school	0.29	0.33	0.00
	0.45	0.48	0.02
College	0.16	0.17	-0.05
	0.36	0.38	-0.77
Household size	3.27	3.51	-0.25
	1.32	1.30	-1.35
Age	43.75	45.81	-2.01
	12.53	10.32	-1.42
Female	0.17	0.15	0.05
	0.37	0.36	0.98
Income (1000 HUF)	1050.72	1138.88	-69.79
	462.04	560.38	-0.91
Consumption to income	0.82	0.82	-0.02
	0.30	0.26	-0.53
Food exp. to income	0.20	0.20	0.00
	0.10	0.10	0.34
Payment to income	0.15	0.14	0.02
	0.08	0.08	1.52
Have liquid assets	0.23	0.32	-0.10
	0.42	0.47	-1.48
Capital	0.16	0.05	0.11**
	0.37	0.22	3.67
County capital	0.24	0.27	-0.09
	0.43	0.45	-1.34
Town	0.30	0.30	-0.00
	0.46	0.46	-0.04
Village	0.30	0.38	-0.02
	0.46	0.49	-0.24
Observations	961	52	1013

Notes: The table presents descriptive statistics by loan currency denomination for households borrowing after 2003 in the HKÉF in 2008. The first three columns show the average characteristics of foreign currency borrower households and local currency borrowers. The third column reports the difference between the average characteristics of foreign and local currency borrowers. The first seven rows report the characteristics of the household head, and the remaining rows show household-level characteristics. Consumption and income are scaled by the Oxford equivalence scale.

Table A.2: Foreign currency debt exposure and consumption categories

	COICOP categories											
	(1) Food & non-alc	(2) Alcohol Tobacco	(3) Clothing Footwear	(4) Housing utilities	(5) Furnishing HH equipment	(6) Health	(7) Transport	(8) Communication	(9) Recreation Culture	(10) Education	(11) Restaurants Hotels	(12) Misc
FC × *Post*	-0.0183	-0.0625	-0.0500	-0.0137	-0.114	-0.0765	-0.0559	-0.131**	-0.0739	-0.0832	-0.0240	-0.0840*
	(0.0248)	(0.0591)	(0.0472)	(0.0529)	(0.0701)	(0.0692)	(0.0512)	(0.0321)	(0.0474)	(0.142)	(0.0832)	(0.0411)
Household and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2												
N	59321	51821	58671	59249	59179	57214	48544	58188	58661	23216	37371	59253

Notes: This table reports results from estimating equation (1) by Poisson pseudo-maximum likelihood (PPML) for various categories of consumption. Standard errors are clustered at household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table A.3: Heterogeneity in the MPC estimates

	Income in 2008		Liquidity in 2008		Education		Age	
	(1) Low	(2) High	(3) Low	(4) High	(5) Low	(6) High	(7) Young	(8) Old
Payment surprise	-1.275*	-0.776+	-1.126**	-0.668	-1.217*	-0.941+	-1.056**	-1.013
	(0.606)	(0.442)	(0.400)	(0.723)	(0.508)	(0.486)	(0.356)	(1.094)
Household & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	12594	12358	16127	8825	13679	11273	13357	11595

Notes: This table presents estimates of the marginal propensity to consume by household characteristics. Columns 1 and 2 estimate equation (3) separately for households with above and below median income in 2008. Columns 3 and 4 split the sample into households who report having low and high liquidity. Low liquidity households are those who report that they cannot pay for an "unexpected and large" expense. Columns 5-6 and 7-8 split by above and below median education and age. Standard errors are clustered at household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table A.4: Foreign currency debt exposure and consumption: Alternative adjustments for household size

Panel A: PPML					
	Total		Per capita	OECD	Square Root
	(1)	(2)	(3)	(4)	(5)
FC $\times$ Post	-0.0325*	-0.0374**	-0.0515**	-0.0431**	-0.0415**
	(0.0148)	(0.0141)	(0.0174)	(0.0148)	(0.0143)
Household and Year FE	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
Contemp. Household size		Yes			
N	59321	59321	59321	59321	59321
Panel B: Marginal propensity to consume					
	Total		Per capita	OECD	Square Root
	(1)	(2)	(3)	(4)	(5)
Payment surprise	-0.659^{+}	-0.786*	-1.123**	-0.906**	-0.872**
	(0.351)	(0.335)	(0.394)	(0.339)	(0.332)
Household and year FE	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
Contemp. household size		Yes			
First stage F-statistics	1125.5	1127.1	692.8	969.8	1034.1
N	59321	59321	59321	59321	59321

Notes: Panel A presents estimates of equation (1) for alternative consumption equivalence scales. Panel B presents the corresponding MPC estimates from equation (3). The Oxford scale attaches weight of 1 to the first adult in the household, 0.7 to all other adults, and 0.5 to children below the age of 14. The OECD scale similarly attaches a weight of 1 to the first adult, but gives a weight of 0.5 for all the consecutive adults, while children get a weight of 0.3. Standard errors are clustered at household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table A.5: Effect of foreign currency debt on consumption: Robustness on a propensity score matched sample

	LC control		LC & NoDebt control	
	(1)	(2)	(3)	(4)
FC $\times$ Post	-0.0499*	-0.0469*	-0.0513**	-0.0460**
	(0.0231)	(0.0188)	(0.0170)	(0.0167)
Household & Year FE	Yes	Yes	Yes	Yes
Household controls		Yes		Yes
N	7125	7125	11856	11856

Notes: This table presents estimates of equation (1) on a propensity score matched sample. The dependent variable is log nondurable consumption. Households are matched within waves. The baseline household control variables for calculating the propensity score: age of the household head, gender of the household head, educational attainment of the household head, household size, and the location of the household. The caliper is set to 0.001. Columns 1 and 2 present results using only LC debtors as controls. Columns 3 and 4 present results using both LC debtors and non-debtors as controls. Standard errors are clustered at household level. +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table A.6: Balancedness for propensity score matched sample, LC debtors as controls

	Treatment	Control	Treatment-Control Diff.	t-statistic	Normalized Diff.
Primary school	0.12	0.11	0.01	0.30	0.02
Vocational school	0.46	0.46	-0.00	-0.02	-0.00
High school	0.30	0.32	-0.02	-0.46	-0.03
College	0.13	0.11	0.01	0.54	0.03
Household size	3.24	3.22	0.02	0.13	0.01
Age	43.35	43.04	0.31	0.28	0.02
Female	0.15	0.13	0.02	0.84	0.05
Income (1000 HUF)	1023.58	1035.19	-11.61	-0.30	-0.02
Consumption to income	0.83	0.82	0.01	0.33	0.03
Food exp. to income	0.20	0.21	-0.00	-0.26	-0.02
Payment to income	0.15	0.15	-0.00	-0.05	-0.00
Have liquid assets	0.08	0.10	-0.01	-0.37	-0.03
Capital	0.15	0.11	0.04	1.22	0.09
County capital	0.23	0.32	-0.09+	-1.86	-0.14
Town	0.30	0.33	-0.03	-0.77	-0.05
Village	0.32	0.24	0.08*	2.07	0.13

Notes: This table presents the average characteristics of treatment (FC debtor) and control (LC debtors) households for the propensity score matched sample. The Normalized Difference is defined as $\frac{\bar{X}_1 - \bar{X}_0}{\sqrt{V_1 + V_0}}$, where $\bar{X}_\omega$ (V_ω) is the sample average (variance) for the treatment and control groups, as defined in Imbens and Wooldridge (2009).

Table A.7: Balancedness for propensity score matched sample, LC debtors and non-debtors as controls

	Treatment	Control	Treatment-Control Diff.	t-statistic	Normalized Diff.
Primary school	0.14	0.12	0.02	1.13	0.04
Vocational school	0.42	0.40	0.02	0.68	0.03
High school	0.29	0.33	-0.04	-1.42	-0.06
College	0.15	0.15	-0.00	-0.01	-0.00
Household size	3.22	3.18	0.04	0.48	0.02
Age	44.01	45.19	-1.18	-1.62	-0.07
Female	0.17	0.17	0.00	0.17	0.01
Income (1000 HUF)	1053.90	1017.08	36.81	1.32	0.06
Consumption to income	0.83	0.85	-0.02	-0.97	-0.04
Food exp. to income	0.20	0.22	-0.02**	-3.03	-0.13
Have liquid assets	0.08	0.12	-0.05*	-2.54	-0.11
Capital	0.16	0.19	-0.03	-1.10	-0.05
County capital	0.23	0.25	-0.02	-0.89	-0.04
Town	0.30	0.27	0.03	1.32	0.05
Village	0.31	0.29	0.02	0.60	0.03

Notes: This table presents the average characteristics of treatment (FC debtor) and control (LC debtors and non-debtors) households for the propensity score matched sample. The Normalized Difference is defined as $\frac{\bar{X}_1 - \bar{X}_0}{\sqrt{V_1 + V_0}}$, where $\bar{X}_\omega$ (V_ω) is the sample average (variance) for the treatment and control groups, as defined in Imbens and Wooldridge (2009).

Table A.8: Price and quality adjustment using alternative decomposition of the intensive margin

	Total expenditures	Intensive		Intensive	
		Laspeyres price	Paasche quantity	Paasche price	Laspeyres quantity
FC × Post	-26724.11*	-5394.04	-14272.8*	-5169.53+	-14053.64*
	(10531.05)	(3320.97)	(5953.95)	(3011.8)	(6262.96)
Household and Year FE	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	39689	39689	39689	39689	39689
Percent of total	–	20.18%	53.4%	19.34%	52.58%

Notes: This table reports the estimated effect of FC debt exposure on various measures of household spending based on the decomposition equation (B.8) and (B.9). +, * and ** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

B Data appendix

B.1 Household debt in survey data

Determining the currency denomination of debt HKÉF contains two sets of information on household debt. First, every year households are surveyed about whether they have debt obligations. From this we know whether they have debt, the year of borrowing, the amount borrowed, the maturity of debt, and the monthly installment.

From 2009, households are also surveyed about their housing debt. This gives us information on whether they have housing debt, the type of debt (mortgage vs home equity), year of origination, the currency denomination of debt (including information on the conversion), the total amount payed in the year as installment, and whether any of the household members have another loan from a financial institution.

To determine the currency denomination we exploit that households borrowed in local currency only before the end of 2004, and mostly in Swiss franc after 2004 (see Figure 2).

Annuity model We calculate households' debt burdens by using the following loan characteristics: the year of origination, maturity, type of loan, and currency denomination. With this information we use an annuity formula to impute the monthly payment and remaining balance for each loan. Specifically, for each loan i in currency c of type k originated at time t_0 with maturity m and remaining periods $n = t_0 + m - t + 1$, we denote the imputed values of the monthly payment and remaining loan balance as $\tilde{P}_{it}$ and $\tilde{D}_{it}$. These are computed as

$$\begin{aligned}\tilde{P}_{it} &= \tilde{D}_{it} \left(\frac{1 - R_{ckmt}^{-n}}{R_{ckmt} - 1} \right)^{-1} \\ \tilde{D}_{it} &= \tilde{D}_{i,t-1} \cdot R_{ckm,t-1} - P_{i,t-1},\end{aligned}$$

where $D_{it_0} = \tilde{D}_{it_0}$ is the originated amount. R_{ckmt} is the average monthly gross interest rate charged for that specific loan product (currency, loan type) in period t.

This formula hence calculates the sequence of payments and outstanding debt that we would observe in the absence of default, assuming that loan i pays the average variable rate charged for that loan product. We do not believe that the assumption that loans remain current is severe drawback for this methodology because default rates were very low before the 2008 crisis (see Figure A.2).[42]

High liquidity proxy We proxy household liquidity positions by whether a household can cover an unanticipated expenditure shock of the size of their monthly net income from their own savings. Specifically, we use two questions on whether the household can cover a large unexpected expenditure shock from own savings and the maximum amount it can cover. We define high liquidity households to be those who can cover an unanticipated expenditure shock at least their monthly net income.

[42] Statistics from the National Bank of Hungary show that the fraction of non-perfor ming loans was below

Table B.9: Variables on household debt

Variable name	Year of wave 2005	2006	2007	2008	2009	2010	2011	2012
Asked when questions are about the apartment characteristics								
Has housing loan	Y	Y	Y	Y	Y	Y	Y	Y
Borrowed amount	Y	Y	Y	Y	Y	Y	Y	Y
Year of origination	Y	Y	Y	Y	Y	Y	Y	Y
Maturity	Y	Y	Y	Y	Y	Y	Y	Y
Asked when questions are about collateralized debt								
Has housing loan					Y	Y	Y	Y
What is the collateral					Y	Y	Y	Y
Type of loan (mortgage vs home eq)					Y	Y	Y	Y
Year of origination					Y	Y	Y	Y
Currency denomination					Y	Y	Y	Y
Total payment in the year					Y	Y		
Monthly payment							Y	Y
Household has other types of loans					Y	Y	Y	Y
Questions on personal, car, etc. loans					Y	Y	Y	Y
Delinquent loan due to cash shortage					Y	Y	Y	Y

B.2 Alternative indices for decomposing the intensive margin

In the main analysis, we used the Marshal-Edgeworth index for the decomposition, here we discuss alternative indices for decomposition. In particular, we use the Laspeyres, Paasche and Fisher indices.

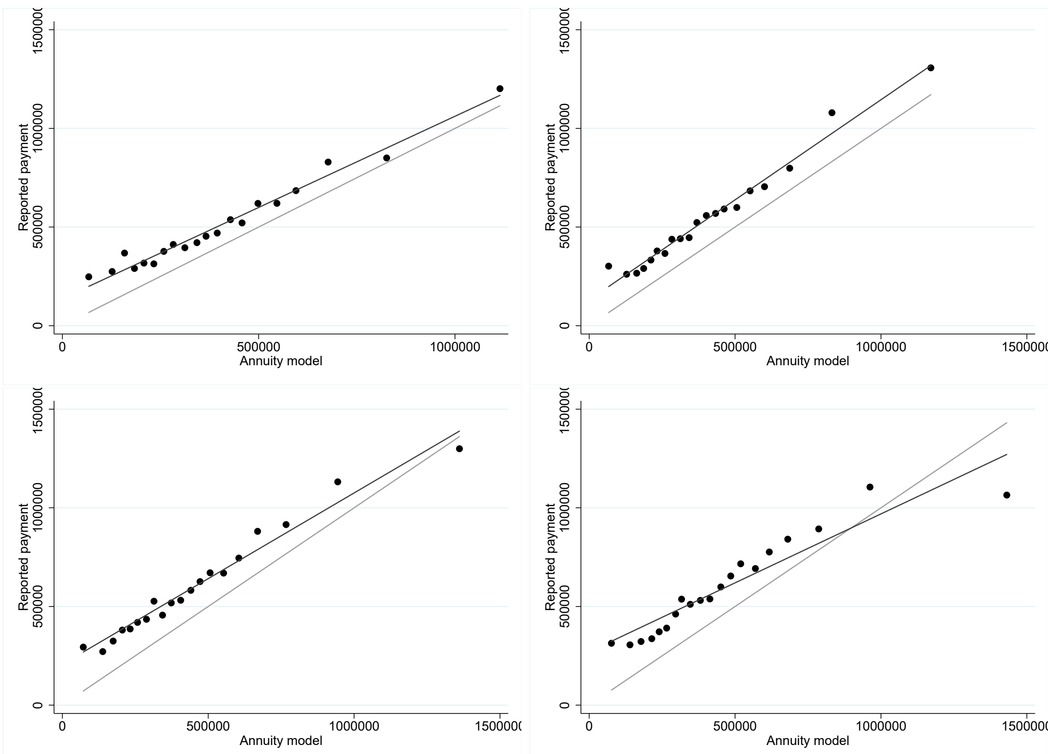
The intensive margin of the change in expenditures can be decomposed as the following:

$$\begin{aligned}
\sum_{j\in J_{t/t-1}} e_{jt} - \sum_{j\in J_{t/t-1}} e_{j,t-1} &= \sum_{j\in J_{t/t-1}} p_{jt}q_{jt} - \sum_{j\in J_{t/t-1}} p_{j,t-1}q_{j,t-1} \\
&= \underbrace{\sum_{j\in J_{t/t-1}} \Delta p_{jt}q_{j,t-1}}_{\text{Laspeyres price change}} + \underbrace{\sum_{j\in J_{t/t-1}} \Delta q_{jt}p_{jt}}_{\text{Paasche quantity change}} && \text{(B.8)} \\
&= \underbrace{\sum_{j\in J_{t/t-1}} \Delta p_{jt}q_{jt}}_{\text{Paasche price change}} + \underbrace{\sum_{j\in J_{t/t-1}} \Delta q_{jt}p_{j,t-1}}_{\text{Laspeyres quantity change}} && \text{(B.9)}
\end{aligned}$$

The Laspeyres price change uses the quantities from $t-1$ as weights, while the Paasche price index uses the quantities from t. This implies that the Laspeyres index is likely to overstate the change in prices as it does not account for the fact that households can change the quantities. The opposite is true for the Paasche index.

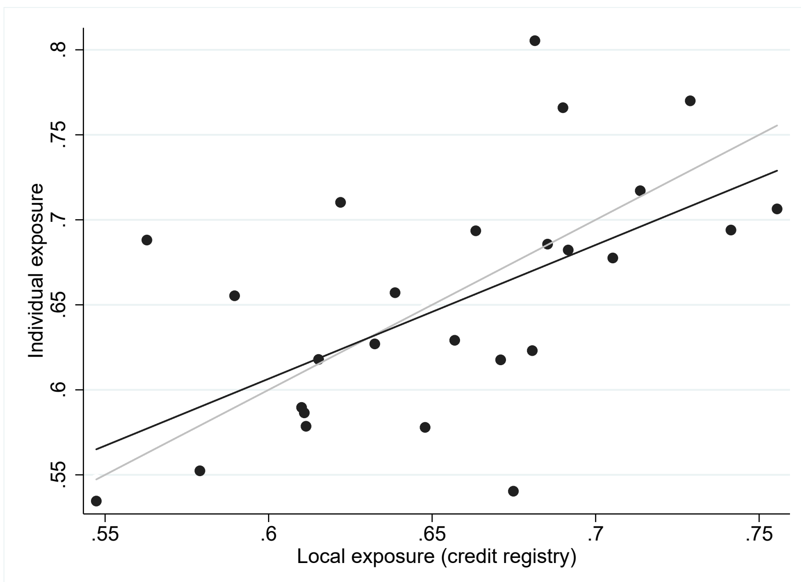
1 percent for both local currency loans and foreign currency housing loans in 2008Q3.

Figure B.11: Calculated annuity payment and reported payment comparison



Notes: The figures show the calculated annuity payment and the reported payment by households in 2009 (top left), 2010 (top right), 2011 (bottom left), and 2012 (bottom right).

Figure B.12: Average individual exposure at the locality level vs administrative exposure



Notes: This figure presents a binscatter of local FC debt exposure in the household credit registry with individual-level exposure from the household consumption survey.

C Foreign Currency Lending to Households in Other Countries

This appendix provides additional examples of episodes where household foreign currency debt left households and banks exposed to adverse balance sheet effects. We discuss both episodes captured in Figure 1 and narrative accounts from other episodes where data is not available.

Argentina In Argentina during its crisis and devaluation in 2002, 80% of mortgages were denominated in dollars, while earnings of borrowers with dollar debt was mainly in pesos (IMF, 2003a). Many Argentine homeowners fell behind on mortgage payments after the devaluation (Weisbrot and Sandoval, 2007). The adverse balance sheet effects from the devaluation led to a forceful and disruptive policy of "pesofication" to convert assets and liabilities into pesos, which benefitted dollar debtors relative to dollar depositors (Kiguel, 2011; Halac et al., 2004).[43]

Azerbaijan Following Azerbaijan's devaluation in 2015, consumers with dollar debts saw installments rise by over one-third, resulting in financial distress and bank loan losses (Fitch, 2015; IWPR, 2015).

The Baltics Estonia, Latvia, and, to a lesser extent, Lithuania also saw significant FC lending to households in the 2000s. Latvia provides an example of an economy with widespread foreign currency debt during a severe bust and balance-of-payments crisis where policy maintained a currency peg and pursued an internal devaluation (Blanchard et al., 2013). Devaluation of the Latvian currency was eschewed in part because of the risk of insolvencies from widespread foreign currency debt exposures.

Austria During the mid-2000s, 12 percent of Austrian households reported having a Swiss franc or Japanese yen loan. In 2007, one-third of new lending to households was FC-denominated. In Austria, this exposure was concentrated among higher-income and risk-loving households (Beer et al., 2010).

Central and Eastern Europe As with the case of Hungary examined in this paper, foreign currency (often Swiss franc) lending to households was widespread during the 2000s in emerging European economies, including Bulgaria, Croatia, Poland, Serbia, Slovenia, Romania, and Ukraine (e.g., Rosenberg and Tirpák, 2008). This resulted in financial distress for foreign currency debtors, rising non-performing loans, and years of legal disputes about the resolution of these debts. In Poland, for example, legal risks associated with FC mortgages originated before the 2008 financial crisis remained a threat to financial stability in 2021 (Reuters, 2021).

[43] Deposits were "pesofied" at 1.4 pesos/dollar (well below market rates), while bank loans in FC were converted to pesos at the highly favorable 1 peso/dollar rate.

Greece Approximately 70,000 households in Greece borrowed in Swiss francs during the 2000s, especially between 2006 and 2010. This resulted in adverse balance sheet effects when the Swiss franc appreciated against the euro starting in 2010. The Greek Supreme Court Ruled in 2019 that borrowers would have to repay loans in full.

Iceland During Iceland's banking and currency crisis in 2008, about 20% of household loans were in foreign currency (often in Swiss franc and Japanese yen), up from less than 5 percent in the early 2000s, and many households did not have foreign currency income. Furthermore, almost all mortgages were indexed to inflation and thereby indirectly exposed to devaluation risk. This drove borrowers toward insolvency, and these debts were subsequently aggressively restructured (Benediktsdóttir et al., 2017).

Mexico Mexico's sudden stop and currency crisis in 1994-95 was preceded by rapid lending growth to households (Musacchio, 2012; Müller and Verner, 2021). These loans were often denominated in foreign currency or had floating rates that adjusted monthly and led to sharp increases in installments with the spike in interest rates that followed the collapse of the peso (Karaoglan and Lubrano, 1995; Corsetti et al., 1999). The devaluation of the peso resulted in rising non-performing loans and financial distress for these indebted households.

Peru The Peruvian exchange rate depreciated significantly (about 25 percent) against the dollar from mid-2013 to 2016 onward, following the Taper Tantrum (Humala, 2019). Despite sustained de-dollarization, especially for household loans, about 34 percent of mortgage loans were still denominated in dollars in 2014 (IMF, 2015).[44] The macro-financial risks from foreign currency household debt in this episode were contained, although 15 percent of debtors, mostly high-income households, had elevated debt-to-income ratios (IMF, 2016).

Russia At the onset of the Global Financial Crisis, about 13 percent of household credit in Russia was FC-denominated (mainly dollar), leading to higher default rates on FC household loans with the depreciation of the ruble (Sprenger and Urošević, 2011). Before the 2014 depreciation of the ruble, the share of household debt in FC declined substantially, and estimates of the number of FC mortgage holders ranged from 25,000 to 150,000.[45] While this represented a small minority of borrowers, the 2014 depreciation of the ruble more than doubled domestic currency installments on dollar loans and led to severe financial distress for many FC borrowers, as well as protests demanding loan restructuring (Business Insider, 2014).

[44] The Peruvian financial system has been highly dollarized following instability and hyperinflation in the 1970s and 1980s, although efforts at de-dollarization had gradually lowered the share of dollar loans and deposits (IMF, 2015).

[45] Based on data from the Central Bank of Russia, by 2014 only 2.5 percent of household debt was denominated in FC in 2013.

Uruguay Uruguay's devaluation in 2002 resulted in an 89 percent increase in the dollar exchange rate. The financial system was highly dollarized, both in terms of credit and deposits. In 2002, 87 percent of bank lending was FC-denominated (IMF, 2003b). Some households with dollar debt experienced a doubling in debt payments (e.g., NYT, 2002).