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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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A data appendix is available at http://www.nber.org/data-appendix/w34234

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.

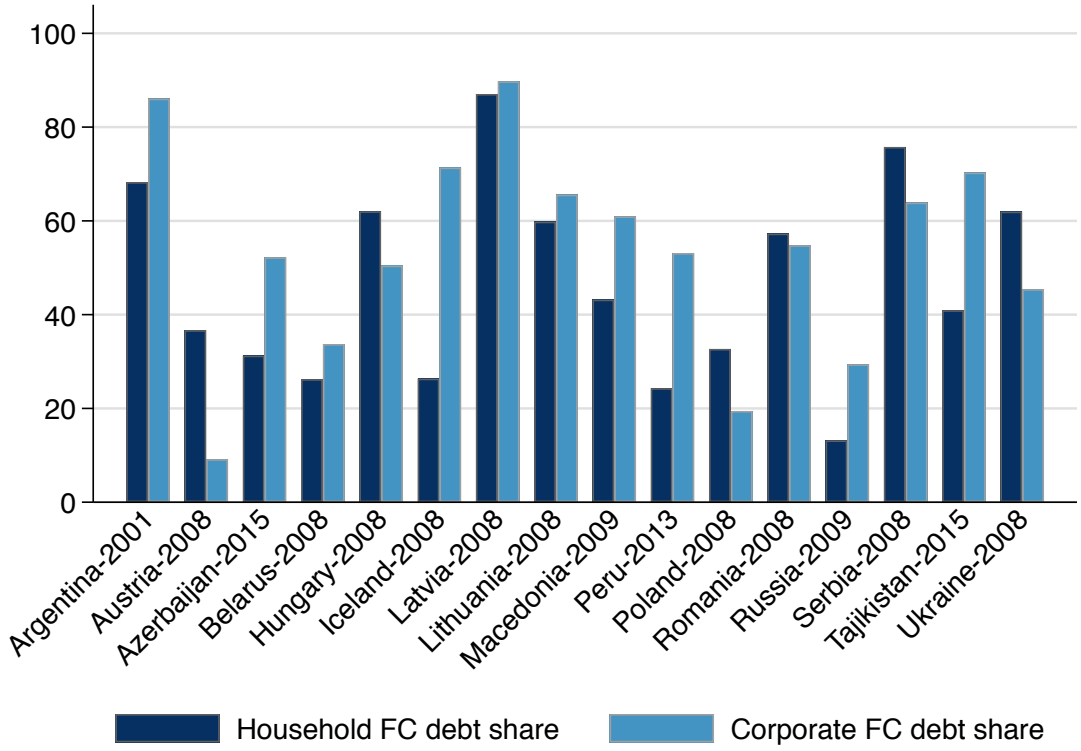
The significant pass-through of the depreciation to consumption through household balance sheets implies a sizable impact on aggregate consumption. Abstracting from general equilibrium effects, the foreign currency debt revaluation reduced annual nondurable consumption by 0.77% of GDP on average over 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.

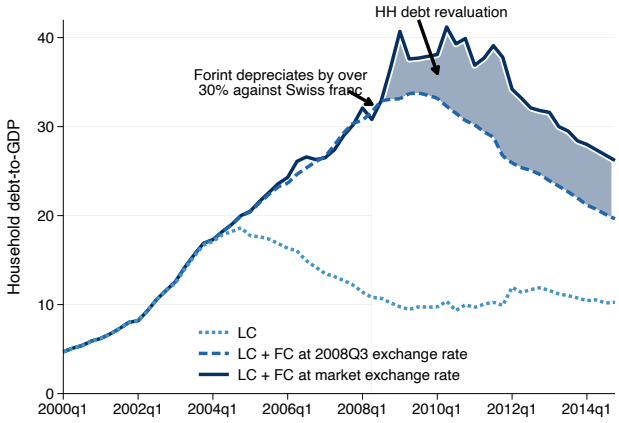
Figure 1: Household and Corporate Foreign Currency Debt Exposure during Selected Crises



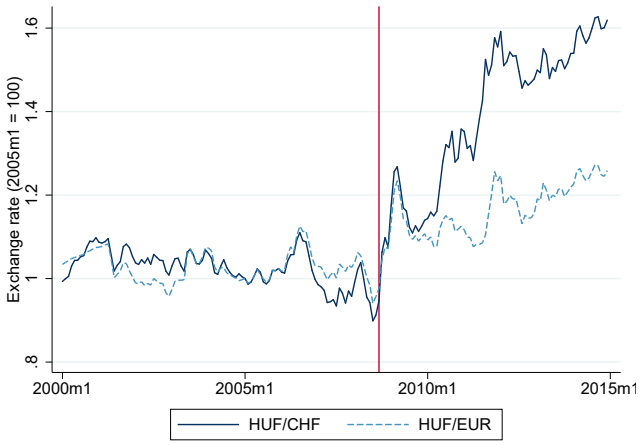
Notes: This figure plots the share of foreign currency loans in total household and non-financial corporate loans during selected episodes. The figure shows that foreign currency debt comprised an important share of household and corporate debt during these episodes. The episodes are chosen based on 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

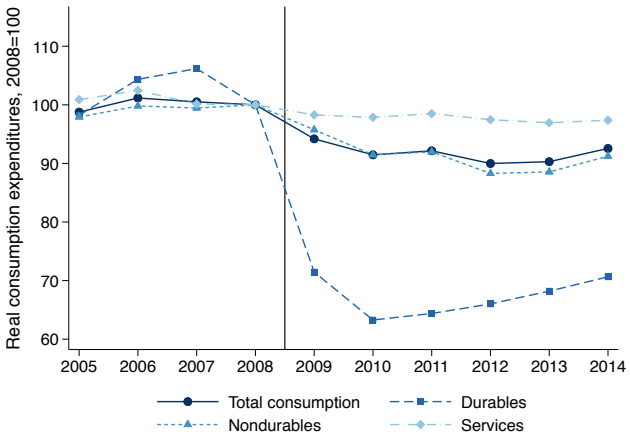
(a) Household debt revaluation



(b) Exchange rate dynamics

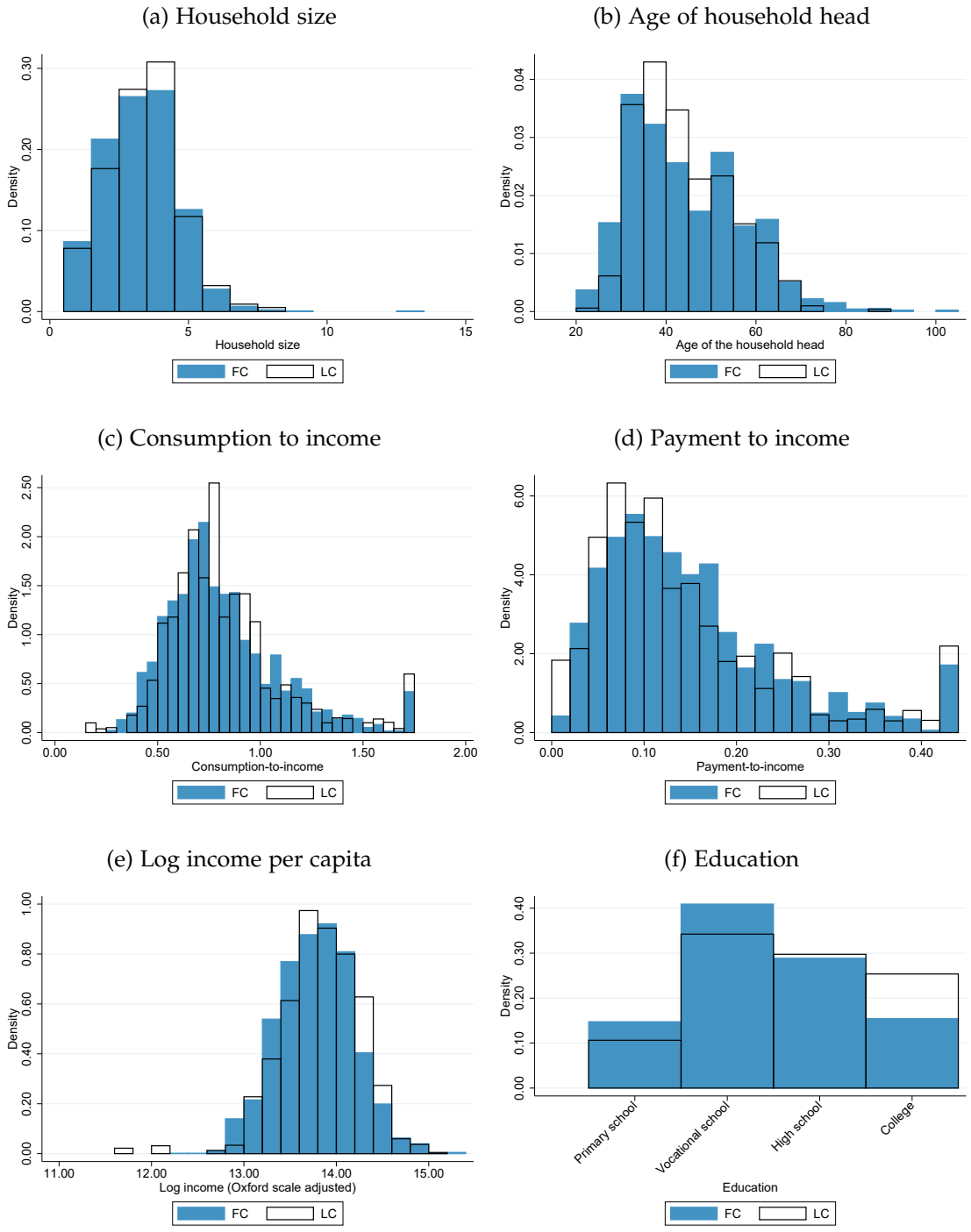


(c) Aggregate consumption dynamics



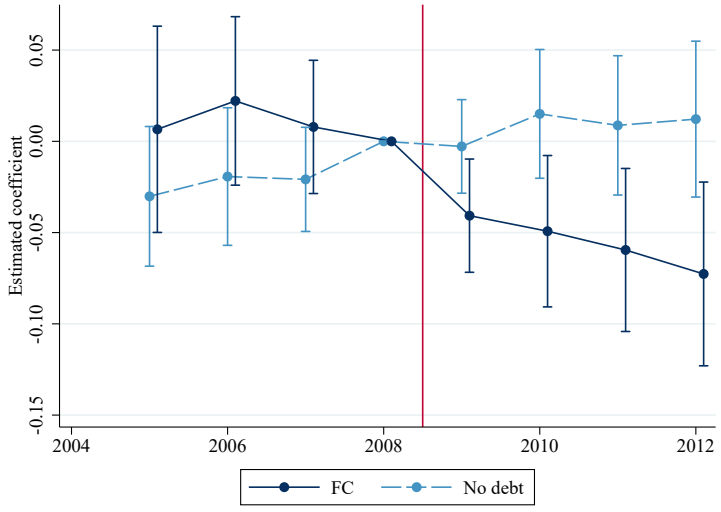
Notes: Panel (a) figure shows the evolution of household debt relative to GDP. The shaded area is the revaluation of household debt triggered by the depreciation of the Hungarian forint and appreciation of the Swiss franc. Panel (b) plots the HUF-CHF and HUF-EUR exchange rates, normalized to 100 in January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

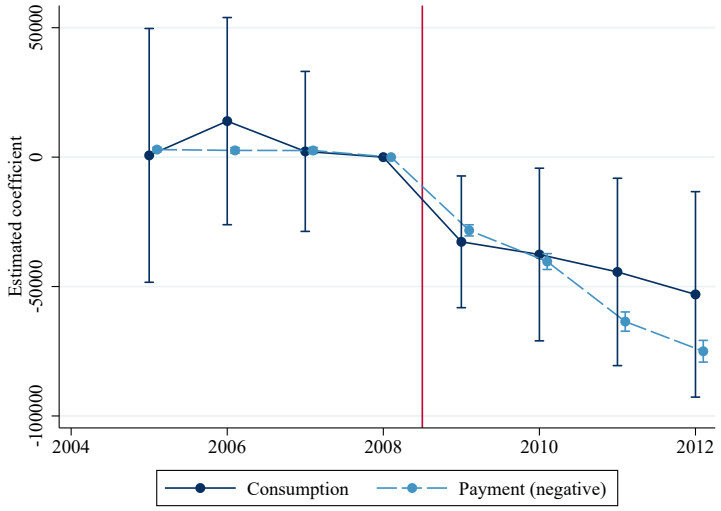
Figure 4: Dynamic Impact of Foreign Currency Debt Exposure on Consumption



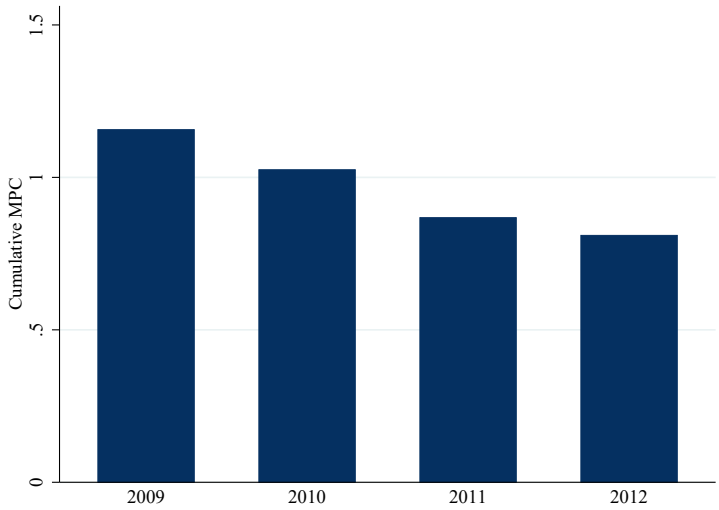
Notes: This figure plots the coefficients of interest from estimating equation (2) with log nondurable consumption as the dependent variable. The omitted category is LC debtors. The specification controls for age of the household head, gender of the household head, educational attainment of the household 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

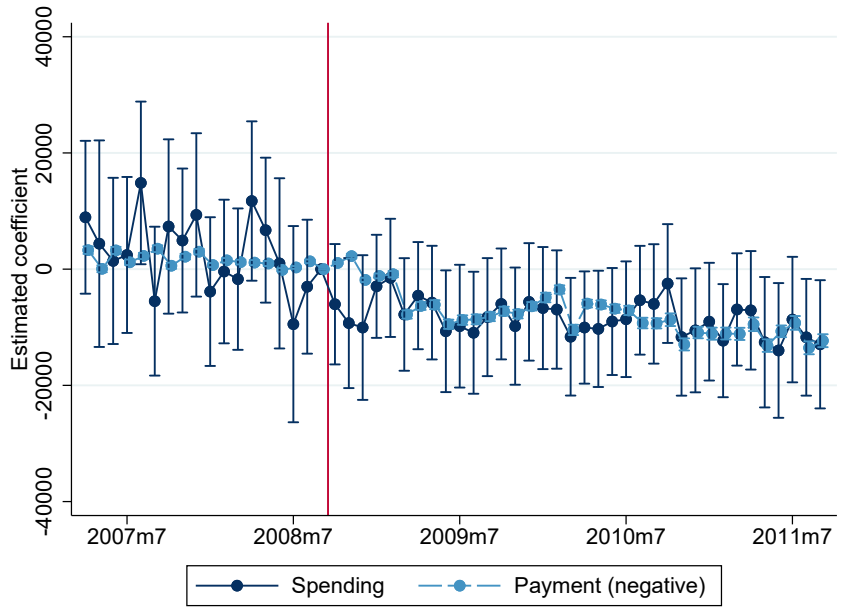


(b) Cumulative MPC out of debt service



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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