The Foreign Currency Fisher Channel: Evidence from Households*

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Abstract

We study how foreign currency debt exposure shapes household adjustment to a large exchange rate depreciation. Using household survey and bank customer data during Hungary's 2008 currency crisis, we find that foreign currency borrowers cut consumption one-for-one with increased debt service, consistent with a *foreign currency Fisher channel*. Both the quantity and quality of expenditures decline, indicating a "flight from quality." Debt revaluation has a limited effect on overall labor supply, but there is substitution toward foreign income and home production. Our findings point to the relevance of open-economy models with incomplete markets, heterogeneous foreign currency exposures, and liquidity constraints.

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1 Introduction

Foreign currency debt often plays a central role in emerging market financial crises. Following a large exchange rate depreciation, the revaluation in foreign currency debt burdens leads to a deterioration in household and firm balance sheets. This balance-sheet shock can depress consumption and investment through a *foreign currency Fisher channel*, the open economy analog of the traditional Fisher debt-deflation channel (Fisher, 1933; Krugman, 1999; Auclert, 2019; Zhou, 2022).

While the impact of foreign currency debt exposure on firm outcomes is well-documented, much less is known about how households respond to foreign currency debt revaluations. Yet, household foreign currency debt often represents a significant vulnerability in emerging market financial crises (e.g., Ranciere et al., 2010). For instance, Figure 1 highlights substantial household foreign currency exposures during crises such as Argentina and Uruguay in 2002, and emerging Europe in 2008.[1] On the theoretical side, household foreign currency debt is a key transmission channel in recent models of international financial crises (Lorenzoni, 2014; de Ferra et al., 2019), and open-economy macroeconomic models are increasingly incorporating household heterogeneity in exposures to foreign assets and liabilities (Auclert et al., 2021; Guo et al., 2023). Despite these theoretical advances, there remains limited micro-level evidence on how heterogeneous foreign currency exposures shape household responses to exchange rate shocks.

In this paper, we provide the first detailed household-level evidence on how households adjust consumption and labor supply to a large revaluation of foreign currency debt burdens during a currency crisis. Our empirical setting is the case of Hungary around the large depreciation of the Hungarian forint starting in late 2008. This setting is appealing for two reasons. First, household foreign currency exposures were substantial. Prior to the crisis, two-thirds of household debt was denominated in foreign currency,

[1] Appendix E provides over a dozen additional examples of unhedged household foreign currency lending and resulting balance sheet effects during large depreciations.

primarily Swiss franc. Second, after a decade of exchange rate stability, the domestic currency unexpectedly depreciated by over 30% against the Swiss franc, sharply increasing household debt burdens for foreign currency (FC) borrowers.

We exploit two micro-datasets to examine the borrower-level effects of the large foreign currency debt revaluation shock. Crucially, both sources contain information on the currency composition of household debt, information that is often lacking in household-level datasets. The first dataset is a household survey that follows households consecutively for four years and contains detailed information on consumption expenditure by category, prices paid, income by source, and working hours. We supplement the survey data with retail customer data from a major bank in Hungary, which allows us to track monthly individual current account expenditures and debt service costs. We use these datasets to provide a granular analysis of how households adjust to a large foreign currency debt revaluation and relate the findings to theoretical models of household behavior.

We estimate the causal effect of a sudden FC debt revaluation by comparing the outcomes of FC borrowers to similar local currency (LC) borrowers around the large exchange rate depreciation using a differences-in-differences research design. Three facts support our identifying assumption of parallel trends. First, we show that FC and LC debtors are similar on observable characteristics, as variation in households' debt currency denomination comes largely from the timing of borrowing due to changes in the availability of a government subsidy for LC loans. Second, FC and LC debtors have parallel pre-trends in key outcomes before the large depreciation. Third, our estimates are essentially unchanged when including a rich set of household controls or matching on household characteristics to account for selection into FC exposure that might correlate with other shocks affecting households during the currency crisis.

We first show that the FC debt revaluation leads to a significant and persistent reduction in household consumption. FC debtors cut nondurable consumption by 5-7% relative to LC debtors after the depreciation. We estimate a marginal propensity to

consume (MPC) out of increased debt service of 0.92–0.99. This implies that nondurable consumption falls roughly one-for-one with the increase in debt payments. FC borrowers were thus unhedged against the depreciation, consistent with models of incomplete risk-sharing. When we consider total household spending including durables, we estimate an even larger marginal propensity to spend (MPS) ranging from 1.1 to 1.3. The estimated MPS is similar across the household survey and bank customer datasets.

The results are consistent with recent models where household foreign currency exposures can be an important transmission channel of large exchange rate shocks (Lorenzoni, 2014; de Ferra et al., 2019; Zhou, 2022; Guo et al., 2023). In terms of magnitudes, the large decline in consumption for FC debtors is most consistent with binding liquidity constraints and "hand-to-mouth" behavior (Campbell and Mankiw, 1989; 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. In contrast, a simple model where debtors are hand-to-mouth provides a closer approximation to our estimated responses (e.g., Eggertsson and Krugman, 2012; Korinek and Simsek, 2016). Further, we show that a more realistic standard consumption-saving model with incomplete markets, augmented with long-term FC mortgage debt, can quantitatively match the estimated MPC.

In the second part of the paper, we decompose the fall in expenditures to understand the structure of the demand response to the FC debt revaluation shock. We use detailed product-level information on expenditures in the household survey data to decompose the change in spending across the intensive and extensive margins of products. Reduction along the intensive margin accounts for 71% of the overall decline in spending. The remaining 29% is driven by the extensive margin. The reduction along the extensive margin is, in turn, primarily driven by reduced entry into new product categories, rather than exit from product categories. This evidence highlights that changes in product adoption is an important margin for how households adjust consumption to shocks.

We further show that "flight from quality" is another important margin of adjustment in consumption (Burstein et al., 2005). Focusing on the intensive margin, 72% of the decline in spending is explained by a reduction in quantities purchased, and the remaining 28% 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 varieties following the balance sheet shock, consistent with nonhomothetic preferences. The finding that an adverse balance sheet shock reduces the quality composition of demand has important 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).

In the third part of the paper, we examine household adjustment through labor supply, another potentially important margin of adjustment in models of international financial crises (Lorenzoni, 2014). In theory, the debt revaluation can either boost labor supply through a wealth effect (e.g., Obstfeld and Rogoff, 1995; Chari et al., 2005) or depress labor supply through a debt overhang effect (e.g., Donaldson et al., 2019). We find no effect of the debt revaluation shock on labor market status, hours, or household income. This points to a weak wealth effect on labor supply, as implied by models with nonseparable preferences over consumption and leisure (Greenwood et al., 1988). Thus, the foreign currency Fisher channel impacts the real economy mainly through household consumption demand rather than labor supply. Nevertheless, while overall labor supply does not increase, a subset of households adjust their labor supply toward foreign income streams by working abroad. Finally, FC debtor households significantly increase home production, suggesting a shift in consumption from money-intensive to time-intensive goods.

Overall, our findings imply that heterogeneity in foreign currency exposures across households can play an important role in the transmission of exchange rate shocks in emerging markets. We document a foreign currency Fisher channel of debt revaluation

that operates mainly through consumption demand. The magnitude of the response is most consistent with binding liquidity constraints. Moreover, nonstandard channels, such as quality downgrading, reduced product adoption, working abroad, and home production are relevant margins of adjustment, while market labor supply is less responsive. Our findings thus provide empirical moments for recent open-economy models incorporating incomplete markets, heterogeneous international financial integration, household liquidity constraints, and nonhomothetic demand (e.g., Lorenzoni, 2014; de Ferra et al., 2019; Saffie et al., 2020; Rojas and Saffie, 2022; Zhou, 2022; Guo et al., 2023).

Related Literature Our paper contributes to the literature on large devaluations and emerging market financial crises. There is a large literature studying the consequences of *firms'* FC debt exposure around devaluations. Most studies find that unhedged FC debt exposure depresses firm investment and increases bankruptcy risk.[2]

There is much less evidence on the transmission of exchange rate shocks through household balance sheets, 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 emerging Europe in the 2008 Global Financial Crisis (Ranciere et al., 2010). The most closely related paper is Verner and Gyöngyösi (2020) (henceforth VG2020). VG2020 also uses data from Hungary's 2008 crisis and estimates the economic impact of the debt revaluation at the *local level*. That paper finds that areas with greater exposure to household FC debt saw a larger decline in auto registrations and a worse local recession, resulting in negative spillover effects on households without FC debt. VG2020 does not examine individual-level effects on consumption or labor supply.[3]

[2]See Galindo et al. (2003), Aguiar (2005), Endrész and Harasztosi (2014), Kim et al. (2015), Kalemli-Ozcan et al. (2016), Salomao and Varela (2021), Vonnák (2018), Niepmann and Schmidt-Eisenlohr (2019), Hardy and Saffie (2023), and Adams and Verdelhan (2021). 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).

[3]The only individual-level outcome studied in VG2020 is loan defaults, which increase disproportionately for FC borrowers.

This paper builds on VG2020 in several dimensions. First, we move beyond local-level new auto registrations and examine significantly more detailed consumption data at the *household level* using both household survey and bank customer data. This allows us to more precisely quantify the MPC out of the debt revaluation shock and the adjustment in the composition of consumption through reduced product adoption and toward lower quality goods. Second, we show that there is limited adjustment in overall labor supply, but significant adjustment in accessing foreign income and home production. These elasticities are important for models, and estimating them requires individual-level data. Regional data only allows for estimation of local equilibrium effects, which are the combination of individual-level consumption and labor supply effects, as well as local equilibrium multipliers. Furthermore, we show that the findings can be rationalized within a lifecycle consumption-saving model with long-term FC debt in which households are reasonably liquidity constrained.

Our work is thus also related to a small literature using micro-data to understand consumption dynamics in emerging markets. Paxson (1992) exploits rainfall shocks in rural Thailand to identify consumption responses among rice farmers. Haushofer and Shapiro (2016) and Egger et al. (2022) use randomized cash transfers in rural Kenya to study how poor households adjust their consumption in response to income shocks. Using household survey data from five crisis episodes, Guntin et al. (2023) find that high-income households display larger consumption-income elasticities compared to other households, pointing to an important role for permanent income shocks. Hong (2023) uses micro-data from Peru and semi-structural methods to estimate the MPC out of transitory income shocks and finds that the MPC is three times larger in Peru than in the U.S. Similar to these studies, we also study consumption behavior during an emerging market crisis, but our analysis differs because we trace the adjustment to an exchange rate shock through household FC exposures instead of income shocks. By shedding light on these dynamics in the Hungarian context, our study contributes to the emerging literature

on international comparative household finance (Badarinza et al., 2016).

Finally, we contribute to the literature on the role of household debt for consumption decisions. This literature has mainly focused on advanced economies and does not generally consider open-economy issues. Several studies show that high household debt and balance sheet shocks impact household consumption (e.g., Dynan, 2012; Mian et al., 2013). Related studies find that changes in household debt service due to interest rate changes or debt modification affect household default and consumption and that liquidity effects are important (Di Maggio et al., 2017; Ganong and Noel, 2020).[4] However, none of these studies estimate the effect of a large debt revaluation. Furthermore, most existing studies use either survey or administrative data, but not both. Another contribution is thus to show that survey and administrative data can provide similar responses to the same shock. There is also limited evidence connecting household debt and labor supply decisions. Bernstein (2021) finds that negative equity from adverse housing wealth shocks depresses labor supply, whereas Zator (2025) finds that mortgage payment shocks increases household labor supply. Studies examining lottery prize winners find that positive wealth shocks lead to small reductions in labor supply (Imbens et al., 2001; Cesarini et al., 2017). Relative to these papers, our data and research design allow us to estimate the household-level consumption and labor supply response to a large and sudden increase in debt for a broad cross-section of debtors and shed light on numerous channels of adjustment and relate these to the prediction of theoretical models.

The rest of the paper is structured as follows. The next section provides background on foreign currency borrowing in Hungary. Section 3 discusses the data. Section 4 outlines theoretical predictions and our identification strategy. Section 5 presents the

[4]Di Maggio et al. (2017) proxy spending responses based on new auto financing, while we use detailed survey and bank account-level spending data, which allows us to estimate MPCs, labor supply responses, and responses for specific subcategories of goods. Moreover, we study an exchange rate shock for FC debtors in an emerging market crisis, while Di Maggio et al. (2017) focuses on interest rate shocks for adjustable rate mortgage borrowers in the U.S. Responses to these two shocks may differ for a variety of reasons, including differences in the factors that drive selection in ARMs versus FC debt and differences in consumption sensitivities across advanced and emerging markets.

results on consumption, section 6 explores the margins of adjustment in consumption, and section 7 presents the results on labor supply. Section 8 concludes.

2 Background on Hungary's Foreign Currency Debt Crisis

This section provides context for Hungary's FC debt boom and crisis. Although home ownership exceeded 90% in Hungary by the early 2000s, most households lacked access to long-term credit.[5] To address this, in 2000 the government introduced a generous subsidy program for LC mortgage loans. Through the program, households could borrow in LC at nominal interest rates similar to the rates on euro-denominated mortgages and significantly below LC market lending rates. Figure 2a shows household debt denominated in LC increased rapidly following the introduction of the subsidy program.

However, in late 2003, the LC subsidy program was unexpectedly cut back as part of a fiscal reform, 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 expansionary foreign monetary policy (Gyöngyösi et al., 2019). Between 2000 and 2008, household debt-to-GDP increased by more than 25 percentage points. In September 2008, 66% of total household debt was denominated in FC, with 97% of FC debt denominated in Swiss franc and the rest mostly in euro. Moreover, the overwhelming majority of FC loans originated during the 2000s were variable rate loans, typically with interest fixation periods of no more than one year

[5]The main residence is typically a household's most valuable asset, and acquiring or renovating residential property is the most common motivation for both saving and borrowing (Boldizsár et al., 2016).

(Figure A.1).[6] Lending standards deteriorated during the credit boom, as indicated by an increase in loan-to-value (LTV) ratios (Figure A.2). Nevertheless, the average LTV ratio was still at 65% at the end of 2008 for the entire stock (MNB, 2009).

The exchange rate was relatively stable before 2008 (Figure 2b). This further contributed to the rapid spread of lending in FC, as observed in the run-up to other emerging market crises (Eichengreen and Hausmann, 1999). The Hungarian National Bank maintained a $\pm$15% exchange rate band to the euro in the 2000s, which Ilzetzki et al. (2019) classify as a *de facto* $\pm$5% band. Meanwhile, the Swiss franc was maintained within a *de facto* $\pm$2% band around the euro. However, 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% against the euro and 32.3% against the Swiss franc between September 2008 and March 2009. By 2012, the forint (HUF) depreciated by 59% against the Swiss franc compared to the pre-crisis period.

The large depreciation surprised both households and professional forecasters. While market participants may have anticipated some depreciation risk, data from Consensus Economics 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.3a). Further, based on a household survey from November 2008, Pellényi and Bilek (2009) find that most FC borrowers did not expect large exchange rate movements.[7]

Most households had limited FC income or wealth. FC debtors were thus not hedged against the exchange rate depreciation. While FC loans accounted for two-thirds of total household loans, FC deposits accounted for only one-sixth of total household deposits in 2008 (Figure A.3b). Most FC debtors in Hungary did not have any FC savings (Figure

[6]These loans did not feature a teaser period with a guaranteed reset to higher rates, as seen in some Western European markets (Fisher et al., 2024). However, banks retained significant unilateral discretion to adjust the interest rate spread. Although this discretion was not exercised extensively in the pre-crisis period, it became a key driver of rising interest burdens during the crisis.

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

A.4).[8] Moreover, although Hungary joined the EU in 2004, only a very small share of households worked abroad and had access to FC income before the crisis.[9]

The unexpected debt revaluation placed a significant burden on FC debtors through rising monthly installments. With the depreciation of the forint, default rates increased to nearly 15% for FC mortgage loans and 22% for FC home equity loans by 2012 (Figure A.3c). Household debt in Hungary is full recourse, and there was no provision for personal bankruptcy. The rise in default rates, therefore, largely reflects the limited ability to service rising installments, consistent with households being exposed to currency mismatch. The crisis also led to a sharp fall in aggregate consumption, which declined by 10% from 2008 to 2012 (Figure 2c).

In addition to the exchange rate shock, rising interest rates on variable rate FC housing loans also increased debt service costs for FC debtors. Banks charged a margin above a money market benchmark (such as CHF LIBOR), but they also retained considerable unilateral discretion to alter this margin (Bethlendi, 2015).[10] Figure A.5 shows that despite the fall in the CHF-LIBOR rate during the crisis, interest rates on the stock of CHF mortgages increased in Hungary, as banks unilaterally increased interest rate spreads. 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 accounted for 75% of the increase in debt service for FC borrowers, while interest rate

[8]Backé et al. (2007) document using repeated cross-sectional survey data that less than 10% 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% of FC borrowers had FC income or savings in 2008.

[9]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 17% of Hungarian households had emigrated by 2011, and emigration only accelerated after 2010. Furthermore, Table 1 below shows that the foreign income share in 2008 was less than 1% for households in the survey we analyze.

[10]In response to rising funding costs and credit risk, the first form of market self-regulation, the so-called Code of Conduct, was introduced in October 2009. The Code listed a broad array of justifications that allowed participating financial institutions to increase interest rates. In practice, this institutionalized wide discretion for lenders to unilaterally raise rates on existing loans (Bethlendi, 2015).

increases accounted for the remaining 25%.

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.[11] Because the program required households to repay their entire outstanding debt, wealthier households were more likely to participate. Approximately 23% 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.[12] Finally, in 2014, the more comprehensive Settlement and Conversion Program provided partial debt relief to FC borrowers for over-payments from unilateral interest rate increases and converted almost all FC loans into LC (Gyongyosi and Verner, 2024). Our analysis focuses mainly on the period from 2008 to 2011, before these policies were implemented.

3 Data and Measurement

3.1 Household Survey Data

Our main source for household-level data is the Household Budget and Living Conditions Survey (HKÉF), administered by the Hungarian Central Statistical Office (KSH).[13] The data contain detailed information on household expenditures along with information on borrowing, income, and demographics. 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 household consumption surveys. Our sample

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

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

[13] Appendix B provides additional details on the data.

period is 2005-2012, which provides four years of data in both the pre-depreciation period (2005-2008) and the post-depreciation period (2009-2012). To ensure representativeness, our analysis uses the household weights provided by KSH.

Measures of consumption We consider two primary outcome variables for household consumption in the household survey. The first is real nondurable consumption expenditures. Nondurable consumption comprises strict nondurable goods, semi-durable goods, and services. The second is total consumption expenditures, including expenditure on durables. The literature on the marginal propensity to consume often focuses on the short-term response of nondurable consumption (e.g., Johnson et al., 2006; Parker et al., 2013a), as this measure is less noisy and more closely tied to models of consumption. However, given that we consider the consumption response to a large shock over a longer horizon (four years), the response of total consumption expenditures, including durables, may be a better measure of the total effect on consumption and welfare (Laibson et al., 2022). Moreover, this measure captures the overall impact on demand in the economy. To ensure that our results are not driven by outliers, we winsorize consumption at the top 97.5%. Consumption expenditures are deflated by three-digit price indices to 2007 levels.

We also use the household survey's detailed information on *quantities* purchased. This information is available at the five-digit level based on the UN's Classification of Individual Consumption by Purpose (COICOP) for three broad consumption categories: food and non-alcoholic beverages, alcohol and tobacco, and clothing and footwear. These three groups comprise 154 product categories and account for 34.3% of nondurable expenditure in 2008. Information on quantities allows us to calculate the average price (unit value) a household pays for the purchased items within five-digit COICOP categories. Finally, 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 The household survey contains various pieces of information on debt currency denomination. From 2009 onward, the survey collects information on the currency denomination of each loan, the type of the housing loan, as well as total debt service 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. This gives us a direct measure of debt currency denomination for all households who are in the survey both before and after 2009.

The survey contains several additional pieces of information about household debt that are highly informative about FC debtor status. In particular, we observe whether a loan participated in the Exchange Rate Cap or the Early Repayment Program (both programs only applied to FC loans), the type of the loan (home equity loans are essentially all in FC), and the year of origination (essentially all loans originated before 2004 are LC, while 79.3% of loans originated in 2004 or after are FC according to Hungary's household credit registry).

With this information, we use two approaches to classify households as FC debtors and LC debtors. Our baseline approach is to count the number of indications of whether a household has an FC or LC loan based on four variables: reported debt currency denomination, future participation in an FC debt relief scheme, whether the loan is a home equity loan, and whether the loan was originated after 2004. We then classify FC status based on the majority indication (for details see Appendix B). As a second approach, we simply use the reported debt currency denomination available from 2009 onward. The results are quantitatively very similar using both approaches, so we report the results from the first approach in the main paper and the second approach in Appendix C.4. The baseline approach provides a sample of 982 FC debtors and 512 LC debtors. As evidence supporting the accuracy of our baseline FC debt classification, Appendix Figure B.3 shows that there is a strong positive correlation between the regional average FC loan share calculated from the survey and the same variable calculated using the administrative

credit registry from the Hungarian National Bank.

Furthermore, since the monthly debt payment is not reported every year, we use an annuity model to reconstruct payments and outstanding debt. We combine information on loan terms with product- and currency-specific average interest and exchange rate data from the Hungarian National Bank. We validate the debt payment estimates 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.2 shows that there is a tight, positive, and nearly one-for-one relation between the two. Second, to address the concern that our reconstructed loan payment may be measured with error, we conduct several simulation exercises to show that our main results are robust to reasonable degrees of measurement error in the reported debt characteristics used to estimate loan payments (see Appendix B).

Scaling We adjust consumption and debt payments for household composition to control for differences in household size and structure. Employing some form of adjustment to control for household size and composition is standard in the literature (e.g., Heathcote et al., 2005; Guvenen, 2007; Blundell et al., 2008; Kaplan, 2012a; Parker et al., 2013a; Attanasio and Pistaferri, 2016; Cloyne et al., 2020; Hong, 2023; Aguiar et al., 2024). Our baseline approach uses the Oxford equivalence scale. This scale assigns relatively higher weights to non-head household members compared to other alternatives (e.g., the OECD or square-root scale) but less weight compared to a per-capita adjustment.[14] In Section 5.3, we show that results are similar when employing other standard equivalence scales. We further show that some households adjust to the debt revaluation shock partly by increasing the number of adults (e.g., multigenerational cohabitation), so the unadjusted consumption response is about 30% smaller.

[14]For further details on scaling, see Appendix B.5.

3.2 Bank Customer Data

To reinforce our analysis using household survey data, we draw on administrative retail customer data from a major bank operating in Hungary. During our sample period, the bank had significant market share in housing loans, especially in the FC loan segment. The data are reported by the bank to the Hungarian National Bank. These data contain information on all retail customers of the bank with loan products as well as current accounts. For loan products, we observe loan contract and customer characteristics at the time of loan origination. These variables include currency denomination, date of origination, amount borrowed, type of loan, as well as borrower year of birth, gender, education, and household size. Moreover, we observe debt service cost and outstanding debt at a monthly frequency. The current account data reports total money received, total money spent, and the account balance at a monthly frequency. We define the spending of the account holder as the total money spent net of debt service cost.

To ensure consistency with our survey sample, we adjust spending for household size reported at loan origination, thereby creating per capita measures.[15] In addition, we winsorize spending at the 5th and 95th percentiles. We further restrict our analysis to individuals with mortgage or home equity debt because basic demographic information—used as control variables—is only available for these borrowers. Specifically, we include only those who had an outstanding mortgage or home equity loan at the start of the crisis and maintained an existing current account at the time of borrowing, ensuring that we focus on customers with a pre-existing banking relationship. Moreover, we exclude loans in default since, in Hungary, banks can garnish wages, which may encourage borrowers with mortgage arrears to open accounts at other banks. Our final sample consists of 6,319 borrowers, of whom 6,026 have foreign-currency (FC) debt and 293 have only local currency (LC) debt.

[15]Since the exact household composition is unknown, we cannot adjust spending using the Oxford scale as done with the survey data.

The bank customer data offers both advantages and drawbacks compared to household survey data. One key advantage is that the data likely contain less measurement error in essential variables, as the information is collected directly by the bank rather than self-reported. In addition, the bank data is available on a monthly basis. However, since the data come from a single bank, we lack information on individuals' accounts at other banks, which might prevent us from reconstructing complete household-level expenditure. Moreover, although the sample is large, the bank's focus on foreign-currency lending means that the number of local currency borrowers is limited. Finally, the bank customer data only capture total spending rather than itemized expenditures. Consequently, we consider the results based on the bank customer data to be complementary to our primary analysis using household survey data.

4 Theory and Empirical Framework

4.1 Theoretical Predictions

We outline theoretical predictions of the impact of a large depreciation on consumption and labor supply of households with FC debt. We use these theoretical predictions to guide our empirical analysis and relate the empirical findings to models.

Perfect versus incomplete risk sharing In a model of complete markets and perfect risk sharing, FC debt exposure should not differentially impact the consumption of FC relative to LC debtors. Moreover, household consumption should actually increase in response to a real depreciation according to the Backus-Smith international risk-sharing condition (Backus and Smith, 1993). Even if markets are incomplete, households with FC debt may be naturally hedged against the depreciation through FC income and assets. In this case, the depreciation should not necessarily adversely affect household wealth and consumption.

In contrast, if markets are incomplete and FC borrowers have unhedged exchange rate exposure, then a depreciation increases real debt burdens and reduces household liquidity and wealth. As discussed in Section 2, household consumption fell sharply around Hungary's depreciation, and FC borrowers were largely unhedged against the depreciation. Therefore, we expect the FC debt revaluation to represent a sharp adverse shock to household balance sheets. The increase in real debt burdens can depress household consumption through what we refer to as the *foreign-currency Fisher channel*. Several recent open-economy models incorporate this channel (Lorenzoni, 2014; de Ferra et al., 2019; Zhou, 2022).

Marginal propensity to consume The magnitude of the consumption response to the increase in real debt burdens depends on the degree of liquidity constraints. We consider three benchmark models of the response.

First, we consider the adjustment of permanent income consumer who can smooth consumption over the life cycle. Suppose the household has unhedged FC debt of d, 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 $\mathcal{E}d - d \equiv \Delta d$. A quadratic utility permanent income (PI) 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.

Second, we consider a hand-to-mouth (HtM) consumer who is liquidity constrained and consumes her resources in each period (e.g., Campbell and Mankiw, 1989; Eggertsson and Krugman, 2012; Korinek and Simsek, 2016). In line with the data, we 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

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

If debt is perpetual ($m \to \infty$), then $\Delta c^{HtM} = -r\Delta d$, 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 at the time of the depreciation 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 substantially larger MPC compared to the PI consumer.

Third, we consider a more realistic life-cycle incomplete markets consumption-saving model augmented with long-term foreign currency debt. The full model is presented in Appendix D. In the model, households consume and supply labor. The wage is denominated in LC currency and is stochastic, exposing households to idiosyncratic income risk. Households thus accumulate wealth through a liquid asset, as in standard buffer-stock savings models (Carroll, 1997; Gourinchas and Parker, 2002). To this standard model, we add the assumption that households have unhedged long-term FC debt. The FC debt requires debt service payments in each period. We allow households to expect a small probability of a depreciation and simulate the response to an exchange rate depreciation as in the data.[16] We find an MPC of 0.970 out of the increase in debt service

[16]Households' expectations about the persistence of the exchange rate depreciation also matter, unless the consumer is fully hand-to-mouth. If households expect that the exchange rate shock is only temporary,

induced by the depreciation. This high MPC is similar to that of the HtM consumer, as FC debtors in the model are relatively liquidity constrained.

In sum, models in which households face substantial liquidity constraints predict an MPC out of the persistent debt service shock of around unity, while a permanent income model predicts a lower MPC of about 0.6.

Composition of consumption Beyond the size of the overall consumption response, we also test the predictions of models of the *composition* of the consumption response. In standard models of homothetic demand (e.g., constant-elasticity-of-substitution, CES, preferences), households with different wealth facing the same relative prices consume different goods in the same proportions.

We use detailed product-level consumption data to examine two departures from the benchmark model of homothetic demand. First, we test whether there is a "flight from quality" (Burstein et al., 2005).[17] In particular, we estimate whether the FC debt revaluation shock leads households to substitute toward lower-quality goods within detailed product categories. Quality downgrading is inconsistent with CES preferences but can be rationalized with nonhomothetic preferences, such as Stone-Geary preferences.[18] Our setting allows us to directly test at the household level whether balance sheet distress leads to changes in consumption baskets toward lower quality goods. Quality downgrading can amplify a downturn, as lower quality goods are less labor intensive (Jaimovich et al., 2019). Moreover, flight from quality can exacerbate import compression during emerging market crises if higher-quality goods are more likely to be imported

the fall in lifetime wealth is smaller than Δd and the implied consumption response would be smaller in both the permanent income and life-cycle models. Our assumption that households expect that the depreciation is highly persistent 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). An advantage of the model is that one can explicitly consider different assumptions about household beliefs about the exchange rate process.

[17]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).

[18]Stone-Geary preferences take the form: $C = \left[\sum_i \omega_i^{\frac{1}{\epsilon}} (c_i + \chi_i)^{\frac{\epsilon-1}{\epsilon}}\right]^{\frac{\epsilon}{\epsilon-1}}$.

(Bems and di Giovanni, 2016).

Second, we test whether the debt revaluation shock leads households to adjust the extensive margin of consumption by reducing entry or increasing exit from product categories. A reduction in entry into new product categories is consistent with a model where household search for new varieties is elastic in household resources, as in Michelacci et al. (2022). Michelacci et al. (2022) show this margin can matter for two reasons. First, reduced product adoption can amplify the decline in consumption and employment crisis by reducing the creation of new products. Second, it can also imply higher household-level inflation, as the welfare-relevant household price index is decreasing in the number of varieties.

Labor supply Households can also adjust labor supply in response to the debt revaluation shock. The impact of debt and wealth shocks on labor supply is a longstanding question with important implications for 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., Obstfeld and Rogoff, 1995; Chari et al., 2005; Devereux and Smith, 2007; Lorenzoni, 2014).[19] When households are poorer, they reduce both consumption and leisure, thereby increasing labor supply. A debt revaluation shock can thus have an expansionary effect through aggregate supply. However, other models assume nonseparability in preferences over consumption and labor to remove the wealth effect on labor supply (Greenwood et al., 1988).[20] With GHH preferences, a debt revaluation has no effect on labor supply. Finally, in models with household debt

[19]Separable preferences, $u(c) - g(l)$, imply that the marginal rate of substitution between consumption (c) and labor (l) is $-\frac{u'(l)}{u'(c)}$ increasing in consumption. For example, with $u(c) = \frac{1}{1-\sigma}c^{1-\sigma}$ and $g(l) = \varphi\frac{1}{1+\frac{1}{\eta}}l^{1+\frac{1}{\eta}}$, we have $-\frac{u'(l)}{u'(c)} = l^{\frac{1}{\eta}}c^{\sigma}$, so a debt revaluation shock that reduces consumption will increase labor supply.

[20]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. Nonseparable 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).

overhang, a large increase in debt leads households to *reduce* work effort, as higher debt service can act as a tax on labor effort (Krugman, 1988; Donaldson et al., 2019). The sign of the effect of a large debt revaluation on labor supply is thus theoretically ambiguous.

4.2 Identification

We isolate the household foreign currency Fisher channel by comparing households with FC debt to households with LC debt around the large and unexpected depreciation of the Hungarian forint. Our analysis uses variants of the following difference-in-differences specification:

$$Y_{it} = \alpha_i + \delta_t + \beta^{FC} FC_i \times Post_t + \beta^{ND} NoDebt_i \times Post_t + \Gamma X_i \times Post_t + \varepsilon_{it}, \qquad (1)$$

where Y_{it} denotes a household-level outcome such as log consumption expenditure, α_i is a household fixed effect, δ_t is a time fixed effect, and $Post_t$ is an indicator variable that equals one after 2008. FC_i is a household-level indicator variable for households with FC debt, and $NoDebt_i$ is an indicator for households without debt. The omitted group is LC debtors. X_i is a set of household-level control variables measured in the household's first sampling period.

The identifying assumption for consistent estimation of β^{FC} is that household-level outcomes such as consumption would have evolved similarly for FC and LC debtors in the absence of exposure to FC debt. The key threat to identification is thus time-varying household-level shocks that affect Y_{it} 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 largely by the *timing* of borrowing. As discussed in Section 2, households who borrowed during

the phase of subsidized LC loans from 2000 to late 2003 have LC loans. The majority (79.3%) of households who borrowed from 2004 onward have FC debt.

The importance of government policy in explaining variation in households' debt 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 compares the average characteristics of households in the HKÉF household survey by the currency denomination of their debt in 2008. We also plot the distribution of key variables by debt currency denomination in Figure 3. 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, liquid assets, and foreign income share. The distributions of these variables across the two groups are also similar (Figure 3). Notably, liquid asset holdings are low in both groups, consistent with evidence that households in emerging markets often have limited liquid wealth to cover unexpected shocks (Badarinza et al., 2021). FC and LC households' consumption baskets also have similar inflation exposure (Figure A.7). There is some difference in income and educational attainment, with LC debtors being more likely to have a college education, but Figure 3 shows that the distributions have considerable overlap.

Table A.2 uses loan-level information from the Hungarian household credit registry to provide a comparison at the borrower-product level. Consistent with the patterns from the household survey, Table A.2 shows that FC and LC loans were also reasonably similar in terms of borrowed amount, monthly payment, and maturity. At the same time, LC loans were typically mortgages, while FC loans contained a substantial share of home equity loans, and FC borrowers had higher levels of debt at the onset of the

crisis. The credit registry evidence further shows that FC loans were more common in settlements with lower population and income, though the difference in settlement income is relatively modest. These regional patterns are in line with the evidence in Verner and Gyöngyösi (2020). Moreover, Appendix Table A.3 presents a similar analysis using the bank customer data. Again, we find that the observable characteristics of the two groups are broadly similar, with normalized differences generally falling below the one-quarter threshold recommended by Imbens and Rubin (2015). For example, FC and LC borrowers exhibit comparable loan sizes, and current account inflows (a proxy for income). Moreover, when comparing the bank customer data to the survey data, the bank's customers appear to have more favorable characteristics, such as higher levels of education and income proxied by money received on the current account, though they are also more highly leveraged.

The broad similarity between FC and LC debtors along these characteristics is consistent with the fact that the variation in exposure is driven primarily by the timing of borrowing, rather than self-selection into loan currency denomination within a given point in time.[21] This mitigates the concern that FC debt exposure is correlated with other unobserved shocks to households. Nevertheless, in our analysis, we always report results with and without controlling for these characteristics. We find that controlling for household characteristics usually has limited effect on the magnitude of the estimates. Moreover, to exploit the sudden policy-induced shift toward FC borrowing in late 2003, we show that results are similar when focusing only on households that borrowed a few years around this shift.

While FC and LC debtors are broadly similar on observables, the differences between borrowers and non-borrowers in Table 1 are more substantial. Households with debt are significantly younger, larger, more educated, and spend a lower share of income on food.

[21]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.

Debtors are also less likely to live in the capital and more likely to live in other towns.

5 Foreign Currency Debt Revaluation and Consumption

5.1 Reduced-Form Results

Table 2 presents the results from the estimation of equation (1) for log household non-durable consumption as the outcome variable in our household survey data. We estimate the regression using Poisson pseudo-maximum likelihood (PPML). PPML avoids the potential bias introduced by heteroskedasticity and naturally deals with zero values of the dependent variable, which can occur for subcategories of spending (Silva and Tenreyro, 2006; Cohn et al., 2022). We find similar results using OLS. 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%, relative to LC debtors, following the large depreciation of the forint. The estimate is statistically significant at the 1% level. The second column shows that coefficient is essentially unchanged when controlling for household characteristics and region fixed effects, interacted with the $Post_t$ dummy.

A concrete threat to identification is that FC debtor households experienced different income shocks in 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%.[22] Finally, in column 4 we control for

[22]In section 7.2, we document that a small but significant subset of households increase their foreign income share, suggesting a small 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 8), which further allays the concern that FC debtors are hit by differential income shocks.

log consumption in 2008. This compares households that have the same pre-crisis consumption level. 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.

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:

$$\ln C_{it} = \alpha_i + \delta_t + \sum_{k \neq 2008} \left[\beta_k^{FC} FC_i \times \mathbb{1}_{t=k} + \beta_k^{ND} NoDebt_i \times \mathbb{1}_{t=k} + \Gamma_k X_i \times \mathbb{1}_{t=k} \right] + \varepsilon_{it}. \quad (2)$$

Figure 4 plots the sequence of 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 2c).

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. With the start of the crisis, FC debtors sharply reduce consumption. The effect continuously builds throughout the crisis, reducing FC debtors' consumption by 7% in 2012. The coefficient is significantly different from zero in all years after the onset of the depreciation. Figure 4 also shows that non-borrowers' consumption evolves similarly to LC debtors. This provides a useful placebo check and indicates that FC debtors saw a fall in consumption relative to both LC debtors and non-debtors.

5.2 Marginal Propensity to Consume

5.2.1 Household Survey Data

To understand the magnitude of the consumption response to the FC debt revaluation, we estimate the MPC out of the shock to annual debt service. In the first stage, we estimate

$$P_{it} = \alpha_i^{FS} + \delta_t^{FS} + \beta^{FS} FC_i \times Post_t + \Gamma^{FS} X_i \times Post_t + \varepsilon_{it}^{FS}, \tag{3}$$

where P_{it} is the "payment surprise," defined as the unanticipated level of debt service induced by the crisis. Motivated by our 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) and the counterfactual debt service holding prices fixed at their September 2008 values.[23] This difference captures changes in debt payments induced by plausibly unexpected changes in the exchange rate and interest rate on FC loans. As discussed above, roughly 75% of the increase in debt service on FC loans in the crisis is explained by the depreciation, while 25% is explained by rising interest rates.

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

$$C_{it} = \alpha_i^{SS} + \delta_t^{SS} + \beta^{SS} \widehat{P}_{it} + \Gamma^{SS} X_i \times Post_t + \varepsilon_{it}^{SS}, \tag{4}$$

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 based on the household survey data. Columns 1-3 present the reduced form effect of FC exposure on the level of consumption. FC debt

[23] Below in section 5.4, we discuss and address the concern that P_{it} in our data may be measured with error. For now, we note that instrumenting P_{it} with FC_i addresses classical measurement error in P_{it}.

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).

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 800 in all specifications, indicating that FC exposure results in a highly significant shock to 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. We take this as evidence of a quantitatively important *foreign currency Fisher channel* of the depreciation through unhedged foreign currency household debt.

How does the marginal propensity to consume evolve over time? Figure 5a plots 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 compare it with 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 HUF ($382 PPP) per adult equivalent by 2012, relative to 2008. This corresponds to a decline in total household nondurable consumption of about 122 thousand HUF ($931 PPP).

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

$$MPC(k) = -\frac{\sum_{j=2009}^{k} \hat{\beta}_j^C}{\sum_{j=2009}^{k} \hat{\beta}_j^P}, \tag{5}$$

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. As the Swiss franc appreciated further, FC debt exposure further depressed consumption. However, the decline in consumption is smaller than the additional increase in debt service in 2011 and 2012. By 2012, the estimated cumulative MPC falls to 0.81. There are several explanations for why the consumption response is front-loaded. First, the initial depreciation may have led households to revise upward their expectations of the likelihood of a future depreciation. Second, household default rates rise substantially by 2011-2012 (Figure A.3c), reducing the pass-through from required debt service to consumption. Third, consumption adjustments may be delayed by habits or commitments (e.g., Chetty and Szeidl, 2007).

MPC heterogeneity Theories of liquidity constraints predict that the MPC should be higher for more liquidity-constrained households. Table A.5 examines heterogeneity in the MPC along several proxies for household liquidity. The MPC is nearly twice as high for low-income households compared to high-income households. Similarly, households with low liquidity buffers, high debt-to-income, and no access to informal credit exhibit larger consumption responses to the shock. These results point to the importance of liquidity constraints in explaining the high MPC of foreign currency borrowers. Table A.6 further shows that the MPC is larger for households with lower levels of education, while MPC is similar for younger and older households.

Marginal propensity to spend on nondurables and durables How do FC debtor households adjust different sub-categories of consumption? Panel A in Table 4 presents estimates of the reduced-form response of major expenditure categories from estimating equation (1). The FC debt shock lowered spending in all categories.[24] The smallest

[24]The effect of FC debt on finer categories of consumption by purpose is summarized in Table A.8.

reductions are for spending on strict nondurable goods (1.3%) and semi-durable goods (5.7%), while the spending effects are larger for services (10%) and durables (16%).

Our baseline MPC estimates in Table 3 are based on total nondurable expenditures, which comprise the categories in columns 1-3 of Table 4. Panel B of Table 4 examines 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%. This estimate is slightly higher than the 4.6% 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 nondurables and durables of 1.23. Thus, once one includes durables expenditures, which are lumpy and have a higher intertemporal elasticity of substitution, the spending response is even larger than the direct cash-flow shock.

Finally, we consider a broader measure of spending that includes housing investment, defined as spending on home maintenance and repairs (COICOP 04.3.1 and 04.3.2). Column 3 in Table 4 panel B shows that FC debtors reduce housing investment expenditures by 25%. 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). In column 4 we aggregate total nondurable and durable expenditures and spending on housing investment. For this broad measure of household spending, we estimate an MPS of 1.30 out of the FC debt service shock.

5.2.2 Bank retail customer data

We complement our household survey findings with estimates based on bank customer data. To measure the marginal propensity to *spend* (MPS) in the bank customer data, we estimate equation (4). Table 5 presents the results. Without controls, the estimated

MPS is 1.24. When we include a similar set of controls as in the survey analysis (gender, age, education, and household size) in column 5, the estimated MPS decreases slightly to 1.23. In the final specification, we also control for contemporaneous income, proxied by money received on the current account. As in the survey data, controlling for money received on the current account may over-control for income since individuals might adjust their labor supply. Under this specification, the estimate falls to 1.02 but remains highly significant. Overall, these MPS estimates based on bank customer data are similar to those obtained from the survey data. For example, our preferred specification yields an MPS of 1.3 in the survey data and 1.23 in the bank customer data.[25] As a robustness check to focus on primary accounts, we restrict the sample to individuals who received at least the minimum wage on their account in two-thirds of the pre-crisis period. Table A.4 shows similar MPS estimates when applying this restriction.

Due to the larger sample size and more precisely measured variables, our analysis benefits from increased statistical power. Based on the point estimate in column 5, we can reject the hypothesis that the MPS is below 0.73 at the 10% significance level, suggesting a substantial expenditure response to the shock.

We also examine the parallel trends assumption in the bank customer data by estimating equation (2) for both expenditure levels and debt service. Figure 6 plots these monthly estimates. The figure shows that consumption of LC and FC borrowers follows parallel trends before the shock, and that consumption falls approximately one for one with the increase in debt service after the depreciation.

MPS heterogeneity We explore heterogeneity in the MPS estimates in the bank customer data in Table A.7. The estimated MPS is higher for individuals receiving lower inflows on their current accounts, a proxy for income. In contrast, individuals with higher current

[25]Note that because spending in Table 5 is monthly, the HUF response in columns 1-3 is about 3 times larger in Table 5 compared to Table 3. This reflects that individuals in the bank customer data have higher income and spending compared to the representative household survey. Since borrowers in the bank customer data also have larger loans, we find that the MPS using bank customer data is approximately similar to the spending response in the household survey data.

account balances—a proxy for liquidity—at the start of the crisis exhibit a lower MPS. The pattern of heterogeneity is thus similar to the household survey data. Additionally, the bank customer data indicate that individuals with higher education and older individuals tend to have higher MPS estimates.

5.2.3 Relating the MPC Estimates to Models

The estimates imply a large and significant effect on household consumption through the foreign currency Fisher channel. In terms of magnitudes, the estimated MPC for nondurable consumption is close to one (0.92 to 0.99) and the estimated MPS for total spending ranges from 1.1 to 1.3. Based on the theoretical framework in Section 4, these estimates are most consistent with hand-to-mouth behavior or binding liquidity constraints. Our results thus suggest that the simple hand-to-mouth formulation is a reasonable approximation to the spending behavior of debtors, as modeled by, for example, Eggertsson and Krugman (2012) and Korinek and Simsek (2016). 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., 2013b; Kaplan and Violante, 2014).

5.3 The Role of Household Size and Composition

Table 6 presents estimates of equation (4) using the household survey data with alternative adjustments for household size. Recall that in our baseline analysis we scale consumption by household size using the Oxford equivalence scale. Column 1 shows the unadjusted results using total household consumption as the outcome. The estimated MPC of 0.66 for nondurable consumption is about 30% smaller than our baseline estimate and is closer to the permanent income hypothesis benchmark of 0.6. The MPS for total spending is 0.88, which is high in absolute terms, but is again lower than the estimate of 1.23 when adjusting for household size.

The lower estimate for unadjusted consumption is partly explained by the fact that the FC debt revaluation leads to an increase in household size. A large, unanticipated increase in household debt may lead households adjust their living arrangements with extended family to benefit from economies of scale, thereby mitigating the fall in per capita consumption. Cohabiting with relatives or having adult children return home 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). Consistent with this, Appendix Figure A.11 shows that FC debtors see a significant increase in the number of adults in the household, which rises by about 0.06 members. This indicates that some FC debtor households adjust to the debt revaluation by consolidating extended family within the household to save on housing costs and exploit economies of scale.[26]

Column 2 in Table 6 thus shows that controlling for contemporaneous household size increases the estimated MPC (MPS) to 0.79 (1.02). Columns 3-5 present results using other common equivalence scales: per capita, OECD, and square-root scales. The resulting MPC estimates range from 0.87 to 1.12 and remain significant across specifications. Further, the MPS ranges from 1.15 to 1.47 with these various household size adjustments.

From a measurement perspective, accounting for the change in household composition in response to the shock is thus important.[27] Unadjusted estimates capture the overall consumption response to the shock, reflecting adjustments along multiple margins, including household size and composition. By contrast, the adjusted estimates, measured per adult-equivalent, are more informative for welfare-relevant outcomes on

[26]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. Rosenzweig and Wolpin (1993) present evidence that parents share residence with their adult sons to help them smooth consumption. Kaplan (2012b) provides related evidence that young individuals use the option to move in and out of the parental home as insurance against labor market risk.

[27]As noted above, many studies account for changes in household composition by controlling for household size and composition, using per capita consumption, or using consumption adjusted by an equivalence scale (see, e.g., Blundell et al., 2008; Parker et al., 2013a; Cloyne et al., 2020; Hong, 2023; Aguiar et al., 2024).

a needs-adjusted basis. While most structural models treat the household as a fixed decision-making unit and model consumption and labor supply per member, in the data, household composition may itself change after a shock. As a result, unadjusted estimates conflate consumption adjustments with changes in household size. In this specific context, the unadjusted response is a downward-biased measure for the overall consumption response to the shock. For households that respond to the shock by adding a new adult member, this member's consumption is not included in the baseline level of household consumption before the shock. Adjusted estimates are therefore both more appropriate for welfare analysis and more directly comparable to the objects studied in standard models.

5.4 Robustness Checks

We submit the results on the effect of the FC debt revaluation on consumption to a battery of additional robustness tests. To sharpen the identification, we directly exploit the variation in FC debt status induced by the policy-driven cutback in LC loan subsidies in late 2003. Specifically, we instrument FC debt status and the payment surprise using a dummy variable indicating whether the loan was originated after 2003. This exercise thus only exploits variation in the FC debt revaluation from the timing of borrowing, which, in turn, is driven by policy variation. The removal of LC subsidies was driven by fiscal consolidation needs and was not targeted at particular borrower types, so this exercise mitigates concerns about self-selection of borrowers into FC loans at a given point in time. Tables A.9 and A.10 show that the results are similar to the baseline, with MPC estimates ranging between 0.95 and 1.17.

As a second exercise to exploit the variation from the policy change, we restrict the sample to loans originated in a narrower window around the late-2003 phase-out of the subsidy program. This allows us to focus on households that borrowed at a similar phase of the credit cycle, one-to-two years before or after the policy shift. This exercise thus

also excludes households that borrowed late in the lending boom, when credit quality deteriorated the most. Tables A.11 and A.12 show that the results are similar using this restriction, with MPC estimates ranging from 0.93 to 1.03.

Appendix C discusses a range of additional robustness checks. We also show that the results are robust to various other tests, including matching FC and LC households using propensity score matching (Tables A.13, A.14, A.15), dropping non-debtors from the sample (Tables A.16, A.17, A.18), re-estimating the main specifications weighting households equally (Tables A.19, A.20, A.21), and applying a simpler classification of FC and LC debtor status that only uses the information on whether a household reports having an FC loan (see Tables A.22, A.23, A.24). We further show that differential shocks to FC and LC borrowers' house prices are unlikely to confound the results (see Figure A.8). We also conduct several simulation exercises to show that our survey-based results are not substantially biased by measurement error in FC loan payments (see Figure A.9 and the discussion in Appendix C.5). Finally, we present results showing that the FC debt revaluation led to a significant increase in household financial distress, measured as self-reported difficulties in making debt payments (see Table A.25).

6 Margins of Adjustment in Consumption

This section analyzes the margins of adjustment in consumption to understand how the structure of household demand changes in response to the debt revaluation shock. We document the quantitative importance of two nonstandard margins of adjustment: reduced product adoption and "flight from quality." These results point to the empirical relevance of models with nonhomothetic demand.

6.1 Quantity and Quality of Expenditures

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). 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

$$\begin{aligned}\Delta_k E_t = E_t - E_{t-k} &= \sum_{j\in J_t} e_{jt} - \sum_{j\in J_{t-k}} e_{j,t-k} \\ &= \underbrace{\sum_{j\in J_{t/t-k}} e_{jt} - \sum_{j\in J_{t/t-k}} e_{j,t-k}}_{\text{Intensive margin}} + \underbrace{\underbrace{\sum_{j\in J_{t/t-k}} e_{j,t-k} - \sum_{j\in J_{t-k}} e_{jt-k}}_{\text{Exit}} + \underbrace{\sum_{j\in J_t} e_{jt} - \sum_{j\in J_{t/t-k}} e_{jt}}_{\text{Entry}}}_{\text{Extensive margin}}, \end{aligned} \tag{6}$$

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 (6) 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.

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 can decrease between two periods for two reasons. First, a household can purchase a lower quantity of the same variety. Second, a

household can purchase a cheaper variety of the same category, but purchase the same amount.

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

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

$$= \underbrace{\sum_{j \in J_{t/t-k}} \Delta_k p_{jt} \frac{q_{jt} + q_{j,t-k}}{2}}_{\text{Price change}} + \underbrace{\sum_{j \in J_{t/t-k}} \Delta_k q_{jt} \frac{p_{jt} + p_{j,t-k}}{2}}_{\text{Quantity change}} \tag{7}$$

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:

$$\Delta_k y_{it} = \delta_k + \beta_k FC_i + \gamma_k NoDebt_i + \Gamma_k X_{it} + u_{it}^k, \tag{8}$$

where $\Delta_k y_{it}$ is a margin of adjustment of household i between year $t-k$ and t. Taking differences sweeps away the household fixed effect. We compute the change in the relevant margins relative to 2008. This transformation makes the estimates directly

[28]Appendix B.4 discusses alternative decompositions of the intensive margin. In Table A.26, we show that these decompositions yield similar results.

comparable to the main results.[29]

Table 7 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, 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.[30] In contrast, exit plays a negligible role. The significant reduction in product adoption (entry) aligns with a model in which household search for new varieties is sensitive to changes in household income or wealth, as described in Michelacci et al. (2022).

Table 7 further 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 72% of the reduction in spending on the intensive margin, while the reduction in prices accounts for the remaining 28%. Both margins are statistically significant at the 5% level.

The reduction in average prices paid 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 thus 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

[29]Specifically, we estimate equation (8) with the change in each margin between consecutive years. We then calculate the levels for each year and average them in the pre-period (2005-2007) and post-period (2009-2012) and report the difference in this average.

[30]Michelacci et al. (2022) 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.

(Burstein et al., 2005). 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.

The flight from quality has several potentially important implications. First, it can amplify the reduction in labor demand if the production of lower-quality goods is less labor intensive (Jaimovich et al., 2019). Second, it can lead to a downward bias in the measurement of inflation if the CPI index does not take into account a reduction in product quality when introducing new goods (Burstein et al., 2005). Third, flight from quality can exacerbate import compression during emerging market crises if higher-quality goods are more likely to be imported (Bems and di Giovanni, 2016). Next, we explore the third of these implications in more detail.

6.2 Import Content of Consumption

Lower-quality goods may be less likely to be imported, a phenomenon known as the Alchian-Allen conjecture. Therefore, the reduction in the quality of expenditures may contribute to import compression, reinforcing expenditure switching from the exchange rate depreciation.[32] During Hungary's 2008 depreciation and crisis, there was a large reversal of the trade balance driven by a large decline in imports (Figure A.3d). Did the household FC debt revaluation contribute to the decline in imports by leading to substitution away from higher-quality imported products?

We examine the adjustment in the import content of consumption of both goods and services by computing the import share of household consumption. We map three-digit COICOP consumption categories to two-digit sectoral input-output tables. We then compute the direct and total (accounting for input-output linkages) import share for each consumption category (see Appendix B.3 for details).

[32]For example, Bems and di Giovanni (2016) use scanner data from a retailer in Latvia. They find that a decline in income led to expenditure switching and a significant drop in imports through substitution to cheaper domestic alternatives, even without a depreciation.

We find that the FC debt revaluation shock leads to a significant reduction in the direct import share for goods, consistent with households reducing purchases of foreign goods (see column 1 in Table A.27). The reduction in the direct import share for goods is consistent with the findings from store-level scanner data in Bems and di Giovanni (2016). However, the reduction in the import share for goods is weaker when taking into account input-output linkages (column 2 in Table A.27). Moreover, when we also account for household expenditures on services, there is no meaningful effect on the overall import share of consumption (columns 5-6 in Table A.27). This within-household finding of no change in the import content of total spending is consistent with the cross-sectional evidence from Borusyak and Jaravel (2021), who find that the import share is stable across the household income distribution.

7 Margins of Adjustment in Labor Supply

7.1 Labor Market Status, Hours, and Income

Do households adjust to the shock by changing labor supply? As outlined in Section 4, models make contrasting predictions about the effect of a debt revaluation shock on labor supply. Models with a strong wealth effect on labor supply predict that households will increase labor supply to service higher debt burdens, while models with a debt overhang effect predict that labor supply can decline.

Table 8 presents estimates equation (1) with various labor market outcomes as the dependent variable. Panel A in Table 8 reveals that there is a small and statistically insignificant effect of FC debt exposure on individual labor market status and the likelihood of being unemployed. Panel B in Table 8 focuses on hours worked in the primary job and across all jobs. FC debt exposure has a negligible effect on hours. For example, the specification in column 4 of Table 8 panel B implies that FC debtors increased weekly labor supply by an insignificant 0.2 hours. Panel C in Table 8 examines the effect on

various measures of household income. FC and LC borrowers' total net income evolved similarly following the depreciation. There is also no significant effect on earned income and social transfers.

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, such as models with nonseparable preferences. For example, in Appendix D, we confirm that a model with GHH preferences implies a similar labor supply response as in the data (0% labor supply response in the model versus 0.9% in the data). The similar evolution of income across FC and LC debtors also supports the assumption that our baseline consumption effects are not biased by contemporaneous adverse income shocks for FC debtors.

7.2 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 most popular destinations for Hungarian households migrating abroad were the UK, Germany, and Austria (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 a significant hedge against the debt revaluation.

Table 9 shows that FC debt exposure increased the probability of having income from abroad by 1.2 percentage points following the depreciation (columns 1-2). This is a modest effect in absolute terms, but it is economically large compared to the baseline probability of having income from abroad in 2008 (0.45%). As a result, FC debt exposure

increased the foreign income share by 0.5-0.6 percentage points in the post-crisis period (columns 3-4). This effect is also large relative to the low base rate of 0.23% in 2008. These results point to a significant labor supply adjustment of a small subset of households by seeking income from abroad. While there is evidence that firms seek foreign export markets in response to a domestic downturn (Almunia et al., 2021), we believe this is the first evidence of substitution to foreign income streams by households.

7.3 Home Production

Finally, exposed households can adjust labor supply by increasing home production. Standard models equate consumption with expenditures. However, models with home production take into account that households can use their time in combination with market goods to derive utility (Becker, 1965).[33] Households may respond to the debt revaluation by allocating more time to 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.

We examine adjustment through home production by focusing on food production, which is covered in the household survey. In 2008, 31% 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. Note that the definition of home production that we use from the household survey HKÉF is more stringent than the definition commonly used in the macroeconomics literature, which defines activities such as cooking and cleaning as home production (e.g., Aguiar et al., 2013).[34] Therefore, our results can be seen as a lower bound on overall home production activity.

Table 10 shows FC debtors become 4.7-5.5 percentage points more likely to engage in

[33]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).

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

home production of food after the depreciation (columns 1-2). This is an 18% increase over the baseline average. Columns 3-6 in Table 10 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. Column 3 shows that FC debtors' total food consumption declines in the aftermath of the crisis by a modest 2.4%. This estimate is not statistically significant. On the other hand, FC borrowers cut back on food service spending by 13% and increase home production by 20%. Thus, there is a large relative substitution away from expensive food away from home and toward home production. 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).

8 Conclusion

This paper provides the first household-level evidence of a *foreign currency Fisher channel* of exchange rate depreciation. The classic Fisher (1933) debt-deflation channel posits that an increase in real debt burdens from deflation can be an important contractionary channel in severe recessions. In emerging markets, where debt is often denominated in foreign currency, the increase in real debt burdens due to exchange rate depreciation can translate into severe declines in spending and output. We quantitatively evaluate this channel using household-level panel datasets around Hungary's 2008 currency crisis. We find that FC debtors reduce consumption roughly one-for-one with increased debt service. The strong response indicates that FC debtors were unhedged against the depreciation.

The magnitudes and heterogeneity in the responses are most consistent with models in which borrowers are liquidity constrained.

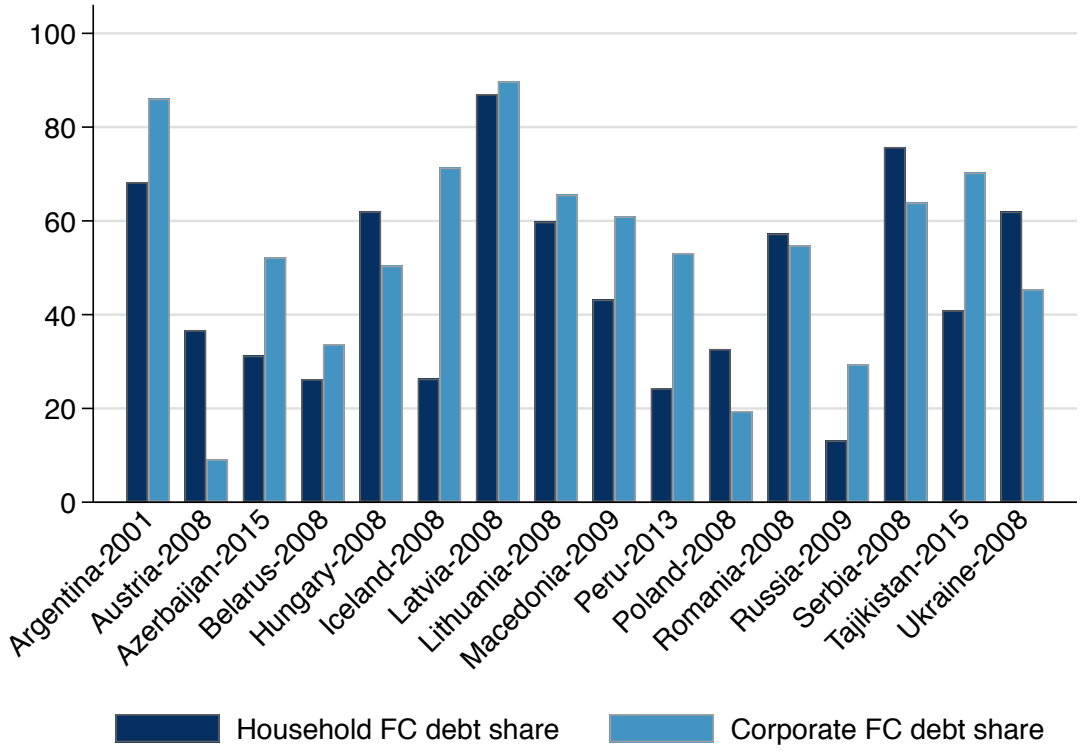
The significant pass-through of the depreciation to consumption through household balance sheets implies a sizable impact on aggregate consumption. Abstracting from general equilibrium effects, the foreign currency debt revaluation reduced annual nondurable consumption by 0.77% of GDP on average over 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% of GDP over 2009-12. This is a large effect, considering it 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 demand, 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. On the extensive margin, households reduce new product adoption. 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." We find no evidence of an increase in labor supply to offset the effect of the debt revaluation, consistent with nonseparable preferences over consumption and labor. However, a subset of households respond by working abroad to access foreign currency income. Finally, there is an increase in home production.

Our findings have broader implications for macroprudential policy in emerging markets, where household borrowing in FC has often amplified the impact of external shocks. Theories of macroprudential regulation highlight that individual borrowers may not internalize the negative effects on aggregate demand or asset prices in a crisis when making financing decisions, leading to excessive FC borrowing during good times (Farhi and Werning, 2016). Our results highlight the importance of *ex-ante* regulatory tools, such

as currency matching requirements, to mitigate these vulnerabilities. While our analysis focuses on Hungary, similar concerns have prompted policymakers in other countries, including Croatia, Peru, Poland, Turkey, and Romania, to adopt progressively tighter lending standards to discourage unhedged FX borrowing or to implement debt relief and conversion schemes (see, e.g., Epure et al., 2018; Novák and Vámos, 2017; Gyöngyösi and Verner, 2024). These policy responses underscore a growing consensus on the need for pre-emptive macroprudential regulation to safeguard household balance sheets in financially open economies.

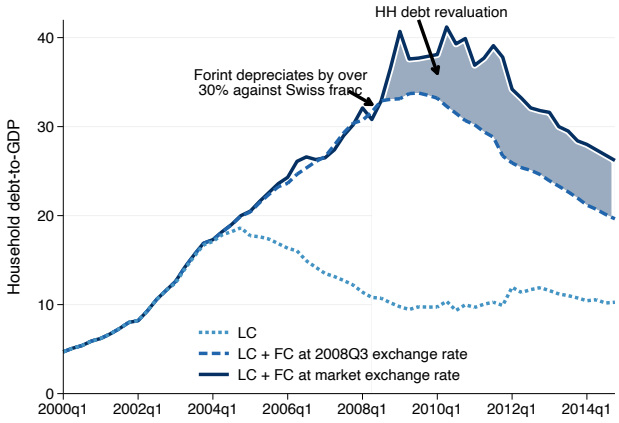
Figure 1: Household and Corporate Foreign Currency Debt Exposure during Selected Crises



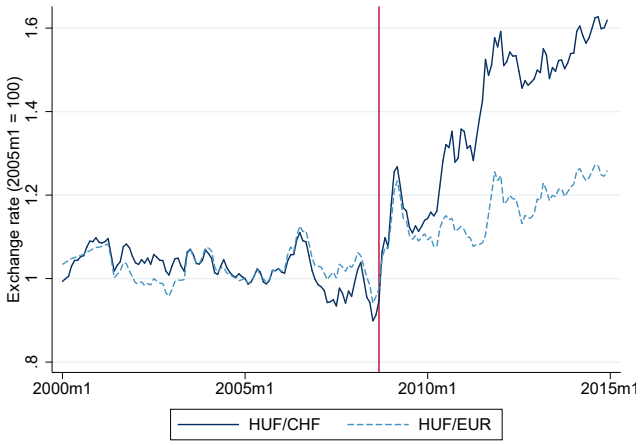
Notes: This figure plots the share of foreign currency loans in total household and non-financial corporate loans during selected episodes. The figure shows that foreign currency debt comprised an important share of household and corporate debt during these episodes. The episodes are chosen based on data availability, and most episodes involved major currency and/or banking crises. Data are collected from individual country national central banks and the European Central Bank. See Appendix E 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 Hungary's Currency Crisis

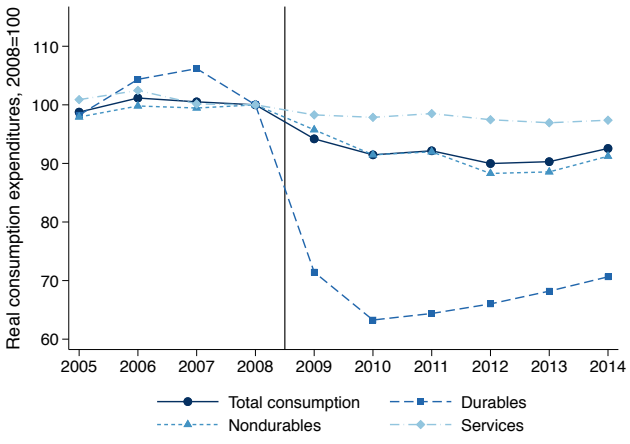
(a) Household debt revaluation



(b) Exchange rate dynamics

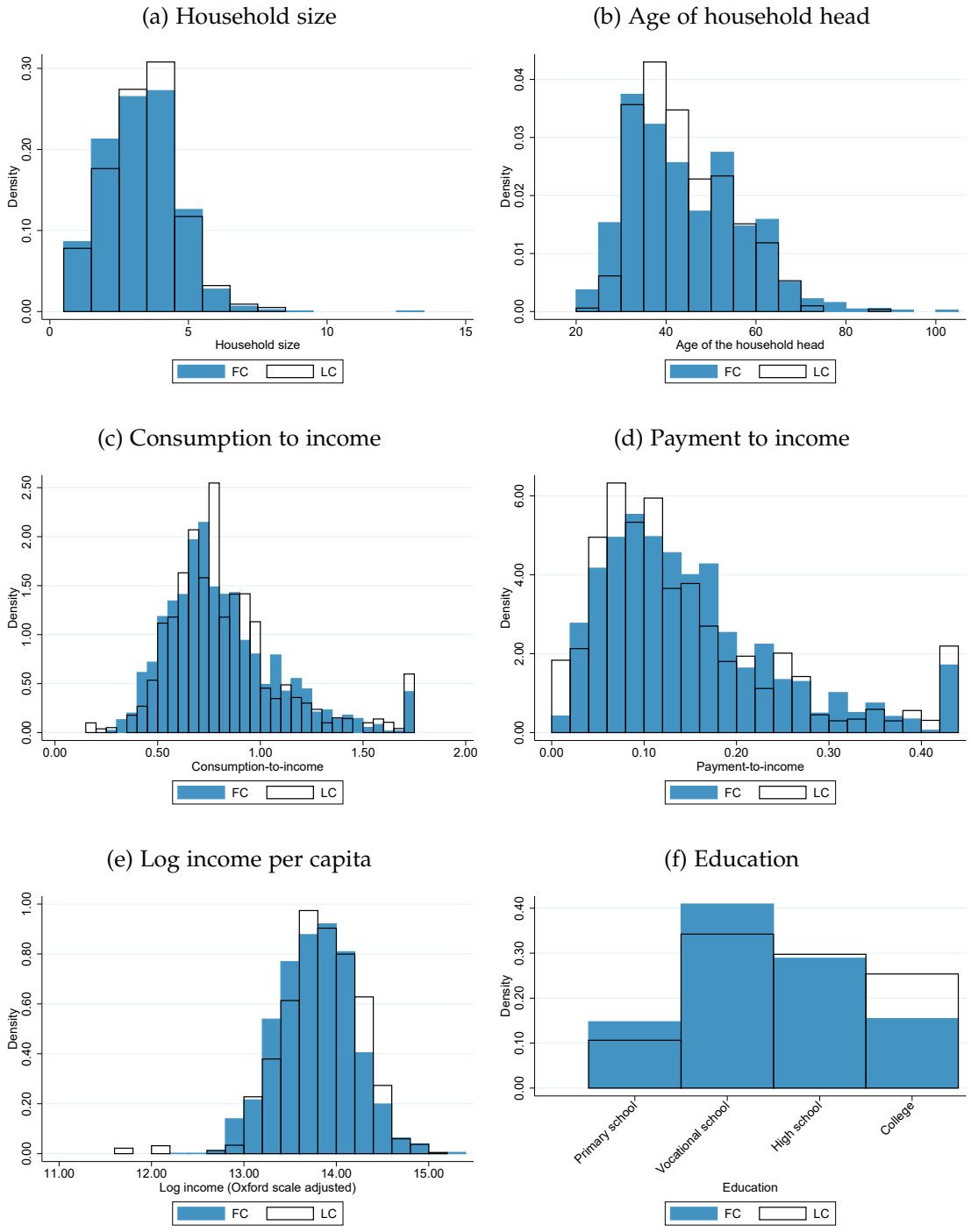


(c) Aggregate consumption dynamics



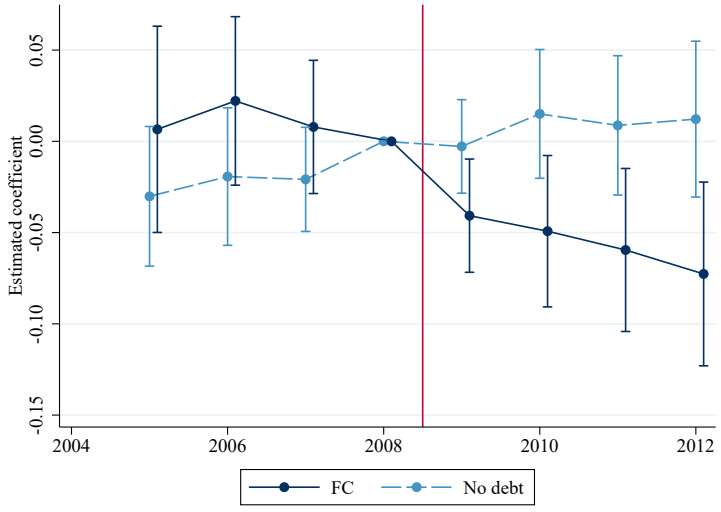
Notes: Panel (a) figure shows the evolution of household debt relative to GDP. The shaded area is the revaluation of household debt triggered by the depreciation of the Hungarian forint and appreciation of the Swiss franc. Panel (b) plots the HUF-CHF and HUF-EUR exchange rates, normalized to 100 in January 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: 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.

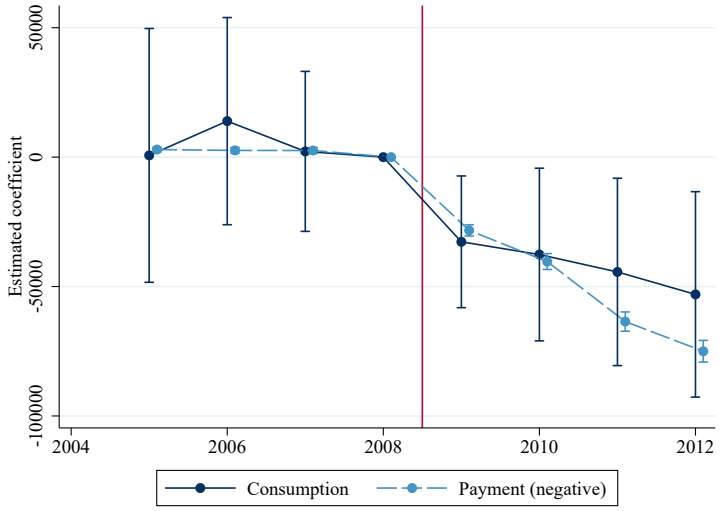
Figure 4: Dynamic Impact of Foreign Currency Debt Exposure on Consumption



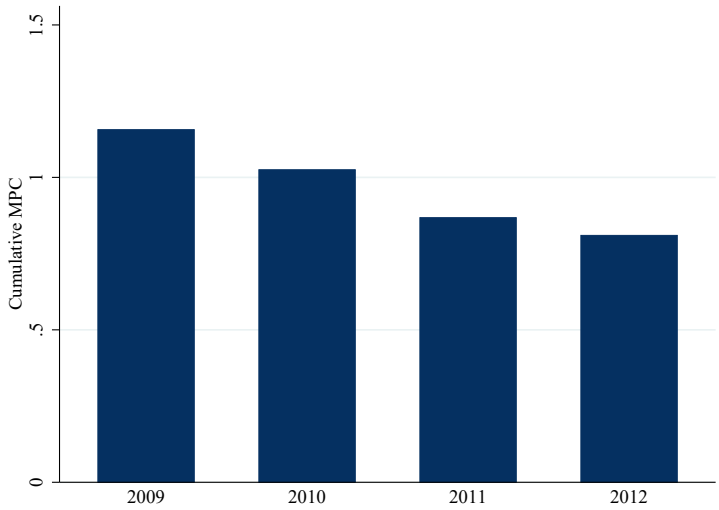
Notes: This figure plots the coefficients of interest from estimating equation (2) with log nondurable consumption as the dependent variable. The omitted category is LC debtors. The specification controls for age of the household head, gender of the household head, educational attainment of the household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

Figure 5: Dynamic Marginal Propensity to Consume

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

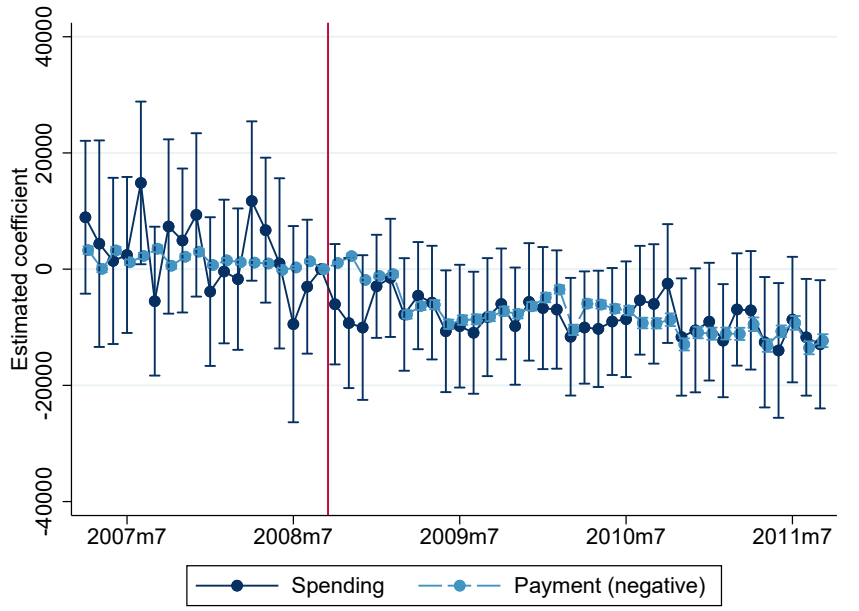


(b) Cumulative MPC out of debt service



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% confidence intervals. Figure (b) plots the cumulative MPC defined in equation (5) using the estimates in panel (a).

Figure 6: Spending and Payment Surprise Response to the Debt Revaluation using Monthly Bank Customer Data



Notes: This figure plots the coefficients of interest from estimating equation (2) with the level (HUF value) of spending and the (negative) monthly payment surprise as the dependent variables using bank customer data. We multiply the payment surprise by negative one, so a negative value implies a reduction in household cash flow. Controls include age, gender, educational attainment, household size, and location fixed effect. All control variables are interacted with month fixed effects. Standard errors are clustered at the individual level. Error bars represent 95% confidence intervals.

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
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
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
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
Borrowed amount (1,000,000 HUF)	4.04	3.69	0.00	0.32+	
	3.45	3.25	0.00	1.76	
Payment to income	0.15	0.15	0.00	0.00	
	0.09	0.10	0.00	0.45	
Foreign income share	0.00	0.00	0.00	-0.00	0.00
	0.04	0.05	0.04	-0.15	0.64
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 household survey 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. "Have liquid assets" refers to whether households say they can cover an "unexpected and large" expense.

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%, 5%, and 1% level, respectively.

Table 3: Marginal Propensity to Consume Out of the Foreign Currency Debt Service Shock

	Non-durable consumption					
	Reduced form (in HUF)			IV (MPC)		
	(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 HUF) of household nondurable consumption. Columns 4-6 present the instrumental variable estimates of the MPC based on equation (4). 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%, 5%, and 1% 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-statistic		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. The lower number of observations in this regression is due to fact that we estimate the model by PPML, so households with no variation in the dependent variable (e.g., all zeros) are dropped. 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%, 5%, and 1% level, respectively.

Table 5: Marginal Propensity to Spend Out of the Foreign Currency Debt Service Shock using Monthly Bank Customer Data

	Reduced form (in HUF)			IV (MPS)		
	(1)	(2)	(3)	(4)	(5)	(6)
FC × Post	-12360.1**	-10884.0**	-9027.1**			
	(2591.7)	(2687.2)	(1609.5)			
Payment surprise				-1.238**	-1.234**	-1.024**
				(0.259)	(0.305)	(0.181)
Household & month FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls		Yes	Yes		Yes	Yes
Current account inflow			Yes			Yes
First stage F-statistic				2961.1	623.5	622.5
N	302051	287996	287996	302051	287996	287996

Notes: This table presents estimates of the marginal propensity to spend out of an increase in monthly debt service induced by the foreign currency debt revaluation using bank customer data. Columns 1-3 present the reduced form estimates of the effect of FC exposure on the level (in forints) of individual spending. Columns 4-6 present the instrumental variable estimates of the MPS based on equation (4). Monthly debt payment surprise is instrumented by FC exposure interacted with $Post_t$. We use the same main control variables as in Table 2, gender, household size, age, and educational categories. All control variables are interacted with the $Post_t$ indicator. Standard errors are clustered at individual level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table 6: Marginal Propensity to Consume Out of the Foreign Currency Debt Service Shock: Alternative Adjustments for Household Size

Panel A: 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			
N	59321	59321	59321	59321	59321
Panel B: Marginal propensity to spend					
	Total		Per capita	OECD	Square Root
	(1)	(2)	(3)	(4)	(5)
Payment surprise	-0.880*	-1.016*	-1.465**	-1.204**	-1.150**
	(0.416)	(0.399)	(0.453)	(0.399)	(0.392)
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: This table presents MPC/MPS estimates based on equation (4). "Contemp. household size" refers to a specification that adds household size in each year as a control variable. The outcome variable in panel A is total nondurable consumption, as in Table 3. The outcome variable in panel B is total consumption as in column (2) of Table 4 Panel B. Columns (1) and (2) report the effect of FC debt on total nondurable or total household consumption, without adjusting for household composition. Column (3) shows results for consumption expenditures scaled by household size. In column (4) the OECD scale is applied to consumption expenditures, which assigns a weight of 1 to the first adult, but gives a weight of 0.5 for all consecutive adults, while children get a weight of 0.3. In column (5), the square root equivalence scale divides consumption expenditures by the square root of household size. Standard errors are clustered at household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table 7: Margins of Adjustment in Consumption

	Total expenditures	Intensive		Extensive	
		Price	Quantity	Entry	Exit
FC × 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 in equations (6) and (7). 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% of nondurable expenditure in 2008. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table 8: 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). Hours worked is only available from 2008, so the sample size declines for this specification. 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%, 5%, and 1% level, respectively.

Table 9: 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 variable 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%, 5%, and 1% level, respectively.

Table 10: 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 product. 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. 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%, 5%, and 1% level, respectively.

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The Foreign Currency Fisher Channel: Evidence from Households

Online Appendix

Győző Gyöngyösi[*] Judit Rariga[†] Emil Verner[‡]

- Appendix A presents additional figures and tables.
- Appendix B provides details on the data.
- Appendix C provides a detailed discussion of the robustness exercises, including ensuring robustness to measurement error.
- Appendix D presents results from a quantitative model.
- Appendix E provides additional cases of widespread foreign currency lending to households.

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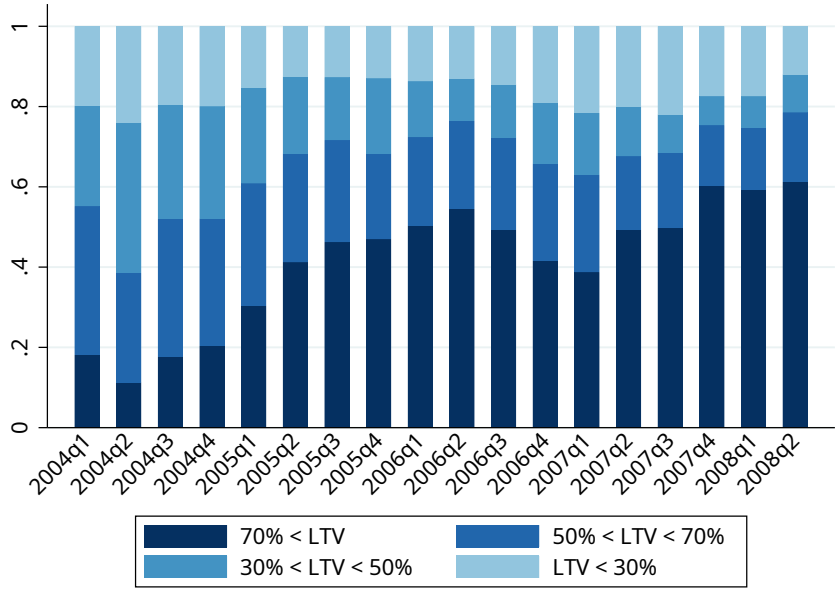
A Appendix Figures and Tables

Figure A.1: Adjustable and Fixed Rate Originations in Swiss Franc



Notes: This figure shows the volume of new Swiss franc-denominated loan originations by adjustable and fixed-rate loans. Solid lines represent new originations of adjustable-rate mortgages and home equity loans, while dashed lines represent fixed-rate mortgages and home equity loans. Loan amounts are expressed in billion HUF. The data are from MNB.

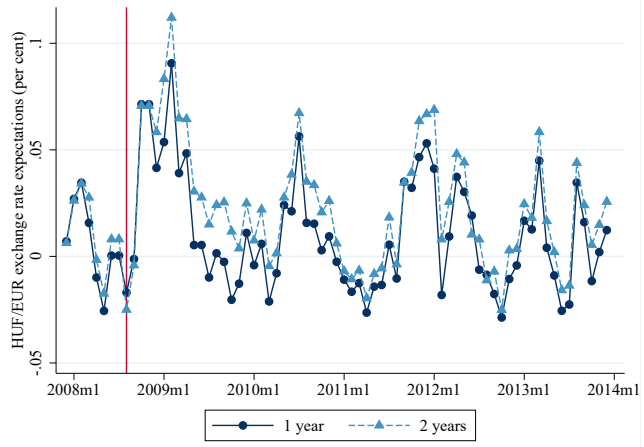
Figure A.2: Distribution of Loan-to-Value Ratio for New Mortgage Loan Originations



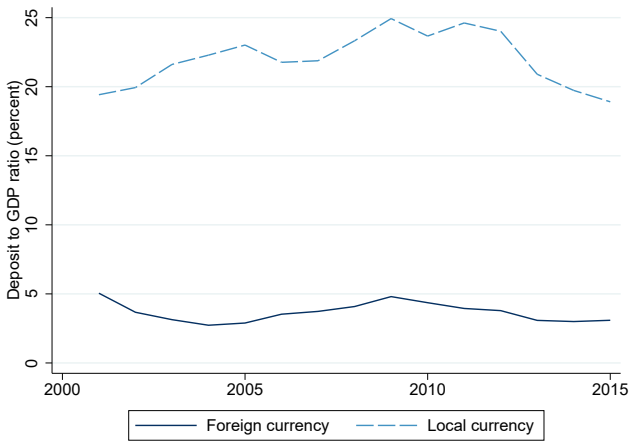
Notes: This figure shows the loan-to-value distribution of new mortgage loans over time. The data are from MNB (2008).

Figure A.3: Exchange Rate Expectations, Deposits by Currency, Default Rates, and Net Exports

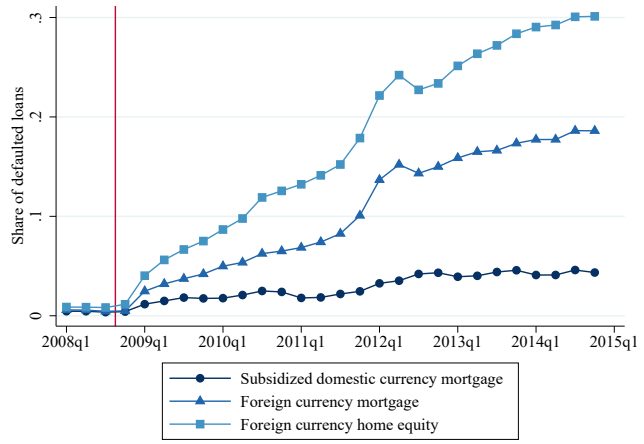
(a) Exchange rate expectations



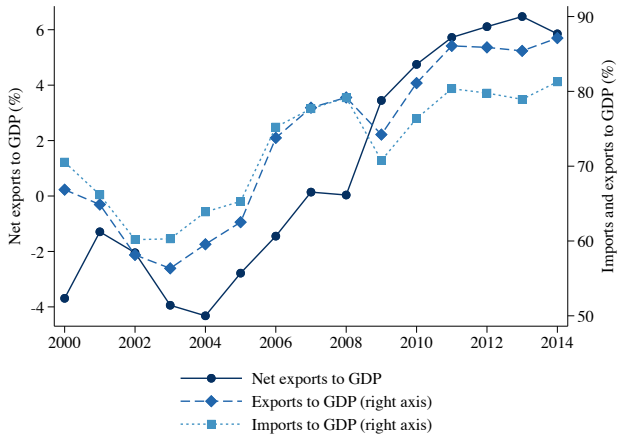
(b) Domestic currency and foreign currency household deposits as a share of GDP



(c) Default rates on housing loans

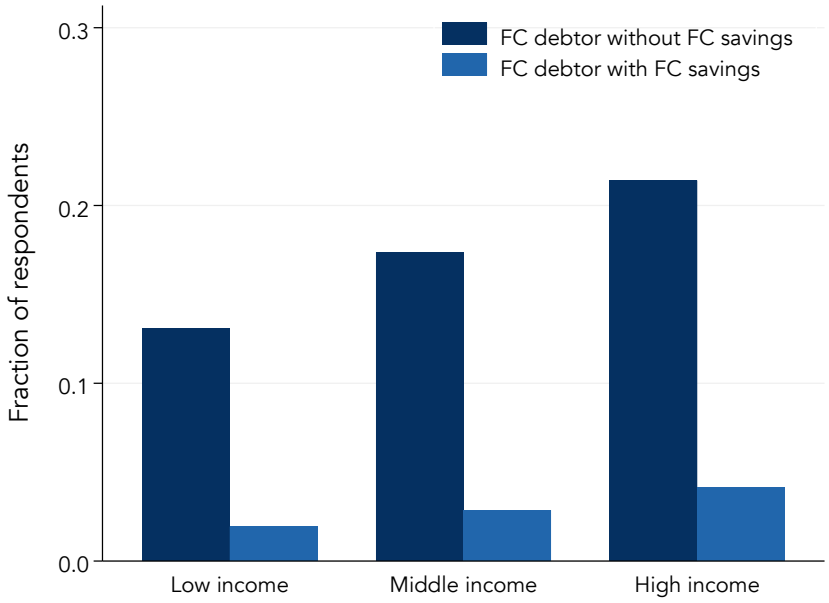


(d) Net export, exports, and imports to GDP



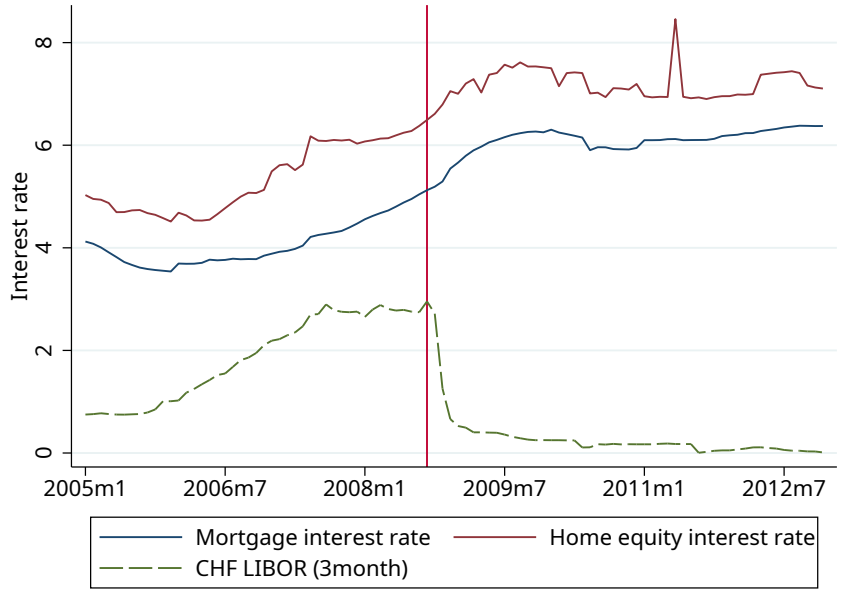
Notes: Panel (a) plots the HUF/EUR exchange rate expectations at the 1- and 2-year horizon from Consensus Economics forecasts. An increase in the series represents an expected depreciation of the HUF relative to the EUR. The vertical line represents September 2008. Panel (b) plots foreign currency and local currency denominated household deposits as a share of GDP. We use end of year (December) information for the deposits from regulatory bank balance sheet data. Panel (c) shows the aggregate default rate on housing loans by currency denomination and loan type. The vertical line represents September 2008. Panel (d) shows net exports, exports, and imports, all as a percentage of GDP. Exports and imports are plotted on the right axis.

Figure A.4: Foreign Currency Debtors With and Without Foreign Currency Savings



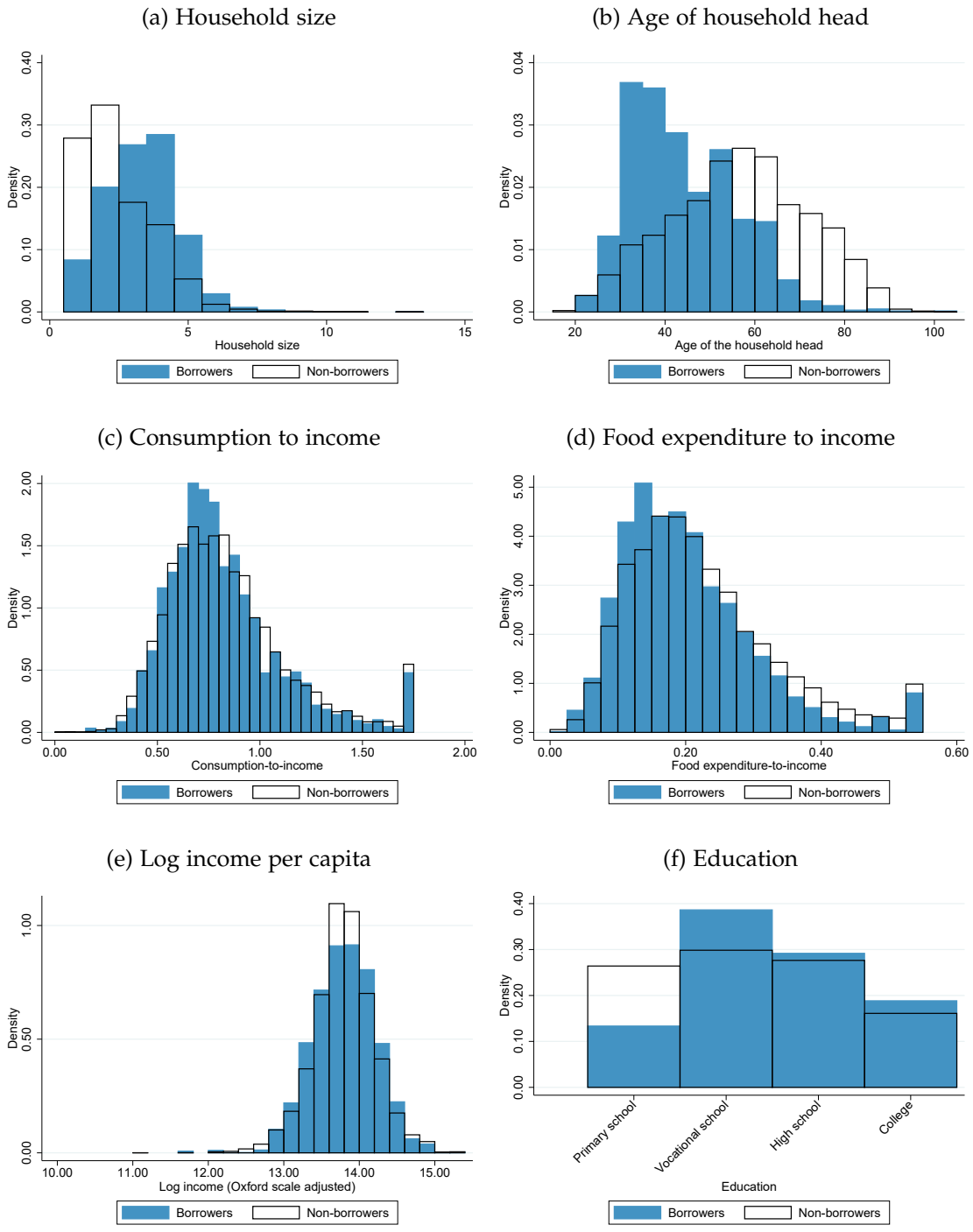
Notes: This figure plots the fraction of households with FC debt across the income distribution, differentiating between households that report holding FC savings and households without FC savings. The figure uses the sample of Hungarian households in the Euro Survey Project in survey waves 2007 through 2011. The figure shows that most FC debtors do not have FC savings. Moreover, the rising exposure to depreciation risk across the income distribution is robust to accounting for FC savings.

Figure A.5: Mortgage and Home Equity Interest Rates and CHF-LIBOR



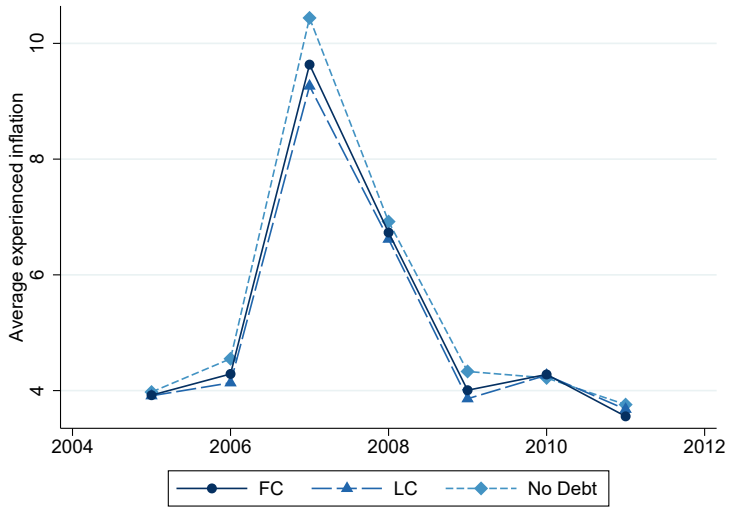
Notes: This figure shows the average interest rates on Swiss franc-denominated mortgages and home equity loans in Hungary, weighted by the outstanding loan stock at the end of each month. The dashed line represents the 3-month CHF-LIBOR rate. The vertical line represents September 2008. Source: MNB.

Figure A.6: Distribution of Household Characteristics in 2008 by Borrower Status



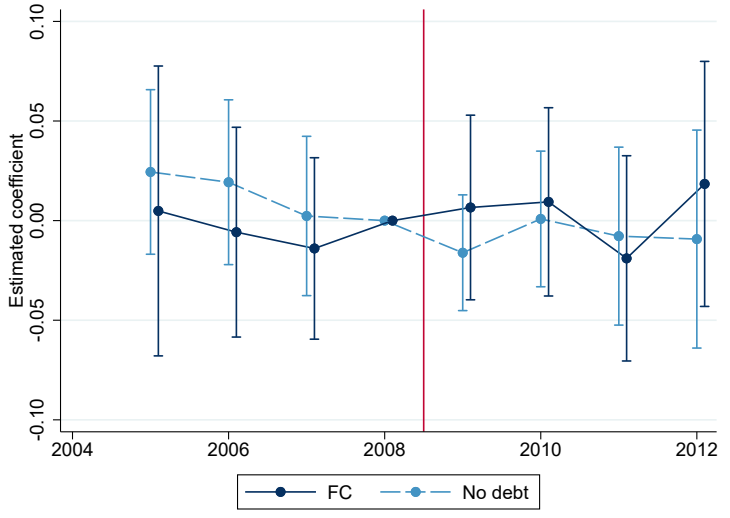
Notes: This figure shows the distribution of household characteristics for borrowers and non-borrowers in 2008. Data are from the HKÉF household survey.

Figure A.7: 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.

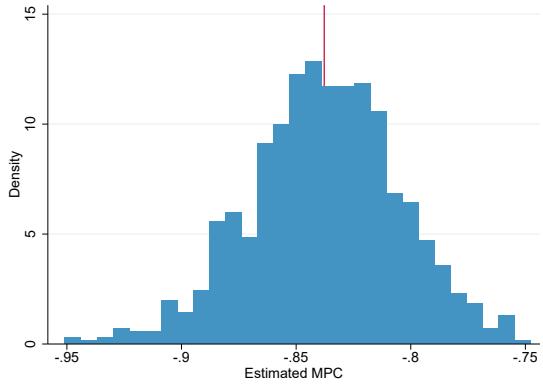
Figure A.8: Foreign Currency Debt Exposure and House Prices



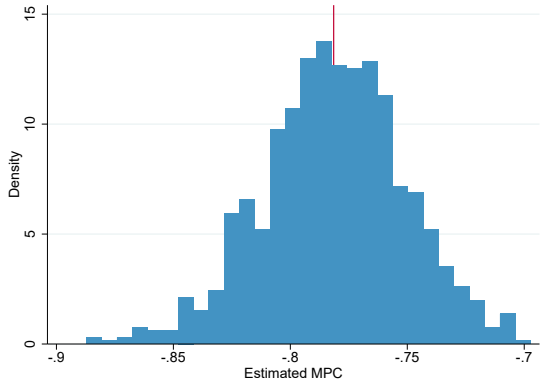
Notes: This figure plots the coefficients of interest from estimating equation (2) with the log of self-reported house price as the dependent variables. Controls in both specifications include age of the household head, gender of the household head, educational attainment of the household head, household 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% confidence intervals.

Figure A.9: Effect on MPC from Simulating Measurement Error in Loan Characteristics

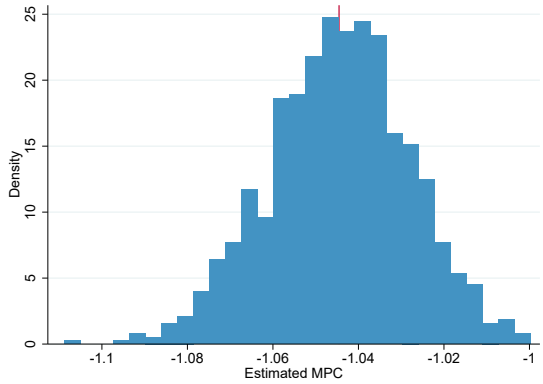
(a) Measurement error in borrowed amount



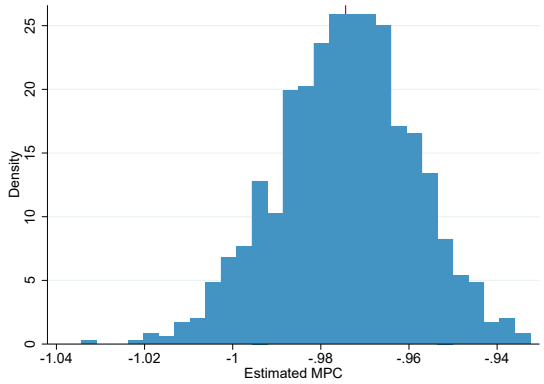
(b) Measurement error in borrowed amount, with income as control



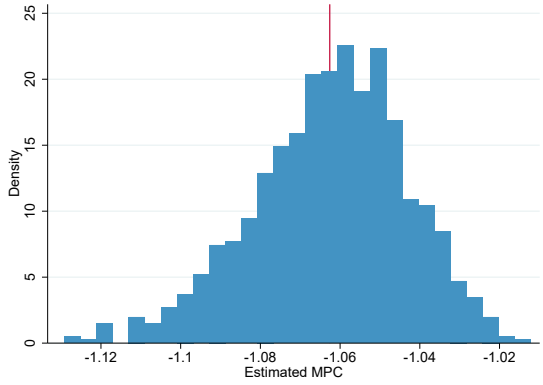
(c) Measurement error in maturity



(d) Measurement error in maturity, with income as control



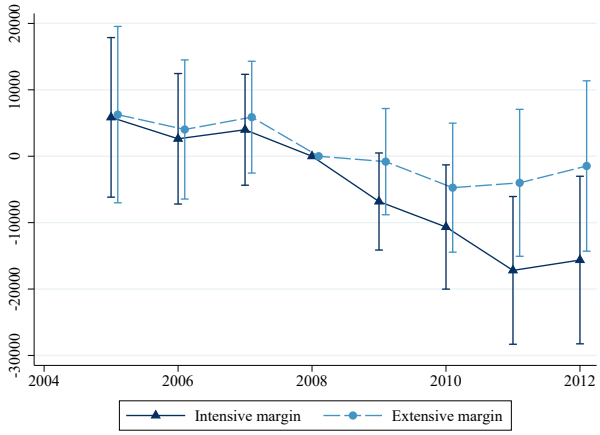
(e) Simulating the payment scheme (annuity vs equal amortization)



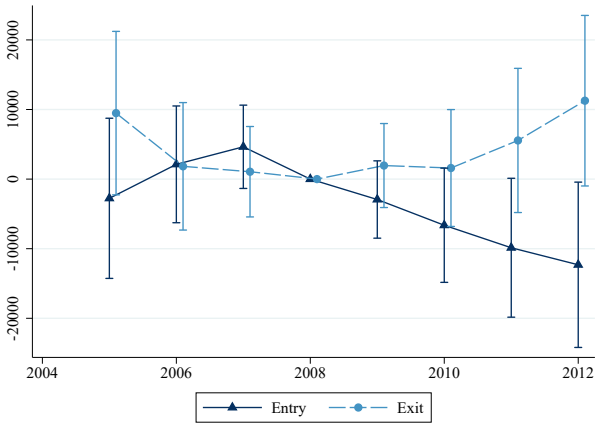
Notes: Panels (a)-(d) show the distribution of marginal propensity to consume estimates when measurement error added to the borrowed amount and maturity. Panel (e) shows the distribution of MPC estimates when assuming that 90% of loans are annuity loans and 10% of loans are equal amortization payment loans.

Figure A.10: Intensive and Extensive Margins of Adjustment

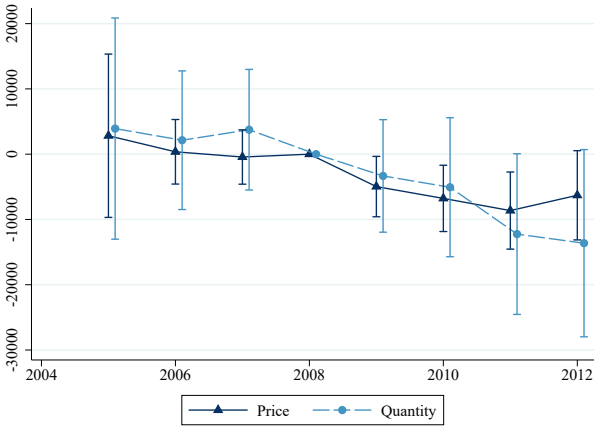
(a) Intensive vs. extensive margin



(b) Extensive margin: Entry vs exit



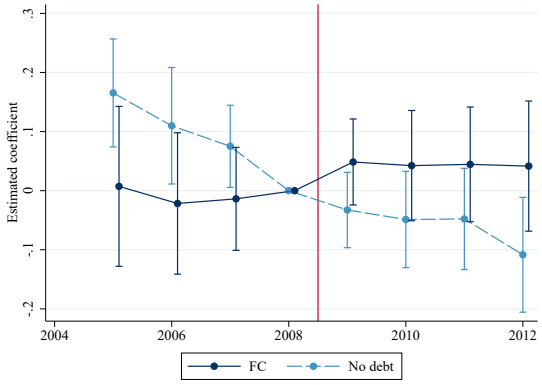
(c) Intensive margin: Price vs quantity



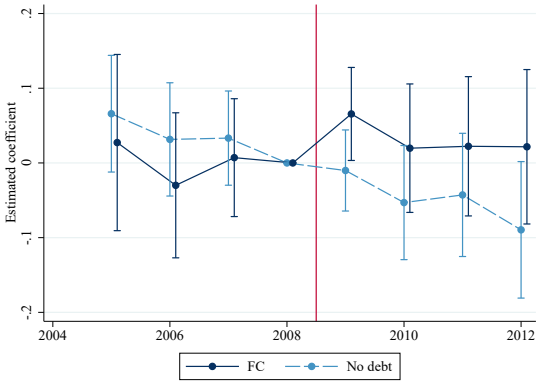
Notes: This figure plots the coefficients of interest from equation (8) using the different margins of adjustment as outcomes. Controls include age of the household head, gender of the household head, educational attainment of the household head, household size, and region (58 units) fixed effect. All control variables are interacted with year dummies. Standard errors are clustered at the household level. Error bars represent 95% confidence intervals.

Figure A.11: Dynamic Impact of Foreign Currency Debt on Household Size

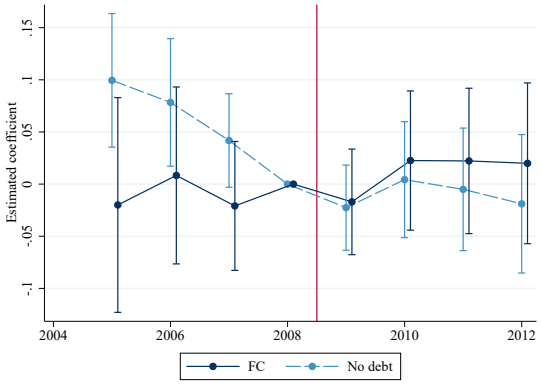
(a) Household size



(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 born after 1990. Error bars represent 95% confidence intervals.

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 as of 2008 by loan currency denomination for households borrowing after 2003 in the HKÉF household survey. 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: Descriptive Statistics by Household Loan Currency Denomination in September 2008 using Household Credit Registry Data

	FC mean/sd	LC mean/sd	FC-LC difference b/t	Normalized difference
Borrowed amount (1,000,000 HUF)	5.85	5.22	0.63**	0.018
	33.65	6.35	12.86	
Mortgage	0.44	0.93	-0.50**	-0.89
	0.50	0.25	-609.93	
Home equity	0.56	0.07	0.50**	0.89
	0.50	0.25	609.93	
Maturity	17.89	17.54	0.35**	0.038
	6.82	6.26	24.85	
Currency: CHF	0.94	0.00	0.94**	3.84
	0.24	0.00	2718.07	
Currency: EUR	0.04	0.00	0.04**	0.19
	0.18	0.00	134.91	
Currency: JPY	0.03	0.00	0.03**	0.17
	0.17	0.00	121.49	
Outstanding debt (1,000,000 HUF)	5.30	4.60	0.70**	0.022
	30.51	6.16	15.69	
Monthly payment (1,000 HUF)	47.82	46.64	1.18**	0.004
	240.56	108.44	3.07	
Borrower's year of birth	1967.90	1967.24	0.66**	0.046
	10.33	9.92	29.72	
Population (settlement)	267202.25	300155.06	-32952.81**	-0.039
	580985.52	608435.80	-21.61	
Income per capita (settlement)	1457.59	1485.73	-28.14**	-0.073
	267.77	273.50	-40.68	
Observations	501684	366087	867771	

Notes: This table reports descriptive statistics on household loans from the credit registry as of September 2008, disaggregated by currency denomination. Columns (1) and (2) display the average characteristics of foreign currency and local currency loans, respectively. Column (3) shows the difference between these two groups. The last column reports the normalized difference between foreign currency and local currency borrowers. 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). For further details on the household credit registry data, see Verner and Gyöngyösi (2020).

Table A.3: Descriptive Statistics by Loan Currency Denomination in September 2008 using Bank Customer Data

	FC	LC	FC-LC difference	Normalized difference
Primary education	0.05	0.08	-0.02	-0.070
	(0.22)	(0.26)	(-1.55)	
Secondary education	0.58	0.52	0.07*	0.093
	(0.49)	(0.50)	(2.20)	
Tertiary education	0.36	0.41	-0.04	-0.060
	(0.48)	(0.49)	(-1.41)	
Household size	1.67	2.16	-0.49**	-0.355
	(0.94)	(1.02)	(-8.09)	
Age	40.00	37.49	2.50**	0.197
	(9.82)	(8.00)	(5.17)	
Male	0.46	0.37	0.09**	0.132
	(0.50)	(0.48)	(3.16)	
Current account inflow (1000 HUF)	93.44	73.28	20.17**	0.142
	(103.91)	(96.43)	(3.48)	
Borrowed amount (1,000,000 HUF)	6.38	5.71	0.67*	0.097
	(5.14)	(4.64)	(2.41)	
Maturity	18.34	18.26	0.08	0.007
	(8.40)	(6.63)	(0.18)	
Observations	6026	293	6319	6319

Notes: The table presents descriptive statistics by loan currency denomination for individuals using bank customer data in September 2008. The first two columns show the average characteristics of foreign currency borrower individuals and local currency borrower individuals. The third column reports the difference between the average characteristics of foreign and local currency borrowers. The fourth column reports the normalized difference between foreign currency and local currency borrowers. 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.4: Marginal Propensity to Spend Out of the Foreign Currency Debt Service Shock using Monthly Bank Customer Data Focusing on Primary Accounts

	Reduced form (in HUF)			IV (MPS)		
	(1)	(2)	(3)	(4)	(5)	(6)
FC × Post	-13868.6**	-12549.2**	-9801.0**			
	(4482.5)	(4764.3)	(2703.7)			
Housing loan payment surprise				-1.160**	-1.204**	-0.940**
				(0.374)	(0.456)	(0.256)
Household & month FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls		Yes	Yes		Yes	Yes
Money received			Yes			Yes
First stage F-statistic				1633.4	308.9	309.2
N	151729	146025	146025	151729	146025	146025

Notes: This table presents estimates of the marginal propensity to spend out of an increase in monthly debt service induced by the foreign currency debt revaluation using bank customer data. The analysis restricts the sample to those individuals who received at least the minimum wage in their current account in two thirds of the pre-crisis sample period. Columns 1-3 present the reduced form estimates of the effect of FC exposure on the level (in forints) of individual spending. Columns 4-6 present the instrumental variable estimates of the MPS based on equation (4). Monthly debt payment surprise is instrumented by FC exposure interacted with $Post_t$. We use the same main control variables as in Table 2, gender, household size, age, and educational categories. All control variables are interacted with the $Post_t$ indicator. Standard errors are clustered at individual level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.5: Heterogeneity in the MPC Estimates: Proxies of Liquidity

	Income in 2008		Liquid savings in 2008		Access to informal credit		Debt-to-income in 2008	
	(1) Low	(2) High	(3) Low	(4) High	(5) No	(6) Yes	(7) Low	(8) High
Payment surprise	-1.275*	-0.776+	-1.126**	-0.668	-1.170**	-0.467	-0.774	-1.052**
	(0.606)	(0.442)	(0.400)	(0.723)	(0.426)	(0.617)	(0.704)	(0.404)
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	21902	9307	2268	1886

Notes: This table presents estimates of the marginal propensity to consume for various subsamples split by household characteristics. Columns 1 and 2 estimate equation (4) separately for households with above and below median income in 2008. Columns 3 and 4 split the sample into households that report having low and high liquid savings. Low liquidity households are those who report in the survey that they cannot pay for an "unexpected and large" expense shock. Columns 5 and 6 split by access to informal credit in the pre-crisis years. Households with access to informal credit are those that provided or received financial support for daily living expenses from relatives, friends, or NGOs. Column 7-8 split by debt-to-income in September 2008. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.6: Heterogeneity in the MPC Estimates: Other Household Characteristics

	Education		Age	
	(1) Low	(2) High	(3) Young	(4) Old
Payment surprise	-1.217*	-0.941+	-1.056**	-1.013
	(0.508)	(0.486)	(0.356)	(1.094)
Household & Year FE	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
N	13679	11273	13357	11595

Notes: This table presents estimates of the marginal propensity to consume by household characteristics. Columns 1-2 and 3-4 split by above and below median education and age. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.7: Heterogeneity in the MPS Estimates using Bank Customer Data

	Current account inflow , 2008m9		Balance of current account, 2008m9		Education		Age	
	(1) Low	(2) High	(3) Low	(4) High	(5) Low	(6) High	(7) Young	(8) Old
Payment surprise	-1.421**	-1.078*	-1.698**	-0.962**	-1.036*	-1.596**	-0.852*	-2.403**
	(0.405)	(0.454)	(0.626)	(0.348)	(0.464)	(0.430)	(0.372)	(0.484)
Household & month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	145170	142826	143876	144120	189614	98382	153027	134969

Notes: This table presents estimates of the marginal propensity to spend by individual characteristics using bank customer data. Columns 1 and 2 estimate equation (4) separately for individuals with above and below median current account inflow in 2008m9. Columns 3 and 4 split the sample into individuals with low and high current account balance in 2008m9. Columns 5-6 and 7-8 split by above and below median education and age. Standard errors are clustered at individual level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.8: 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
$FC \times Post$	-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
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%, 5%, and 1% level, respectively.

Table A.9: Effect of Foreign Currency Debt Shock on Nondurable Consumption: Instrumenting FC Debt Status with Origination Before or After Policy Change

	ln(Non-durable consumption)		
	(1)	(2)	(3)
FC × Post	-0.0415**	-0.0415**	-0.0372**
	(0.0131)	(0.0138)	(0.0133)
Household & year FE	Yes	Yes	Yes
Household controls		Yes	Yes
Contemporaneous inc.			Yes
First stage F-statistic	1523.3	1623.4	1623.2
N	11993	11989	11986

Notes: This table reports results from 2SLS regressions estimating the effect of FC debt status on nondurable consumption. The instrument is an indicator variable equal to one for loans originated after 2003 (after the removal of LC subsidies). 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%, 5%, and 1% level, respectively.

Table A.10: Marginal Propensity to Consume: Instrumenting Payment Surprise with Origination Before or After Policy Change

	ln(Non-durable consumption)		
	(1)	(2)	(3)
Payment surprise	-1.169**	-1.093**	-0.948**
	(0.350)	(0.359)	(0.348)
Household & year FE	Yes	Yes	Yes
Household controls		Yes	Yes
Contemporaneous inc.			Yes
First stage F-statistic	758.5	707.2	706.5
N	11993	11989	11989

Notes: This table reports results from 2SLS regressions estimating the effect of loan payment surprise on nondurable consumption. The instrument for the loan payment surprise is an indicator variable equal to one for loans originated after 2003 (the removal of LC subsidies). 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%, 5%, and 1% level, respectively.

Table A.11: Effect of Foreign Currency Debt Shock on Nondurable Consumption: Subsamples by Year of Origination around 2003 Policy Change

	Year of origination 2002-2005		Year of origination 2001-2006		Year of origination 2000-2007	
	(1)	(2)	(3)	(4)	(5)	(6)
FC × Post	-0.0405	-0.0355	-0.0457*	-0.0410*	-0.0433**	-0.0370*
	(0.0250)	(0.0237)	(0.0192)	(0.0184)	(0.0168)	(0.0163)
Household & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
Contemporaneous inc.		Yes		Yes		Yes
N	4569	4569	6424	6423	8377	8376

Notes: This table reports results from estimating equation (1) by Poisson pseudo-maximum likelihood (PPML) for subsamples by year of origination of the loan. Columns 1-2 restrict the sample to loans issued between 2002 and 2005. Columns 3-4 extend the window to include loans from 2001 to 2006, while columns 5-6 further broaden the window to cover the 2000-2007 period. The dependent variable is log nondurable consumption, adjusted for family composition by the Oxford equivalence scale. *FC* is an indicator variable for households with FC debt. *Post* is an indicator variable that equals one after 2008. See Table 2 for a definition of the control variables. 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%, 5%, and 1% level, respectively.

Table A.12: Marginal Propensity to Consume: Subsamples by Year of Origination around 2003 Policy Change

	Year of origination 2002-2005		Year of origination 2001-2006		Year of origination 2000-2007	
	(1)	(2)	(3)	(4)	(5)	(6)
Payment surprise	-0.998*	-0.925^{+}	-1.025*	-0.958*	-1.032**	-0.944**
	(0.504)	(0.484)	(0.407)	(0.389)	(0.343)	(0.328)
Household & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
Contemporaneous inc.		Yes		Yes		Yes
First stage F-statistic	330.2	328.5	586.4	584.4	763.0	761.2
N	4569	4569	6424	6424	8381	8381

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 for subsamples by year of origination of loans. Columns 1-2 restrict the sample to loans issued between 2002 and 2005. Columns 3-4 extend the window to include loans from 2001 to 2006, while columns 5-6 further broaden the window to cover the 2000-2007 period. The instrumental variable estimates of the MPC based on equation (4). 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%, 5%, and 1% level, respectively.

Table A.13: 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.14: 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.15: Effect of Foreign Currency Debt on Consumption: Robustness on a Propensity Score Matched Sample

	LC control		LC & NoDebt control	
	(1)	(2)	(3)	(4)
FC × 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 are: 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 the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.16: Effect of Foreign Currency Debt Shock on Nondurable Consumption: Excluding Non-borrowers

	ln(Non-durable consumption)			
	(1)	(2)	(3)	(4)
FC × Post	-0.0456**	-0.0410*	-0.0349*	-0.0395*
	(0.0158)	(0.0160)	(0.0156)	(0.0158)
Household & year FE	Yes	Yes	Yes	Yes
Household controls		Yes	Yes	Yes
Contemporaneous inc.			Yes	Yes
Dep. var. 2008				Yes
N	11265	11261	11258	5016

Notes: This table reports versions of Table 2 excluding non-borrowers. See Table 2 for details on the variable definitions and control variables. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.17: Marginal Propensity to Consume Out of the Foreign Currency Debt Service Shock: Excluding Non-borrowers

	Non-durable consumption					
	Reduced form			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
FC × Post	-33598.6**	-32959.0*	-29143.4*			
	(12730.7)	(13069.8)	(12728.3)			
Loan Payment surprise				-0.956**	-0.917*	-0.821*
				(0.363)	(0.365)	(0.357)
Household & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls		Yes	Yes		Yes	Yes
Contemporaneous inc.			Yes			Yes
First stage F-statistic				785.1	744.7	743.3
R^2	0.874	0.876	0.884			
N	11265	11261	11261	11265	11261	11261

Notes: This table reports versions of Table 3 excluding non-borrowers. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.18: Foreign Currency Debt Exposure and Spending on Different Categories of Consumption: Excluding Non-borrowers

	Panel A: By durability			
	Strict non-durables	Semi durables	Services	Durables
	(1) PPML	(2) PPML	(3) PPML	(4) PPML
FC × Post	-0.0126	-0.0366	-0.0905**	-0.180+
	(0.0178)	(0.0415)	(0.0238)	(0.0925)
Household and year FE	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
N	11261	11253	11261	10513

	Panel B: Broad spending response			
	Total consumption		Housing investment	Total spending
	(1) PPML	(2) IV	(3) PPML	(4) IV
FC × Post	-0.0477**		-0.367+	
	(0.0169)		(0.218)	
Loan payment surprise		-1.154**		-1.263**
		(0.411)		(0.424)
Household and year FE	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
First stage F-statistics		744.7		744.7
N	11261	11261	8361	11261

Notes: This table reports versions of Table 4 excluding non-borrowers. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.19: Effect of Foreign Currency Debt Shock on Nondurable Consumption: Unweighted

	ln(Non-durable consumption)			
	(1)	(2)	(3)	(4)
NoDebt × Post	0.0102	0.00773	0.00698	0.00224
	(0.0126)	(0.0132)	(0.0130)	(0.0127)
FC × Post	-0.0457**	-0.0455**	-0.0416**	-0.0458**
	(0.0159)	(0.0160)	(0.0156)	(0.0152)
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 versions of Table 2 with unweighted regressions. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.20: Marginal Propensity to Consume Out of the Foreign Currency Debt Service Shock: Unweighted

	Non-durable consumption					
	Reduced form			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
FC × Post	-33474.2*	-35067.0**	-32532.6*			
	(13019.3)	(13119.4)	(12717.6)			
Loan Payment surprise				-0.933*	-0.968**	-0.909*
				(0.363)	(0.364)	(0.354)
Household & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls		Yes	Yes		Yes	Yes
Contemporaneous inc.			Yes			Yes
First stage F-statistic				814.7	873.2	873.1
R^2	0.879	0.880	0.884			
N	59373	59321	59321	59373	59321	59321

Notes: This table reports versions of Table 3 with unweighted regressions. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.21: Foreign Currency Debt Exposure and Spending on Different Categories of Consumption: Unweighted

	Panel A: By durability			
	Strict non-durables	Semi durables	Services	Durables
	(1) PPML	(2) PPML	(3) PPML	(4) PPML
FC × Post	-0.0193	-0.0624	-0.0842**	-0.196*
	(0.0175)	(0.0405)	(0.0245)	(0.0906)
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	-0.0549**		-0.457*	
	(0.0165)		(0.229)	
Loan payment surprise		-1.262**		-1.417**
		(0.400)		(0.419)
Household and year FE	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
First stage F-statistics		873.2		873.2
N	59321	59321	43202	59321

Notes: This table reports versions of Table 2 with unweighted regressions. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.22: Effect of Foreign Currency Debt Shock on Nondurable Consumption: Alternative FC Debtor Classification

	ln(Non-durable consumption)			
	(1)	(2)	(3)	(4)
NoDebt × Post	0.0147	0.0141	0.0134	0.0115
	(0.0131)	(0.0134)	(0.0131)	(0.0134)
FC × Post	-0.0536**	-0.0511**	-0.0474**	-0.0489**
	(0.0178)	(0.0176)	(0.0171)	(0.0171)
Household & year FE	Yes	Yes	Yes	Yes
Household controls		Yes	Yes	Yes
Contemporaneous inc.			Yes	Yes
Dep. var. 2008				Yes
N	57335	57283	57272	23968

Notes: This table reports versions of Table 2 with an alternative foreign currency debtor classification. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.23: Marginal Propensity to Consume Out of the Foreign Currency Debt Service Shock: Alternative FC Debtor Classification

	Non-durable consumption					
	Reduced form			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
FC × Post	-39511.6**	-39554.7**	-37723.7**			
	(14285.3)	(14260.0)	(13774.4)			
Loan Payment surprise				-1.050**	-1.047**	-0.999**
				(0.379)	(0.379)	(0.366)
Household & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls		Yes	Yes		Yes	Yes
Contemporaneous inc.			Yes			Yes
First stage F-statistic				623.4	649.5	649.4
R^2	0.879	0.880	0.884			
N	57335	57283	57283	57335	57283	57283

Notes: This table reports versions of Table 3 with an alternative foreign currency debtor classification. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.24: Foreign Currency Debt Exposure and Spending on Different Categories of Consumption: Alternative FC Debtor Classification

	Panel A: By durability			
	Strict non-durables	Semi durables	Services	Durables
	(1) PPML	(2) PPML	(3) PPML	(4) PPML
FC × Post	-0.0173	-0.0486	-0.108**	-0.125
	(0.0195)	(0.0495)	(0.0270)	(0.103)
Household and year FE	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
N	57283	56952	57281	51671

	Panel B: Broad spending response			
	Total consumption		Housing investment	Total spending
	(1) PPML	(2) IV	(3) PPML	(4) IV
FC × Post	-0.0559**		-0.333	
	(0.0185)		(0.240)	
Loan payment surprise		-1.241**		-1.358**
		(0.423)		(0.438)
Household and year FE	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
First stage F-statistics		649.5		649.5
N	57283	57283	41748	57283

Notes: This table reports versions of Table 4 with an alternative foreign currency debtor classification. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.25: Effect of Foreign Currency Debt Exposure on Payment Difficulties

	Mortgage	Common cost	Utilities	Bank credit	Private credit
	(1)	(2)	(3)	(4)	(5)
FC × 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%, 5%, and 1% level, respectively.

Table A.26: 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.9) and (B.10). +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.27: Foreign Currency Debt Shock and the Import Content of Consumption

	Goods		Services		Total Expenditures	
	(1) Direct	(2) Total	(3) Direct	(4) Total	(5) Direct	(6) Total
FC × Post	-0.00888*	-0.00333	-0.00188	-0.00304	-0.00112	0.00423
	(0.00438)	(0.00245)	(0.00185)	(0.00309)	(0.00399)	(0.00340)
Household & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.679	0.726	0.663	0.662	0.670	0.683
N	59321	59321	59223	59223	59321	59321

Notes: This table reports the estimated effect of FC debt exposure on the import share of consumption expenditures based on the estimation of equation (1). Each column represents a different outcome variable: the direct import share of goods expenditures (column 1), the total import share of goods expenditures accounting for input-output linkages (column 2), the direct import share of services expenditures (column 3), the total import share of goods expenditures accounting for input-output linkages (column 4), the direct import share of total expenditures (column 5), and the total import share of total expenditures (column 6). See Appendix B for details on how the import shares are constructed. 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%, 5%, and 1% level, respectively.

Table A.28: Heterogeneity in Labor Supply Responses by Local Labor Market Conditions

	Labor market participation		Unemployment		Total income		Oxford adjusted income	
	Low	High	Low	High	Low	High	Low	High
FC × Post	-0.0119	-0.00370	-0.00719	0.0215	0.00385	-0.0231	-0.0143	-0.0335
	(0.0175)	(0.0214)	(0.0220)	(0.0202)	(0.0227)	(0.0263)	(0.0237)	(0.0278)
Household & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes				
Household controls					Yes	Yes	Yes	Yes
R^2	0.679	0.702	0.513	0.522				
N	82745	71338	39749	34761	30964	28357	30964	28357

Notes: This table reports the estimated effect of FC debt exposure on various measures of labor supply by local labor market conditions. We split regions into two groups by the increase in local unemployment rate and separately estimate the effect of FC debt exposure on various labor market outcomes. Standard errors are clustered at the household level. +, * and ** denote significance at the 10%, 5%, and 1% level, respectively.

B Data Appendix

B.1 Household Survey Data: Additional Information

The Household Budget and Living Conditions Survey (HKÉF) is a representative survey of 8,000-10,000 households residing in Hungary. Our sample period is 2005-2012. The sample period ends in 2012, as KSH started data collection with a completely new set of households in 2013 for the EU-SILC survey.

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. An example of the diary is presented in Figure B.1. 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).[35] Household members are also surveyed about their labor market status, income, and transfers in the previous year.

B.2 Household Debt in the Household 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.

Table B.1: Variables on Household Debt

	Year of wave							
Variable name	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

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

Figure B.1: 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 (söröző̈ben)	111128	2	800	
07	2	munkahelyi étterem, 1 ebéd	111211	1	550	
08	2	10 db tojás	011470	10	300	
09	3	tornacipő̈ 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, 2.8 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).

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 paid in the year as installment, and whether any of the household members have another loan from a financial institution.

To precisely determine loan currency denomination, we collect various pieces of

information that are strong predictors of loan currency denomination. First, we use the information on loan currency denomination collected starting in 2009. Second, we use the year of origination, as essentially all loans originated before 2004 are LC, while 79.3% of loans originated in 2004 or after are FC according to Hungary's household credit registry (see also Figure 2). Third, we use information on participation in the 2012 Exchange Rate Cap or the 2011 Early Repayment Program schemes, since these programs only applied to FC loans. For our baseline FC/LC classification, 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. As robustness, we also use the simpler classification based on the loan currency denomination collected starting in 2009. See Appendix C.4 for evidence that the results are very similar across the two approaches.

Annuity model We calculate households' debt burdens and loan payments (debt service) by using the following loan characteristics: year of origination, maturity, loan type, and currency denomination. With this information we use an annuity formula to impute the monthly payment and remaining balance for each loan. The use of an annuity formula is motivated by the fact that annuity payment was the most common payment structure for mortgage and home equity loans. Based on the Hungarian household credit registry maintained by the Hungarian National Bank, Table B.2 shows that loans with an annuity payment structure accounted for almost 75% of all housing loans. In principle, some of the loans in the "Grace period" and "Other" category may also have repayment structures that are very similar to annuity loans. Equal installment and bullet repayment loans account for only 5% of mortgage and home equity loans according to the household credit registry.

Table B.2: Frequency of Loan Payment Types in the Credit Registry for Loans Originated between 2000 and 2008

	Nr	Share (%)
Annuity	514,033	73
Bullet repayment	8,518	1
Grace period	65,511	9
Equal principal payment	16809	2
Other	101,415	15
Observations	706,286	100

Notes: This table reports the frequency of mortgage and home equity loans by repayment type for loans originated in the period 2000-2008. Data is from the Hungarian household credit registry, which covers 79% of all outstanding household debt in 2008.

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

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

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.3c).[36]

High liquidity proxy We use several proxies to measure household liquidity positions. First, we assess whether a household can cover an unanticipated expenditure shock equivalent to their monthly net income using their own savings. Specifically, we rely on two questions from HKÉF: whether the household could cover a large unexpected expense from their own savings, and the maximum amount they could cover. We classify households as having high liquidity if they are able to cover an unexpected expense at least equal to their monthly net income. Second, we consider access to informal credit. Households are asked whether they gave or received financial support from relatives, friends, or NGOs for daily living expenses. We classify households as having access to informal credit if they responded affirmatively to either question in the pre-crisis period. Third, we use the household's debt-to-income ratio in September 2008 as a measure of liquidity. Fourth, we use household income in 2008 as an additional proxy for liquidity.

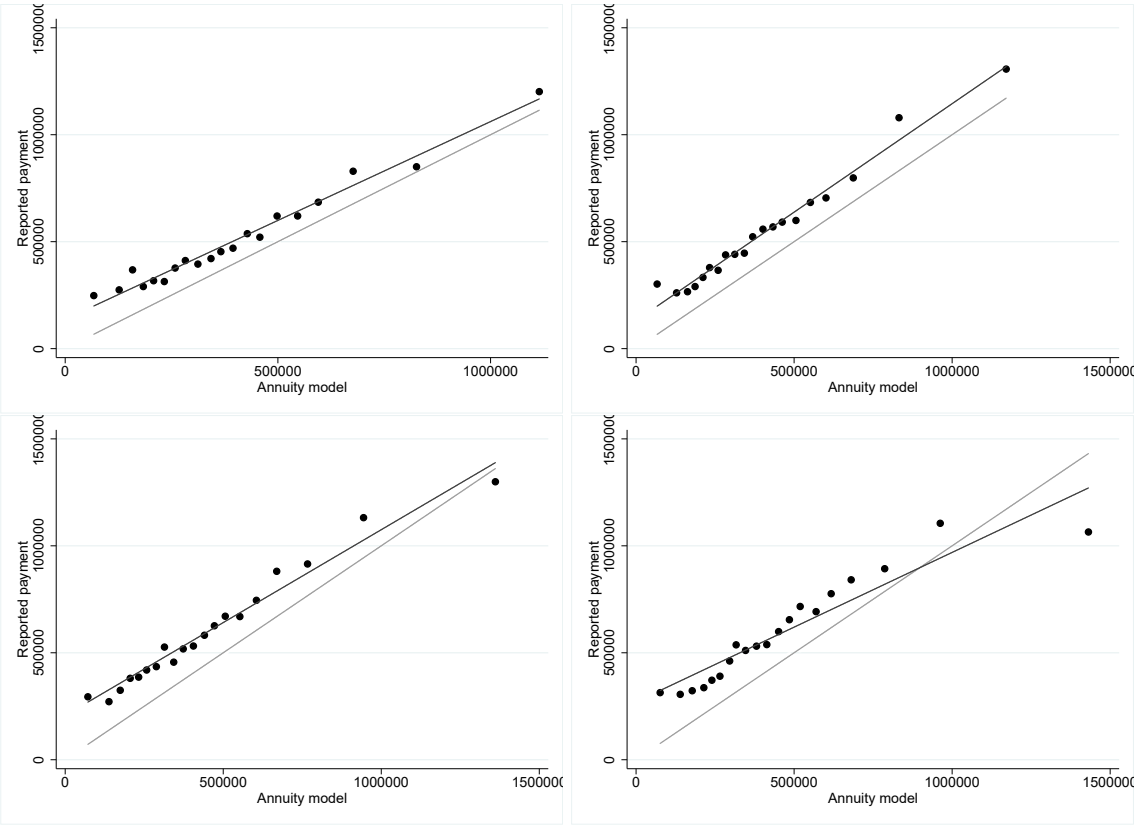
Individual-level identifier The data contain a household identifier, but not an individual-level panel identifier. Therefore, for the analysis on individual level data in Table 8, we create an individual-level identifier by matching individuals within households across waves using date of birth (year and month), gender, and educational attainment.

B.3 Import Content of Consumption

To measure the import content of consumption expenditures, we start with a sector level input-output table for Hungary. The input-output table has several relevant pieces of information. First, for each sector, it has sector level information on the value of domestic and foreign inputs. Second, it contains the final output by sector. Third, sector level household consumption is also divided into domestic and imported consumption. These allow us to calculate the overall (direct and indirect) share of import content of household consumption.

[36] Statistics from the National Bank of Hungary show that the fraction of non-performing loans was below 1% for both local currency loans and foreign currency housing loans in 2008Q3.

Figure B.2: 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).

The overall import share of consumption is given by

$$S_i^{HH} = s_i^{HH,Direct} + (1 - s_i^{HH,Direct}) \times S_i^F.$$

Tto ease the notation, we disregard the time index in this derivation. Here, s_i^{Total} is the share of household consumption from sector i that is directly imported from abroad, and $(1 - s_i^{Direct})$ is the share of household consumption from sector i that is domestically produced. As this production can also have import needs, we multiply it with the sum of import needs of firms in sector i, s_i^F.

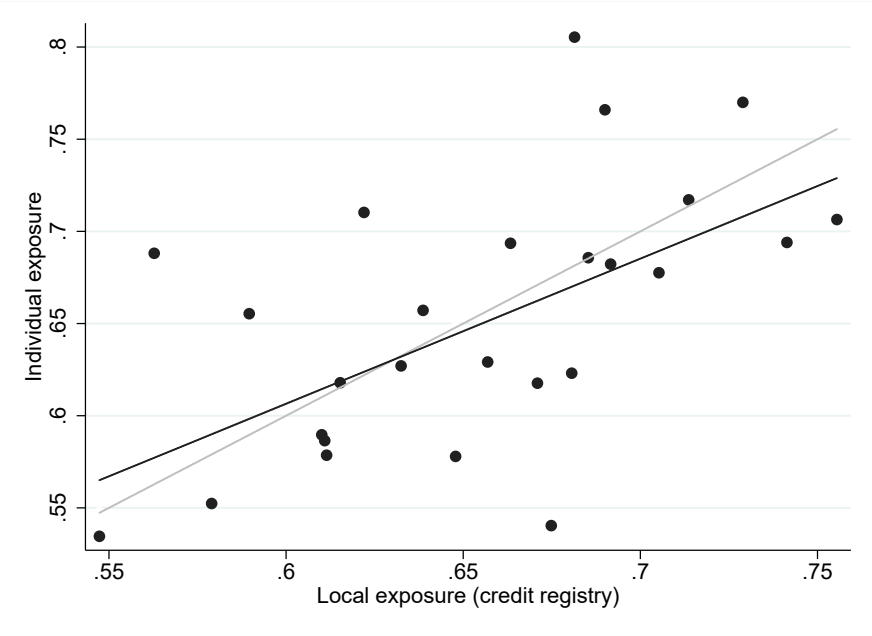
The total import share of firms in sector i is defined recursively as

$$S_i^F = s_i^{F,Direct} + (1 - s_i^{F,Direct}) \times \sum_j A_{ij} S_j^F,$$

where $s_i^{F,Direct}$ is the direct import share of sector i, $(1 - s_i^{F,Direct})$ is the indirect import share, and A_{ij} is the share of inputs from sector j to sector i.

Combining the import share of consumption at the sector level with sector-COICOP

Figure B.3: Average Individual FC Exposure at the Locality Level vs Exposure in Administrative Data

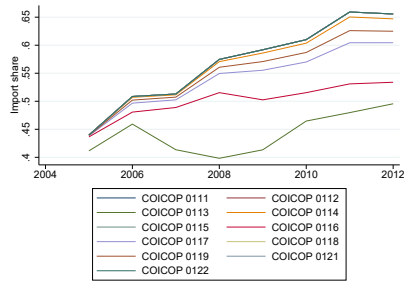


Notes: This figure presents a binscatter of local FC debt exposure in the household credit registry with individual-level exposure from the household consumption survey. While we expect some noise, given the relatively small number of households in each region in the household survey, there is a strong positive correlation, indicating our approach correctly distinguishes between FC and LC debtor households.

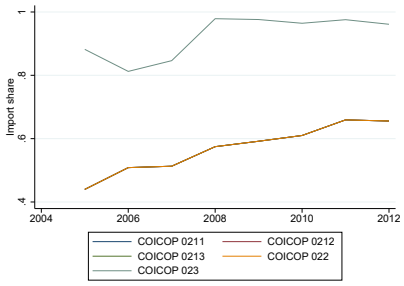
mapping from the U.K. Office for National Statistics, we can determine the import share of COICOP consumption categories. This mapping gives the import share of 111 major consumption categories. Figure B.4 reports the import share of the product groups over time. To focus on FC borrower households' adjustment to debt revaluation shock, we disregard the economy-wide adjustment during the crisis and use the 2008 import shares.

Figure B.4: Import Share of COICOP Consumption Product Categories

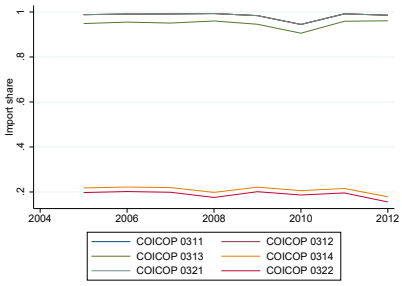
(a) Food and non-alcoholic beverages



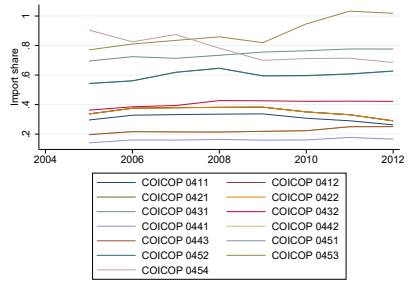
(b) Alcohol and tobacco



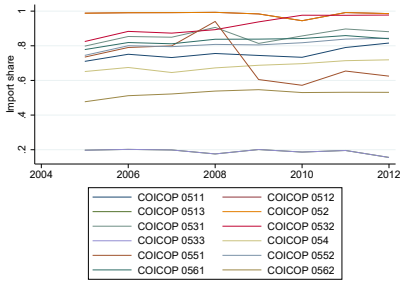
(c) Clothing and footwear



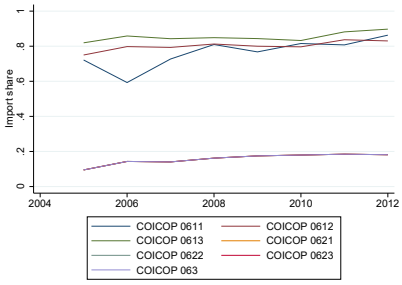
(d) Housing, water, electricity, gas and other fuels



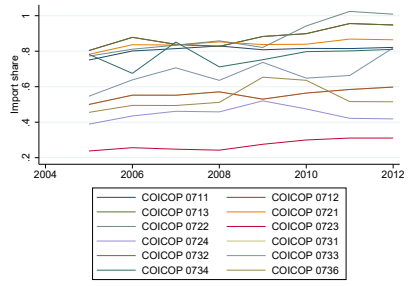
(e) Furnishings, household equipment and routine maintenance



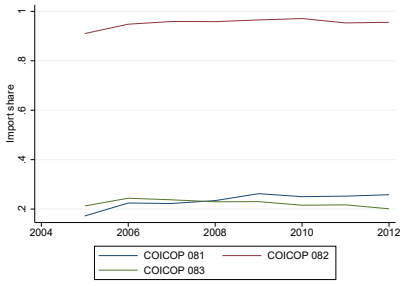
(f) Health



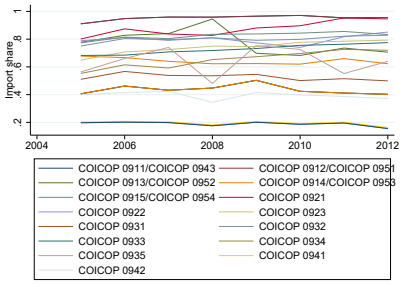
(g) Transport



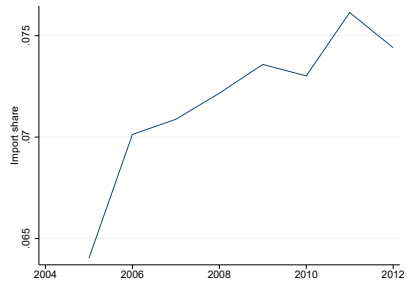
(h) Communication



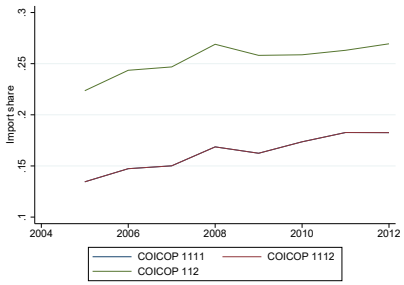
(i) Recreation and culture



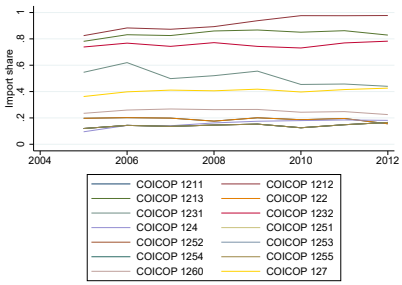
(j) Education



(k) Restaurants and hotels



(l) Miscellaneous goods and services



Notes: This figure plots the import share of consumption S_{it}^{HH} for 111 major consumption categories.

B.4 Alternative Indices for Decomposing the Intensive Margin

In the main analysis, we use the Marshall-Edgeworth index for the decomposition. Here we discuss alternative indices for decomposition. In particular, we use the Laspeyres and Paasche indices. The intensive margin of the change in expenditures can be decomposed as follows:

$$\begin{aligned}
\sum_{j \in J_{t/t-1}} e_{jt} - \sum_{j \in J_{t/t-1}} e_{j,t-1} &= \sum_{j \in J_{t/t-1}} p_{jt} q_{jt} - \sum_{j \in J_{t/t-1}} p_{j,t-1} q_{j,t-1} \\
&= \underbrace{\sum_{j \in J_{t/t-1}} \Delta p_{jt} q_{j,t-1}}_{\text{Laspeyres price change}} + \underbrace{\sum_{j \in J_{t/t-1}} \Delta q_{jt} p_{jt}}_{\text{Paasche quantity change}} \qquad \text{(B.9)} \\
&= \underbrace{\sum_{j \in J_{t/t-1}} \Delta p_{jt} q_{jt}}_{\text{Paasche price change}} + \underbrace{\sum_{j \in J_{t/t-1}} \Delta q_{jt} p_{j,t-1}}_{\text{Laspeyres quantity change}} \qquad \text{(B.10)}
\end{aligned}$$

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. Table A.26 presents decomposition of the intensive margin using these alternative decompositions.

B.5 Common Examples of Equivalence Scales

The use of equivalence scales allows us to compare outcomes that are equivalent across households, adjusting outcomes both for household size and composition. Table B.3 shows the adult equivalent for different household compositions using the Oxford, OECD and square root scales. The Oxford scale gives a weight of 1 to the first adult in the household, 0.7 to subsequent adults and 0.5 to children. 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.

Table B.3: Equivalence Scales for Common Family Types

Family type	Oxford scale	OECD scale	Square root
1 adult	1	1	1
2 adults	1.7	1.5	1.41
1 adult + 1 child	1.5	1.3	1.41
2 adults + 1 child	2.2	1.8	1.73
2 adults + 2 children	2.7	2.1	2
2 adults + 3 children	3.2	2.4	2.24

Notes: This table shows equivalence scales for common family types for the most common scaling methods.

C Robustness Tests

This appendix provides details on the robustness of the consumption results from Section 5.

C.1 Propensity score matching using survey data

Although FC and LC debtor households are broadly similar on observables, there are statistically significant differences between the two groups in terms of educational attainment (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.13 and Table A.14. 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.15 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.

C.2 House Price Shocks

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.[37] We use self-reported house price data from the survey to test whether FC debtor households perceived their house price differently from LC borrower households by estimating equation (2) for house prices. Figure A.8 plots the dynamic impact of FC debt status, which shows that perceived house prices evolved similarly for FC and LC borrower households.

C.3 Alternative Sample and Weighting

In our analysis based on survey data, we keep non-borrowers in the sample, as their consumption behavior provides a useful benchmark. To ensure that this does not affect our results, we re-estimate our main regression using a subsample excluding non-borrower households. Table A.16, Table A.17 and Table A.18 present the PPML, MPC and MPS

[37] 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 the homeownership rate is almost 91% in the 2011 census in Hungary, housing capture a large part of household assets.

results, respectively. They are close to our main estimates proving their robustness to sample choice.

As an additional robustness check, we limit the sample to loans originated around the time of the late-2003 phase-out of the subsidy program. Re-estimating the PPML and MPC specifications on these narrower subsamples yields results that closely align with our main findings, as shown in Tables A.11 and A.12, respectively.

We use weights provided by the Central Statistical Office to make sure that the sample accurately reflects the population. However, the weighting does not take into account debtor status of households.[38] Therefore we re-estimate our main regressions weighting households equally and report the results in Table A.19, Table A.20 and Table A.21. These estimates are similar to the main results, suggesting that our results are robust to alternative weighting schemes.

C.4 Robustness to Potential Measurement Error in FC Debtor Status

We next conduct several robustness checks to show that potential measurement error in the household survey data is unlikely to materially affect our main results.

In the main analysis, we rely on several pieces of information to classify debtors' loan currency denomination. In particular, we use self-reported currency denomination, the date of origination, and participation in a debt relief program targeting FC borrowers to determine the currency denomination of loans. The motivation behind using various pieces of information is to construct what we believe is the most accurate FC classification.

Next, we show that our results are not sensitive to using this exact classification. In particular, we show that our results are robust to using only the self-reported currency denomination to classify FC debt status, ignoring the other variables. We re-estimate the main regressions in Table 2, Table 3, and Table 4 using this simpler FC/LC classification method. The results are reported in Table A.22, Table A.23 and Table A.24. These tables show that the new point estimates and the original point estimates are quantitatively very similar. For example, FC exposure leads to 4.89% reduction using the simpler classification versus 4.46% is the original classification. The MPC is 0.999 using the simpler classification versus 0.920 in the original classification. This indicates that our results are robust to alternative methods to classify foreign currency debtor households. In fact, the baseline classification method is slightly conservative in terms of the magnitudes of the estimates.

C.5 Robustness to Potential Measurement Error in Debt Payments

Our measure of outstanding debt $\tilde{D}_{it}$ and debt service cost $\tilde{P}_{it}$ relies on an annuity model using self-reported information (date of origination, borrowed amount, maturity, currency denomination). As in any setting using survey data, if a household reports any debt-related information erroneously, it can lead to measurement error that may bias our

[38]The Central Statistical Office calculates weights relying on the census and use demographics and geographical location variables to calculate weights.

estimates. Note that this only affects the analysis on the MPC using household survey data in Section 5.2.

Two facts alleviate concerns about measurement error in outstanding debt and debt service. First, instrumenting the payment surprise with FC debt status removes the attenuation bias stemming from classical measurement error in the payment surprise (Hausman, 2001). Second, we find similar estimates using administrative bank customer data. While bank customer data could also have measurement error from leakages, the fact that the results are similar across two independent datasets gives us confidence that the findings are not substantially biased by measurement error.

In this section, we present a simulation analysis to further verify that our results are not materially biased by measurement error. Specifically, we conduct a simulation exercise to evaluate how measurement error in the reported debt characteristics impacts our estimates of the MPC out of increased debt service cost. We consider measurement error in both the borrowed amount and maturity. We assume the measurement error is normally distributed, with a mean of zero and a variance equal to the sample variance of the original variables. Using the borrowed amount with measurement error, we re-calculate the outstanding debt and loan payment and re-estimate equation (5) for the marginal propensity to consume. We run 1000 simulations and estimate the IV regression from Table 3 column 5 (baseline controls) and column 6 (with income as an additional control). In a second step, we repeat this exercise for maturity, again applying a measurement error of mean zero and variance equal to the sample variance of maturity.

Figure A.9 reports the distribution of the estimated marginal propensity to consume from the simulation. Panels (a)-(b) consider measurement error in the borrowed amount. For this simulation, the MPC is slightly lower than our baseline (around 0.84 versus 0.95). This suggests that the measurement error in borrowed amount biases our MPC estimates downward and that the true estimate may be even larger.

Figure A.9 panels (c)-(d) considers measurement error in maturity. The results show that despite the added measurement error, the average estimated MPC (0.97-1.04) is reasonably close to our baseline MPC estimate reported in Table 2. Moreover, the distribution of MPCs is reasonably tight, with most of the mass between 0.94 and 1.08 across the two panels. This suggests that our approach is robust to a reasonable degree of mis-measurement in maturity parameter of the annuity model.

As a further check, we also assess the validity of the annuity model assumption. In an annuity model, borrowers have constant debt service cost, conditional on the interest rate and currency denomination. In an equal principal payment scheme, a borrower has higher payments at the beginning of the loan and lower payments closer to maturity. As foreign currency housing loans were originated between 2004 and 2008, the annuity model assumption implies relatively lower payments during the crisis period between 2009 and 2012, given the long average maturity of these loans.

We run simulations that randomly assign annuity and equal amortization payment schemes to loans. We assume that 10% of the loans have a constant amortization scheme, which is conservative based on data on loan types from Hungary's household credit registry reported in Table B.2. We run 1000 simulations and re-estimate the marginal propensity to consume. Figure A.9 panel (e) plots the distribution of MPCs and shows that the average MPC of 1.06, not too far from our baseline estimate.

These simulation exercises illustrate that adding measurement error equal with variance equal to the population variance in borrowed amount and maturity or assuming that some loans do not follow an annuity only changes the estimate MPC by about 0.1. Moreover, the direction of the potential bias depends on the source of measurement error. Overall, we take this as indication that the results are unlikely to be substantially biased by measurement error.

C.6 Results on 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 A.25 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.

D Lifecycle Model with Long-Term FC Mortgage Debt

This appendix presents a simple quantitative consumption-saving model with long-term foreign currency debt. We use the model to study the consumption response to a large persistent depreciation, as in our empirical setting.

D.1 Model set-up

We consider an economy with a continuum of *ex ante* identical homeowners with mortgage debt. Each household lives for T periods, and time runs from $t = 1, ..., T$. Homeowners begin life with initial long-term mortgage debt d_0 with maturity $T_M \leq T$. Mortgages are denominated in foreign currency, and the initial mortgage debt is drawn from a distribution F_{d_0}. For simplicity, we do not explicitly model housing and mortgage choice. Similar to our empirical setting, we take households' mortgage debt as given and study the response to a large depreciation shock.[39]

Households have preferences over consumption (c_t) and labor (n_t) given by

$$\mathbb{E} \sum_{t=1}^{T} \beta^t u(c_t, n_t).$$

The household's flow of funds constraint is given by

$$c_t + a_{t+1} + \mathcal{E}_t pmt_t = w_t n_t + (1 + r_a) a_t,$$

where a_t is a liquid asset that earns return r_a, pmt_t is the mortgage payment (in FC), w_t is the wage, and $\mathcal{E}_t$ is the exchange rate. We assume the exchange rate $\mathcal{E}_t$ follows a Markov process with transition matrix $\Pi_{\mathcal{E}}$. We also assume that there is a borrowing constraint on the liquid asset:

$$a_{t+1} \geq \underline{a}.$$

Following our empirical setting, we assume the mortgage payment (in FC) follows an annuity:

$$pmt_t = d_t \frac{r}{1 - (1 + r)^{-T_M + t - 1}}, \quad \text{for } 1 \leq t \leq T_M.$$

When the loan is repaid after T_M, the payment is zero. The evolution of a household's debt (in FC) without default follows a standard annuity formula

$$\begin{aligned} d_{t+1} &= d_t(1 + r) - pmt_t \\ &= d_t \left((1 + r) - \frac{r}{1 - (1 + r)^{-T_M + t - 1}} \right). \end{aligned}$$

[39] Similarly, Campbell and Cocco (2015), who study default, also do not model housing or mortgage choice.

To introduce uninsurable idiosyncratic risk, we assume the wage follows an exogenous process

$$w_t = \rho w_{t-1} + u_t,$$

where u_t is an iid uninsurable shock. The household's exogenous state variables are thus $(t, \mathcal{E}_t, w_t, d_t)$ and the endogenous state variable is a_t.

D.2 Calibration

We solve the model backwards using the method of endogenous gridpoints. Given the limited labor supply response we estimate in the data, we assume the following GHH functional form for preferences (Greenwood et al., 1988) :

$$u(c,n) = \frac{1}{1-\frac{1}{\sigma}} \left(c - \phi \frac{n^{1+\frac{1}{\eta}}}{1+\frac{1}{\eta}} \right)^{1-\frac{1}{\sigma}}. \tag{D.11}$$

In contrast to standard separable preferences, this specification removes the wealth effect on labor supply, ensuring that households do not counterfactually boost labor supply in response to the increase in debt burdens. To see this, note that the marginal utilities are

$$u_c = \left(c - \phi \frac{n^{1+\frac{1}{\eta}}}{1+\frac{1}{\eta}} \right)^{-\sigma}, \quad u_n = -\phi \left(c - \phi \frac{n^{1+\frac{1}{\eta}}}{1+\frac{1}{\eta}} \right)^{-\sigma} n^{\frac{1}{\eta}}, \tag{D.12}$$

so intra-temporal first-order condition is

$$\begin{aligned} w_t &= -\frac{u_n(c_t, n_t)}{u_c(c_t, n_t)} \\ \Rightarrow w_t &= \phi n_t^{\frac{1}{\eta}}, \end{aligned}$$

which is independent of consumption c_t.

Table D.4 summarizes the parameter values we use in the calibration. We assume that the mortgage maturity is $T_M = 20$ based on the modal mortgage maturity for FC loans originated before the crisis in the MNB credit registry. The average foreign currency borrower is aged 44 in 2008 (Table 1), and the average age at origination is 41. The WHO life expectation at age 41 in 2010 was 32 years for men and 39 for women, so we assume the household lives (i.e., has a remaining life at the time of borrowing) for $T = 35$ years. We set the mortgage rate equal to $r = 5.5\%$ based on the average interest rate on FC loans from published interest rate data by the Hungarian National Bank (MNB). We set the return on the liquid asset equal to $r - 2.5\%$ based on the average deposit rate from 2005-2012 from MNB deposit rate data.

For the initial debt distribution F_{d_0}, we target a debt payment-to-income distribution

of $\mathcal{N}(0.15, 0.1^2)$ based on the mean and variance of the pre-crisis debt payment-to-income reported in Table 1.

We model the exchange-rate as a five-state Markov process $\mathcal{E} \in \{1, 1.23, 1.32, 1.5, 1.59\}$. The values of the exchange rate are set to the average depreciation from 2008m9 to the average of 2009, 2010, 2011, and 2012 (see Figure 2b). We assume that the exchange rate follows a transition matrix of the form

$$\Pi_{\mathcal{E}} = \begin{bmatrix} 0.94 & 0.04 & 0.02 & 0.0 & 0.0 \\ 0.0 & 0.85 & 0.1 & 0.03 & 0.02 \\ 0.0 & 0.0 & 0.85 & 0.1 & 0.05 \\ 0.0 & 0.0 & 0.0 & 0.9 & 0.1 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 \end{bmatrix}.$$

Calibrating the exact household beliefs about the future likelihood and size of the depreciation is challenging, as there is limited data on the household exchange rate expectations. This transition matrix allows households to anticipate a small change of a depreciation. Pellényi and Bilek (2009) present survey evidence that 74.4% of households with FC debt were informed about currency risk, but 87.2% of households did not expect FX volatility at the 2008 level. This motivates setting a non-zero but small probability of a substantial depreciation. Moreover, it allows households to expect a risk of further depreciation, once the initial depreciation has occurred. For example, Fidrmuc et al. (2013) find that the depreciations in emerging Europe led households to revise upward their estimate of the chance of additional depreciation. Pellényi and Bilek (2009) find that in November 2008, after the initial depreciation started, FC borrowers would have been willing to pay 5% of their installment to to avoid additional exchange rate risk, suggesting they appreciated some risk of an additional depreciation. We assume further that there is no chance of an appreciation once the exchange rate has depreciated.

We set the discount factor to $\beta = 0.970$, which is similar to values typically used in macroeconomic models (de Ferra et al., 2019; Auclert et al., 2021, e.g.). We set the elasticity of intertemporal substitution to $\sigma = 1$, a standard value used for open-economy macroeconomic models with heterogeneous agents (de Ferra et al., 2019; Auclert et al., 2021, e.g.). We set the Frisch elasiticty to $\eta = 0.16$ based on the value calibrated by Gyongyosi and Verner (2024), which studies the income response to a debt relies policy in the aftermath of Hungary's FC debt crisis. This Frisch elasticity accords with other microeconomic estimates of the labor supply elasticity (Chetty et al., 2011; de Silva, 2023), but is lower than typically assumed in macroeconomic models.

D.3 Results

Model experiment. Figure D.5 plots the results of simulating a debt revaluation shock in the model of the same magnitude as in the data. Panel (a) plots the exchange rate path with the depreciation as in the data. The cumulative depreciation from 2008 to 2012 is 59%. We also consider a counterfactual without a depreciation. Note that the depreciation shock is unlikely, but not fully unexpected by households in the model.

Figure D.5b plots the evolution of debt in local currency terms. The depreciation leads

Table D.4: Calibration

	Parameter	Value	Source
Remaining life	T	35	WHO life tables
Discount factor (annual)	β	0.970	Auclert et al. (2021)
EIS	σ	1	de Ferra et al. (2019)
Frisch elasticity	η	0.16	Gyongyosi and Verner (2024)
Labor disutility	ϕ	1	Normalization: income=1
Wage process persistence	ρ	0.94	HKÉF survey estimate
Wage process volatility	σ_w	0.18	HKÉF survey estimate
Liquid asset return	r_a	0.025	MNB interest rate data
Mortgage rate	r	0.055	MNB interest rate data
Mortgage maturity	T_M	20	MNB credit registry

to a sizable debt revaluation. Average income in the economy is 1, so the debt revaluation implies an increase in debt-to-income of over 40 percentage points by 2012, relative to the counterfactual without the depreciation. Figure D.5c shows that debt payment-to-income rises from 15% to 24%.

Figure D.5d plots the effect of the depreciation on log consumption in the model. We also overlay the response in the data from Figure 4. The model quantitatively matches the gradual and persistent decline in consumption observed in the data in response to the debt revaluation shock.

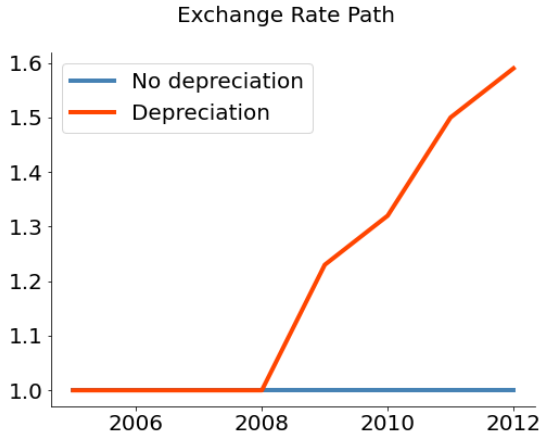
Figure D.5e plots the cumulative MPC. The cumulative MPC in the model is calculated in the same way as in the empirical analysis based on equation (5). In particular, this captures the cumulative reduction in consumption relative to the (negative) cumulative increase in debt service payments. The model captures the high MPC. The model implied MPC out of the increase in debt service is 0.970 , which sits in the middle of the estimates reported in Table 3 (0.92 to 0.99). Moreover, Figure D.5e reveals that the MPC is highest in 2009 and 2010 and then declines over time, similar to the MPC in the data. Finally, by construction given our assumption of GHH preferences, the model implies there is no effect of the debt revaluation shock on labor supply, which is similar to the small negative response in the data (see table D.5).

Table D.5: MPC and Labor Supply Response to Debt Revaluation Shock in the Model

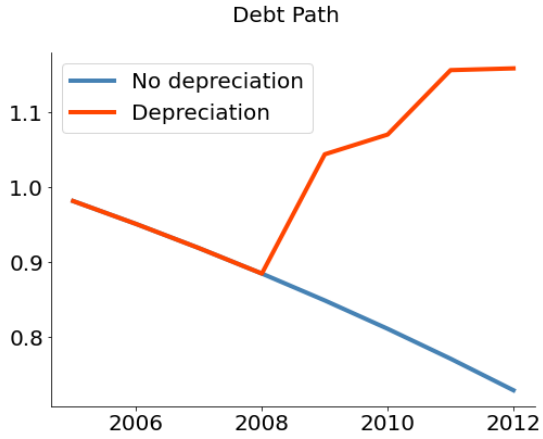
	Model	Data	Data source
Marginal propensity to consume (MPC)	0.970	0.92–0.99	Table 3, Cols. (4)–(6)
Labor supply response (in logs)	0.000	-0.009	Table 8C, Col. (1)

Figure D.5: Debt Revaluation Shock in the Model

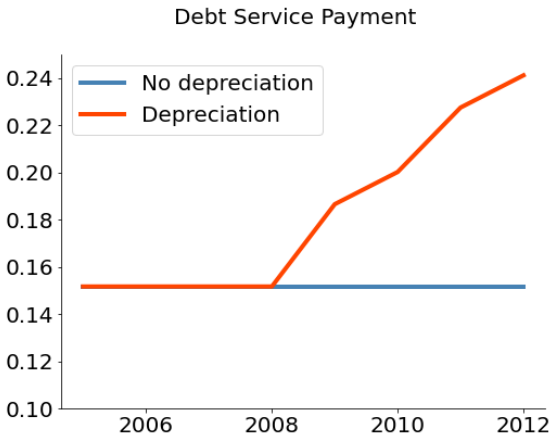
(a) Exchange rate path



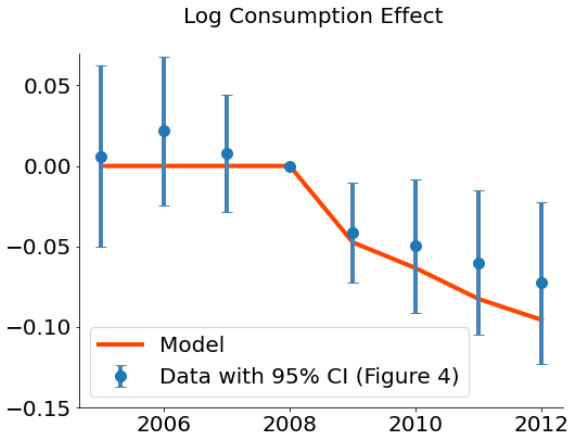
(b) Debt (in local currency)



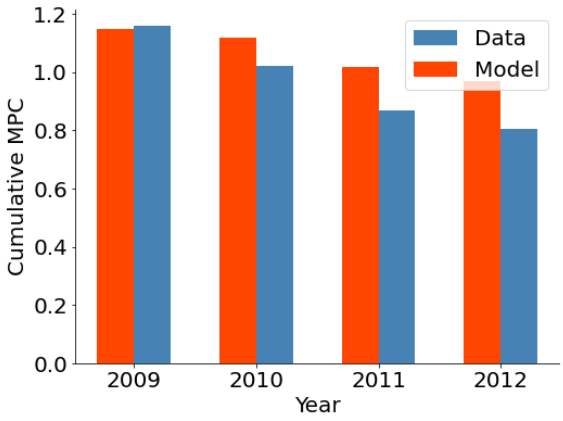
(c) Debt payment-to-income (in local currency)



(d) Effect of debt revaluation on log consumption



(e) Cumulative MPC out of debt service



E Foreign Currency Lending to Households: Other Cases

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).[40]

Australia Following the deregulation of Australian financial markets in the early 1980s, some nonfinancial firms and households (including farmers) borrowed unhedged in Swiss francs in what became known as the "Swiss loans affair." Kingston (1995) notes that FC loans were mass-marketed by banks and estimates between 2,000 and 3,000 foreign currency loans were originated during this time. When the Australian dollar more than halved in value relative to the Swiss franc in 1985 and 1986, these borrowers experienced large losses (James and Vallence, 2020). This resulted in significant litigation by borrowers against banks (Kingston, 1995).

Austria During the mid-2000s, 12% 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).

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.

[40] 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.

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).

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% 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%) 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% of mortgage loans were still denominated in dollars in 2014 (IMF, 2015).[41] The macro-financial risks from foreign currency household debt in this episode were contained, although 15% 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% 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,

[41]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).

and estimates of the number of FC mortgage holders ranged from 25,000 to 150,000.[42] 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).

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

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