The Micro Anatomy of Macro Consumption Adjustments*

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Abstract

We study crises characterized by large adjustments of aggregate consumption through their microlevel patterns. We document the cross-sectional patterns of consumption adjustment across the income distribution and find large adjustments for top-income households, who exhibit consumption-income elasticities similar to or larger than the average. We construct a heterogeneous-agent open economy model of consumption under income fluctuations and show that the data patterns are largely consistent with theories that attribute the dynamics of aggregate consumption to changes in aggregate permanent income. We also discuss our findings' implications for theories based on the tightening of households' borrowing constraints and analyze policy implications.

Keywords: Consumption dynamics, economic crises, international borrowing, sudden stops, business cycles, heterogeneous-agent models

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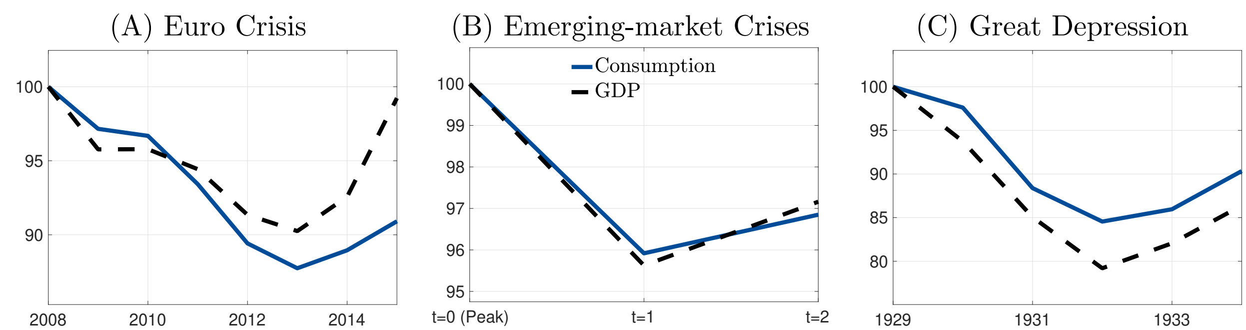
1. Introduction

The main crises in macroeconomic history tend to be characterized by large adjustments of aggregate consumption. Salient examples of these, depicted in Figure 1, include the recent Euro crisis, emerging-markets "sudden stops," and the Great Depression. These episodes attracted significant attention from macroeconomists because the large consumption adjustments relative to income appear to be in contrast to the predictions of canonical business-cycle theories. In this paper, we examine what consumption adjustments at the micro level reveal about the drivers of macro consumption adjustment. To this end, we document how different households adjust their consumption during these episodes and use this measurement to inform theories of aggregate consumption adjustment.

Figure 1: Selected Episodes of Aggregate Consumption Adjustment During Crises



Notes: This figure shows the dynamics of real aggregate private consumption and real GDP for selected crises. Panel (A) shows the average of Greece, Italy, Ireland, Portugal, and Spain for the Euro crisis that started in 2008. Data source: WDI. Panel (B) shows the average of a set of 24 emerging market recession episodes since the 1980s that occurred during episodes of "systemic sudden stop," identified by Calvo and Ottonello (2016). Data source: WDI. Panel (c) shows the average of 16 Great Depression episodes starting in 1929, identified by Barro (2006). Data source: Barro and Ursua (2008). In all episodes, consumption and income are set to 100 at the peak before the recession.

The first part of the paper uses microlevel expenditure and income data to document the cross-sectional patterns of consumption adjustment during episodes of large aggregate consumption adjustment. We focus on five crisis episodes, which have been widely studied in the macro literature, and with available microlevel data on expenditure and income: two episodes from the Euro crisis—Italy and Spain—and three emerging-market sudden stops—the 1994 Mexican "Tequila" crisis and the 2008 crises in Mexico and Peru. At the macro level, the economies in our sample exhibit excess volatility of aggregate consumption relative to output and sudden stops, which are salient traits that distinguish fluctuations in emerging markets and Southern European economies from regular U.S. business cycles. We begin by analyzing the cross-sectional patterns of consumption adjustment across the income distribution. We show that a salient feature of all episodes is the large consumption adjustment for top-income households (e.g., top 10% or 5%), who exhibit consumption-income elasticities similar to or larger than the average consumption-income elasticity in the economy and close to 1. In European crises, this occurs with flat consumption-incomes elasticities across the income distribution; in emerging-market sudden stops, it occurs with increasing consumption-income elasticities in households' income level. We also show that episodes of aggregate consumption adjustments have distributional implications. In all episodes, low-income households experience a more severe adjustment in their income. Consequently, these episodes tend to be characterized by a rise in income inequality, which in some cases is mirrored by a rise in consumption inequality.

We complement our evidence on consumption adjustments across the income distribution by characterizing cross-sectional adjustments across other households' characteristics. Our main finding is that the large consumption-income elasticities that characterize these crisis episodes are ubiquitous and observed in most household groups. First, they are observed in households with substantive levels of liquid assets, suggesting that consumption adjustments are not driven by a hand-to-mouth behavior resulting from low amounts of liquid assets. Second, they are observed in households that do not own a home, do not own a business, or have a low share of risky liquid assets, suggesting that they are not driven by wealth revaluations or by households exploiting potential returns from risky assets that arise in these episodes. Third, they are observed in households with different demographic characteristics: young, middle-aged, and old households; households with different levels of education; households engaged in all economic activities; and households in different geographic regions of the countries under analysis.

The second part of the paper uses our empirical evidence to inform leading theories of aggregate consumption adjustment. We begin by considering theories that link the dynamics of aggregate consumption to changes in permanent income (Aguiar and Gopinath, 2007; Barro, 2006). According to this view, crises involve a large contraction of households' permanent income, leading to a sharp contraction of desired consumption levels. We study the cross-sectional implications of these theories by considering a canonical heterogeneous-agents model of optimal consumption under income fluctuations and considering a crisis experiment characterized by permanent and persistent contraction in the expected path of aggregate income (consistent with evidence following crisis episodes, documented by Cerra and Saxena, 2008). Conducting the same measurement in the model-simulated data as in our empirical model, we show that the permanent-income view of crises goes a long way in explaining the micro- and macro-level patterns during these episodes. In particular, in the calibrated model for the Italian economy, the model predicts a flat pattern of consumption adjustments across the income distribution, with consumption-income elasticities close to 1 for all income deciles, consistent with the data patterns. These predictions are robust to several variants of model specifications, including accounting for the observed heterogeneous loadings on the aggregate income shock, negative revaluation of liquid assets that happened during the crisis, and the increase in the dispersion of households' idiosyncratic incomes. In the calibrated model for the Mexican economy, we also show that the permanent-income view can explain the increasing pattern of consumption-income elasticities across the income distribution observed in emerging markets once we extend the model with non-homotheticities and account for the larger share of households close to the subsistence levels of consumption observed in emerging economies relative to developed markets.

We also study the microlevel predictions of theories that attribute the dynamics of aggregate consumption during crises to a tightening in households' borrowing constraints (see, for example, Mendoza, 2005, 2010; Eggertsson and Krugman, 2012). According to this view, even transitory negative income shocks, when followed by a tightening of borrowing constraints, can preclude households' consumption smoothing and drive a large adjustment of aggregate consumption. To study this view, we enrich our heterogeneous agent model by including financial frictions in the form of borrowing constraints that vary with aggregate income. Our formulation captures both exogenous tightenings in borrowing constraints that occur during downturns or endogenous tightening of borrowing constraints through prices that are linked to aggregate income in general equilibrium. We show that theories that rely on transitory income changes and tightening of borrowing constraints tend to predict that rich households with liquid assets should be able to smooth consumption and experience a milder consumption adjustment during crises than would poor households. As a consequence, in a crisis experiment based on a tightening of borrowing constraints and designed to account for the aggregate consumption adjustment—through the sensitivity of borrowing constraints to changes in aggregate income—the model predicts a decaying pattern of elasticities across the income distribution, with richer households exhibiting more consumption smoothing, which is at odds with the patterns observed in the data.

We argue that discerning between the views of macro adjustments has relevant implications for policy. We illustrate this by analyzing the effects of stimulus policies based on fiscal transfers under the different crisis experiments. We show that the effects of these policies are significantly smaller under the permanent-income view of crises than under the credit-tightening view. Our findings suggest the difficulty stimulus policies can encounter in dealing with crises that involve macro-consumption adjustments.

Finally, it is worth stressing that our analysis abstracts from what determines the path of aggregate income during these crises. In fact, financial frictions could affect households' consumption through how they persistently affect income. As shown in previous literature, in economies with financial frictions in production, even transitory negative shocks to productivity can endogenously give rise to near-permanent effects on economic activity (see, for example, Benigno and Fornaro, 2018; Queralto, 2020; Ates and Saffie, 2020). In addition, our analysis abstracts from illiquid wealth revaluations, which could be relevant for explaining the consumption adjustment of households that hold substantive amounts of illiquid assets (see, for example, Mian, Rao and Sufi, 2013; Kaplan and Violante, 2018, and references therein).

Related Literature The starting point of our paper is the literature on international business cycles and capital flows (see, Mendoza, 1991; Backus, Kehoe and Kydland, 1992; Baxter and Crucini, 1993, for examples of earlier contributions). This literature has identified a set of countries that exhibit excess volatility of aggregate consumption relative to output, which includes emerging market economies as well as Southern European economies (e.g., Uribe and Schmitt-Grohé, 2017, and references therein). This gave rise to the development of alternative theories that can account for business cycle patterns in these economies (see, for example, Neumeyer and Perri, 2005; Aguiar and Gopinath, 2007; Mendoza, 2010; Garcia-Cicco, Pancrazi and Uribe, 2010; Chang and Fernández, 2013). We contribute to this literature by providing microlevel evidence characterizing consumption adjustments in these economies, and showing how this measurement can be used to inform leading business cycle theories.[1] In this sense, our analysis also contributes to the understanding of episodes of sudden stops, financial crises, consumption disasters, and great depressions, which have been widely studied (for example, Calvo, 1998; Kehoe and Prescott, 2007; Barro and Ursua, 2008; Reinhart and Rogoff, 2009).

Our paper is also related to the large body of literature that studies households' consumption. We build on the microlevel measurement used in this literature (see, for example, Blundell, Pistaferri and Preston 2008; Aguiar, Bils and Boar 2020, and the work surveyed in Jappelli and Pistaferri 2017).[2] Recent work has studied the heterogeneous impacts of aggregate fluctuations on U.S. households' consumption (see, for example, Parker and Vissing-Jorgensen, 2009 for an analysis of business-cycle fluctuations, and Petev, Pistaferri and Saporta, 2012; Chetty, Friedman, Hendren, Stepner *et al.*, 2020 for studies of U.S.

[1]Methodologically, our work is related to papers that use microlevel moments to inform macro theories. Examples include the early work of Bils and Klenow (2004); Aguiar and Hurst (2007); the work surveyed in Nakamura and Steinsson (2018); and, more recently, Straub (2018) and Berger, Bocola and Dovis (2019) in the context of consumption dynamics. See also the related work of Cochrane (1994); Campbell and Deaton (1989); Blundell and Preston (1998); Ludvigson (1999); and Ludvigson and Michaelides (2001), who use consumption data to inform consumption-savings theories.

[2]For a recent survey of this literature, see Kaplan and Violante (2018). Other related bodies of work are those that study consumption inequality (see, for example, Attanasio, Battistin and Ichimura, 2004; Krueger and Perri, 2006; Aguiar and Bils, 2015; Quadrini and Ríos-Rull, 2015, and references therein); consumption during the life cycle (see, for example, Huggett, 1996; Carroll, 1997; Gourinchas and Parker, 2002); and consumption responses to income transfers (see, for example, Johnson, Parker and Souleles, 2006; Parker, Souleles, Johnson and McClelland, 2013; Kueng, 2018; Lewis, Melcangi and Pilossoph, 2019).

crises). We complement this literature by documenting households' heterogeneous consumption adjustments during sudden stops and business cycles in emerging markets and Southern European economies.

Finally, our model analysis is related to an emerging literature that incorporates household heterogeneity in open-economy models.[3] Most of this literature was developed in the analysis of monetary policy (see, for example, De Ferra, Mitman and Romei, 2020; Auclert, Rognlie, Souchier and Straub, 2021; Guo, Ottonello and Perez, 2021). We complement this body of work by studying the transmission of aggregate shocks in the context of a business-cycle model with heterogeneous households. Related to our work, Hong (2020) studies the sources of business cycles in emerging economies through the lens of a heterogeneous-agent model and Villalvazo (2021) studies the asset-price implications of incroporating household heterogeneity in the analysis of sudden stops.

The rest of the paper is organized as follows. Section 2 presents the empirical analysis. Section 3 presents the theory and analyzes the evidence through the lens of the permanent-income view of crises. Section 4 studies the view of crises based on credit tightening and analyzes the macroeconomic effects of stimulus policies. Section 5 concludes.

2. Empirical Analysis

We now document households' microlevel patterns during episodes of large adjustments of aggregate consumption. Section 2.1 describes the sample of episodes, data, and measurement. Section 2.2 presents our main empirical results, characterizing consumption adjustments across the income distribution. Section 2.3 presents additional empirical analyses and discusses alternative interpretations of the results.

[3]See Kaplan and Violante (2014); Werning (2015); Guerrieri and Lorenzoni (2017), for examples of earlier contributions in the closed-economy literature.

2.1. Data Description

Sample of episodes Our empirical analysis includes five episodes of large adjustment of aggregate consumption: two from the Euro crisis and three from emerging markets that have been identified in the literature of sudden stops. The European countries included in the analysis are Italy and Spain, which have been at the epicenter of the Euro crisis. Panels (a) and (b) of Figure 2 depict the dynamics of output and consumption during these two episodes, with similar large adjustments of consumption and output. Both countries have rich microdata on households' expenditure and income, along with households' asset positions. The emerging economies included in the analysis are Mexico and Peru. These Latin American economies feature three widely studied episodes in the literature of sudden stops: the Mexican 1994 Tequila crisis and the 2008 recession in the context of the global financial crisis, which affected both Mexico and Peru. Figure 2 shows that in all episodes, aggregate consumption exhibits sharp adjustments, tracking the dynamics of output.[4] Appendix B.1 shows that the episodes in our sample exhibit persistent output declines, which are comparable to those observed during emerging-market sudden stops and financial crises, providing external validity for the dynamics observed during the crisis episodes we analyze.

Data sources For all countries, we use publicly available microlevel data on surveys of households' expenditure and income. For Italy, we use data from the *Survey on Household Income and Wealth* (SHIW), conducted by the Bank of Italy. The SHIW is representative of the Italian resident population, and contains detailed cross-sectional and panel data on households' income, consumption, wealth, and demographics. Jappelli and Pistaferri (2010) provide a detailed description of the survey design and analysis of the quality of these data. For Spain, we use data from the *Encuesta de Presupuestos Familiares* (EPF), conducted by the *Instituto Nacional de Estadistica* (INE) of Spain. The EPF is representative of the Spanish resident population and contains cross-sectional data on households' income,

[4] In these crises, Mexico experienced recessions with contractions of output above 10 p.p. from peak to trough relative to trend. Peru did not experience a contraction in output but a strong growth reversal. Before the global financial crisis, output per capita was growing at annual rates of around 6%–7%, but during the crisis growth reversed to 0%.

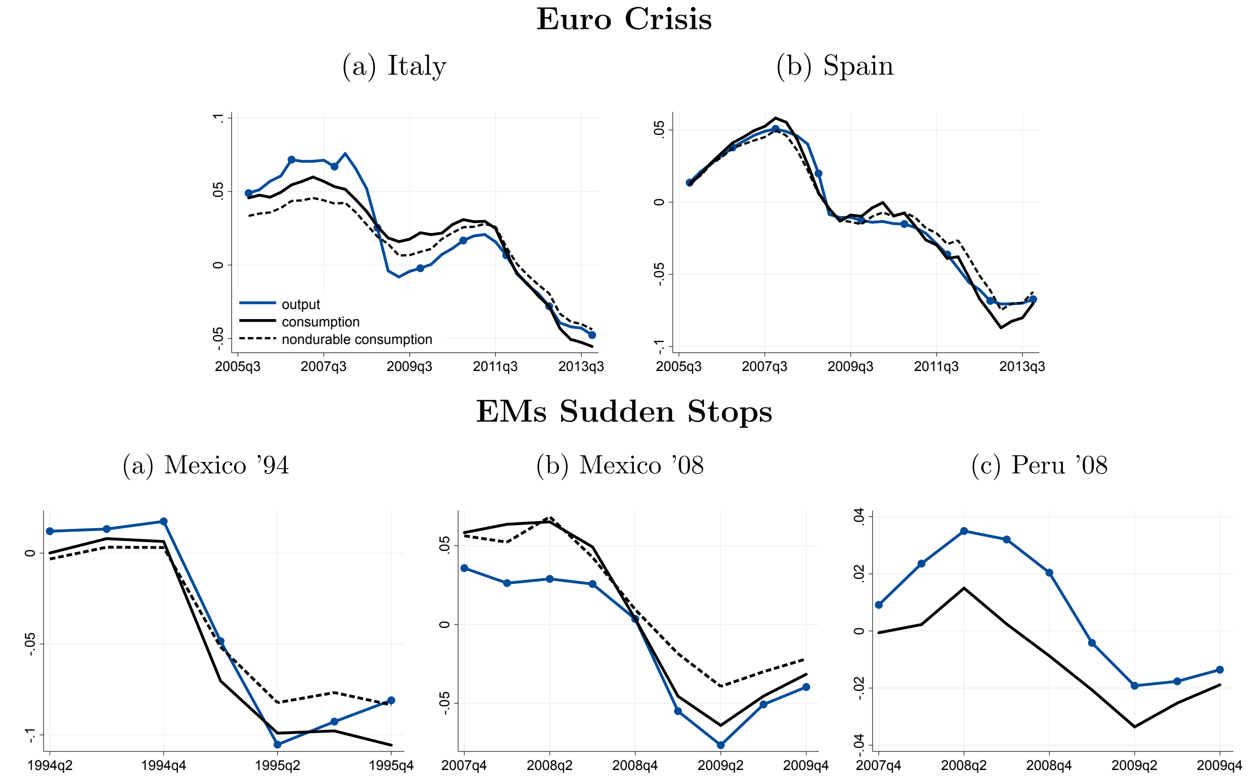
consumption, and demographics. We complement the EPF with data from the Survey of Household Finances (EFF), an official survey undertaken by the Bank of Spain that provides detailed information on assets and debt holdings, as well as income, for the Spanish resident population. The EFF is designed such that it provides a representative cross-sectional sample and a rotating panel. For Mexico, we use data from the *Encuesta Nacional de Ingresos y Gastos de los Hogares* (ENIGH), conducted by the *Instituto Nacional de Estadística y Geografa* (INEGI) of Mexico. The ENIGH is representative of the Mexican resident population, and contains cross-sectional data on households' income, consumption, and demographics. For Peru, we use data from the *Encuesta Nacional de Hogares* (ENAHO), conducted by the *Instituto Nacional de Estadstica e Informatica* (INEI) of Peru. The ENAHO is representative of the Peruvian resident population and contains cross-sectional and panel data on households' income, consumption, and demographics.

Appendix A provides a more detailed description of the data, including frequency, coverage, and our sample selection. It also compares the dynamics of per capita disposable income and total consumption from the microlevel data with their counterparts from national accounts for our period of analysis.

Measurement and descriptive statistics To measure consumption and income, we follow standard practices in the literature (e.g., Blundell *et al.*, 2008). Our baseline measure focuses on monetary nondurable consumption and monetary nonfinancial after-tax income; we analyze other categories of consumption and income in the robustness analysis. We residualize the measures of consumption and income by projecting these variables onto households' observable characteristics: number of family members, number of children in the household, household head's sex, age, and education, and geographic dummies (for details, see Appendix A.2). We also include time trends to detrend the series. Table B.2 shows that while covariates are relevant explanatory variables, most of the variation is still left unexplained, with the R^2 of regressions ranging between 10% and 40%.

To further characterize the data used in our empirical analysis, Appendix B.2 uses the data from the countries in our sample with panel data (Italy and Peru) and estimates

Figure 2: Episodes Included in the Empirical Analysis: Macro-consumption Adjustment



Notes: All variables are in per capita terms and log difference with respect to trend. Output refers to GDP, Consumption refers to private consumption expenditure; nondurable consumption includes private consumption expenditure on nondurable goods and services. Further details in Appendix A. Data sources: OECD, FRED, Bank of Italy, INE Spain, INEGI Mexico, and INEI Peru.

individual consumption-to-income elasticities, and compares them with U.S. counterparts, estimated using CEX data. In addition, we follow the method of Blundell *et al.* (2008) to provide estimates of partial consumption insurance coefficients in response to permanent and transitory idiosyncratic income shocks. The results, shown in Appendix Table B.1, indicate two main takeaways. First, individual consumption elasticities, in the range of 0.31 to 0.52 for the countries in our sample, indicate that households engage in consumption smoothing, a fact that is in line with results from the literature on household consumption (e.g., Johnson *et al.*, 2006; Parker *et al.*, 2013). Second, the consumption of households in the countries of our sample respond more to permanent shocks than to transitory ones, a finding that is also consistent with the analysis of Blundell *et al.* (2008) for the U.S. In the comparison with the U.S., it is also worth noting that the countries in our sample exhibit less consumption insurance than the U.S. (with both larger individual elasticities and partial insurance coefficients), which makes them interesting laboratories to study the role of credit conditions potentially driving aggregate consumption crises.

2.2. Consumption Adjustment Across the Income Distribution

We are interested in documenting the consumption adjustment patterns across the income distribution. For this, we compute consumption-income elasticities for different income groups during the period of aggregate adjustment. More specifically, we measure the consumption-income elasticities of households in income group j as $\hat{\varepsilon}_{cy}^{j} = \frac{\Delta_h \log \bar{c}_{j,\tau+h}}{\Delta_h \log \bar{y}_{j,\tau+h}}$, where $\bar{c}_{j,t} \equiv \frac{1}{n_{j,t}} \sum_{i \in \mathcal{I}_{j,t}} c_{i,t}$ and $\bar{y}_{j,t} \equiv \frac{1}{n_{j,t}} \sum_{i \in \mathcal{I}_{j,t}} y_{i,t}$ denote, respectively, the average (residualized) consumption and income of households in income group j in period t; $\mathcal{I}_{j,t}$ is the set of households in income group j; $n_{j,t}$ is the number of households in this group; τ is the peak of output during the episode; and h is the time interval of the output peak and trough in the episode.[5] While we focus our baseline measurement on synthetic cohorts from the income distribution—which can be applied to countries in our sample that only have repeated cross-sectional data—we show that we obtain similar results if we compute consumption-income elasticities for fixed household groups in the countries of our sample with available panel data.

[5]For each of the five episodes, we measure consumption-income elasticity in the window from peak to trough of the aggregate detrended income constructed from survey data. The resulting dates are 2006 to 2014 for the Italian Euro Crisis; 2008 to 2013 for the Spanish Euro crisis; 1994 to 1996 for the Mexican Tequila crisis; 2006 to 2010 for the Mexican global financial crisis; and 2007 to 2010 for the Peruvian global financial crisis. These dates are also aligned with the evolution of aggregate output from national accounts, with the caveat that the survey from Mexico is available biennially. We define income groups based on non-financial income. Results are robust to measuring income groups based on total income.

Table 1: Consumption-income Elasticities: Average and Top-income Households

		Euro Crisis		Emerging-market Crises			
		Italy	Spain	Mexico ‘94	Mexico ‘08	Peru	Average
a. All Households							
$\Delta \log Y$	Average	-0.17	-0.15	-0.38	-0.16	-0.08	-0.19
	Top-income	-0.13	-0.12	-0.42	-0.19	-0.11	-0.19
$\Delta \log C$	Average	-0.19	-0.14	-0.30	-0.11	-0.08	-0.16
	Top-income	-0.12	-0.11	-0.33	-0.17	-0.12	-0.17
Elasticity	Average	1.13	0.97	0.78	0.73	0.99	0.92
	Top-income	0.95	0.90	0.79	0.88	1.15	0.93
b. Households with Liquid Assets							
$\Delta \log Y$	Average	-0.12	-0.13	-0.40	-0.11	-0.27	-0.21
	Top-income	-0.14	-0.11	-0.44	-0.16	-0.37	-0.24
$\Delta \log C$	Average	-0.14	-0.13	-0.33	-0.07	-0.19	-0.17
	Top-income	-0.16	-0.15	-0.33	-0.14	-0.32	-0.22
Elasticity	Average	1.11	1.01	0.83	0.66	0.70	0.86
	Top-income	1.19	1.35	0.76	0.91	0.84	1.01
N Observations		7,067	21,802	13,122	27,038	21,170	90,199

Notes: Income (Y) is defined as monetary after-tax nonfinancial income. Consumption (C) is defined as consumption of nondurable goods and services. Both variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Top-income households are those in the highest decile of residualized income. Households with liquid assets are those with liquid assets greater than a country-specific threshold. Further details in Appendix A. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table 1 and Figure 3 provide summary statistics of the consumption-income elasticities for households in different income groups. Table 1 shows that the average elasticity across episodes ranges from 0.73 to 1.13, with a mean across episodes of 0.92 (see Panel (a) of Table 1). This implies large adjustments of consumption relative to income in these episodes, consistent with the behavior reported in the macro data. Regarding the shape of consumption-income elasticities along the income distribution, Panel (a) of Figure 3 shows a flat pattern in the Euro crisis episodes, with consumption-income elasticities close to 1 for all deciles; Panel (b) shows that in the case of emerging-market sudden stops the consumption-income elasticity is increasing in the income level. One salient feature that is common to all episodes is the large consumption-income elasticities for high-income households: In all episodes, the consumption-income elasticities at the top of income distribution are as large as those of the rest of the households in the economy. Table 1 shows that the consumption-income elasticities for households in the top decile range from 0.79 to 1.15, with a mean across episodes of 0.93 (see Panel (a) of Table 1).

Appendix Tables B.3, B.4, and B.5 show that these results are robust to several variants in the baseline measurement of the variables of interest. Panel (a) of Table B.3 extends the baseline measures of elasticities for households in the top 20% and top 5% of the income distribution. Panel (b) of Table B.3 reports the elasticities without residualizing consumption and income (as described before, our baseline measurement residualizes consumption and income from households' observable characteristics, following Blundell *et al.* (2008)). Panel (c) of Table B.3 reports our results when using the average of logs (instead of the log of averages), as stressed by Attanasio and Weber (1993). Panel (b) of Table B.4 reports elasticities when we include financial income and Panel (c) when we include durable consumption (our baseline measure excludes financial income and durable consumption). Panel (d) of Table B.4 reports elasticities when all monetary and nonmonetary components of consumption and income are included (our baseline excludes nonmonetary components). In all of these variants we find results similar to those in the baseline, with income-rich households exhibiting high consumption-income elasticities similar to the average elasticity across income deciles. It is worth mentioning that, as is usual with survey data, financial income does not include capital gains.[6] Given this data limitation, in Section 2.3 we isolate the role of valuation changes by studying the consumption responses of households that do not own substantive amounts of risky assets. In addition, in Section 3.2 we estimate the effects of valuation changes by combining our quantitative model with information on observed asset holdings and price changes.

Finally, for countries with available panel data, Table B.5 reports similar consumption-income elasticities when we compute them using fixed income groups across time, instead of using synthetic cohorts from the income distribution as in our baseline measurement.[7]

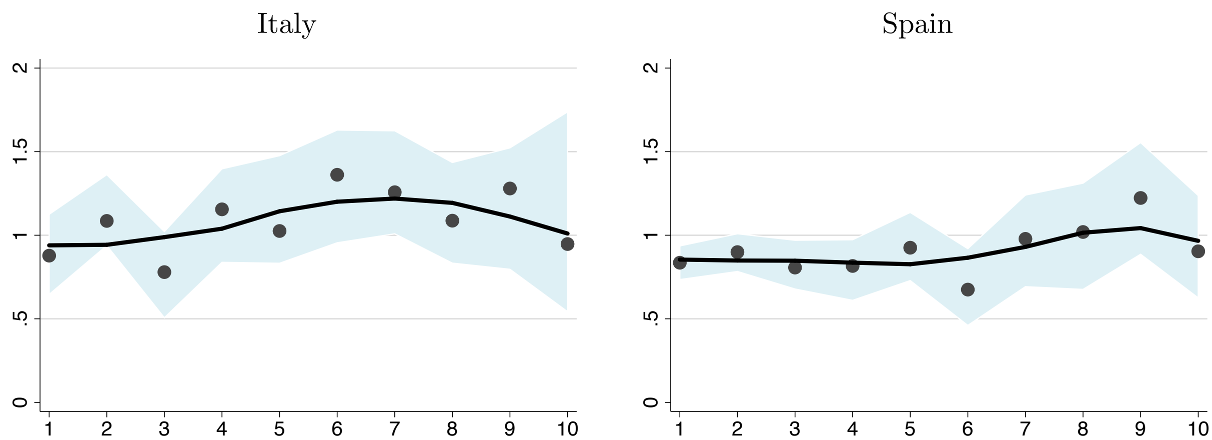
Table 1 and Appendix Figure B.3 complement the analysis of consumption-income elas-

[6] For all countries in our sample financial income includes rents and, in the cases of Italy and Mexico, it also includes interest payments on financial securities.

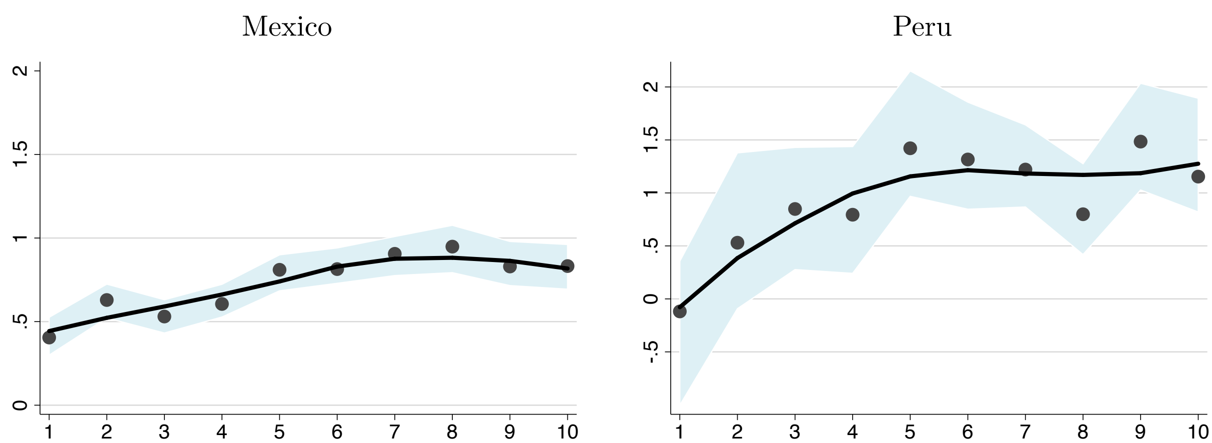
[7] Complementing this analysis, Appendix Figure B.2 provides descriptive statistics of the mobility of households across income deciles for the countries in our sample with panel data.

Figure 3: Consumption-income Elasticities Across the Income Distribution

(a) Euro Crisis



(b) Emerging-market Crises



Notes: This figure shows consumption-income elasticities for different deciles of residualized income on the horizontal axis. Income is defined as monetary after-tax nonfinancial income. Consumption is defined as consumption of nondurable goods and services. Income and consumption are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Dots correspond to observed elasticities, the solid line is the locally weighted smoothing of observed elasticities, and the shaded area shows the 90% confidence intervals of the elasticities. Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Confidence intervals are computed using 2,000 bootstrap replications. Elasticities for Mexico are the simple average of its two episodes in the sample (1994 and 2008). Further details in Appendix A. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

ticities by providing summary statistics of the adjustment of consumption and income for households in different income groups. Table 1 shows that in all crisis episodes, income and consumption exhibit an average negative adjustment. Appendix Figure B.3 shows that episodes of aggregate consumption adjustment have distributional implications across households, measured by the differential income and consumption adjustments across the income distribution. In the European episodes, lower-income households experience larger adjustments of their income and consumption, which indicates an increase in income and consumption inequality during these episodes. To further illustrate this, Appendix Figures B.6 and B.7 show that in these episodes the income variance and difference between 90th and 10th percentiles of the income distribution increase during these episodes, and so do the variance and difference between 90th and 10th percentiles of consumption. In emerging-market episodes, Appendix Figure B.3 shows that income adjustments exhibit an inverted-U shape across the income distribution and consumption adjustments exhibit a decreasing pattern, indicating that low-income households experience a milder adjustment of consumption than high-income households. Finally, Appendix Figures B.4 and B.5 depict the dynamics of income and recovery half-life indicators across the income distribution. While there is heterogeneity in the persistence of the shock, there is no clear pattern across the income distribution.

2.3. Additional Empirical Results

The role of wealth Our analysis so far has documented patterns of consumption adjustment along the income distribution. We now turn our attention to the role of wealth, and document that the large consumption adjustments during our episodes of analysis are observed for households with different wealth levels.

First, we analyze the role of low levels of liquid assets driving large consumption adjustments. In the spirit of Kaplan, Violante and Weidner (2014), we identify high-liquidity households as those with liquid assets that exceed 2 weeks of their income. For details on the method used to identify high-liquidity households in each country, see Appendix A. Panel (b) of Table 1 shows that households with liquid assets exhibit a consumption-income elasticity of 1 and close to average elasticity, including rich-income households. This suggests that our results are not driven by the behavior of the "wealthy hand-to-mouth."

Second, we study the role of wealth revaluation. Panel (a) of Table 2 shows that we observe large consumption-income elasiticity for households who do not own a home or who do not own a business. This suggests that the large consumption adjustments during these episodes are not driven by wealth changes resulting from the revaluation of illiquid assets. For the case of Italy, in which we can observe the composition of liquid wealth, Appendix Table B.6 shows that we observe large consumption-income elasticities for households with low levels of risky liquid assets, suggesting that the large consumption elasticities are not driven by wealth changes resulting from the revaluation of risky liquid assets. In addition, Appendix Tables B.6 and B.7 show that the large consumption-income elasticities also observed for high-income households that do not own a home, do not own a business, or do not hold substantive amounts of risky liquid assets suggests that our results for income-rich households are not driven by wealth revaluations. Since our exercise conditions on households that do not own a home, a business, or substantive amounts of risky liquid assets at both the peak and trough of the crisis, these results suggest that the large consumption adjustments are not driven by an increase in the returns of risky assets that stimulates savings.[8] In addition, Appendix Figure D.5 shows that the episodes in our sample are not characterized by an increase in the returns of safe liquid assets, measured by deposit rates and international safe rates.

Finally, Appendix Figure B.8 depicts consumption-income elasticities along the liquid wealth distribution for the Italian episode. These indicate a large consumption adjustment across the wealth distribution, which suggests that the large consumption adjustments are not driven by households' wealth levels. The figure also shows the consumption-income elasticities along the distribution of debt and debt-to-income, which suggests that consumption adjustments are not driven by household leverage.

[8]See Villalvazo (2021) for a study of the role of household heterogeneity in driving asset fluctuations during sudden stops.

Table 2: Consumption-income Elasticities by Household Characteristics

	Euro Crisis		Emerging-market Crises			
	Italy	Spain	Mexico '94	Mexico '08	Peru	Average
a. By Holdings of Illiquid Assets						
Firm Ownership						
Yes	1.31	1.96	0.68	0.97	1.64	1.31
No	1.10	0.93	0.79	0.59	1.03	0.89
Home Ownership						
Yes	1.29	1.04	0.79	0.71	1.02	0.97
No	0.90	0.79	0.67	0.75	1.03	0.83
b. By Other Household Characteristics						
Age Group						
≤ 35	1.07	0.78	0.72	0.71	1.80	1.01
$35 >$ and ≤ 50	1.17	0.96	0.81	0.77	1.16	0.98
> 50	1.06	1.17	0.77	0.69	0.71	0.88
Education Level						
Low	1.24	0.91	0.70	0.69	2.70	1.25
High	1.05	1.02	0.80	0.76	0.79	0.89
Geographic Location						
Large Population	1.37	0.88	0.82	0.78	0.91	0.95
Low Population	0.95	1.08	0.69	0.60	1.42	0.95
Sector						
Primary	0.75	1.64	0.73	0.70	0.97	0.96
Industry	1.08	0.87	0.75	0.68	1.02	0.88
Services	1.18	0.95	0.80	0.76	1.29	0.99
Full-Time Employee						
Yes	1.26	N/A	0.79	0.81	0.92	0.95
No	1.00	N/A	0.73	0.53	1.28	0.89
N Observations	7,067	21,802	13,122	27,038	21,170	90,199

Notes: This table shows consumption-income elasticities by ownership, age, education, geography, sector, and employment. Income is defined as monetary after-tax nonfinancial income. Consumption is defined as consumption of nondurable goods and services. Both variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Age, education, and sector are for the household head. Categories are constructed such that they are comparable across countries. Industry is composed of manufacturing and construction sectors. Full-time employees are for households with at least one paid employee working 35 or more hours per week. Further details in Appendix A. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Consumption baskets So far, our analysis has focused on aggregate measures of nondurable consumption for all households. Motivated by the fact that households with different levels of income have different consumption baskets, we analyze consumption-income elasticities for narrower and more comparable consumption baskets. In particular, Tables B.8 and B.9 report the elasticities for durable and nondurable, luxury and non-luxury, and tradable and non-tradable goods. Appendix A.2 provides a definition of each of the consumption categories. Although results indicate heterogeneous elasticities across consumption categories—e.g., luxury goods have larger elasticities than non-luxury goods—overall, we do not find consistently different elasticities between income-rich households and average elasticity.

Another dimension that heterogeneous consumption baskets introduce is the differential price dynamics these baskets may exhibit during crises, as documented by Cravino and Levchenko (2017). Table B.10 reports consumption-income elasticities using deflators specific to each income decile, and shows results similar to the baseline with high consumption-income elasticities for income-rich households.

Households characteristics Panel (b) of Table 2 reports consumption-income elasticities for households with different observable characteristics: Levels of education, age, work characteristics, and geographic location. We find high consumption-income elasticities for young, middle-aged, and old households; for households with low and high levels of education; for households working in all economic activities; for households whose head is or is not a full-time employee; and for households living in all geographic regions of the countries we analyze. This suggests that the large-consumption adjustments during these episodes are generalized across households with different observable characteristics.

The analysis above suggests that large consumption-income elasticities observed for rich income households are not driven by certain specific observable characteristics that are related to income. Still, large consumption adjustments of the income-rich could partly reflect unobserved differences in preferences (see Fuchs-Schündeln and Schündeln, 2005). For example, if income-rich households are less risk averse than the average household, this could partly explain their large consumption adjustments.

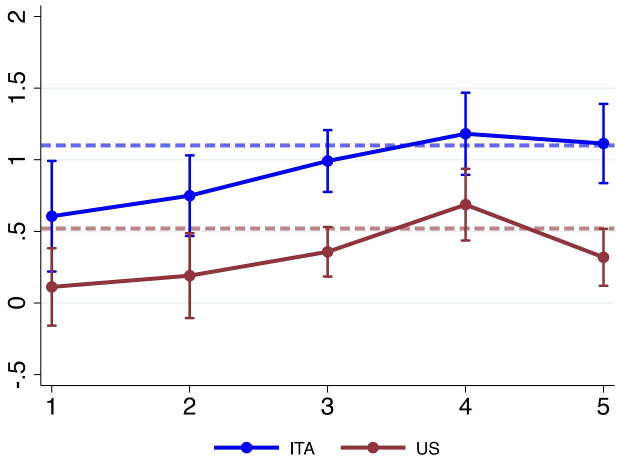
We account for the role of permanent heterogeneity by analyzing consumption responses during the crisis episodes of households that are more similar in their permanent consumption-income elasticities. We focus on the cases of Italy and Peru, which have available panel data, and estimate household-specific consumption-income elasticities over the entire samples. We then separate our sample of households into those with high and low elasticities and compute consumption-income elasticities during crisis episodes for average and top-income households. Table B.11 shows that within each group of households, the elasticities of top-income households are similar to those of the average. This suggests that the main results persist even when we compare households with similar permanent unobserved heterogeneity.

From crises to business cycles Although our empirical analysis focuses on crisis episodes, in this section we analyze the extent to which our results extend to regular business cycles. At the macro level, in all countries of our sample the volatility of consumption is close to that of income; see Uribe and Schmitt-Grohé (2017) for Italy and Spain and Aguiar and Gopinath (2007) for Mexico and Peru. At the micro level, we focus on Italy, which has available microdata for a large period of time (more than four decades). We estimate consumption-income elasticities for each income quintile for the entire time period by estimating the following specification:

$$\Delta \ln c_{q,t} = \alpha_q + \beta_q \Delta \ln y_{q,t} + \varepsilon_{q,t}$$

where $c_{q,t}, y_{q,t}$ are the average residualized nondurable consumption and income of income quintile q at year y, and Δ refers to the biennial change (given the available frequency of the data). Figure 4 reports the estimates of β_q, which are close to 1 for all income quintiles. This result suggests that in our sample, the general lack of consumption smoothing is not only a feature of large crises but also of regular business cycles.

Figure 4: Consumption-income Elasticities: Italy and U.S. Business Cycles



Notes: This figure shows consumption-income elasticities (β_q) estimated using the following specification: $\Delta \ln c_{q,t} = \alpha_q + \beta_q \Delta \ln y_{q,t} + \varepsilon_{q,t}$ for the U.S. and Italian business cycles. Vertical lines correspond to the estimates' confidence intervals at the 90% level. Dotted horizontal lines correspond to the estimates using aggregate data from National Acccounts. Details in Section 2.3. Data sources: SHIW-BI Italy and CEX-US based on Dauchy, Navarro-Sanchez and Seegert (2020).

To put this result into perspective, we also analyze the case of the U.S., which is a prototypical economy that displays consumption smoothing in the aggregate (see Kydland and Prescott, 1982, for a classic reference). We estimate the same specification using data from the CEX for the period 1980-2010.[9] Estimates for the U.S., shown in Figure 4, are lower than those for Italy, with consumption-income elasticities ranging between 0.2 and 0.6 for all income quintiles. Therefore, the results of our microlevel analysis are consistent with the traditional view, from the macro data, that the U.S. exhibits more consumption smoothing than the countries in our sample.

[9]Our treatment of the CEX follows standard practices in the literature. We refer to Dauchy *et al.* (2020) for further details.

3. Consumption Adjustments through the Lens of the Permanent-income View of Crises

In this section, we lay out a heterogeneous-agent model of a small open economy and use it to interpret the empirical evidence. We argue that large consumption adjustments at both the micro and macro level can be understood a long way through the "permanent-income view of crises", which links the dynamics of consumption to changes in permanent income (PI). We first present the theoretical framework and an analytical characterization of consumption responses for a particular case. We then conduct the quantitative analysis and argue that the predictions are robust to multiple model extensions.

3.1. Theoretical Framework

Environment We model a small open economy composed of a continuum of heterogeneous households. Each household has preferences defined over an infinite stream of consumption,

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_{it}), \tag{1}$$

where $u(\cdot)$ is increasing and concave, c_{it} denotes the consumption of household i in period t, and $\beta \in (0,1)$ is the subjective discount factor. Each period, households receive an endowment of tradable goods y_{it}, given by

$$y_{it} = h(\mu_{it}, Y_t),$$

where μ_{it} is the idiosyncratic component of endowment, Y_t is the aggregate endowment, and h is a non-decreasing function in both arguments, which is such that $\int h(\mu_{it}, Y_t)\, \mathrm{d}i = Y_t$. We assume that Y_t follows a deterministic path and that μ_{it} is a stochastic process. For the moment, we do not impose any structure to this process.

Asset markets are incomplete, and households can save and borrow in a riskless bond that pays $1 + r$ in the following period, where r is the international interest rate. The household's budget constraint is given by

$$c_{it} = y_{it} - a_{it+1} + (1+r)a_{it}, \tag{2}$$

where a_{it+1} are the household's i bond purchases in period t that pay in period $t+1$. Finally, we assume that households face a fixed debt limit:

$$a_{it+1} \geq -\kappa, \tag{3}$$

where $\kappa > 0$.

The household's problem is to choose state-contingent plans $\{c_{it}, a_{it+1}\}_{t=0}^{\infty}$ to maximize (1) subject to the budget constraint (2), the borrowing constraint (3), and the laws of motion that characterize the income stochastic process.

We now study the individual consumption responses to a permanent contraction in aggregate income. This exercise captures theories that have attributed the large response of aggregate consumption during crises to changes in permanent income, and is close to that considered in Aguiar and Gopinath (2007) to explain the excess sensitivity of consumption in emerging economies and in Barro (2006) to explain consumption disasters and asset prices.

Analytical Characterization To obtain an analytical characterization of individual consumption responses, in this section we make the following parametric assumptions.

Assumption 1. *The period utility is given by $u(c) = ac - bc^2$, where $a, b > 0$; the individual endowment is given by $h(\mu_{it}, Y_t) = \mu_{it} Y_t$; and $\beta(1+r) = 1$.*

Assuming quadratic utility gives rise to linear marginal utility and allows for an analytical characterization. The second assumption imposes a multiplicative structure of income, by which an aggregate income shock affects the income of all households by the same proportion. As we show in the next section, the main results do not rely on these assumptions. Solving for consumption by iterating forward on the Euler equation and using the budget constraint, we obtain

$$c_{it} = \underbrace{ra_{it}}_{\substack{\text{flow from} \\ \text{liquid assets}}} + \underbrace{\frac{r}{1+r}\mathbb{E}_t\left[\sum_{s=0}^{\infty}\frac{y_{it+s}}{(1+r)^s}\right]}_{\text{flow from permanent income}} - \underbrace{\frac{r}{1+r}\mathbb{E}_t\left[\sum_{s=0}^{\infty}\frac{\lambda_{it+s}}{(1+r)^s}\right]}_{\text{value of binding constraint in the future}}, \tag{4}$$

where λ_{it} is the Lagrange multiplier associated with the borrowing constraint (3) in period t. The optimal unrestricted consumption includes a flow from initial assets (first term) and a flow from the net present value of the permanent income (second term). The presence of the borrowing constraint may preclude attaining this level of consumption if there is a positive probability of a binding constraint in the future (third term).

We study a permanent aggregate income shock. In this experiment, all households suffer a proportional drop in their permanent income. Hence, the optimal response for all households is to adjust consumption by approximately the same proportion as the drop in income. We formalize this result in the following proposition, which characterizes the consumption behavior of all households when the interest rate is sufficiently small ($\lim r \to 0$).[10]

***Proposition* 1.** *Assume that in period t the economy experiences an unexpected shock to aggregate income that is expected to be permanent, i.e., $Y_{t+h} = Y_t < Y_{ss}$, where Y_{ss} is its steady-state level. Define the consumption-income elasticity of households when the interest rate is sufficiently small as $\varepsilon_{cy} \equiv \lim_{r\to 0} \frac{\partial c_{it}}{\partial y_{it}} \frac{y_{it}}{c_{it}}$. Additionally, define constrained households as those with $a_{it+1} = -\kappa$, and permanently unconstrained households as those with $\lambda_{it+s} = 0$, for all $s \geq 0$ in equation (4).*

1. *The consumption-income elasticity of permanently unconstrained households is $\varepsilon_{cy} = 1$.*

2. *The consumption-income elasticity of constrained households is $\varepsilon_{cy} = 1$ when evaluated at initial debt at the borrowing constraint.*

We include all proofs in Appendix C. The proposition states that there are unitary

[10]This condition on the interest rate allows for an analytical characterization by ensuring that the portion of households' income that comes from liquid assets is sufficiently small. Later, in Section 3.2, we relax this assumption and analyze the role of income from liquid assets and find that the quantitative results are in line with the characterization of this particular case.

consumption-income elasticities in response to a permanent aggregate income shock for constrained and unconstrained households. Constrained households do not alter their savings policies and have the same adjustment of consumption and income. Unconstrained households adjust their consumption in response to the permanent feature of the aggregate shock. This result does not rely on any assumption about the stochastic process of the idiosyncratic component of income μ_{it}. Finally, in Appendix C, we also characterize predictions for the marginal propensity to consume out of the permanent shock to aggregate income, and explain why we focus on consumption-income elasticities in the main analysis.

3.2. Quantitative Analysis

In this section we perform a quantitative analysis of the model and contrast its predictions with observed data. We first calibrate the steady state of the model to match key features of the micro data and then introduce a contraction in aggregate income in which we parameterize its persistence.[11] Our main calibration is for Italy, which is the country in our sample with the richest micro data, and we also study an alternative calibration for an emerging economy.

A period is a year. For functional forms, we pick a CRRA period utility $u(c) = c^{1-\gamma}/(1-\gamma)$ and an autoregresive idiosyncratic income in logs:

$$\ln \mu_{it} = \rho_\mu \ln \mu_{it-1} + \sigma_\mu \epsilon_{it}, \qquad \epsilon_{it} \sim N\left(-\frac{\sigma_\mu}{2(1+\rho_\mu)}, 1\right).$$

Our model then features six parameters, $\{\beta, \gamma, r, \kappa, \rho_\mu, \sigma_\mu\}$, whose values are detailed in Table 3. In the calibration, we fix the coefficient of relative risk aversion to $\gamma = 2$ and the annual risk-free rate to $r = 0.02$, which are standard values used in the literature. We normalize the steady-state value of aggregate income to 1, and estimate the parameters that drive the idiosyncratic income process, ρ_μ and σ_μ, using micro-level data, and obtain values of $\rho_\mu = 0.88$ and $\sigma_\mu = 0.26$. We then calibrate the discount factor β and the borrowing limit κ to target the average liquid-wealth-to-income ratio and the proportion of hand-to-mouth

[11] We focus on an unexpected aggregate shock that hit the same economy in the steady state. In Appendix D, we show that similar results are obtained if we analyze economies with aggregate risk.

Table 3: Model Parameters

Parameter		Value
Discount factor	β	0.90
Risk-aversion coefficient	γ	2.00
Risk-free interest rate	$r*$	0.02
Persistence of idiosyncratic process	ρ_μ	0.88
Volatility of idiosyncratic process	σ_μ	0.26
Financial constraints	κ	0.23

Notes: This table shows the parameter values of the model calibration for Italy.

(HtM) consumers. Values for these data moments are detailed in Table 4.[12] The model approximates these moments fairly well, with $\beta = 0.90$ and $\kappa = 0.23$.

We assess the model's ability to reproduce certain untargeted moments related to the distribution of liquid wealth and income. Table 4 reports a set of moments in the data, which are well approximated in the model. Appendix Figure D.4 shows the observed liquid wealth distribution and its model counterpart.

We then analyze the effects of an unexpected permanent contraction in aggregate income. Panel (a) of Figure D.2 shows the dynamics of aggregate income under this crisis experiment. The economy at $t = 0$ experiences a contraction in aggregate income of magnitude ϵ_Y, which we calibrate to match the contraction of income during the crisis.[13] The shock is expected to be permanent, with the expected evolution of aggregate income following $\log Y_t = \log Y_{t-1} + \rho_g^t \epsilon_Y$. This means that the original shock is akin to a persistent shock to the growth rate, as in Aguiar and Gopinath (2007), and we calibrate its persistence, ρ_g, to match the aggregate consumption-income elasticity documented in Section 2. Panel (a) of Figure D.1 shows how the persistence of the growth shock is identified by the aggregate consumption-income elasticity. The calibrated values are $\epsilon_Y = -0.15$ and $\rho_g = 0.24$.

It is worth highlighting that the dynamics of aggregate income in this crisis experiment are consistent with the observed ex post evolution of aggregate income during crisis episodes.

[12] Because the model features a single liquid financial asset, we target moments of the liquid wealth distribution. In the data, most of the wealth is concentrated in illiquid assets (see Appendix Table D.1).

[13] We introduce the shock as a purely unexpected one-period shock. In Appendix D, we show that we obtain similar results when we analyze a negative shock that lasts for 6 years, as in the Italian data.

Table 4: Targeted and Untargeted Moments

Variable	Model	Data
Targeted		
Wealth-to-income ratio	0.87	0.87
Hand-to-mouth share	0.23	0.23
Non-Targeted		
Gini index income	0.30	0.30
Income share bottom 75	0.49	0.56
Income share top 10	0.24	0.23
Income share top 5	0.15	0.13
Gini index wealth	0.75	0.78
Wealth share bottom 75	0.09	0.14
Wealth share top 10	0.59	0.65
Wealth share top 5	0.39	0.51

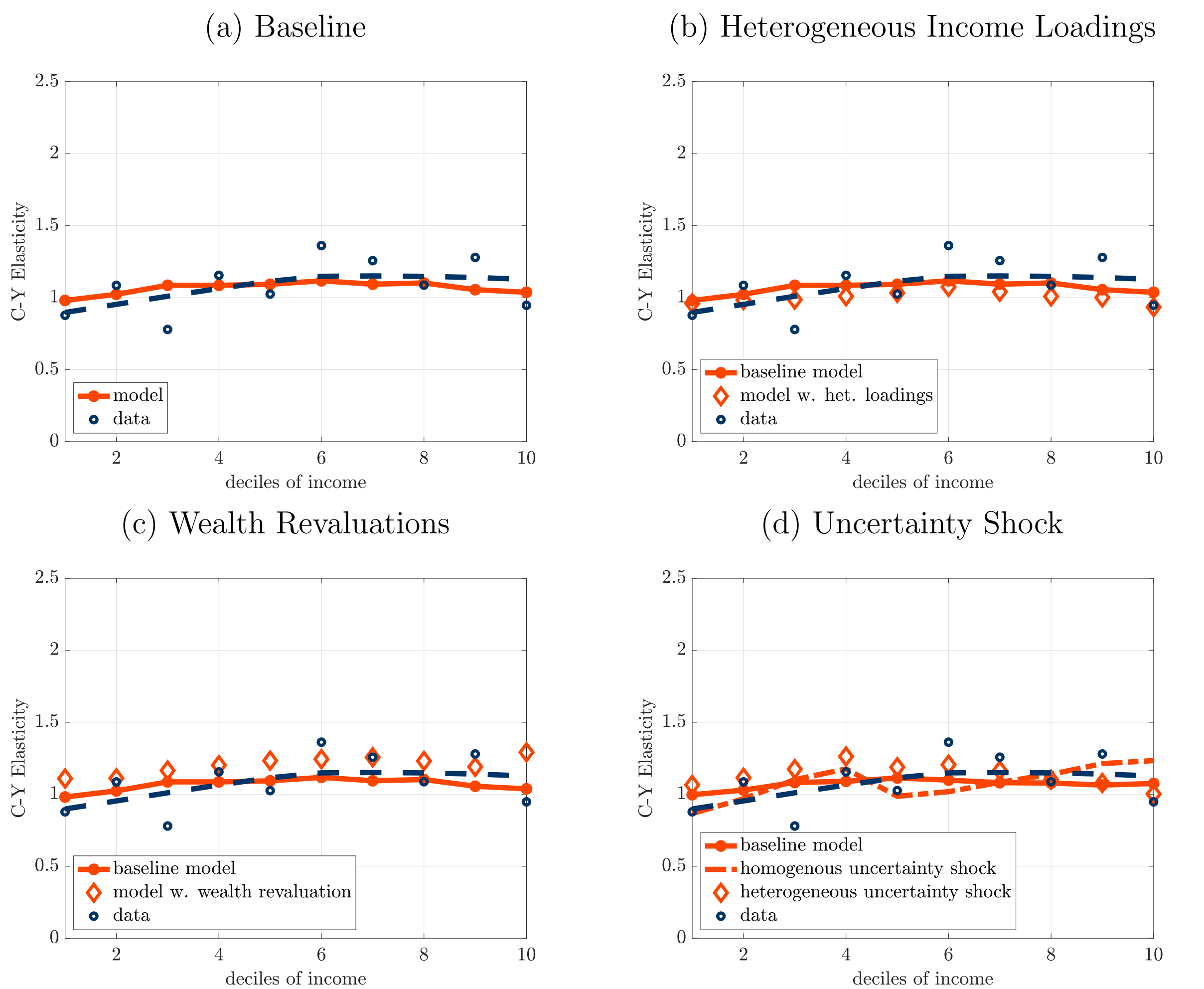
Notes: This table compares model-simulated moments with those observed in the data. Wealth-to-income ratio refers to the average ratio of liquid wealth to annual income. Hand-to-mouth share refers to the share of households with liquid assets that are less than 2 weeks of income. Data source: SHIW-BI Italy.

As we show in Appendix B.1, aggregate income in the crisis episodes of our analysis—as well as in episodes of sudden stops and financial crises—exhibits persistent declines aligned with the path assumed in the crisis experiment.

We now analyze the cross-sectional implications for the behavior of consumption in this crisis experiment and compare them with the data. We replicate the same data statistics in the model-simulated data by computing consumption-income elasticities for different deciles in the initial period of the aggregate shock.[14] Figure 5 shows that the quantitative model's predicted consumption-income elasticities are remarkably close to the data and in line with those predicted in Proposition 1. Even after relaxing the assumptions made for tractability, the elasticities in the model are close to 1 for all income deciles, because the aggregate shock affects the permanent income of all households.

[14]We provide further details on these computations in Appendix D. There we also report the model's predictions for alternative ways to compute the consumption-income elasticities, which yield results similar to those reported in this section. We also compute the marginal propensities to consume out of the aggregate permanent shock and compare these with their data counterparts.

Figure 5: Consumption-income Elasticities under the PI View Crisis Experiment



Notes: This figure shows the consumption-income elasticities for different income deciles in the Italian crisis (described in Section 2) and in the crisis experiments of the model calibrated for Italy (described in Section 3). Panel (a) shows the elasticities in the baseline model. Panel (b) shows the elasticities in the model extended to include heterogeneous income processes. Panel (c) shows the elasticities in the model extended with asset revaluations. Panel (d) shows the elasticities in the model extended with homogeneous and heterogeneous uncertainty shocks. Elasticities are computed using average income and consumption by decile, and are defined as the ratio of the log change in consumption to the log change in income. The dashed line corresponds to the locally weighted smoothed data. Further details in Appendix A. Data sources: SHIW-BI Italy.

3.3. Extensions of the PI view of crises model

In this section, we extend the permanent-income model in several key dimensions: We allow for heterogeneous income processes and introduce additional features that are common to crisis episodes by accounting for negative revaluations of liquid assets and increases in the dispersion of households' idiosyncratic income. We show that in these extensions, the predictions of the permanent-income view of crises are still aligned with the observed data. We also conduct a quantitative analysis for Mexico and show that the permanent-income view can explain the increasing pattern of consumption-income elasticities across the income distribution once we extend the model with non-homotheticicities and account for the larger share of households close to the subsistence levels of consumption observed in Mexico relative to Italy. We conclude from this analysis that the permanent-income view can go a long way toward explaining the micro- and macro-level patterns of consumption during crises.

Heterogeneous loadings to aggregate income As shown in Figure B.3, different income deciles exhibited heterogeneous drops in income during the Italian crisis episode. In this section, we assess how our main results change once we allow for heterogeneous loadings to the aggregate shock, which capture the heterogeneous impacts of the crisis on the income of different households. In particular, we now assume that households' income is given by

$$y_{it} = \mu_{it} Y_t^{\Gamma(\mu_{it})}, \tag{5}$$

where $\Gamma(\mu_{it})$ is a nonparametric function that depends on the idiosyncratic component of income. This process allows for heterogeneous impacts of the aggregate shock and also nests our baseline model when $\Gamma(\mu_{it}) = 1$ for all μ_{it}. Appendix D describes how we estimate the function $\Gamma(\mu_{it})$ using data on the income dynamics of each income decile. Consistent with our findings from Section 2.2, we estimate higher loadings on the aggregate shock for income-poor households.

Panel (b) of Figure 5 shows the cross-sectional consumption-income elasticities that result from performing the crisis experiment in this model extension. In this model, income-poor households suffer a shock that is proportionally larger than that suffered by income-rich households. The elasticities are similar to those of the baseline model. This reflects the fact that heterogeneity in the impact of the shock is not a relevant driver of the elasticities. What is a relevant driver of the elasticities is the expected dynamic path of individual income relative to the initial impact of the crisis, and this path is similar to the baseline one since the expected loadings on the aggregate shocks do not vary significantly, given the persistence of the idiosyncratic component of income.

Accounting for asset valuations A simplifying feature of our model is the availability of a riskless bond with which agents can save or borrow. While this can be a reasonable representation of a large share of households in the economy, it is less so for households at the top of the income distribution. Income-rich households invest part of their financial assets in equities and risky bonds. During economic crises the prices of these assets tend to suffer significant contractions, causing negative wealth revaluations for income-rich households. This, in turn, can potentially lead to large consumption-income elasticities among those households.

We include asset revaluations as an unexpected shock that affects households heterogeneously, depending on their portfolio of financial assets. In addition to the aggregate negative income shock, we now assume that households' wealth drops by $\Delta p_{it} a_{it}$, where we estimate Δp_{it} and a_{it} from the observed data.

We take the level of initial financial wealth from the observed data. To estimate household-specific asset price changes, we first measure the portfolio of financial assets and separate assets into bank deposits, fixed income and mutual funds, and equity. We then compute the dynamics of the prices of these three asset classes. Given that income-rich households have a larger incidence of equity in their wealth, they suffer larger wealth revaluations (see Appendix Figure D.3). We then impose the estimated wealth revaluations as an unexpected drop in assets for each household and compute the consumption-income elasticities.

Panel (c) of Figure 5 shows the model-implied consumption-income elasticities for households in different income deciles, after we incorporate asset valuations. The estimated drop in wealth valuation precipitates larger elasticities. However, the effects are quantitatively small. Only for households in the top income decile do we observe significantly larger elasticities compared with those predicted by the model without revaluation effects. The reason is that financial wealth is small relative to income. The average stock of financial wealth ranges between 50% and 120% of annual income for households in different income deciles. In addition, Appendix Figure D.4 shows that these results are similar if we conduct the revaluation exercise starting from the observed wealth distribution instead of the model's ergodic distribution.

Accounting for an increase in uncertainty These crisis episodes also bring an associated increase in idiosyncratic income uncertainty. This is reflected in a larger dispersion of individual income in the cross-section. We perform two exercises to assess the quantitative effects of the increase in uncertainty. First, we introduce a common increase in idiosyncratic income risk σ_μ that matches the increase in the cross-sectional standard deviation of idiosyncratic income.[15] Second, motivated by the heterogeneous dynamics of countercyclical risk (Guvenen, Ozkan and Song, 2014), we estimate a heterogeneous change in uncertainty that depends on the level of idiosyncratic income. We assume that the standard deviation of the innovations to idiosyncratic income is given by $\Sigma(\mu_{it})\sigma_{\mu,t}$, where $\sigma_{\mu,t}$ is the aggregate uncertainty, which follows the same dynamics as in the homogeneous shock, and $\Sigma(\mu_{it})$ is a nonparametric function that depends on the idiosyncratic component of income. Appendix D describes how we estimate the function $\Sigma(\mu_{it})$ using data on the standard deviation of log income for each income decile. We estimate higher loadings on the aggregate uncertainty shock for income-poor households.

Panel (d) of Figure 5 shows the model-implied consumption-income elasticities for households in different income deciles after we incorporate the homogeneous and heterogeneous increase in uncertainty. The elasticities are, on average, higher in both crisis experiments

[15]We assume that the uncertainty shock gradually dissipates, with an autocorrelation of 0.33, which matches the subsequent dynamics of income dispersion over time. The main quantitative results are robust to changing the persistence of the uncertainty shock.

once we introduce the uncertainty shock, because of an increase in precautionary savings. However, in both exercises, the effects are quantitatively modest and the baseline conclusions are not affected by the introduction of this shock.

Emerging markets and the role of nonhomotheticities So far, our quantitative exercises have focused on the case of Italy. In this section, we extend our analysis to Mexico. The case of emerging markets is interesting, because our empirical evidence regarding consumption-income elasticities along the income distribution, shown in Figure 3, indicate an increasing pattern, with income-rich households adjusting more than the mean. Although in principle these patterns would be challenging for the permanent-income model, we show that a simple extension that incorporates the nonhometicities can account for both the flat pattern in developed economies and the increasing pattern in emerging economies.

Our extended model with nonhomotheticities features Stone–Geary preferences given by

$$u(c_{it}) = \frac{(c_{it} - \underline{c})^{1-\gamma}}{1-\gamma},$$

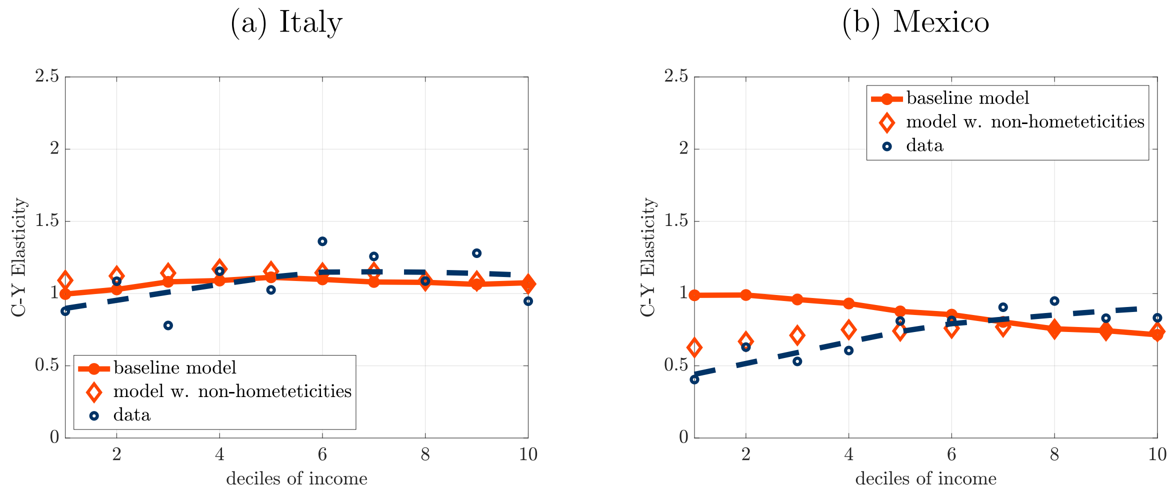
where $\underline{c}$ is a subsistence level of consumption. This source of nonhomotheticities introduces a strong desire to smooth consumption for households with close-to-subsistence levels of consumption, and therefore has a chance of explaining why low-income households can exhibit low consumption-income elasticities. Moreover, this mechanism can be particularly relevant in emerging economies, in which a large share of households are close to the subsistence level of consumption.

We perform two calibrations of the extended model with nonhomotheticities: one for Italy and the other for Mexico. In both calibrations we parameterize $\underline{c}$ to target the share of households that are close to the consumption subsistence level. We focus on a moment we can measure similarly in the model and the data. In the data, countries report a share of households with income below its indigence level. In the model, we set the value of $\underline{c}$ to the threshold of income that has the same share of households with income below that threshold.

For Italy, we recalibrate the parameters of the model, β, κ to match the same statistics in our baseline calibration. We follow the same calibration strategy for Mexico, with details presented in Appendix D.

We then reproduce the crisis experiment in the two calibrated economies with nonhomotheticities.[16] The results, shown in Figure D.7, indicate that the model-predicted elasticities are consistent with those observed in the data for both countries. Figure D.7 shows that nonhomotheticties are particularly relevant in the case of Mexico to account for the increasing patterns observed in the data. In Italy, since the share of poor households is small (1% compared with 16% in Mexico, according to our measure), the results of the model with nonhomotheticities are close to the baseline model.

Figure 6: Consumption-income Elasticities in the PI View Crisis Experiment with Nonhomotheticities



Notes: This figure shows the average consumption-income elasticities for different income deciles in the Italian and Mexican crises (described in Section 2) and in the PI crisis experiment calibrated for Italy and Mexico in the baseline model and in the model extended with nonhomothetic preferences (described in Section 3). Elasticities are computed using the average income and consumption by decile, and are defined as the ratio of the log change in consumption to the log change in income. The dashed line corresponds to the locally weighted smoothed data. Further details in Appendices A and D.2.2. Data sources: SHIW-BI Italy, ENIGH-INEGI Mexico.

Interest rate shocks Episodes of consumption adjustment are often accompanied by

[16]Following the baseline calibration strategy, in both economies we recalibrate the aggregate shocks to match the same targeted moments—namely, the aggregate consumption-income elasticity and the drop in aggregate income.

increases in interest rates. Figures D.5 and D.6 show that interest rates exhibited differential behavior in the crisis episodes analyzed in Section 2: Whereas international safe interest rates and domestic deposit rates remain roughly unchanged, sovereign spreads and domestic lending rates increased. In this section we assess the effects of including shocks to the interest rate as part of the crisis experiments.

We focus on the case of Mexico, which had increases in the borrowing interest rates, and analyze the effects of including in the crisis experiment an additional shock that increases the interest rate by the same magnitude as the one observed in the data.[17] Figure D.7 shows the consumption-income elasticities along the income distribution, which now include an increase in the interest rate, jointly with the contraction in income. The consumption-income elasticities are similar to those in the baseline model and slightly larger for income-poor households. Thus, our main conclusions hold even after accounting for the dynamics of interest rates.

Additional robustness analysis Finally, in Appendix D we analyze the robustness of the main quantitative results to other model variants. First, we consider crisis experiments that last for 6 years, which is the duration of the contraction in aggregate income during the Italian crisis. Second, we solve two alternative versions of our baseline model, which include a version of the model with aggregate risk and a closed-economy version in which the interest rate adjusts to clear the asset market. A common result of this analysis is that under all of these variants, the permanent-income view of crises has the ability to reproduce the observed micro patterns of consumption adjustments.

[17] We recreate the same interest rate dynamics as observed in the data by introducing an asymmetric interest rate shock for households that are saving and borrowing, with each interest rate changing by the same magnitude as in the data. Quantitative results do not change significantly if we introduce a symmetric interest rate shock that replicates the increase in the average between the saving and borrowing interest rates.

4. The Role of Credit Tightening and Policy Implications

In this section, we study the microlevel predictions of theories that attribute the dynamics of aggregate consumption during crises to a tightening of households' borrowing constraints in the context of a transitory contraction in aggregate income. We argue that these theories face the challenge of explaining the large consumption adjustments of income-rich households with liquid assets. We end this section by studying the implications of our theoretical analysis for the effectiveness of stimulus policies.

4.1. Credit-tightening View of Crises

Environment We study the predictions of credit-tightening theories through the lens of the baseline theoretical framework studied in Section 3.1 with a modified borrowing constraint that takes the form of

$$a_{it+1} \geq -\kappa f(Y_t), \tag{6}$$

where $f(Y_t) \geq 0$ is a non-decreasing function. The case of $f(Y_t) = 1$ corresponds to the baseline model of Section 3. The case of $f(Y_t)$ strictly increasing captures both models in which households' borrowing constraints exogenously tighten during recessions and those in which they do so endogenously through a fall in prices that affects collateral values and households' ability to borrow (e.g., Mendoza, 2005, 2010; Eggertsson and Krugman, 2012).[18]

We then use this model to study a crisis experiment that consists of a mean-reverting aggregate income shock that also tightens borrowing constraints. The model's prediction under this crisis experiment is that the consumption response of households is heterogeneous. Whereas unconstrained households are able to smooth their consumption adjustment in

[18] In Appendix D, we show that we reach similar conclusions when we consider income-dependent borrowing constraints, i.e., when f is also a function of μ_{it}. We also show how this type of constraints maps onto models with tradable and non-tradable goods in which households can pledge a fraction of the value of their income, which depends on equilibrium relative prices (as in, for example, Mendoza, 2005).

response to the income shock, households that are borrowing-constrained have to adjust their consumption because their credit access is tightened.

Analytical Characterization We first formalize this result analytically in the context of the particular case of quadratic utility analyzed in Section 3.1. Denote the elasticity of the borrowing constraint to aggregate income as $\varepsilon_{fY} \equiv f'(Y)\frac{Y}{f(Y)}$.

***Proposition* 2.** *Suppose that functional forms satisfy Assumption 3.1. Assume that in period t the economy experiences an unexpected shock to aggregate income that is expected to be mean-reverting, i.e., $Y_{t+h} = \rho^h Y_t + (1-\rho^h)Y_{ss}$, with $0 < \rho < 1$. Define the consumption-income elasticity of households, constrained and permanently unconstrained households as in Proposition 1.*

1. *The consumption-income elasticity of permanently unconstrained households has $\varepsilon_{cy} < 1$, increasing in ρ and $\varepsilon_{cy} \to 0$ when $\rho \to 0$.*
2. *The consumption-income elasticity of a constrained household i is increasing in the income elasticity of the borrowing constraint, i.e., $\varepsilon_{cy} = g_i(\varepsilon_{fY})$, with $g_i' > 0$. Additionally, when initial debt is evaluated at the borrowing constraint, $\varepsilon_{cy} > 1$.*

Additionally, if μ_{it} is mean-reverting and bounded below, households with high enough μ_{it} are permanently unconstrained.

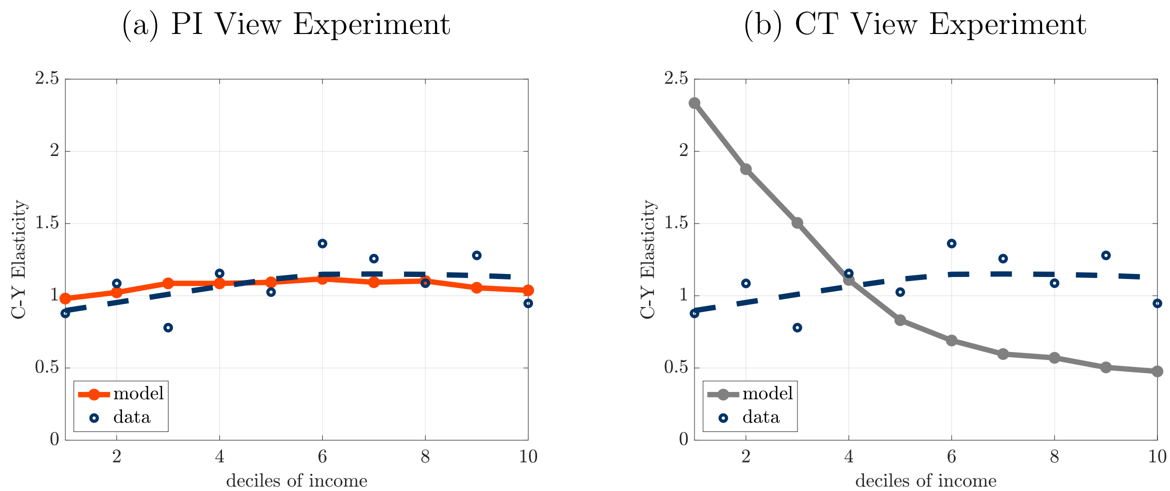
This proposition states that the consumption-income elasticity of unconstrained households is smaller and close to zero if the aggregate shock is transitory. In contrast, the consumption-income elasticity of constrained households is determined by the elasticity of the borrowing constraint to aggregate income. If access to credit tightens during a recession—in the model this would correspond to a high ε_{fY}—constrained households need to adjust their consumption by more than their drop in income. Finally, the last part of the proposition argues that income-rich households are more likely to be permanently unconstrained.

Quantitative analysis We now conduct a quantitative analysis of this credit-tightening crisis experiment for Italy and argue that it faces a challenge in accounting for the micro patterns of consumption adjustments observed in the data. To facilitate the comparison between crisis experiments, we use the same steady-state calibration described in Section 3.2 and introduce a credit-tightening crisis experiment that targets the same aggregate moments as the permanent-income crisis experiment. In the credit-tightening crisis experiment, the economy at $t = 0$ experiences the same contraction in aggregate income as in the permanent-income experiment, but unlike the latter, the shock to aggregate income is expected to be transitory and borrowing constraints are tightened as a consequence of the shock.

Appendix Figure D.2 shows the dynamics of aggregate income and the borrowing constraint under this crisis experiment. The experiment is akin to those considered in theories of sudden-stops driven by endogenous borrowing constraints on consumption (see Appendix D for more details). In particular, in this experiment the expected evolution of aggregate income follows $\log Y_t = \rho_Y^t \epsilon_Y$, with $\rho_Y = 0.9$, the average persistence of output in the economy.[19] We parameterize the evolution of the borrowing constraint by $f(Y_t) = Y_t^{\nu}$ and calibrate the sensitivity of the borrowing constraint to income, $\nu = 4$, to match the aggregate consumption-income elasticity. Panel (b) of Figure D.1 shows how the income elasticity of the borrowing constraint is identified by the aggregate consumption-income elasticity.

[19]This persistence is estimated following the standard procedure in the business-cycle literature of estimating an autoregressive process on detrended output at an annual frequency.

Figure 7: Consumption-income Elasticities in the PI View and CT View Crisis Experiments



Notes: This figure shows the consumption-income elasticities for different income deciles in the Italian crisis (described in Section 2) and in the crisis experiments of the model calibrated for Italy (described in Sections 3 and 4). Panel (a) shows the permanent-income view experiment and Panel (b) the credit-tightening view experiment. Elasticities are computed using average income and consumption by decile, and are defined as the ratio of the log change in consumption to the log change in income. The dashed line corresponds to the locally weighted smoothed data. Further details in Appendix A. Data sources: SHIW-BI Italy.

Figure 7 shows the predicted cross-sectional consumption adjustments in response to this crisis experiment and compares them with the observed consumption adjustments. In response to this crisis experiment, consumption-income elasticities are decreasing in households' income. This is because the tightening of borrowing constraints that occurs during the crisis is more likely to affect the consumption allocation of income-poor households, which were closer to the constraint before the shock. By contrast, income-rich households can smooth their consumption in response to their transitory negative income shock by using their assets or borrowing. In this sense, the credit-tightening crisis experiment faces a challenge in explaining the microlevel patterns of consumption adjustments.

In Appendix D we extend the credit-tightening crisis experiment to account for: (i) the differential loadings that households have on the aggregate income shock; (ii) the observed negative revaluations of liquid assets; and (iii) the observed increase in the dispersion of households idiosyncratic income. A common result of this analysis is that under all of these variants, the CT view of crises still has difficulty explaining why income-rich households adjust as much as the average. As shown in Appendix Figure D.16, if the tightening of borrowing constraints is accompanied by a permanent aggregate income shock, then income-rich households exhibit large consumption adjustments similar to those in the data, but the calibrated tightening of the borrowing constraint that matches the aggregate consumption-income elasticity is low.

4.2. Policy Implications

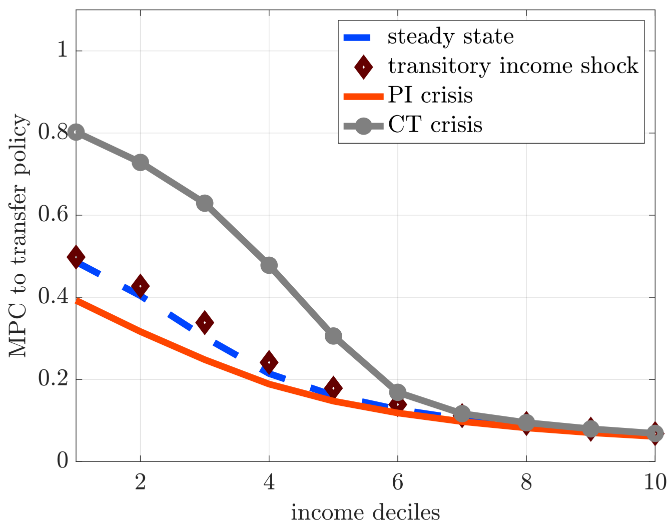
In this section we assess the effects of stimulus policies through fiscal transfers under the permanent-income and credit-tightening crisis experiments. We consider the effects of a one-time transfer T_0 to households during the crisis period, financed with external public debt, and assume that after the crisis period the government levies a flat lump-sum tax on all households to repay the interest on public debt, i.e., $T_t = -T_0 r$ for all $t > 0$. In Appendix D.4, we provide more details on agents' optimization problems under these policies and show that our results are robust to alternative transfer schemes with different degrees of progressivity.

We study the response of households' consumption to this policy under both crisis experiments. We also compare their effects with the effect under two benchmarks scenarios: one in which the economy is in the steady state and one in which it experiences a negative transitory shock to aggregate income without a tightening of borrowing constraints. Figure 8 shows the responses to the transfer for different households in the income distribution. In all scenarios, households' response is decreasing in the level of income.[20] The effectiveness of the policy is largest under the credit-tightening crisis. As shown in Table D.2, this is mostly due to the higher marginal propensity to consume of hand-to-mouth households in response to the tightening of borrowing constraints. In fact, households' responses under a transitory income shock without a tightening of borrowing constraints are comparable to those in the steady state, albeit slightly larger for hand-to-mouth households. Finally, the

[20]The decreasing patterns of consumption responses across the income distribution is consistent with the evidence in Hong (2022), and stem from the one-asset structure of the model, which implies that hand-to-mouth households are particularly concentrated at the bottom of the income distribution. We leave for future work the analysis of these policies in a two-asset model that features wealthy hand-to-mouth households.

effectiveness of the policy under the permanent-income crisis is the lowest.[21] Taken together, these exercises emphasize differences in how effective stimulus policies are dependent on the nature of crises, which highlights the relevance of distinguishing between these views of crises for policy design.

Figure 8: Policy Analysis: Consumption Responses to Fiscal Transfers



Notes: This figure shows the marginal propensity to consume (MPC) from a one-time transfer across the income distribution. The dashed blue line corresponds to MPCs when the policy is conducted in the steady state, maroon diamonds to MPCs when the policy is conducted during a temporary aggregate income shock without credit tightening, the solid orange line to MPCs when the policy is conducted during the PI view crisis experiment, and the gray line to MPCs when the policy is conducted during the CT view crisis experiment.

5. Conclusion

In this paper, we documented the microlevel patterns of consumption and income adjustments during episodes of aggregate consumption adjustments, such as the Euro crisis and emerging-market sudden stops. Our measurement serves two main roles in the study of these

[21]The consumption response in the permanent-income crisis scenario is slightly below the steady state because the permanent nature of the income shock implies that the economy moves towards a steady state with a smaller share of hand-to-mouth households in the economy. This is because the borrowing constraint as a fraction of permanent income—which is the relevant measure that determines the relevance of the borrowing constraint—is lower in the permanent-income crisis.

episodes. First, it can be directly used by researchers and policymakers interested in understanding the distributional aspects of these crises. Second, combined with heterogeneous-agent models, it can be used to inform about their macro drivers. Our analysis shows that theories that attribute the dynamics of consumption to changes in permanent income can go a long way in explaining micro- and macro-level patterns during episodes of aggregate consumption adjustment. This implies that governments interested in stimulating aggregate demand during crises might encounter challenges to do so through policies directly targeting private consumption. Instead, the importance of permanent aggregate shocks driving generalized large consumption adjustments along the income distribution highlights the relevance of designing policies that address the missing insurance of permanent income shocks or that focus on affecting the changes in permanent income that characterize these episodes.

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Appendices

A. Data Description

A.1. Macrolevel Data

In the analysis involving aggregate data, we use real per capita GDP to measure aggregate income and real per capita personal consumption expenditure (PCE) and nondurable PCE, including services, to measure aggregate consumption. The data are from the following sources:

1. *Italy and Spain.* National accounts data and annual population estimates are from the OECD. National accounts data are quarterly and seasonally adjusted. To compute per capita income and consumption, we linearly interpolate annual population.

2. *Mexico.* National accounts data are from the OECD and annual population estimates from FRED. Quarterly GDP series are available with seasonal adjustment from the OECD. We seasonally adjust quarterly PCE and nondurable PCE using the X-12 ARIMA method. To compute per capita income and consumption, we linearly interpolate annual population.

3. *Peru.* National accounts and population data are from *Instituto Nacional de Estadistica e Informatica de Peru* (INEI-Peru). National accounts data are quarterly and seasonally adjusted. To compute per capita income and consumption, we linearly interpolate annual population.

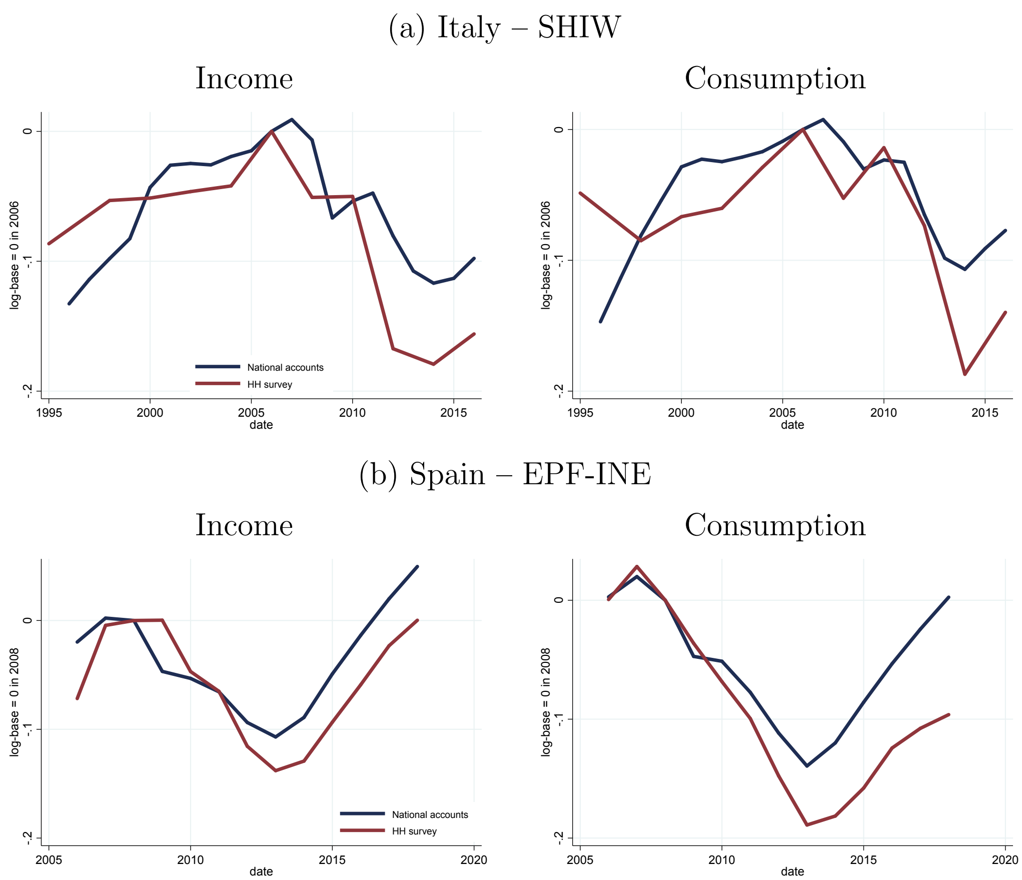
In Figure 2, we use these data to document the macro dynamics in the crisis episodes of our sample. The data are log-linearly detrended, using as the detrending period for each country the same window for which the microlevel data are available.

A.2. Microlevel Data

In this section we describe the data sources, sample selection criteria, and variable definitions for our empirical analysis in Section 2. Our sample selection criteria and income/consumption definitions are as homogeneous as possible across countries and databases, and follow standard practices in the literature (e.g., Blundell *et al.*, 2008; Aguiar *et al.*, 2020). As noted in Section 2, our empirical results are robust to several variants of the baseline measurement.

A.2.1. Italy

Figure A.1: Microlevel Data and National Accounts: Euro Economies



Notes: This figure compares microlevel data on per capita disposable income and total consumption expenditure consumption from the surveys used in the empirical analysis in Section 2 with national accounts data (GDP and PCE). Panel (a) shows the data for Italy, corresponding to the SHIW, and Panel (b) shows the data for Spain, corresponding to the EPF-INE. These sources are further described in Sections A.2.1 and A.2.2. Sources for the national accounts data are described in Section A.1. Moments from the microlevel data are computed using sample weights.

For Italy, we use data from the *Survey on Household Income and Wealth* (SHIW), conducted by the Bank of Italy for the period 1995 to 2016. In this period, the survey was conducted on a biennial basis (except for the period 1995 to 1998, with a 3-year interval).[22] Following Jappelli and

[22] One exception is the analysis of business cycles in Section 2.3, for which we use the time period 1980-2016.

Pistaferri (2010), Panel (a) of Figure A.1 compares the dynamics of per capita disposable income and total consumption from the microlevel data with their counterparts from national accounts for our period of analysis.

The original sample of the SHIW includes 86,729 units observed during the period 1995 to 2016 with available data on consumption, income, and demographics. From this, our sample selection adopts standard practices in the literature using consumption household-level data. First, we exclude observations corresponding to households in small locations (with fewer than 5,000 residents). Second, we only include in the sample units in which the household head's age is between 25 and 60 years. Third, we exclude observations with negative income or with income-to-consumption ratio in the top 0.5% or bottom 0.5% of the distribution to ensure that our results are not driven by outliers. Table A.1 details the observations dropped from each of these filters, which results in a sample of 42,278. Our analysis of consumption-income elasticities uses observations from consumption and income data during the peak and trough of the 2006-2014 crisis, involving 7,067 observations. We compute moments with these data using sample weights provided by the SHIW unless otherwise noted.

Table A.1: Sample Selection SHIW-Italy

	Obs. Dropped	Obs. in Sample
All units, 1995-2016		86,729
Excluding residents in small locations	10,752	75,977
Excluding age < 25 or > 60	32,472	43,505
Excluding outliers	1,227	42,278
Crisis episode (2006 and 2014)		7,067

Notes: This table shows the number of observations resulting from our sample selection for the SHIW in Italy. The first line, *All units*, shows the original sample of units observed during the period 1995 to 2016. The following lines detail the set of observations dropped from different filters applied to the sample and the resulting number of observations. *Outliers* refer to observations with negative income or with an income-to-consumption ratio in the top 0.5% or bottom 0.5% of the distribution. More details on these filters can be found in the text. Data source: SHIW Italy.

Our baseline measures of consumption and income used to compute consumption-income elasticities in Section 2 are, respectively, nondurable monetary consumption—defined as nondurable expenditure minus payments in kind and imputed rents from owner-occupied housing—and households' after-tax monetary nonfinancial income, defined as the sum of labor income (excluding payments in kind), self-employment income, transfers, pension benefits, and rents from real capital, minus income taxes. We also provide empirical results when all monetary and nonmonetary components of consumption and income are included. As discussed in Section 2, our empirical analysis of consumption-income elasticities follows standard practices in the consumption literature (see, for example, Blundell *et al.*, 2008; Guvenen and Smith, 2014), and residualizes consumption and income using the empirical model

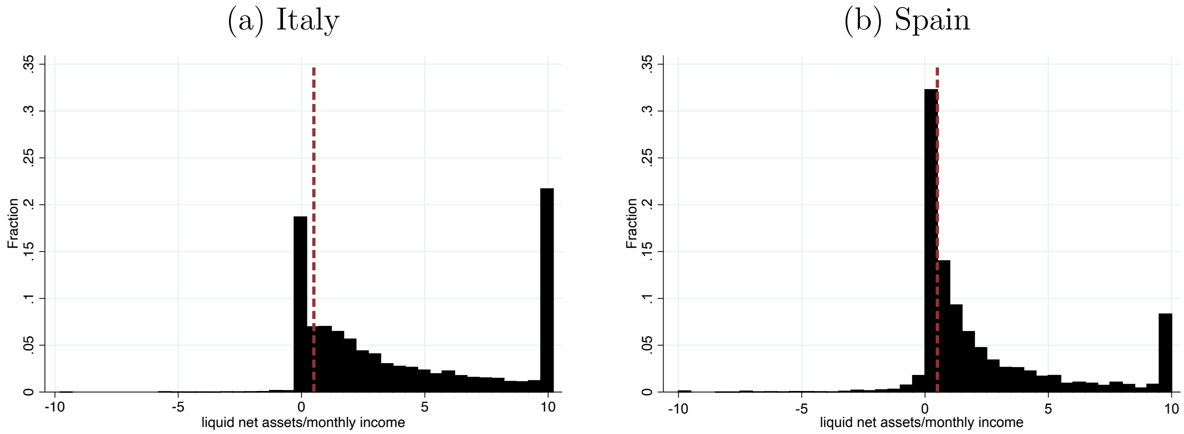
$$\ln\left(X_{it}\right) = \mathbf{Z}_{it}'\boldsymbol{\beta} + t\mathbf{D}_{it}'\boldsymbol{\gamma} + t\eta + \hat{x}_{it}, \tag{7}$$

where X_{it} is either the consumption or income of household i at period t, $\mathbf{Z}_{it}$ and $\mathbf{D}_{it}$ are vectors of household demographics, and $\hat{x}_{i,t}$ is the residualized consumption and income of household i in period t. We include in the vector $\mathbf{Z}_{it}$ a quadratic function of the household head's age, gender of the household's head, an indicator for the household head's education level (elementary school or less, middle school, high school, bachelor's degree or more), an indicator for the household's size, and controls for the household's region of residence population size. The vector $\mathbf{D}_{it}$ includes the education and gender of the household's head and is interacted with linear time trends.

Section 2.3 of our empirical analysis studies consumption-income elasticities for households with different levels of liquid assets and wealth-to-income ratio. An advantage of the Italian data for this analysis is that the SHIW contains data on consumption, income, and wealth in the same dataset. We measure liquid assets using households' net financial assets, which include deposits, bonds, stocks, mutual funds, and investment accounts. Using this definition of liquid assets, we follow Kaplan *et al.* (2014) and define hand-to-mouth households as those with assets worth less than 2 weeks of income.[23] Panel (a) of Figure A.2 shows the distribution of net liquid assets to monthly income in the Italian data.

[23] The implicit assumption is that they receive income at a monthly frequency. In addition to the liquid assets-to-income ratio, Kaplan *et al.* (2014) also consider the reported credit limit to identify hand-to-mouth households.

Figure A.2: Net Liquid Asset-to-monthly Income Distribution: Italy and Spain



Notes: This figure shows the distribution of the ratio of net liquid assets to monthly income for Italy and Spain. For Italy, net liquid assets are defined as net financial assets. Income excludes financial income. For Spain, net liquid assets includes deposits/accounts usable for payments, public equity shares, fixed-income securities, mutual funds and portfolios under management, and credit card debt. The vertical line corresponds to the HtM cutoff of 2 weeks of income (i.e., 0.5 net liquid assets-to-income). Values are truncated at -10 and 10. Data sources: SHIW-BI Italy, EFF Spain.

A.2.2. Spain

For Spain, we use data from the *Encuesta de Presupuestos Familiares* (EPF), conducted by the *Instituto Nacional de Estadistica* (INE), available at an annual frequency since 1997. We use data for the period 2006-2018, which use a consistent methodology. Panel (b) of Figure A.1 compares the dynamics of per capita disposable income and total consumption from the microlevel data with their counterparts from national accounts for our period of analysis.

The original sample of the EPF for the period 2006-2018 contains 282,848 observations. We adopt a sample selection process similar to that for Italy, excluding observations that correspond to households in small locations, units in which the household's head age is below 25 or above 60 years, and observations with negative income or with an income-to-consumption ratio in the top 0.5% or bottom 0.5% of the distribution to ensure that our results are not driven by outliers. Table A.2 details the observations dropped from each of these filters, which results in a sample of 137,703. Our analysis of consumption-income elasticities uses observations from consumption and income data during the peak and trough of the 2008-2013 crisis, involving 21,802 observations. We compute moments with these data using sample weights provided by the EPF unless otherwise noted.

Table A.2: Sample Selection EPF-Spain

	Obs. Dropped	Obs. in Sample
All units, 2006-2018		282,848
Excluding residents in small locations	69,790	213,058
Excluding age < 25 or > 60	73,047	140,011
Excluding outliers	2,308	137,703
Crisis episode (2008 and 2013)		21,802

Notes: This table shows the number of observations resulting from our sample selection for the EPF-INE in Spain. The first line, *All units*, shows the original sample of units observed during the period 2006 to 2018. The following lines detail the set of observations dropped from different filters applied to the sample and the resulting number of observations. *Outliers* refer to observations with negative income or with an income-to-consumption ratio in the top 0.5% or bottom 0.5% of the distribution. More details on these filters can be found in the text. Data source: EPF-INE Spain.

Our empirical analysis in Section 2 focuses on concepts of consumption and income similar to those we used for Italy. For the computation of nondurable consumption expenditure, we follow criteria close to Fernandez-Villaverde and Krueger (2007) by identifying a four-level goods category of nondurable goods, durable goods, and services. The nondurables included are food expenditure at home and away, drinks, tobacco and narcotics, cleaning products, medication, fuel expenditure, personal care products, and clothing. Services include entertainment services, educational services, health services, transportation services, personal care services (e.g., hairdressing), maintenance, provision of energy and water, and miscellaneous services. Durable consumption includes purchases of vehicles and their parts, housing maintenance and expansion, furniture, housing rent payments, household and medical appliances, and other durable goods (e.g., jewelry). On the income side, one caveat is that the EPF does not provide separate information on after-tax income components. The survey's definition of after-tax income includes labor and self-employed income, pensions, unemployment benefits, other social transfers, rents from property, and financial income. Finally, as in the data for Italy, we residualize consumption and income variables using empirical model (7). We include in the vector $\mathbf{Z}_{it}$ a quadratic function of household head's age, gender of the household's head, an indicator of household head's education level (at most primary, first part of secondary, second part of secondary, at least some tertiary), an indicator of household size, and controls for the household's region of residence population size. The vector $\mathbf{D}_{it}$ includes the education and gender of the household's head and is interacted with linear time trends.

For our empirical analysis of Section 2.3, we complement the EPF with data from the Survey of Household Finances (EFF), an official survey undertaken by the Bank of Spain that provides detailed information on the asset and debt holdings of the Spanish resident population. The EFF provides joint data on wealth and income, which we use to identify households that are likely to have high levels of liquid assets, as further described below. The survey starts in 2002 and has a triennial frequency. The EFF is designed such that it provides a representative cross-sectional sample and a rotating panel. In addition, it oversamples high-wealth households. On average, the sample has approximately 6,100 observations per survey wave.

Using the EFF, we define total wealth as assets minus debt, where assets are composed of financial assets, business equity, and housing and other nonfinancial assets; debt is composed of housing debt, personal loans, credit card debt, and other debt. We define liquid assets as the sum of deposits/accounts usable for payments, public equity shares, fixed-income securities, mutual funds, and portfolios under management. From the liquid assets, we subtract credit card debt to compute net liquid asset holdings. Panel (b) of Figure A.2 shows the distribution of net liquid assets relative to monthly income in Spain. We can observe that the distribution has a mass point of households with less than 2 weeks of income; these are the hand-to-mouth households under our simple criteria. We estimate the probability of being a hand-to mouth household based on the household's income and characteristics with the following empirical model:

$$\text{HtM}_{it} = f(X'_{it}\beta_t) + \varepsilon_{it}, \tag{8}$$

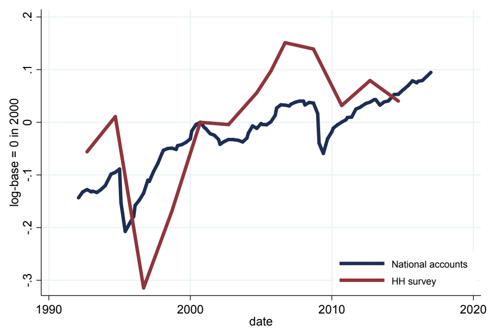
where HtM_{it} denotes a dummy variable that takes the value 1 if household i at survey in t is hand-to-mouth, and $X_{i,t}$ are characteristics of the household that can be identified in both the EFF and EPF. The characteristics of the household used for the imputations are ownership of business; house ownership; household size; household head's age, gender, and marital status; and the household's position in the income distribution. We estimate model (8) using EFF data. We then use the estimated coefficients and the income and characteristics of households in the EPF dataset to estimate the probability of a household in the EPF being hand-to-mouth. In our empirical analysis in Section 2.3 we identify high-liquidity households as those with a predicted probability smaller than 0.5 of being HtM using the estimated coefficients of model (8).

A.2.3. Mexico

Figure A.3: Microlevel Data and National Accounts: Emerging Economies

(a) Mexico – ENIGH

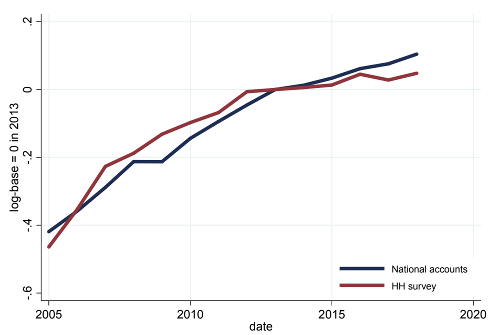
Income



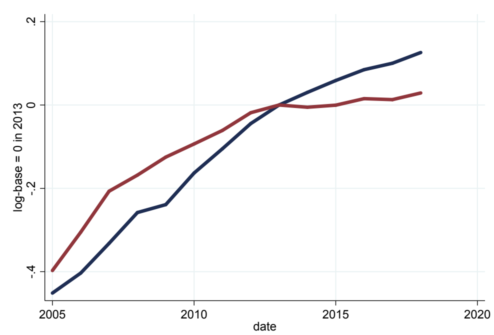
Consumption

(b) Peru – ENAHO

Income



Consumption



Notes: This figure compares the microlevel data on per capita disposable income and total consumption expenditure from the surveys used in the empirical analysis in Section 2 with national accounts data (GDP and PCE). Panel (a) shows the data for Italy, corresponding to the SHIW, and Panel (b) shows the data for Spain, corresponding to the EPF-INE. These sources are further described in Sections A.2.3 and A.2.4. Sources for national accounts data are described in Section A.1. Moments from the microlevel data are computed using sample weights.

For Mexico, we use data from the *Encuesta Nacional de Ingresos y Gastos de los Hogares* (ENIGH), conducted by the *Instituto Nacional de Estadística y Geografa* (INEGI), available at a biennial frequency with a uniform methodology from from 1992 to 2014 (except for the period 2004 to 2006, which is available annually). Panel (a) of Figure A.3 compares the dynamics of per capita disposable income and total consumption from the microlevel data with their counterparts from national accounts for our period of analysis.

The original sample of the ENIGH for the period 1992-2014 contains 204,421 observations. We adopt a sample selection criteria similar to that used for Italy and Spain, and exclude observations corresponding to households in small locations, units in which the household head's age is below 25 or above 60 years, and observations with negative income or an income-to-consumption ratio in the top 0.5% or bottom 0.5% of the distribution to ensure that our results are not driven by outliers. Table A.3 details the observations dropped from each of these filters, as well as excluding units with missing data on our variables of interest, which results in a sample of 108,194. Our analysis of consumption-income elasticities uses observations from consumption and income data during the peak and trough of crisis episodes, involving 13,122 observations for the 1992-1994 Tequila crisis and 27,038 observations for the 2006-2010 global financial crisis. We compute moments with these data using sample weights provided by the ENIGH unless otherwise noted.

Table A.3: Sample Selection ENIGH-Mexico

	Obs. Dropped	Obs. in Sample
All units, 1992-2014		204,421
Excluding units with missing data	3,611	200,810
Excluding residents in small locations	56,626	144,184
Excluding age < 25 or > 60	34,727	109,457
Excluding outliers	1,263	108,194
Crisis episode 1 (1992 and 1994)		13,122
Crisis episode 2 (2006 and 2010)		27,038

Notes: This table shows the number of observations resulting from our sample selection for the ENIGH in Mexico. The first line, *All units*, shows the original sample of units observed during the period 1992 to 2014. The following lines detail the set of observations dropped from different filters applied to the sample and the resulting number of observations. *Outliers* refer to observations with negative income or with an income-to-consumption ratio in the top 0.5% or bottom 0.5% of the distribution. More details on these filters can be found in the text. Data source: ENIGH-INEGI Mexico.

Our empirical analysis in Section 2 focuses on concepts of consumption and income similar to those we used for Italy and Spain. For the computation of nondurable consumption expenditure, we also follow criteria close to Fernandez-Villaverde and Krueger (2007). In particular, for nondurable consumption we include food expenditure at home and away, public transportation services, clothing, housing services (e.g., water and electricity supply), cleaning products, personal care products, health services, medication, fuel expenditure, communication services, cultural and entertainment services (e.g., movies), hotels and accommodation services, and other services (e.g., financial or insurance). Durable consumption includes household rent payments, household furniture, equipment and appliances, entertainment and communication equipment (e.g., cameras or phones), jewelry and art products, and vehicle and vehicle parts purchases. In Appendix B.3 we use alternative definitions such as non-tradable (proxy as services) and tradable (proxy as durable and nondurable goods), or including rental income and durable consumption. On the income side, we focus on after-tax monetary nonfinancial income. Finally, as in the data for Italy and Spain, we residualize consumption and income variables using empirical model (7). We include in the vector $\mathbf{Z}_{it}$ a quadratic function of the household head's age, gender of the household's head, indicator of the household head's education level (low: less than primary completed; medium: at most secondary completed; high: at least one year of tertiary education), an indicator for each level of the household's size, and controls for the household's region of residence population size. The vector $\mathbf{D}_{it}$ includes the education and gender of the household's head and is interacted with linear time trends.

For our empirical analysis in Section 2.3, we identify households with liquid wealth through their asset income information. In particular, we define liquid asset holders as households that receive income or have expenditures from checking and savings accounts, stocks and bonds, and long-term deposits. Also, we consider households that hold liquid assets as those that retire/make deposits or change positions in bonds, stocks, or similar financial securities.

A.2.4. Peru

For Peru, we use data from the *Encuesta Nacional de Hogares* (ENAHO), conducted by the *Instituto Nacional de Estadstica e Informatica* (INEI). The ENAHO survey is conducted annually since 1995, with its quality significantly improving after 2007.[24] Since 2007, the sample is constructed as a rotating panel of approximately 20% of the sample. The design of the survey is such that both samples, the panel and cross-sectional, are representative. Panel (b) of Figure A.3 compares the dynamics of per capita disposable income and total consumption from the microlevel data with their counterparts from national accounts for our period of analysis.

[24] In particular, from 2007 onward the survey was improved through the MECOVI program, which was developed to improve statistical measurement in Latin America. The program is directed by the World Bank, Inter-American Development Bank (IADB), and Economic Commission for Latin America and the Caribbean (CEPAL).

The original sample of the ENAHO for the period 2004-2018 contains 398,138 observations. We adopt a sample selection similar to that for Italy, Spain, and Mexico, and exclude observations corresponding to households in small locations, units in which the household head's age is below 25 or above 60 years, and observations with negative income or with an income-to-consumption ratio in the top 0.5% or bottom 0.5% of the distribution to ensure that our results are not driven by outliers. Table A.4 details the observations dropped from each of these filters, which result in a sample of 183,102 observations. Our analysis of consumption-income elasticities uses observations on consumption and income data during the peak and trough of the 2007-2010 crisis, involving 21,170 observations. We compute moments with these data using sample weights provided by the ENAHO unless otherwise noted.

Table A.4: Sample Selection ENAHO-Peru

	Obs. Dropped	Obs. in Sample
All units, 2004-2018		398,138
Excluding residents in small locations	133,580	264,558
Excluding age < 25 or > 60	78,631	185,927
Excluding outliers	2,825	183,102
Crisis episode (2007 and 2010)		21,170

Notes: This table shows the number of observations resulting from our sample selection for the ENAHO in Peru. The first line, *All units*, shows the original sample of units observed during the period 2004 to 2018. The following lines detail the set of observations dropped by different filters applied to the sample and the resulting number of observations. *Outliers* refer to observations with negative income or with an income-to-consumption ratio in the top 0.5% or bottom 0.5% of the distribution. More details on these filters can be found in the text. Data source: ENAHO Peru.

Our empirical analysis in Section 2 focuses on concepts of consumption and income similar to those we used for Italy, Spain, and Mexico, focusing on nondurable monetary consumption and after-tax monetary nonfinancial income. The nondurable measure of consumption is computed by excluding expenditure on housing rent and household equipment (this includes vehicles and appliances) from the total consumption reported by the survey. The total monetary measure of income includes transfers (private and public), excludes taxes and rents from property, and includes labor and self-employed income. Thus, to construct the income measure we subtract from after-tax total monetary income the income received from rents from property. To compute the after-tax rents, we assume the same tax rate as the one implied by the after-tax and before-tax ratio of income reported by the survey. Finally, as in the data for the rest of the countries, we residualize consumption and income variables using empirical model (7). We include in the vector $\mathbf{Z}_{it}$ a quadratic function of household head's age, gender of the household's head, an indicator of household head's education level (less than primary completed; at most secondary completed; at least 1 year of tertiary education), an indicator of the household's size, and controls for the household's region of residence population size. The vector $\mathbf{D}_{it}$ includes the education and gender of the household's head and is interacted with linear time trends.

For our empirical analysis in Section 2.3, as in the case of Mexico, we identify households with liquid wealth through their asset income information. In particular, we define liquid asset holders as households that receive interest payments from bank deposits and income from a fixed income or dividends from direct holdings of stocks.

B. Additional Empirical Results

B.1. Aggregate Income Dynamics During Crisis Episodes

In this appendix we further characterize the dynamics of aggregate income during the crisis episodes included in our sample. We do so by estimating the empirical model used in Cerra and Saxena (2008) to characterize output dynamics during financial crises. In particular, we estimate the empirical model:

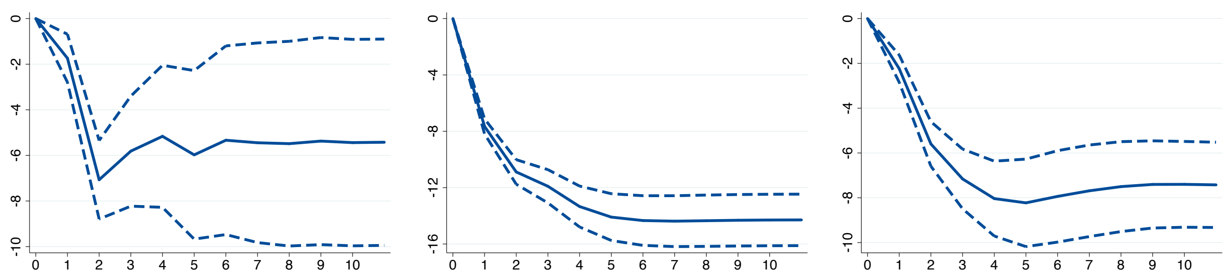
$$g_{it} = a_i + \sum_{j=1}^{4} \beta_j g_{i,t-j} + \sum_{s=0}^{4} \delta_s D_{i,t-s} + \varepsilon_{it}$$

where g_{it} is the percentage change in country's i real GDP in year t and D_{it} is a dummy variable indicating a crisis episode.

Panel (a) shows that our episodes of analysis are characterized by persistent declines in aggregate income. To analyze the external validity of the output dynamics observed in these episodes, we estimate a similar empirical model for a broader set of emerging-market sudden stop episodes, using the sample of episodes identified in Calvo, Izquierdo and Talvi (2006) for 32 emerging markets since the 1980s. The results from this exercise, depicted in Panel (b), show that output dynamics during sudden stop episodes resemble that of our episodes of analysis, providing external validity for the results from our sample of episodes. Finally, Panel (c) reproduces the results from Cerra and Saxena (2008), which shows that the dynamics observed during our episodes of analysis and emerging-market sudden stops are also similar to that of financial crisis episodes.

Figure B.1: Output Dynamics following Crisis Episodes

(a) Episodes in Sample of Analysis (b) Sudden Stops (c) Financial Crises



Notes: Panel (a) "Episodes in Sample of Analysis" estimates the impact on real GDP for Italy, Spain, Mexico, and Peru for 1988-2019 for the five crisis episodes. Panel (b) "Sudden Stops" is for the 32 emerging markets in Calvo *et al.* (2006) for 1980-2004 where the crisis year is the year following the peak in output. Panel (c) "Financial Crises" replicates Cerra and Saxena (2008) Figure 4 for the impact on real GDP from banking crises for their full sample of countries for 1974-2001. This estimation uses the following model: $g_{it} = a_i + \sum_{j=1}^{4} \beta_j g_{i,t-j} + \sum_{s=0}^{4} \delta_s D_{i,t-s} + \varepsilon_{it}$ for country i in year t where a is a country fixed effect, g is the percentage change in real GDP, and D is a dummy variable indicating the first year of a crisis. The impulse response shows the estimated percentage point impact on real GDP from a crisis using the estimated coefficients. The dashed lines show a one standard deviation error band computed from 1,000 Monte Carlo simulations using the variance-covariance matrix of the estimated coefficients and their asymptotically normal distribution. Data sources: Caprio and Klingebiel (2003), Calvo, Izquierdo and Talvi (2006), Cerra and Saxena (2008), Mueller (2008), World Bank WDI.

B.2. Estimates of Consumption Partial Insurance

In this appendix we apply the procedure of Blundell *et al.* (2008) to the data on Italy and Peru to estimate the response of household consumption to idiosyncratic permanent and transitory income shocks. We assume that the household's residualized income is $y_{i,t} = \eta_{i,t} + \nu_{i,t}$, where $\eta_{i,t} = \eta_{i,t} + \zeta_{i,t}$ is a random walk process with $\zeta_{i,t} \sim^{iid} (0, \sigma_\zeta^2)$ and $\nu_{i,t} = \varepsilon_t + \theta \varepsilon_{t-1}$ is an MA(1) process with $\varepsilon_{i,t} \sim^{iid} (0, \sigma_\varepsilon^2)$. Then income growth is

$$\mathit{\Delta} y_{i,t} = \zeta_{i,t} + \varepsilon_{i,t} + (\theta - 1)\varepsilon_{i,t-1} - \theta \varepsilon_{i,t-2}, \tag{9}$$

and we postulate that consumption growth is

$$\Delta c_{i,t} = \phi \zeta_{i,t} + \varphi \varepsilon_{i,t} + \epsilon_{i,t}, \tag{10}$$

with $\epsilon_{i,t} \sim^{iid} (0, \sigma_\epsilon^2)$ non-income-related changes in consumption, ϕ the permanent shock consumption insurance coefficient, and φ the temporary shock consumption insurance coefficient.

In order to estimate the variance of the income shocks and the partial insurance coefficients, we use a minimum distance estimation between the observed variance and covariance matrices of income and consumption growth and their analytical expressions derived from equations (10) and (9). For the data moments we use our estimations of the residual income and consumption. For the analytical expressions we use the annual growth moments for Peru and the biennial moments for Italy.[25] The sample periods used for our estimation are 2007-2018 for Peru and 1998-2016 for Italy.

Table B.1: Individual Elasticities and Partial Insurance Coefficients

		U.S.	Italy	Peru
Individual Elasticity		0.16	0.52	0.31
Blundell et al. (2008) coefficients				
Persistent shocks	ϕ	0.642	0.662	0.786
Transitory shocks	φ	0.053	0.297	0.204

Notes: Income is defined as monetary after-tax nonfinancial income. Consumption is defined as consumption of nondurable goods and services. Both variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Individual elasticities are estimated with panel data and an individual-level regression of the log change in consumption on the log change in income and a constant. Persistent and transitory shocks coefficient estimates for the U.S. are from Blundell *et al.* (2008). Estimates for Italy and Peru are our own computations following the method of Blundell *et al.* (2008), further described in Section B.2. Data source: SHIW for Italy and ENAHO for Peru.

Table B.1 shows the results. We find that the permanent shocks partial insurance coefficient is

[25] In Italy we have annual flows of income and consumption, but the surveys have a biennial frequency. Thus we derive the analytical moments using two-period differences.

large (i.e., more than 0.5) and larger than those of transitory shocks for all countries. The transitory shocks partial insurance estimate is close to 0 for the U.S. but around 0.2-0.3 for Peru and Italy.

B.3. Additional Figures and Tables

Table B.2: Standard deviation of income and consumption by residualization

	Euro Crisis				Emerging-market Crises			
	Italy		Spain		Mexico		Peru	
	Y	C	Y	C	Y	C	Y	C
Non-residualized	0.68	0.58	0.62	0.65	0.83	0.72	0.92	0.71
Residualized by:								
Age (quadratic)	0.68	0.58	0.62	0.64	0.82	0.71	0.91	0.70
+ Sex	0.68	0.57	0.61	0.63	0.82	0.70	0.90	0.70
+ Education	0.63	0.55	0.57	0.61	0.73	0.64	0.84	0.65
+ Household size	.	.	0.52	0.53	0.71	0.61	0.81	0.59
+ Region	0.62	0.55	0.52	0.53	0.70	0.60	0.80	0.57
+ Sex × year	0.62	0.55	0.51	0.52	0.70	0.60	0.79	0.56
+ Education × year	0.62	0.55	0.51	0.52	0.69	0.60	0.79	0.56
Residualized (Baseline model)	0.62	0.55	0.51	0.52	0.69	0.60	0.78	0.56
R^2 (Baseline model)	0.17	0.10	0.32	0.35	0.30	0.31	0.29	0.40

Notes: Non-residualized are the standard deviation of the log of Income (Y) and Consumption (C) deflated by the CPI. Rows 2 and below are for residualized log of Income and Consumption by successively adding the covariates shown from households' observable characteristics and time trends. Residualized (Baseline model) is the full empirical model after also adding time trends and R^2 is for this regression. For Italy, income and consumption are divided by household size, other countries are total household income and consumption. Regressions use sample weights. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table B.3: Consumption-income Elasticities: Alternative Measures

		Euro Crisis		Emerging-market Crises			
		Italy	Spain	Mexico ‘94	Mexico ‘08	Peru	Average
a. Baseline							
	Average	-0.17	-0.15	-0.38	-0.16	-0.08	-0.19
$\Delta \log Y$	Top 20-income	-0.13	-0.11	-0.41	-0.17	-0.10	-0.18
	Top 10-income	-0.13	-0.12	-0.42	-0.19	-0.11	-0.19
	Top 5-income	-0.13	-0.14	-0.43	-0.22	-0.12	-0.21
	Average	-0.19	-0.14	-0.30	-0.11	-0.08	-0.16
$\Delta \log C$	Top 20-income	-0.15	-0.12	-0.32	-0.14	-0.12	-0.17
	Top 10-income	-0.12	-0.11	-0.33	-0.17	-0.12	-0.17
	Top 5-income	-0.10	-0.12	-0.32	-0.19	-0.13	-0.17
	Average	1.13	0.97	0.78	0.73	0.99	0.92
Elasticity	Top 20-income	1.10	1.02	0.79	0.86	1.24	1.00
	Top 10-income	0.95	0.90	0.79	0.88	1.15	0.93
	Top 5-income	0.80	0.85	0.75	0.87	1.07	0.87
b. Non-residualized							
	Average	-0.14	-0.18	-0.40	-0.15	-0.16	-0.20
$\Delta \log Y$	Top 20-income	-0.12	-0.12	-0.44	-0.18	-0.22	-0.22
	Top 10-income	-0.11	-0.14	-0.46	-0.20	-0.24	-0.23
	Top 5-income	-0.10	-0.15	-0.49	-0.21	-0.27	-0.24
	Average	-0.15	-0.21	-0.31	-0.07	-0.13	-0.17
$\Delta \log C$	Top 20-income	-0.10	-0.20	-0.37	-0.12	-0.21	-0.20
	Top 10-income	-0.10	-0.21	-0.40	-0.13	-0.23	-0.21
	Top 5-income	-0.07	-0.25	-0.41	-0.13	-0.23	-0.22
	Average	1.08	1.19	0.77	0.48	0.80	0.87
Elasticity	Top 20-income	0.85	1.58	0.85	0.64	0.94	0.97
	Top 10-income	0.89	1.54	0.87	0.64	0.95	0.98
	Top 5-income	0.77	1.69	0.83	0.61	0.84	0.95
c. Average of logs							
	Average	-0.19	-0.18	-0.37	-0.17	-0.07	-0.19
$\Delta \log Y$	Top 20-income	-0.13	-0.10	-0.40	-0.14	-0.08	-0.17
	Top 10-income	-0.11	-0.11	-0.41	-0.17	-0.08	-0.18
	Top 5-income	-0.09	-0.12	-0.42	-0.19	-0.09	-0.18
	Average	-0.20	-0.16	-0.28	-0.12	-0.06	-0.16
$\Delta \log C$	Top 20-income	-0.17	-0.09	-0.33	-0.15	-0.11	-0.17
	Top 10-income	-0.13	-0.08	-0.34	-0.19	-0.11	-0.17
	Top 5-income	-0.09	-0.08	-0.35	-0.22	-0.10	-0.17
	Average	1.10	0.86	0.76	0.68	0.89	0.86
Elasticity	Top 20-income	1.33	0.90	0.82	1.08	1.37	1.10
	Top 10-income	1.21	0.70	0.82	1.13	1.29	1.03
	Top 5-income	0.95	0.61	0.83	1.13	1.16	0.94
N Observations		7,067	21,802	13,122	27,038	21,170	90,199

Notes: Income (Y) is defined as monetary after-tax nonfinancial income. Consumption (C) is defined as consumption of nondurable goods and services. Both variables are deflated by the CPI. Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Panel (a) shows the baseline calculations in which income and consumption are residualized from households' observable characteristics and time trends. Panel (b) shows the same calculations without residualizing variables. Panel (c) uses residualized income and consumption with the elasticity calculated using the average of the log for each variable. Top 20-income, Top 10-income, and Top 5-income households are those above the 80th, 90th, and 95th percentile of income respectively. Further details in Appendix A. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table B.4: Consumption-income Elasticities: By Income and Consumption Definitions

		Euro Crisis		Emerging-market Crises			Average
		Italy	Spain	Mexico ‘94	Mexico ‘08	Peru	
a. Baseline							
$\Delta \log Y$	Average	-0.17	-0.15	-0.38	-0.16	-0.08	-0.19
	Top-income	-0.13	-0.12	-0.42	-0.19	-0.11	-0.19
$\Delta \log C$	Average	-0.19	-0.14	-0.30	-0.11	-0.08	-0.16
	Top-income	-0.12	-0.11	-0.33	-0.17	-0.12	-0.17
Elasticity	Average	1.13	0.97	0.78	0.73	0.99	0.92
	Top-income	0.95	0.90	0.79	0.88	1.15	0.93
b. Including All Monetary Income							
$\Delta \log Y$	Average	-0.15	-0.15	-0.37	-0.15	-0.08	-0.18
	Top-income	-0.12	-0.12	-0.39	-0.18	-0.13	-0.19
$\Delta \log C$	Average	-0.19	-0.14	-0.30	-0.11	-0.08	-0.16
	Top-income	-0.12	-0.11	-0.33	-0.15	-0.14	-0.17
Elasticity	Average	1.22	0.97	0.79	0.76	0.97	0.94
	Top-income	1.05	0.90	0.86	0.85	1.13	0.96
c. Including Durable Consumption							
$\Delta \log C$	Average	-0.22	-0.17	-0.28	-0.13	-0.08	-0.18
	Top-income	-0.14	-0.15	-0.26	-0.18	-0.14	-0.17
Elasticity	Average	1.43	1.16	0.76	0.89	0.96	1.04
	Top-income	1.20	1.22	0.67	1.01	1.09	1.04
d. Including All Monetary and Nonmonetary Items							
$\Delta \log Y$	Average	-0.17	-0.14	-0.37	-0.14	-0.07	-0.18
	Top-income	-0.13	-0.11	-0.38	-0.18	-0.13	-0.19
$\Delta \log C$	Average	-0.19	-0.15	-0.28	-0.13	-0.07	-0.17
	Top-income	-0.15	-0.13	-0.25	-0.19	-0.13	-0.17
Elasticity	Average	1.14	1.14	0.76	0.93	0.93	0.98
	Top-income	1.20	1.15	0.66	1.04	1.05	1.02
N Observations		7,067	21,802	13,122	27,038	21,170	90,199

Notes: Income (Y) and Consumption (C) are deflated by the CPI and residualized from households' observable characteristics and time trends. Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Panel (a) shows the baseline, in which Income is defined as monetary after-tax nonfinancial income and consumption includes nondurable goods and services. Panel (b) shows the results when including all of the monetary components of income and nondurable consumption; Panel (c) including all of the monetary components of consumption and income; and Panel (d) including all of the monetary and nonmonetary components of consumption and income. Top-income households are those above the 90th percentile of income. Further details in Appendix A. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

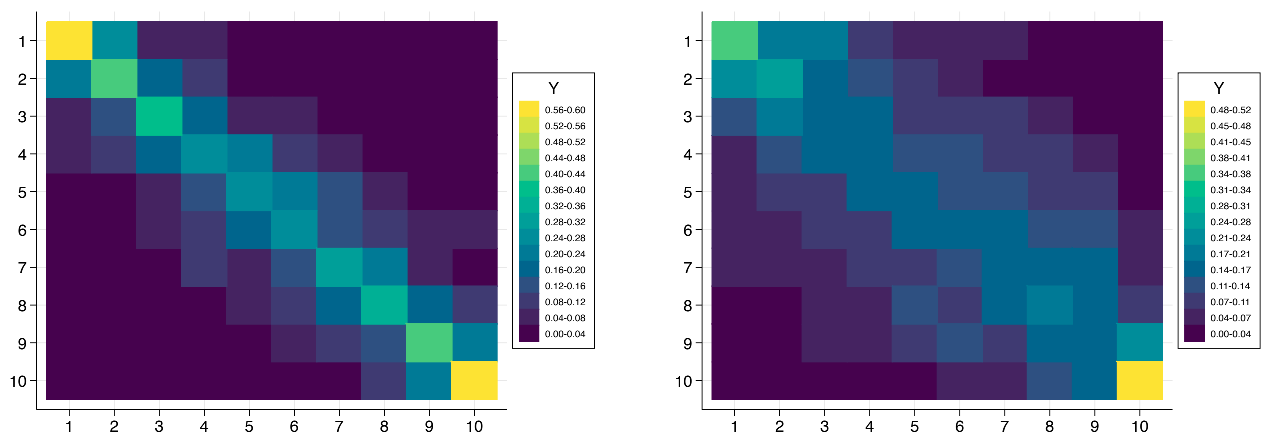
Table B.5: Consumption-income Elasticities: Synthetic Cohort and Panel

		Euro Crisis Italy		Emerging-market Crises Peru	
		Synthetic Cohort	Panel	Synthetic Cohort	Panel
$\Delta \log Y$	Average	-0.17	-0.07	-0.08	-0.07
	Top-income	-0.13	-0.12	-0.11	-0.20
$\Delta \log C$	Average	-0.19	-0.09	-0.08	-0.11
	Top-income	-0.12	-0.11	-0.12	-0.24
Elasticity	Average	1.13	1.32	0.99	1.70
	Top-income	0.95	0.92	1.15	1.21
N Observations		7,067	1,044	21,170	2,114

Notes: Income (Y) is defined as monetary after-tax nonfinancial income. Consumption (C) is defined as consumption of nondurable goods and services. Both variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Top-income households for the synthetic cohort are those in the highest decile of residualized income in each year, and for the panel are on average over all years in the episode. The synthetic cohort values are calculated using sample weights and panel values are an unweighted average. Further details in Appendix A. Data sources: SHIW-BI Italy, and INEI Peru.

Figure B.2: Income mobility in Italy and Peru

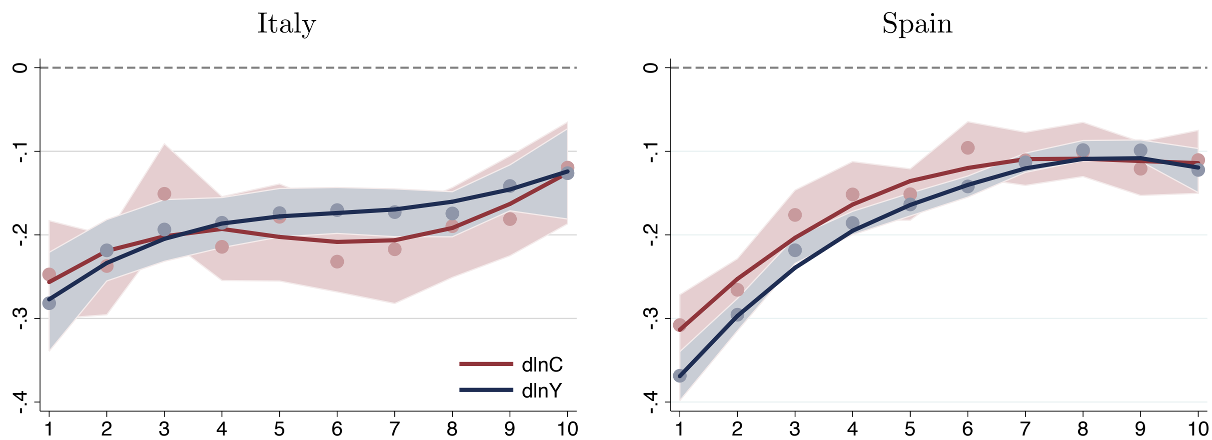
(a) Italy (b) Peru



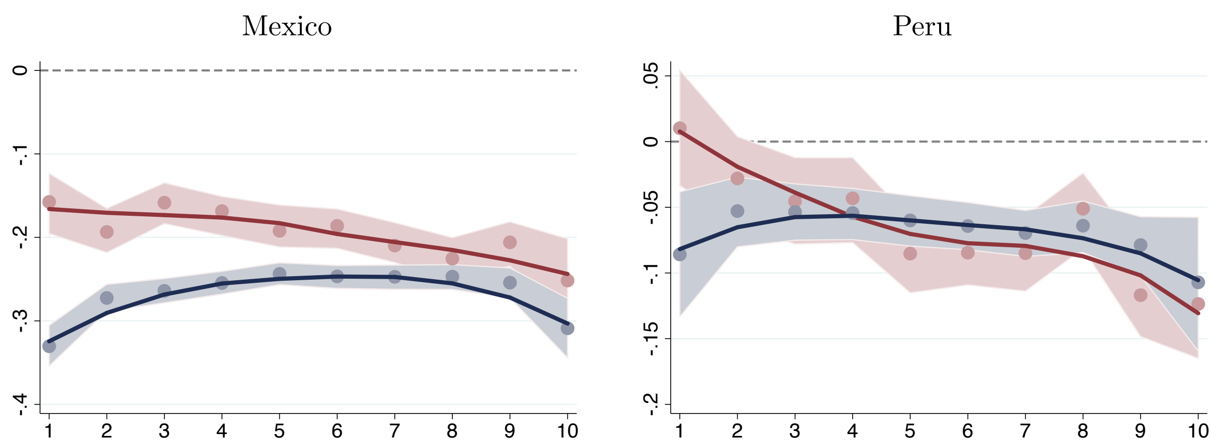
Notes: Panel (a) and (b) show the income transition probabilities across income deciles in Italy and Peru, respectively. Each square shows the probability of moving from a given initial income decile (row) to the next period's income decile (column). For Italy the probability is biennial and for Peru the probability is annual. Income is defined as monetary after-tax nonfinancial income. Income is deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). The transition probabilities are calculated for the crisis episodes. Data sources: SHIW-BI Italy, and ENAHO-INEI Peru.

Figure B.3: Consumption-income Elasticities Across the Income Distribution

(a) Euro Crisis



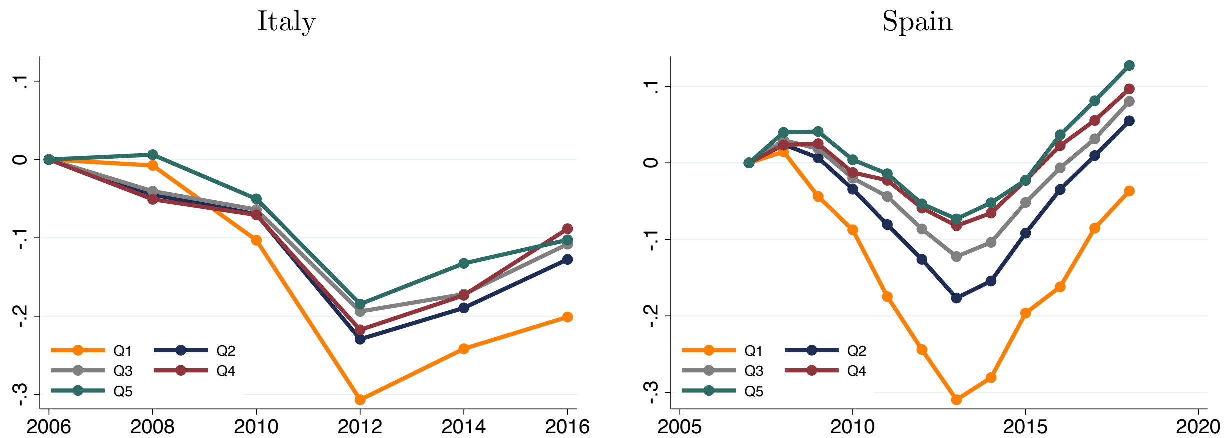
(b) Emerging-market Crises



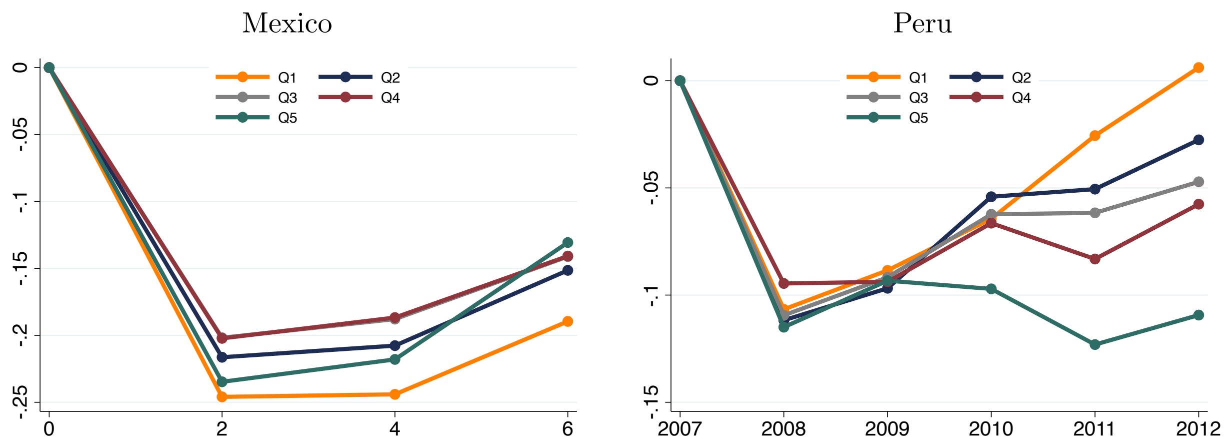
Notes: This figure shows the log-change of consumption and income during each episode for different deciles of residualized income on the horizontal axis. Income is defined as monetary after-tax nonfinancial income. Consumption is defined as consumption of nondurable goods and services. Income and consumption are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Dots correspond to observed values, the solid line is the locally weighted smoothing of observed values, and the shaded area shows the 90% confidence intervals computed using 2,000 bootstrap replications. Values for Mexico are the simple average of its two episodes in the sample (1994 and 2008). Further details in Appendix A. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Figure B.4: Income Dynamics by Income Quintiles

(a) Euro Crisis



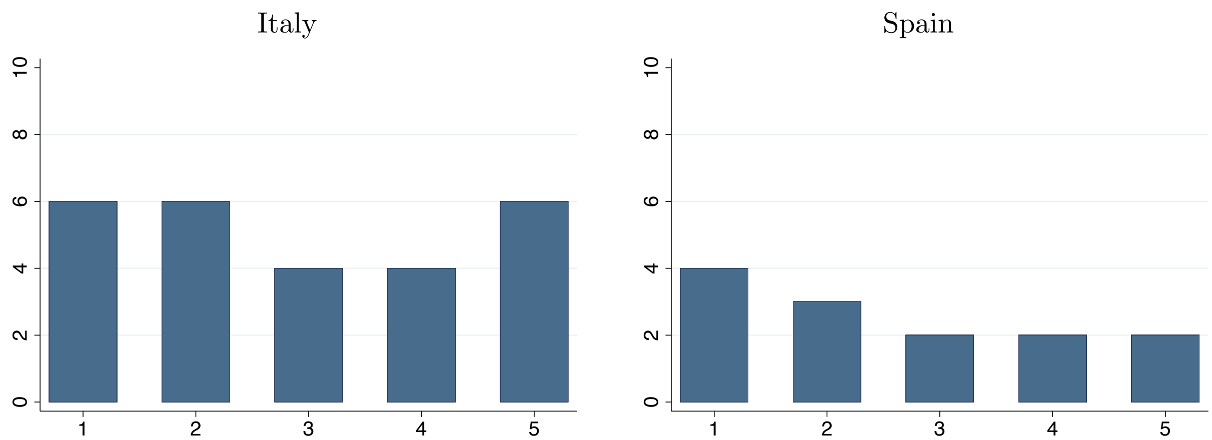
(b) Emerging-market Crises



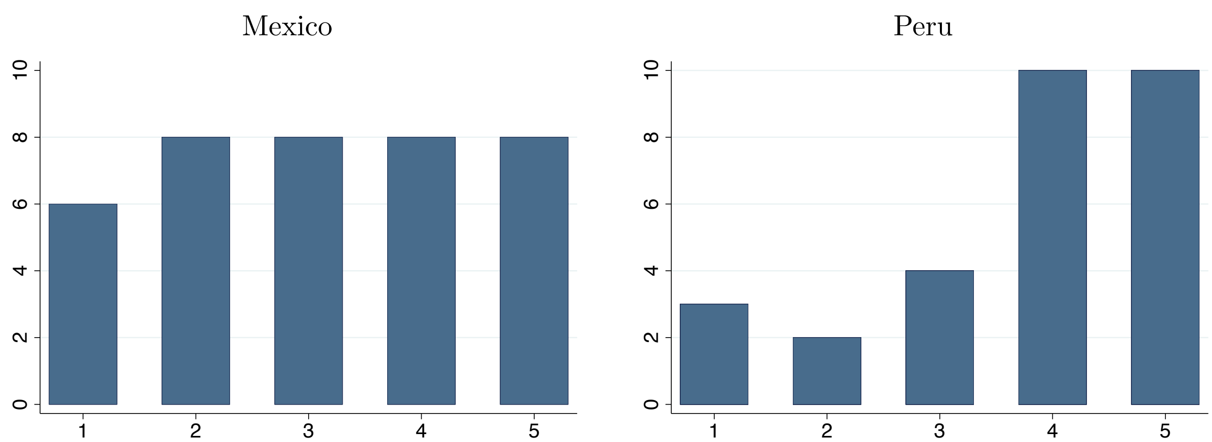
Notes: This figure shows the detrended income during each episode for different income quintiles of residualized income. Income is defined as monetary after-tax nonfinancial income, deflated by the CPI. Values for Mexico are the simple average of its two episodes in the sample (1994 and 2008). Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Figure B.5: Half-life of Income by Income Quintiles

(a) Euro Crisis



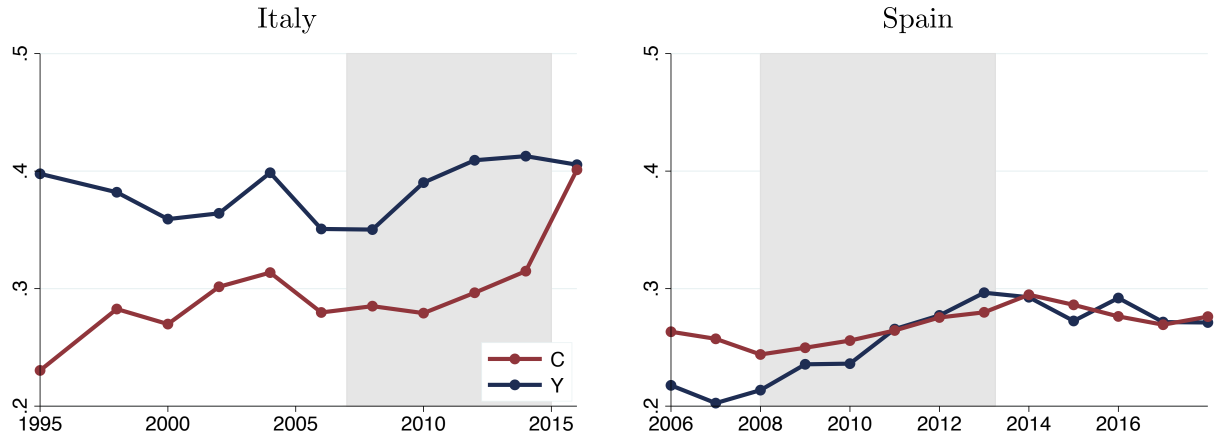
(b) Emerging-market Crises



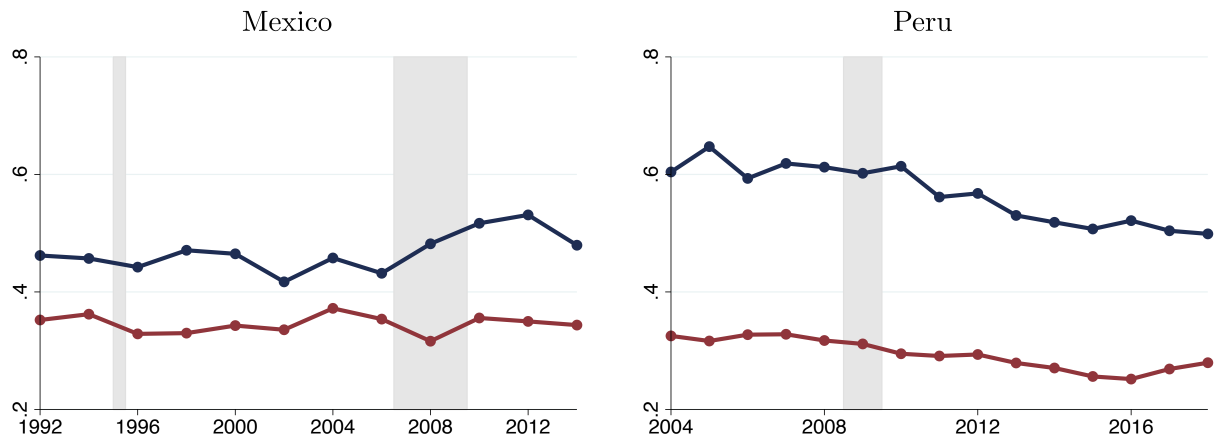
Notes: This figure shows the half-life of detrended income during each episode for different quintiles of residualized income. Half-life refers to the number of years that took to recover half of the contraction in income. Values for Mexico are the simple average of its two episodes in the sample (1994 and 2008). Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Figure B.6: Variance of Consumption and Income

(a) Euro Crisis



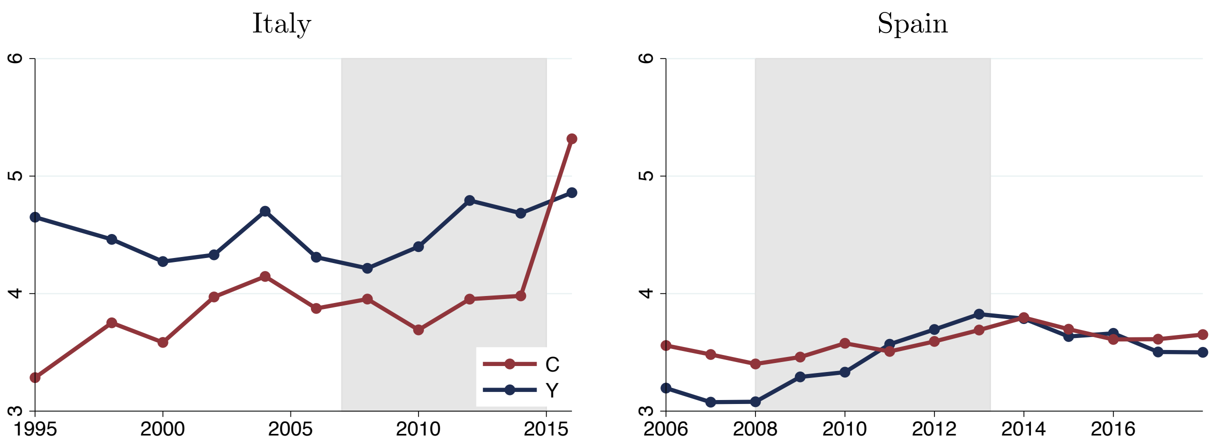
(b) Emerging-market Crises



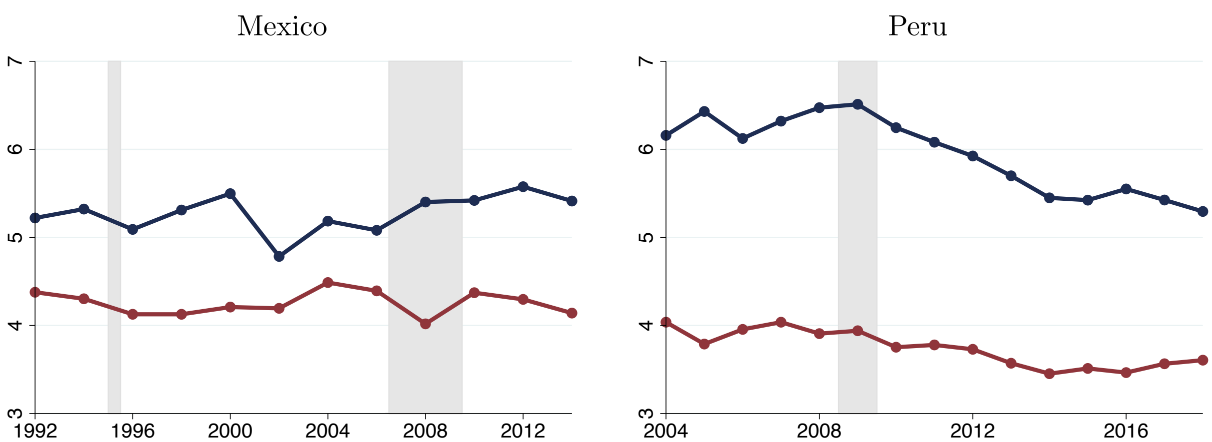
Notes: This figure shows the cross-sectional variance of the log of consumption and income in each year. Income is defined as monetary after-tax nonfinancial income. Consumption is defined as consumption of nondurable goods and services. Income and consumption are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). The shaded area is peak-to-trough of detrended GDP per capita during each episode. Data sources: OECD, SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Figure B.7: 90/10 Ratio of Consumption and Income

(a) Euro Crisis



(b) Emerging-market Crises



Notes: This figure shows the ratio of the 90th percentile to the 10th percentile of consumption and income in each year. Income is defined as monetary after-tax nonfinancial income. Consumption is defined as consumption of nondurable goods and services. Income and consumption are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). The shaded area is peak-to-trough of detrended GDP per capita during each episode. Data sources: OECD, SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table B.6: Consumption-income Elasticities: Illiquid Wealth – Italy

		Value	Elasticity
a. All Households			
Total Net Wealth-to-Income	Low	1.85	1.11
	High	14.19	1.39
Liquid Wealth-to-Income	Low	0.14	1.20
	High	1.49	1.19
Risky Liquid Wealth-to-Income	Low	0.29	2.93
	High	2.19	1.55
Debt-to-Income	Low	0.29	1.03
	High	3.51	1.13
N Observations		7,067	7,067
b. Top-Income			
Total Net Wealth-to-Income	Low	2.15	1.23
	High	13.37	0.89
Liquid Wealth-to-Income	Low	0.17	1.59
	High	1.68	0.73
Risky Liquid Wealth-to-Income	Low	0.24	3.45
	High	1.84	1.00
Debt-to-Income	Low	0.43	1.29
	High	3.58	0.81
N Observations		1,359	1,359

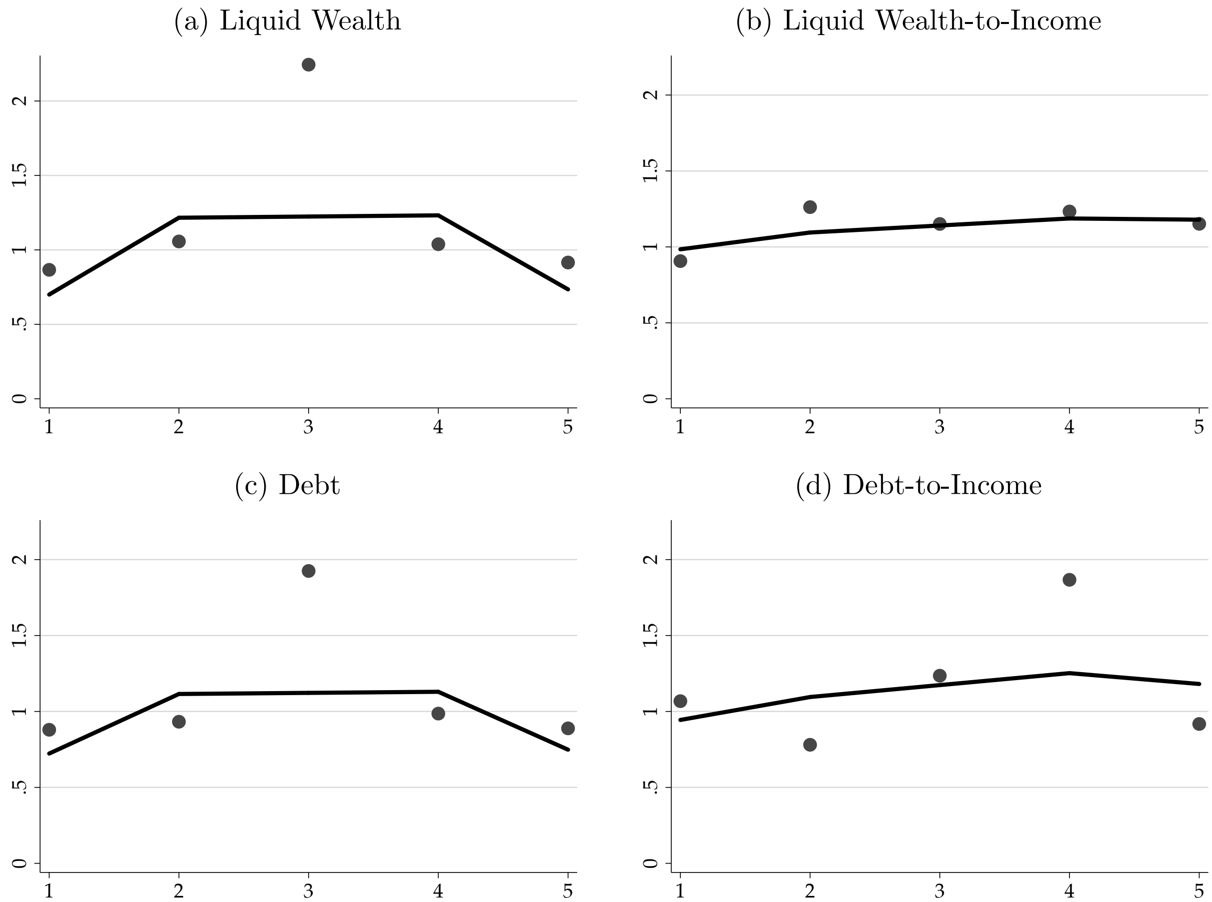
Notes: The column Value is the median ratio of wealth to annual income by wealth category. The column Elasticities shows the elasticities by wealth category. Low (high) households are those with wealth-to-income ratio below (above) the median. The sample is limited to households with positive values of wealth/debt for each category. Total net wealth is the sum of the households liquid wealth and illiquid assets. Liquid assets are net financial assets, which include deposits, bonds, stocks, mutual funds, and investment accounts. Illiquid assets are real assets, which include real estate, business assets, and valuables. Risky liquid assets are government bonds, stock holdings, and other securities. Debts are financial liabilities, which include liabilities to banks and companies, trade debt, and liabilities to other households. Top-income households are those in the highest quintile of income. Income (Y) is defined as monetary after-tax nonfinancial income. Consumption (C) is defined as the consumption of nondurable goods and services. Both variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Data sources: SHIW-BI Italy.

Table B.7: Consumption-income Elasticities by Ownership of Illiquid Assets

	Euro Crisis		Emerging-market Crises			
	Italy	Spain	Mexico ‘94	Mexico ‘08	Peru	Average
a. All Households						
Firm Ownership						
Yes	1.31	1.96	0.68	0.97	1.64	1.31
No	1.10	0.93	0.79	0.59	1.03	0.89
Home Ownership						
Yes	1.29	1.04	0.79	0.71	1.02	0.97
No	0.90	0.79	0.67	0.75	1.03	0.83
N Observations	7,067	21,802	13,122	27,038	21,170	90,199
b. Top-Income						
Firm Ownership						
Yes	1.49	1.61	0.68	1.08	1.87	1.35
No	1.00	0.94	0.82	0.76	1.17	0.94
Home Ownership						
Yes	0.73	1.03	0.78	0.89	1.26	0.94
No	0.81	1.00	0.70	0.79	1.08	0.88
N Observations	1,359	4,300	2,444	5,184	4,401	17,688

Notes: This table shows consumption-income elasticities by ownership. Income is defined as monetary after-tax nonfinancial income. Consumption is defined as consumption of nondurable goods and services. Both variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Categories are constructed such that they are comparable across countries. Top-income households are those in the highest quintile of income.Further details in Appendix A. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Figure B.8: Consumption-income Elasticities By Liquid Wealth — Italy



Notes: This figure shows consumption-income elasticities for different quintiles of liquid wealth on the horizontal axis. Income is defined as monetary after-tax nonfinancial income. Consumption is defined as consumption of nondurable goods and services. Income and consumption are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Dots correspond to observed elasticities and the solid line is the locally weighted smoothing of observed elasticities. Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Liquid wealth is the households financial assets, which include deposits, bonds, stocks, mutual funds, and investment accounts. Debts are financial liabilities, which include liabilities to banks and companies, trade debt, and liabilities to other households. Further details can be found in Appendix A. Data source: SHIW-BI Italy.

Table B.8: Consumption-income Elasticities: Durable and Nondurable Goods

		Euro Crisis		Emerging-market Crises			Average
		Italy	Spain	Mexico '94	Mexico '08	Peru	
$\Delta \log Y$	Average	-0.17	-0.15	-0.38	-0.16	-0.08	-0.19
	Top-income	-0.13	-0.12	-0.42	-0.19	-0.11	-0.19
a. Nondurable							
$\Delta \log C$	Average	-0.19	-0.14	-0.30	-0.11	-0.08	-0.16
	Top-income	-0.12	-0.11	-0.33	-0.17	-0.12	-0.17
Elasticity	Average	1.13	0.97	0.78	0.73	0.99	0.92
	Top-income	0.95	0.90	0.79	0.88	1.15	0.93
b. Durable							
$\Delta \log C$	Average	-0.29	-0.17	-0.25	-0.26	-0.20	-0.23
	Top-income	-0.04	-0.18	-0.21	-0.30	-0.23	-0.19
Elasticity	Average	1.77	1.15	0.64	1.67	2.51	1.55
	Top-income	0.35	1.46	0.51	1.57	2.12	1.20
N Observations		7,067	21,802	13,122	27,038	21,170	90,199

Notes: This table shows various moments related to households' consumption of nondurable and durable goods. Income (Y) is defined as monetary after-tax nonfinancial income. In Panel (a) Consumption (C) is defined as consumption of nondurable goods and services. In Panel (b) it is defined as consumption of durable goods. Both income and consumption variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Top 10-Income households are those in the highest decile of residualized income. Further details on the classification of goods in Appendix A. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table B.9: Consumption-income Elasticities: Tradable/Non-tradable and Luxury/Non-luxury Goods

		Euro Crisis	Emerging-market Crises		Average
		Spain	Mexico '94	Mexico '08	
$\Delta \log Y$	Average	-0.15	-0.38	-0.16	-0.23
	Top-income	-0.12	-0.42	-0.19	-0.25
a. Tradable					
$\Delta \log C$	Average	-0.18	-0.23	-0.06	-0.16
	Top-income	-0.13	-0.14	-0.16	-0.14
Elasticity	Average	1.19	0.60	0.41	0.73
	Top-income	1.03	0.34	0.81	0.73
b. Non-tradable					
$\Delta \log C$	Average	-0.17	-0.37	-0.26	-0.27
	Top-income	-0.16	-0.40	-0.27	-0.28
Elasticity	Average	1.13	0.98	1.66	1.26
	Top-income	1.35	0.95	1.38	1.23
c. Luxury					
$\Delta \log C$	Average	-0.34	-0.36	-0.31	-0.34
	Top-income	-0.30	-0.29	-0.33	-0.31
Elasticity	Average	2.26	0.94	1.97	1.72
	Top-income	2.42	0.69	1.73	1.61
d. Non-luxury					
$\Delta \log C$	Average	-0.13	-0.26	-0.05	-0.15
	Top-income	-0.11	-0.23	-0.09	-0.14
Elasticity	Average	0.86	0.67	0.34	0.62
	Top-income	0.88	0.55	0.48	0.63
N Observations		21,802	13,122	27,038	61,962

Notes: This table shows various moments related to households' consumption of tradable and non-tradable goods and luxury and non-luxury goods. Income (Y) is defined as monetary after-tax nonfinancial income. In Panels (a) and (b) Consumption (C) is defined as consumption of tradable and non-tradable goods, respectively. In Panels (c) and (d) Consumption (C) is defined as consumption of luxury and non-luxury goods, respectively. Both income and consumption variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Top 10-Income households are those in the highest decile of residualized income. Further details on the classification of goods in Appendix A. Data sources: EPF-INE Spain, ENIGH-INEGI Mexico.

Table B.10: Consumption-Income Elasticities Adjusted by Inflation Heterogeneity

		Emerging-market Crises			Average
		Mexico '94	Mexico '08	Peru	
Average − Top-income Inflation		2.0%	0.9%	1.3%	1.4%
$\Delta \log Y$	Average	-0.38	-0.16	-0.08	-0.21
	Top-income	-0.42	-0.19	-0.11	-0.24
$\Delta \log C$	Average	-0.31	-0.11	-0.08	-0.17
	Top-income	-0.33	-0.20	-0.12	-0.22
Elasticity	Average	0.82	0.73	1.06	0.87
	Top-income	0.79	1.01	1.09	0.96
N Observations		13,122	27,038	21,170	61,330

Notes: The first row refers to the difference between the average inflation and the inflation of households in the top income decile. Inflation for both groups is computed using log-differences from the peak (CPI = 100) to trough of each episode. Income (Y) is defined as monetary after-tax nonfinancial income. Consumption (C) is defined as consumption of nondurable goods and services. Both variables are residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Income is deflated using baseline CPI and consumption decile-specific CPI constructed using the decile's consumption basket. Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Data sources: ENIGH-INEGI Mexico, and ENAHO-INEI Peru.

Table B.11: Robustness: Permanent Heterogeneity

		Euro Crisis Italy	EM Crises Peru	Average
Low-Elasticity HHs				
$\Delta \log Y$	Average	-0.14	-0.12	-0.13
	Top-income	-0.08	-0.14	-0.11
$\Delta \log C$	Average	-0.13	-0.08	-0.11
	Top-income	-0.07	-0.09	-0.08
Elasticity	Average	0.94	0.64	0.79
	Top-income	0.88	0.65	0.76
High-Elasticity HHs				
$\Delta \log Y$	Average	-0.12	-0.14	-0.13
	Top-income	-0.10	-0.15	-0.13
$\Delta \log C$	Average	-0.13	-0.18	-0.16
	Top-income	-0.10	-0.20	-0.15
Elasticity	Average	1.11	1.27	1.19
	Top-income	1.00	1.29	1.15
N Observations		1,044	2,114	3,158

Notes: Income (Y) is defined as monetary after-tax nonfinancial income. Consumption (C) is defined as consumption of nondurable goods and services. Both variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (7) in Appendix A for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Top-Income households are those above the median of residualized income. Households with high (low) elasticity are those with individual estimated elasticities above (below) the median. Further details in Appendix A. Data sources: SHIW-BI Italy, ENAHO-INEI Peru.

C. Omitted Proofs and Results

C.1. Proof of Proposition 1

We start by showing the first result. Consider the permanently unconstrained households, for which the borrowing constraint never binds. The optimal consumption given by (4) simplifies to

$$c_{it} = ra_{it} + \frac{r}{1+r} \sum_{s=0}^{\infty} \frac{\mathbb{E}_t \left[\mu_{it+s}\right] Y_{t+s}}{(1+r)^s}. \tag{11}$$

It will be useful to characterize the elasticity of permanently unconstrained households in response to any aggregate shock, and then for the particular case of permanent shocks. The consumption-income elasticity in response to an aggregate shock is given by

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} \frac{y_{it}}{c_{it}}.$$

The marginal propensity to consume is given by

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} = \frac{\frac{r}{1+r} \sum_{s=0}^{\infty} \frac{\mathbb{E}_t[\mu_{it+s}] \frac{\partial Y_{t+s}}{\partial Y_t}}{(1+r)^s}}{\mu_{it}}. \tag{12}$$

This implies that the elasticity is given by

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} \frac{y_{it}}{c_{it}} = \frac{\frac{r}{1+r} \sum_{s=0}^{\infty} \frac{\mathbb{E}_t[\mu_{it+s}] \frac{\partial Y_{t+s}}{\partial Y_t}}{(1+r)^s}}{\mu_{it}} \frac{\mu_{it} Y_t}{\left(ra_{it} + \frac{r}{1+r} \sum_{s=0}^{\infty} \frac{\mathbb{E}_t[\mu_{it+s}] Y_{t+s}}{(1+r)^s} \right)}. \tag{13}$$

Taking limits when $r \to 0$ and using the assumption that $Y_{t+s} = Y_t$ for $s \geq 0$ yields $\varepsilon_{cy} = 1$.

Now consider constrained agents. The consumption of a constrained household is given by

$$c_{it} = \mu_{it} Y_t + (1+r) a_{it} + \kappa f(Y_t).$$

It will be useful to characterize the elasticity of constrained households for any $f(Y_t)$, and then for the particular case of $f(Y_t) = 1$. The marginal propensity to consume of this household is given by

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} = \frac{\mu_{it} + \kappa f'(Y_t)}{\mu_{it}}. \tag{14}$$

The consumption-income elasticity is given by

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} \frac{y_{it}}{c_{it}} = \frac{\mu_{it} + \kappa f'(Y_t)}{\mu_{it}} \frac{\mu_{it} Y_t}{\mu_{it} Y_t + (1+r)a_{it} + \kappa f(Y_t)}. \tag{15}$$

In this case we have that $f'(Y_t) = 0$. Additionally, by evaluating the elasticity at $a_{it} = -\kappa f(Y_t)$ and taking the limits when $r \to 0$, we obtain $\varepsilon_{cy} = 1$.

C.2. Proof of Proposition 2

We start by showing the first result. The consumption-income elasticity of a permanently unconstrained household is given by (13). Using the assumption that $Y_{t+h} = \rho Y_t + (1-\rho) Y_{ss}$ for $h \geq 1$, the elasticity is given by

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} \frac{y_{it}}{c_{it}} = \frac{\frac{r}{1+r} \sum_{s=0}^{\infty} \frac{\rho^s \mathbb{E}_t[\mu_{it+s}]}{(1+r)^s}}{\mu_{it}} \frac{\mu_{it} Y_t}{\left(r a_{it} + \frac{r}{1+r} \sum_{s=0}^{\infty} \frac{\mathbb{E}_t[\mu_{it+s}](\rho^s Y_t + (1-\rho^s) Y_{ss})}{(1+r)^s} \right)}.$$

Using the fact that $Y_t < Y_{ss}$, this expression is increasing in ρ. Additionally, taking the limits when $r \to 0$, we obtain that $\varepsilon_{cy} < 1$ and $\varepsilon_{cy} \to 0$ when $\rho \to 0$.

We now show the second result. The elasticity of a constrained household is given by (15), or equivalently,

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} \frac{y_{it}}{c_{it}} = \frac{\frac{y_{it}}{\kappa f(Y_t)} + \varepsilon_{fY}}{\frac{y_{it} + (1+r)a_{it}}{\kappa f(Y_t)} + 1},$$

where ε_{fY} is the elasticity of the borrowing constraint to aggregate income. It follows that the individual elasticity is an increasing function of ε_{fY}, since the denominator is positive. Additionally, by evaluating the elasticity at $a_{it} = -\kappa f(Y_t)$ and taking the limits when $r \to 0$, we obtain

$$\varepsilon_{cy}|_{a_{it} = \kappa f(Y_t)} = 1 + \frac{\kappa f(Y_t)}{y_{it}} \varepsilon_{fY} > 1.$$

Finally, we show the last statement of the proposition. We need to show that if μ_{it} is mean-reverting, households with high enough μ_{it} are permanently unconstrained. For this, it suffices to show that there exists a large enough μ_{it} such that the households never hit the borrowing constraint, even if they receive the lowest possible endowment in all periods going forward. Recall that the level of unconstrained consumption c_{it}^{unc} is given by (11). It can be verified that if μ_{it} is mean-reverting (i.e., $\mathbb{E}_t\left[\mu_{it+1}\right] = \rho_\mu \mu_{it} + (1-\rho_\mu)\overline{\mu}$), then $\frac{\partial c_{it}^{unc}}{\partial \mu_{it}} \leq 1$. Denote the minimum level of income as $\underline{y}$. Then there exists a cutoff level of income such that if current income is larger than this value, the household can ensure the level of unrestricted consumption. This level of income is given by

$$\tilde{y}_{it} = c_{it}^{unc} - (1+r)a_{it} + \sum_{s=0}^{\infty} \frac{\left[c_{it}^{unc} - \underline{y}\right]}{(1+r)^s}.$$

If follows that if μ_{it} is large enough, then income is larger than this cutoff value and hence the household is unconstrained.

C.3. Characterizations of MPCs

In this section we characterize the MPCs in response to both crisis experiments. We argue that MPCs depend on the properties of the stochastic process of the idiosyncratic component of income. Additionally, when the idiosyncratic component of income is mean-reverting, MPCs are decreasing in income under both crisis experiments. This result implies that MPCs are less useful in qualitatively distinguishing between the crisis views than consumption-income elasticities.

The following proposition characterizes MPCs under the permanent-income view of crises.

***Proposition* 3.** *Suppose that functional forms satisfy Assumption 3.1, and that μ_{it} is mean-reverting. Assume that in period t the economy experiences an unexpected shock to aggregate income that is expected to be permanent, i.e., $Y_{t+h} = Y_t < Y_{ss}$. Define the marginal propensity to consume of households when the interest rate is sufficiently small as $mpc \equiv \lim_{r\to 0} \frac{\partial c_{it}}{\partial y_{it}}$. Additionally, define constrained and permanently unconstrained households as in Proposition 1.*

1. *For permanently unconstrained households mpc is decreasing in income.*

2. *For constrained households $mpc = 1$.*

Proof. We start by showing the first result. The MPC of permanently unconstrained households is given by (12), where $\frac{\partial Y_{t+s}}{\partial Y_t} = 1$, given that the aggregate shock is permanent. Additionally, since μ_{it} is mean-reverting, we have that $\frac{\frac{r}{1+r}\sum_{s=0}^{\infty}\frac{\mathbb{E}_t[\mu_{it+s}]}{(1+r)^s}}{\mu_{it}}$ is decreasing in μ_{it}. Combining these two properties yields the first result.

The second result follows from noting that the MPC of constrained households is given by (14), and under the permanent-income view of crises $f'(Y_t) = 0$. □

It is worth noting that the MPC of permanently unconstrained households is not 1 despite the aggregate shock being permanent. The reason is that given the multiplicative structure of income, the permanent aggregate shock does not imply a permanent shock to individual income when the idiosyncratic component is mean-reverting.

The following proposition characterizes MPCs under the credit-tightening view of crises.

***Proposition* 4.** *Suppose that functional forms satisfy Assumption 3.1, and that μ_{it} is mean-reverting. Assume that in period t the economy experiences a shock to aggregate income that is expected to be mean-reverting, i.e., $Y_{t+h} = \rho^h Y_t + (1-\rho^h)Y_{ss}$, with $0 < \rho < 1$. Define the marginal propensity to consume of households, constrained and permanently unconstrained households as in Proposition 3.*

1. *For permanently unconstrained households mpc is decreasing in income.*

2. *For constrained households mpc is also decreasing in income.*

Proof. We start by showing the first result. The MPC of permanently unconstrained households is given by (12), where $\frac{\partial Y_{t+s}}{\partial Y_t} = \rho^s$, given that the aggregate shock is permanent. Additionally, since μ_{it} is mean-reverting, we have that $MPC = \frac{\frac{r}{1+r}\sum_{s=0}^{\infty}\frac{\mathbb{E}_t[\mu_{it+s}]\rho^s}{(1+r)^s}}{\mu_{it}}$ is decreasing in μ_{it}.

The second result follows from noting that the MPC of constrained households is given by (14), where $f'(Y_t) > 0$ under the credit-tightening view of crises. □

D. Additional Results of Quantitative Analysis

D.1. Additional Figures and Tables

Table D.1: Wealth Distribution in Italy: Summary Statistics

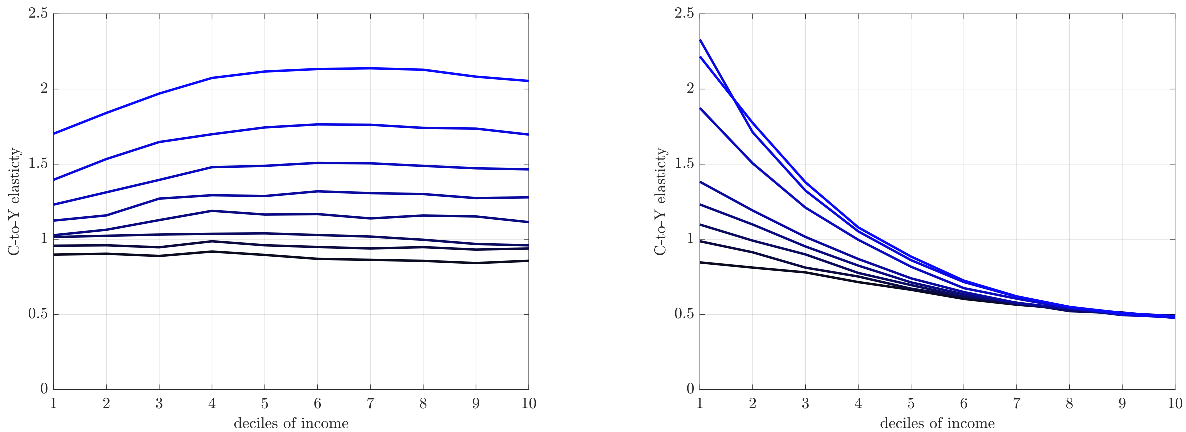
Variable	Liquid	Non-Liquid	Total
Wealth-to-income	0.87	7.20	8.06
Av. Wealth-to-income	0.68	7.20	7.88
Std. Dev. Wealth-to-income	1.92	14.53	15.01
Gini index wealth	0.78	0.67	0.68
Wealth share bottom 75	0.14	0.26	0.27
Wealth share top 10	0.65	0.49	0.48
Wealth share top 5	0.51	0.35	0.34
N Observations	17,349	17,349	17,349

Notes: This table compares moments of wealth distribution by category. The value is the average over the episode from 2006 to 2014, where the calculation for each year uses household survey weights. Wealth-to-income is the ratio of aggregate wealth to aggregate annual income by wealth category. Average Wealth-to-income is the average ratio of household wealth to annual income by wealth category. Income is defined as monetary after-tax nonfinancial income. Total wealth is the sum of the households liquid wealth and non-liquid assets. Liquid assets are financial assets, which include deposits, bonds, stocks, mutual funds, and investment accounts, net of credit card debt. Non-liquid assets are real assets, which include real estate, business assets, and valuables. Data source: SHIW-BI Italy.

Figure D.1: Model Analysis: Identification of Main Parameters

PI View Experiment
Persistence of Growth Shock (ρ_g)

CT View Experiment
Elasticity Financial Constraint-to-Y (ν)

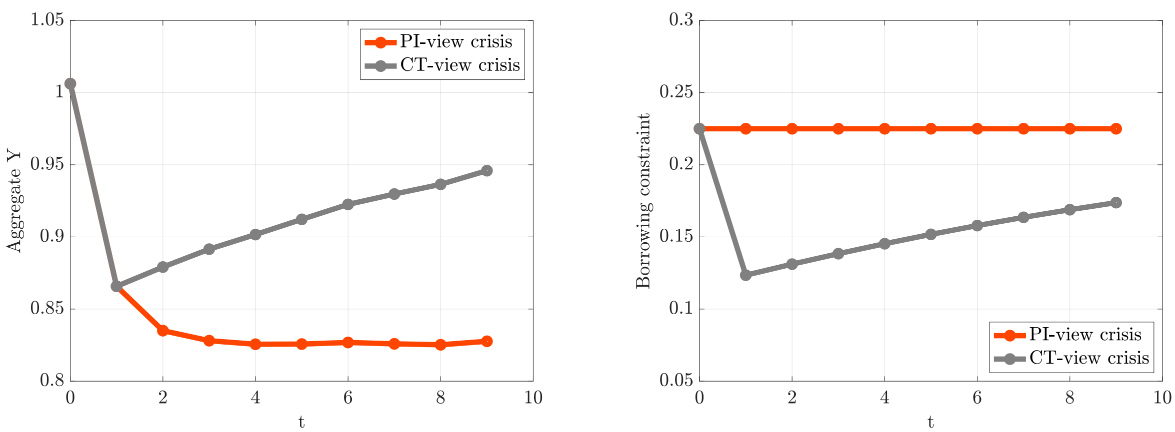


Notes: This figure shows the consumption-income elasticities in the calibrated model presented in Sections 3 and 4 and for different parameterizations of ρ_g and ν. From darker to lighter blue, the parameters grow larger.

Figure D.2: Crisis Experiments: Aggregate Shocks

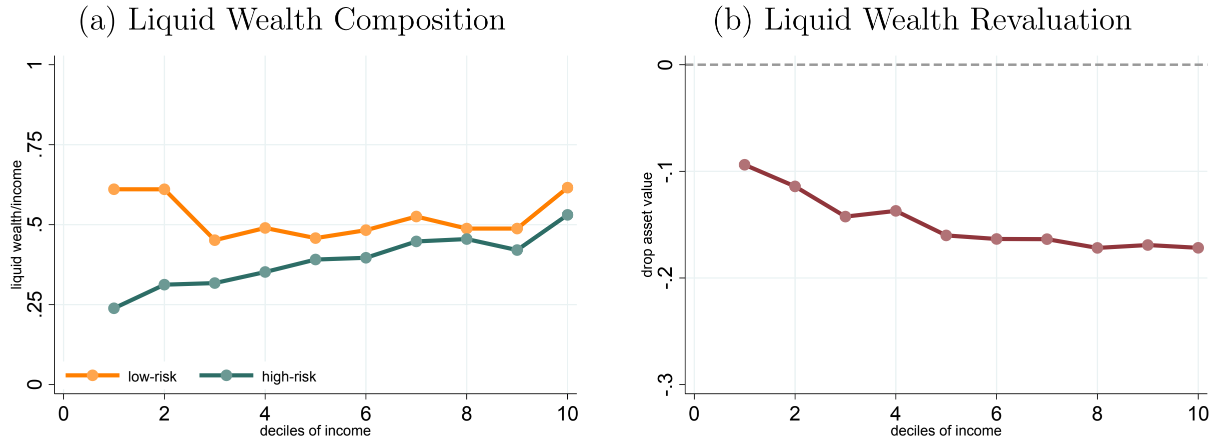
(a) Aggregate Income

(b) Borrowing Constraint



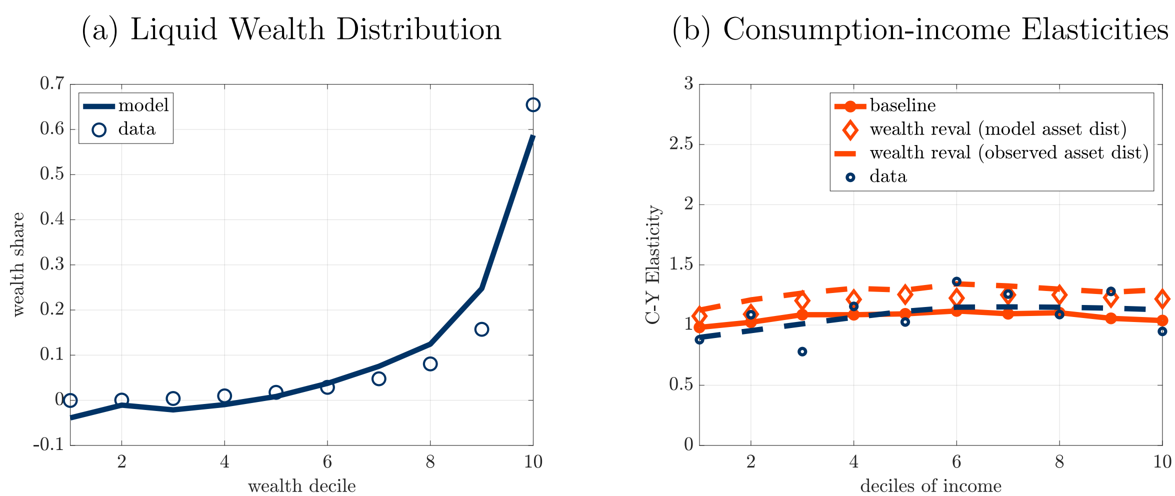
Notes: This figure shows the path of aggregate income and borrowing constraints under each of the crisis experiments. The horizontal axis refers to years. For details of each experiment, see Sections 3 and 4.

Figure D.3: Liquid Asset Revaluation in Italy



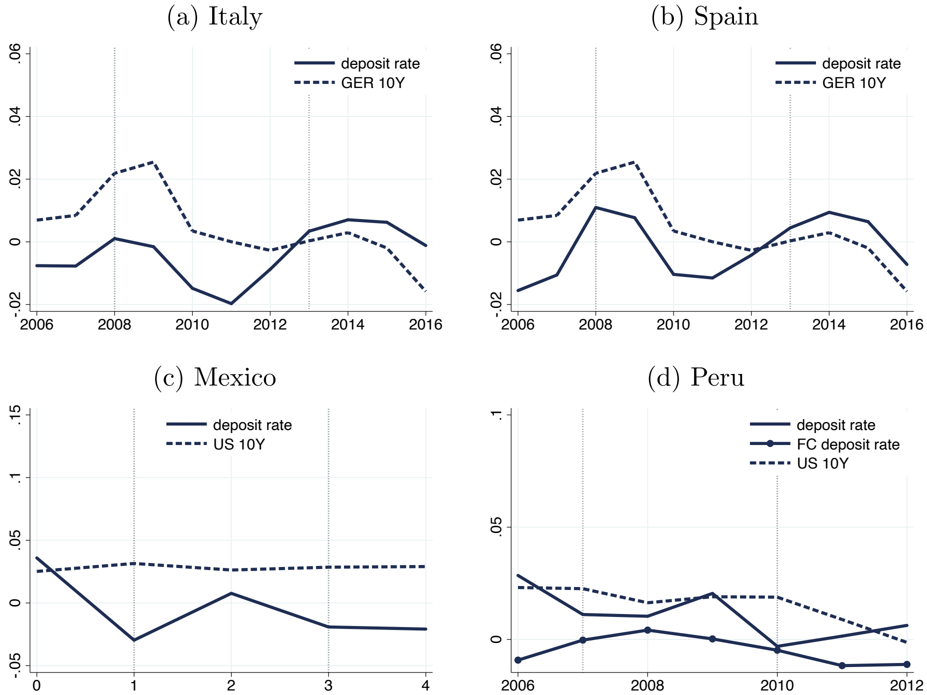
Notes: Panel (a) shows the share of liquid assets for the period 1995 to 2016 split into low-risk and high-risk liquid assets. Low-risk liquid assets are deposits and high-risk liquid assets are government bonds, stock holdings, and other securities. Panel (b) shows the change in the value of liquid assets by income level. To calculate the change in the value we impute the observed changes in asset prices across liquid asset classes from peak-to-trough. Data sources: SHIW-BI Italy.

Figure D.4: Consumption-income Elasticities with Wealth Revaluation



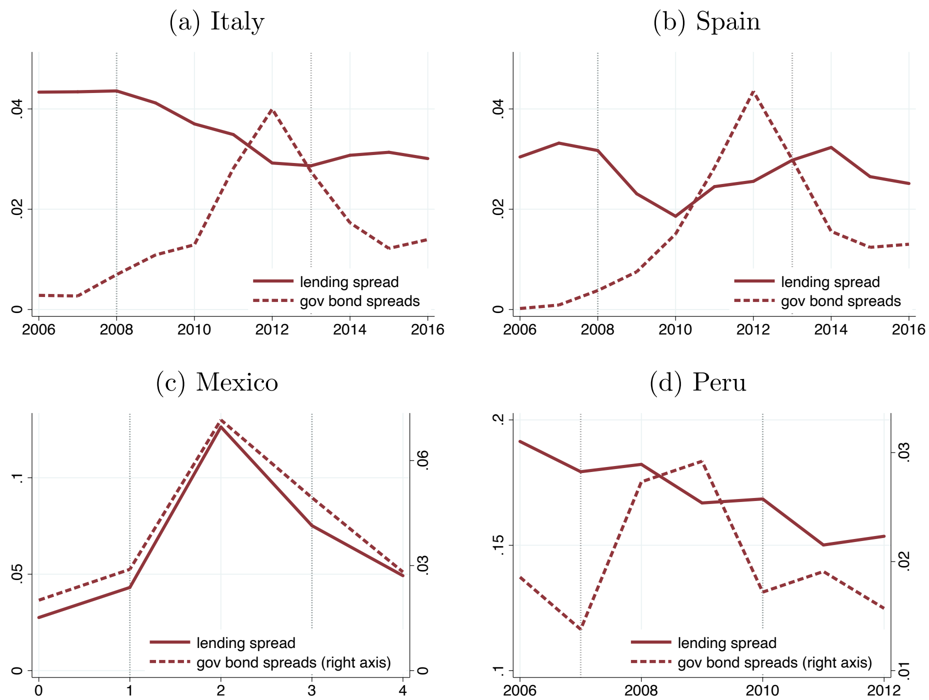
Notes: Panel (a) shows the liquid wealth share for different deciles of wealth in the model and the data. Panel (b) shows elasticities from the baseline PI experiment and the average elasticities of consumption to income evaluated in the model and the observed liquid wealth distribution with imputed observed wealth revaluations across income deciles (labeled “wealth reval (model asset dist)” and “wealth reval (observed asset dist),” respectively). Baseline elasticities are computed using average income and consumption by decile and are defined as the ratio of the log change in consumption to the log change in income. The dashed blue line corresponds to locally weighted smoothed data. Wealth revaluations for each income decile are calculated using observed bond and stock prices during the crisis and the liquid wealth holdings and composition. Further details can be found in Appendix A. Data sources: SHIW-BI Italy.

Figure D.5: Safe Interest Rates during Crises Episodes



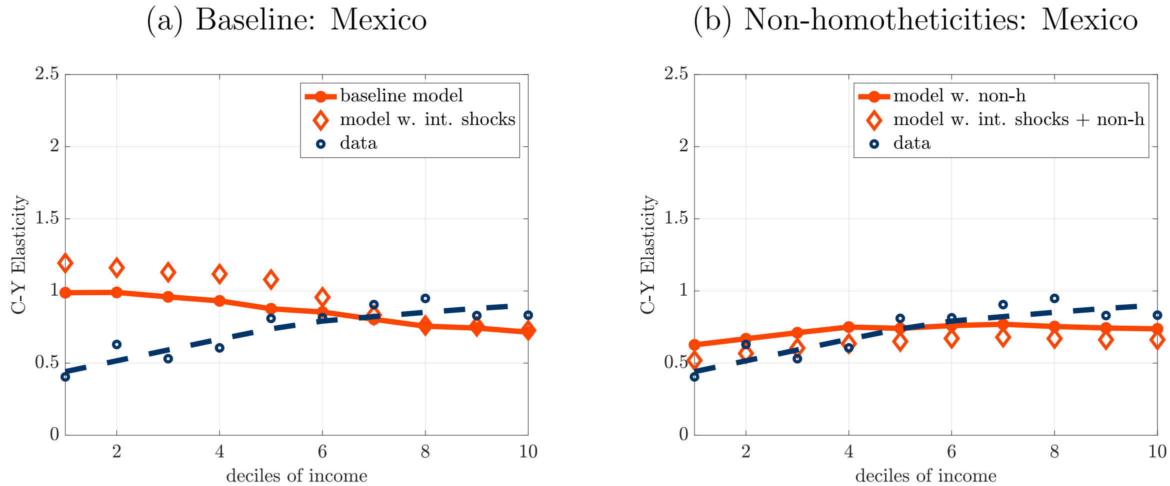
Notes: Panel (a) and Panel (b) show the real deposit rate in Italy and Spain, respectively, and the German government 10-year bond real rate. Panel (c) shows the real deposit rate in Mexico for the average of the Tequila and Global Financial Crises and the U.S. Treasury 10-year bond real rate. Panel (d) shows the real domestic and foreign currency deposit rate in Peru and the U.S. Treasury 10-year bond real rate. Domestic deposit rates are for households. Interest rates are in real terms and calculated deflating by ex post inflation. Data sources: World Bank, IFS, Bank of Italy, Bank of Spain, FRED.

Figure D.6: Risky Borrowing Interest Rates during Crises Episodes



Notes: The figures show domestic lending to deposit bank rates spread andthe government bonds' spreads for each episode analyzed. Domestic lending and deposit bank rates are for households. Spreads are relative to 10-year German bonds for Italy and Spain and EMBI spreads for Mexico and Peru. Data sources: World Bank, IFS, Bank of Italy, Bank of Spain, JP Morgan, FRED.

Figure D.7: Consumption-income Elasticities in PI View Model: Interest Rate Shocks



Notes: This figure shows the average consumption-income elasticities for different income deciles in the Mexican crises (described in Section 2) and the crisis experiments of the model calibrated for Mexico (described in Section 3). Panel (a) shows the elasticities in the model extended to include interest rate shocks. Panel (b) shows the elasticities in the model extended to include interest rate shocks and nonhomothetic preferences (described in Section 3). The interest rate shock is simulated such that it replicates the interest rate dynamics in Figures D.5 and D.6 for Mexico. Elasticities are computed using the average income and consumption by decile, and are defined as the ratio of the log change in consumption to the log change in income. The dashed line corresponds to the locally weighted smoothed data. Further details in Appendix A. Data sources: ENIGH-INEGI Mexico.

Table D.2: Consumption Response to Policy: The Role of Hand-to-Mouth Households

	HtM	Non-HtM	Average
Scenarios			
Steady state	0.46	0.14	0.22
Transitory income shock	0.51	0.15	0.23
PI crisis	0.38	0.13	0.18
CT crisis	0.95	0.21	0.37

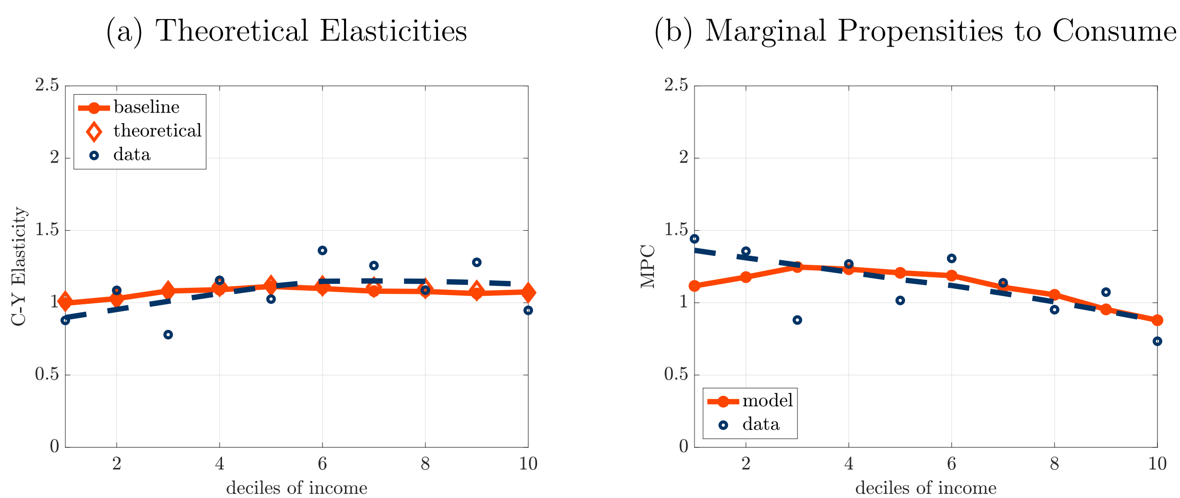
Notes: This table shows the marginal propensity to consume (MPC) from a one-time transfer for hand-to-mouth (HtM), non-hand-to-mouth (Non-HtM), and all households (Average) for different scenarios. MPCs are computed as the difference between consumption with and without the policy, divided by the transfer received. Statistics are computed for the baseline transfer policy. The MPC is computed when the policy is conducted in four alternative scenarios: in the steady state, during a transitory aggregate income shock without credit tightening, during the PI view crisis experiment, and during the CT view crisis experiment.

D.2. Appendix for the PI View of Crises Model

D.2.1. Additional exercises with baseline model

Alternative Measures of Aggregate Responses In this section we analyze different measures of responses to the aggregate shocks. We first compare the baseline consumption-income elasticities in the model with the theoretical elasticities predicted in Section 3.1. The baseline elasticities in the model are computed by treating the model-simulated data in the same way as the observed data. We compute average consumption and income by deciles of income and then compute the elasticity as the ratio of the log change of these variables. The theoretical elasticities correspond to the individual consumption-income elasticities in response to the aggregate income shock, leaving the idiosyncratic component of income fixed. Panel (a) of Figure D.8 shows similar results for both methods of computing the elasticities.

Figure D.8: Consumption-income Elasticities in the Model: Alternative Measures

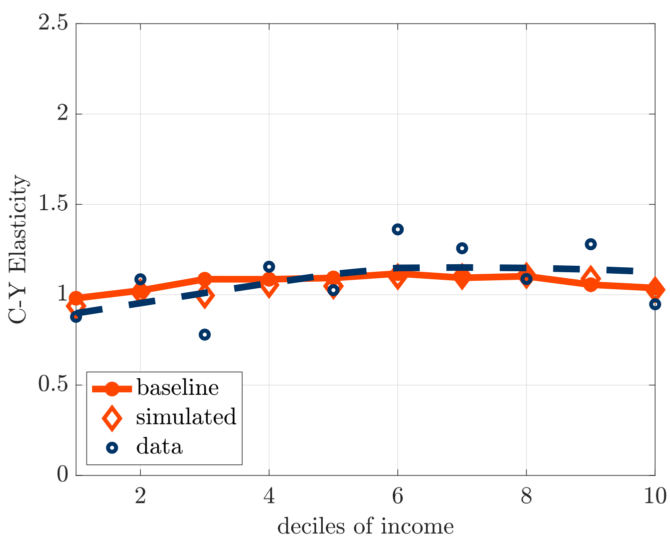


Notes: This figure shows different moments of consumption adjustment for different income deciles in the Italian crisis (described in Section 2) and the crisis experiment of the model calibrated for Italy (described in Section 3). Panel (a) shows the elasticities from the baseline PI experiment and the average elasticities computed directly from the policy function of consumption evaluated at the steady-state asset level and different levels of the idiosyncratic shock (labeled *theoretical*). Panel (b) shows the MPCs from the baseline PI experiment. Baseline elasticities are computed using the average income and consumption by decile, and are defined as the ratio of the log change in consumption to the log change in income. Baseline MPCs are defined are defined as the ratio of the level change in consumption to the level change in income. The dashed line corresponds to locally weighted smoothed data. Further details in Appendix A. Data source: SHIW-BI Italy.

Second, we analyze the marginal propensities to consume in response to the permanent aggregate shock. As shown in Panel (b) of Figure D.8, the PI view crisis experiment exhibits a decreasing shape across the income distribution. This result is consistent with the theoretical analysis in Appendix C. Figure D.8 also shows that the model is able to correctly fit the shape and level of these data moments.

Alternative crisis experiments This section analyzes an alternative crisis experiment that lasts for 6 years, which is the duration of the contraction in aggregate income during the Italian crisis. We compute this variant by introducing 6 consecutive negative income shocks with an expected persistence that is the same as in the baseline crisis experiment. That is, households face shocks for 6 consecutive years that are expected to be permanent. We then compute the consumption-income elasticities by computing the peak-to-trough change in log consumption and income. Figure D.9 shows that the consumption-income elasticities preserve the same shape as in the baseline crisis experiment.

Figure D.9: Consumption Response: Protracted Crisis Simulation



Notes: This figure shows the consumption-income elasticities simulating the same income path as in the data for Italy. Elasticities are computed using average income and consumption by decile, and are defined as the ratio of the log change in consumption to the log change in income. The dashed line corresponds to the locally weighted smoothed data. Further details in Appendix A. Data sources: SHIW-BI Italy.

Model with aggregate risk In this appendix we extend our baseline model to allow for aggregate shocks. We assume the aggregate endowment is subject to both trend and transitory shocks. In particular, we follow Aguiar and Gopinath (2007)[26] and assume that $Y_t = Z_t\Gamma_t$, where Z_t is the transitory component that follows the stochastic process

$$\ln Z_t = \rho_z \ln Z_{t-1} + \sigma_z \epsilon_t^z, \qquad \epsilon_t^z \sim N\left(-\frac{\sigma_z}{2(1+\rho_z)}, 1\right), \tag{16}$$

and $\Gamma_t = e^{g_t}\Gamma_{t-1}$ is a stochastic trend subject to shocks to the growth rate g_t that follow

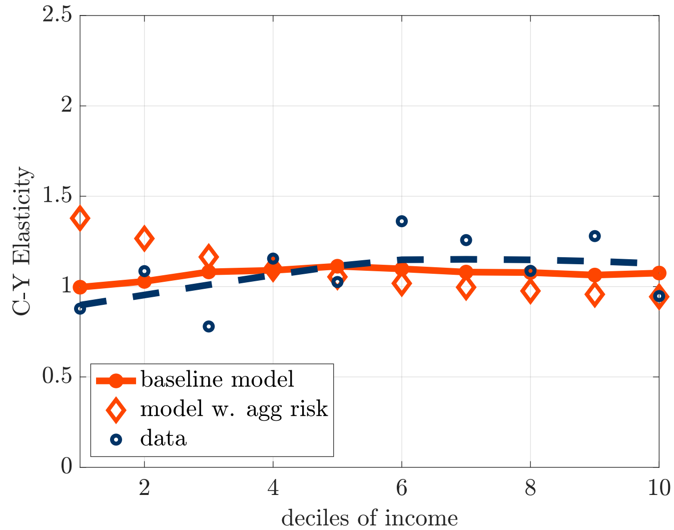
$$g_t = (1-\rho_g)\alpha_g + \rho_g g_{t-1} + \sigma_g \epsilon_t, \qquad \epsilon_t^g \sim N\left(-\frac{\sigma_g}{2(1+\rho_g)}, 1\right). \tag{17}$$

We parameterize the model for the Italian economy. The calibration targets the same moments as in our baseline calibration by calibrating the relative volatility of aggregate permanent and transitory shocks. We deliberately do not target individual consumption responses to a crisis, and leave this behavior as a means to test the validity of the theory in explaining the micro-anatomy of consumption adjustments.

Figure D.10 shows the consumption-income elasticities in the model with aggregate risk under the PI view crisis experiments, and compares it with the data and the baseline model. The main quantitative conclusions still hold in the model with aggregate risk.

[26]In their case, the exogenous processes are productivity shocks, whereas in our model the exogenous processes correspond to endowments, given our focus on consumption behavior.

Figure D.10: Consumption-income Elasticities in the Model with Aggregate Risk



Notes: This figure shows the consumption-income elasticities for different income deciles in the Italian crisis (described in Section 2) and in the crisis experiments of the model calibrated for Italy (described in Section 3). It shows the experiment from the baseline model, presented in Figure D.2 (labeled *baseline*), and that from the model with aggregate risk (labeled *aggregate risk*), described in Appendix D. Elasticities are computed using the average income and consumption by decile, and are defined as the ratio of the log change in consumption to the log change in income. The dashed line corresponds to locally weighted smoothed data. Further details in Appendix A. Data sources: SHIW-BI Italy.

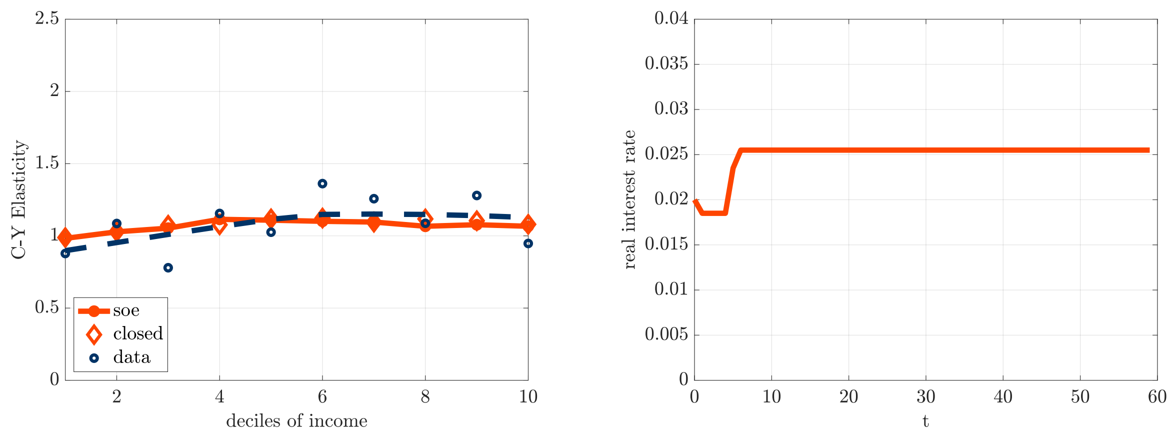
Closed-economy model In this section we consider the extension of a closed economy. There are two main differences with the baseline model. The first is that the interest rate on liquid assets r is endogenous. The second is that we introduce a constant level of government debt, B_g, and homogeneous lump-sum taxes, τ. In this variant of the model, asset market clearing implies $\int_i a_{it} = B_g$. This introduction of government debt allows the model to feature a realistic distribution of liquid assets for households. The introduction of taxes implies that y_{it} should now be interpreted as after-tax income in this version of the model.

We calibrate this model to feature the same steady state as the baseline model by setting B_g as the level of external assets in the steady state of the baseline economy. The difference with the closed economy is that during the crisis experiments, the level of government debt remains unchanged and the interest rate adjusts to clear the asset market.

Figure D.11 shows the dynamics of the interest rates and the consumption-income elasticities under the PI view crisis experiment. In the closed economy, the interest rate increases to a permanently higher level. The reason is that households are permanently poorer and thus scale down their demand of liquid assets, which requires a permanently higher interest rate for a given level of government debt. The consumption-income elasticities are not very different from the open-economy version, suggesting that the endogenous effect of the interest rate is mild.

Figure D.11: Consumption and Interest Rate Responses in a Closed Economy

(a) Consumption-Income Elasticities (b) Interest Rate



Notes: This figure shows the consumption-income elasticities in a closed economy. Panel (a) shows the experiment from the baseline model, presented in Figure D.2 (labeled *soe*), and that from the closed economy model (labeled *closed*), described in Appendix D. Elasticities are computed using average income and consumption by decile, and are as the ratio of the log change in consumption to the log change in income. The dashed line corresponds to locally weighted smoothed data. Panel (b) shows the interest rate that closes the asset market at the initial steady state aggregate level of net assets holdings. Further details in Appendix A. Data sources: SHIW-BI Italy.

D.2.2. Additional details on PI view of crises model extensions

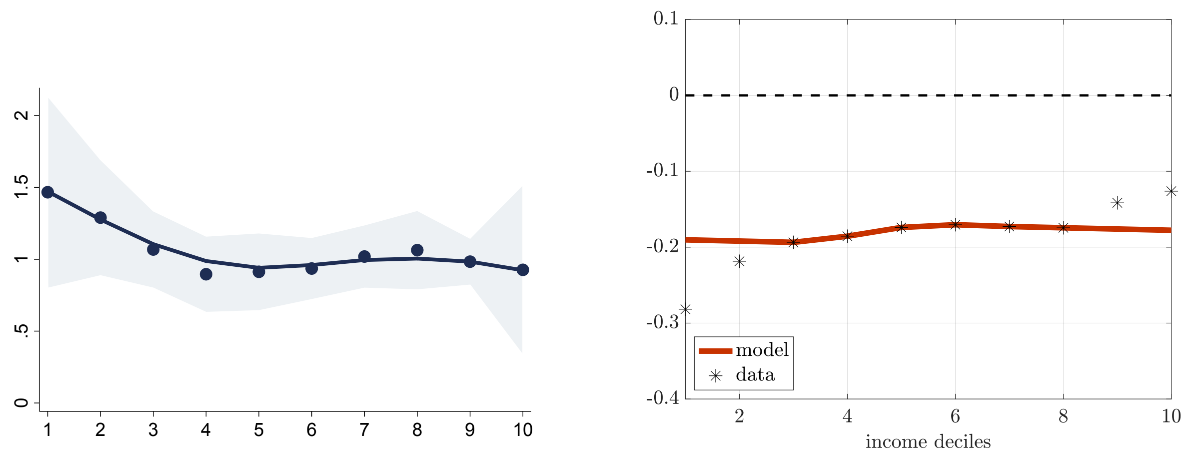
Model with heterogeneous loadings This section provides details on how we estimate the function $\Gamma(\mu_{it})$, which governs the heterogeneity in loadings to the aggregate income shock. We proceed in two steps. First, using the full time period for which we have microdata available, we estimate the following regression for each income decile:

$$\ln(y_{d,t+1}) - \ln(y_{d,t}) = \Gamma_d \left(\ln(Y_{t+1}) - \ln(Y_t)\right) + \varepsilon_{d,t+1},$$

where $y_{d,t}$ is the average detrended income in decile d at time t, and Y_t is the aggregate detrended income. Second, we estimate a locally weighted smoothing function using the estimates Γ_d as inputs. Panel (a) of Figure D.12 shows that the estimated function $\Gamma(\mu_{it})$ is decreasing, with higher loadings on the aggregate shock estimated for income-poor households. Panel (b) shows the heterogeneous impact of the crisis on each income decile in the data and in the model, which are close to each other. In this crisis episode, income-poor households suffer a greater impact of the crisis.

Figure D.12: Loadings to Aggregate Income and Simulations

(a) Loadings to Aggregate Income by Decile (b) Heterogeneous Impact of Crisis



Notes: Panel (a) shows the estimates Γ_d, i.e. loadings to aggregate income across the income distribution. The dots are point estimates, the line a locally weighted smoother, and the shadow the 95% confidence interval. The horizontal axis refers to income deciles. Panel (b) shows the simulated drop in income (orange line) in the model extended to include a heterogeneous income process and the observed drop in income (black dots). Data sources: SHIW-Italy.

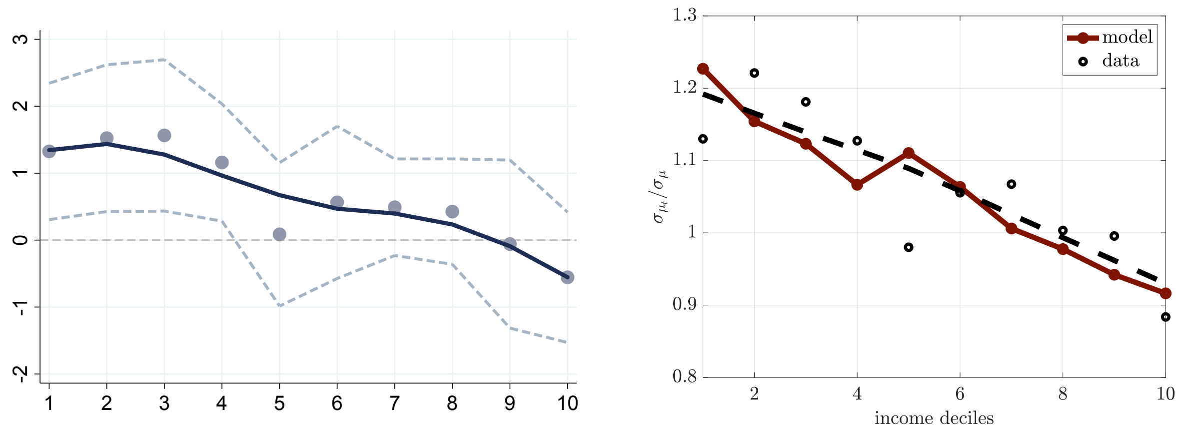
Model with uncertainty shock In this section we provide details on the model extension that features uncertainty shocks. The uniform increase in uncertainty is computed as the increase in the cross-sectional standard deviation of log income, which in the data increases from 0.54 in 2006 to 0.62 in 2014. In the case of heterogeneous increase in uncertainty, we follow a similar approach as in the model with heterogeneous loadings and estimate the following regression for each income decile:

$$\ln(\sigma_{d,t+1}) = \alpha_d + \Sigma_d \ln(\sigma_t) + \varepsilon_{d,t+1}, \tag{18}$$

where $\sigma_{d,t})$ is the standard deviation of log income in income decile d at time t, and σ_t is the standard deviation of log income using the entire sample of households. Second, we estimate a locally weighted smoothing function using the estimates Σ_d as inputs. Panel (a) of Figure D.13 shows that the estimated function $\Sigma(\mu_{it})$ is decreasing, with higher loadings on the aggregate uncertainty shock estimated for income-poor households. Panel (b) shows the heterogeneous change in uncertainty on each income decile in the data and in the model, which are close to each other. In this crisis episode, income-poor households suffer a larger increase in uncertainty during the crisis.

Figure D.13: Heterogeneous Changes in Income Dispersion

(a) Loadings by Decile (b) Changes in Income Dispersion by Decile



Notes: Panel (a) shows the estimates of the function across the income distribution using specification (18). The dots are point estimates, the line a locally weighted smoother, and the dotted lines indicate the upper and lower bounds of the 95% confidence interval. The horizontal axis refers to income deciles. Panel (b) shows the ratio between the income dispersion in the trough relative to the peak in the data and model. The dotted line indicates the observed values, the dashed line a locally weighted smoother of the observations, and the solid (maroon) line corresponds to the model simulation. Data source: SHIW-Italy.

Model with nonhomotheticities Table D.3 shows the parameterizations of the model with nonhomotheticities in the calibrations for Italy and Mexico. The calibration of the baseline model for Mexico uses the same parameters as the model with nonhomotheticities with the exception of $\underline{c}$, which is set to zero. Table D.4 shows targeted and untargeted moments for the Mexican calibration.

Table D.3: Model with Nonhomotheticities: Italy and Mexico

Parameter		Italy	Mexico
Country-Specific			
Discount factor	β	0.90	0.91
Persistence of idiosyncratic process	ρ_μ	0.88	0.97
Volatility of idiosyncratic process	σ_μ	0.26	0.18
Financial constraints	κ	0.23	0.18
Assigned Parameters			
Risk-aversion coefficient	γ	2.00	2.00
Risk-free interest rate	$r*$	0.02	0.02
Nonhomothetic			
Consumption subsistence level	$\underline{c}$	0.04	0.26

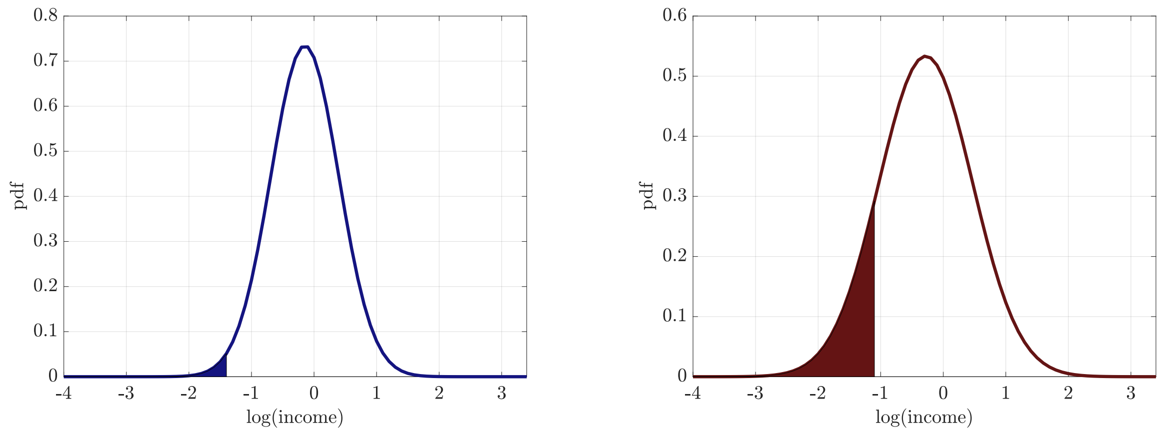
Table D.4: Model Goodness of Fit: Mexico

Variable	Model	Data
Targeted		
Gini index income	0.43	0.43
No liquid assets	0.55	0.55
Share below subsistence	0.16	0.16
Non-Targeted		
Income share bottom 75	0.51	0.50
Income share top 10	0.36	0.28
Income share top 5	0.24	0.18

The key moment that makes the calibration of Mexico and Italy different is the share of households with income below the indigence level, which is 1.4% in Italy and 15.7% in Mexico. In the model the subsistence level of consumption is set to match these two rates. Figure D.14 shows the distribution of income in both calibrations and the share of households with income below the subsistence level of consumption.

Figure D.14: Model Extensions: Income Distribution and Subsistence Level of Consumption

(a) Italy (b) Mexico



Notes: This figure shows the distribution of log income in the calibrated model for Italy and Mexico. Shaded areas indicate the population with an income below the indigence level. We define the indigence level using the World Bank 5.5 USD/day PPP 2011 poverty line. For Mexico, the average poverty level is 15.7% from 1992 to 2018, and for Italy the average is 1.4% from 1995 to 2014. The distribution of income is approximated using a log-normal distribution that matches the model's steady-state income distribution. Further details in Appendix A. Data source: World Bank.

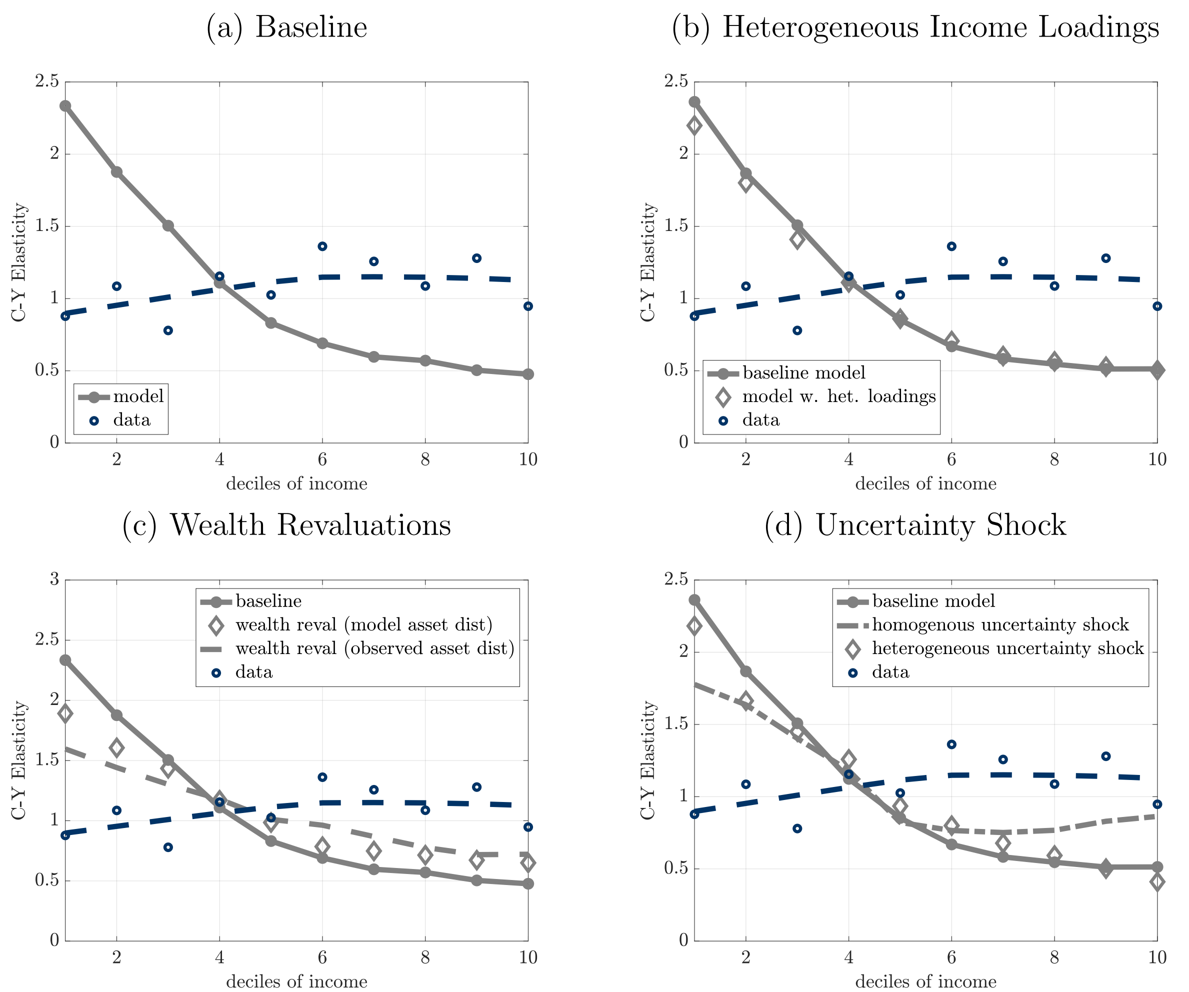
D.3. Appendix for the CT View of Crises Model

D.3.1. Model extensions and additional exercises

This section discusses model extensions and additional exercises for the baseline CT view of crises model, presented in Section 4.1. First, we show that the conclusions from the baseline CT view of crises model extend to all model extensions considered for the PI view of crises model presented in Section 3.3, namely, accounting for: (i) the differential loadings that households have on the aggregate income shock; (ii) the observed negative revaluations of liquid assets; and (iii) the observed increase in the dispersion of households' idiosyncratic income. For each of these extensions, we consider the same formulation as for the PI view of crises model (detailed in Section D.2.2) and recalibrate the sensitivity of the borrowing constraint to income, ν, to match the aggregate consumption-income elasticity. Figure D.15 shows the predicted cross-sectional consumption adjustments in response to the CT crisis experiment under the different model extensions and compares them with the consumption adjustments observed in the data. Similar to the baseline model, in response to this crisis experiment, consumption-income elasticities are decreasing in households' income. It follows that under all of these variants, the CT view of crises still has difficulty explaining why income-rich households adjust as much as the average.

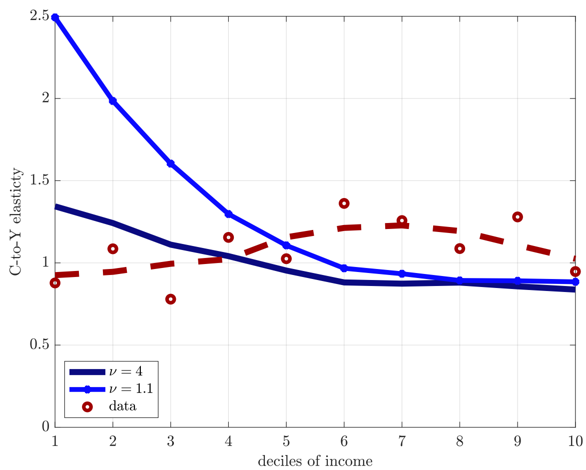
Second, we consider a crisis experiment with a tightening of borrowing constraints accompanied by a permanent aggregate income shock. Figure D.16 shows the predicted cross-sectional consumption adjustments in response to a crisis experiment that features an aggregate permanent shock to income with $\rho_g = 0$ and alternative values for the sensitivity of the borrowing constraint to income, ν. The results show that setting the sensitivity of the borrowing constraint to income to that from the baseline CT view experiment ($\nu = 4$) leads to consumption-income elasticities for the top-income deciles close to those observed in the data, but overestimates the consumption-income elasticities at the bottom of the income distribution. Decreasing the sensitivity of the borrowing constraint to income has little effect on the consumption-income elasticities of top income deciles—which are less likely to be affected by the tightening of borrowing constraints—but brings the consumption-income elasticities of low-income households closer to those observed in the data. The case in which borrowing constraints are close to being unaffected ends up being the parameterization that results in consumption-income elasticities closer to those observed in the data across the income distribution.

Figure D.15: Consumption-income Elasticities under the CT View Crisis Experiment



Notes: This figure shows the consumption-income elasticities for different income deciles in the Italian crisis (described in Section 2) and in the crisis experiments of the model calibrated for Italy (described in Section 4). Panel (a) shows the elasticities in the baseline model. Panel (b) shows the elasticities in the model extended to include heterogeneous income processes. Panel (c) shows the elasticities in the model extended with asset revaluations evaluated at the model's and observed liquid wealth distribution. Panel (d) shows the elasticities in the model extended with homogeneous and heterogeneous uncertainty shocks. Elasticities are computed using average income and consumption by decile, and are defined as the ratio of the log change in consumption to the log change in income. The dashed line corresponds to the locally weighted smoothed data. Further details in Appendix A. Data sources: SHIW-BI Italy.

Figure D.16: Consumption-income Elasticities under Combined Crisis Experiment



Notes: This figure shows the consumption-income elasticities for different income deciles in the Italian crisis (described in Section 2) and in the crisis experiments of the model calibrated for Italy that combines a permanente income for $\nu = 4$ (value in CT experiment calibration) and $\nu = 1.1$ that matches the observed average elasticity. For both, the permanent shock has $\rho_g = 0$. Elasticities are computed using average income and consumption by decile, and are defined as the ratio of the log change in consumption to the log change in income. The dashed line corresponds to the locally weighted smoothed data. Further details in Appendix A. Data sources: SHIW-BI Italy.

D.3.2. Model with income-based borrowing constraints

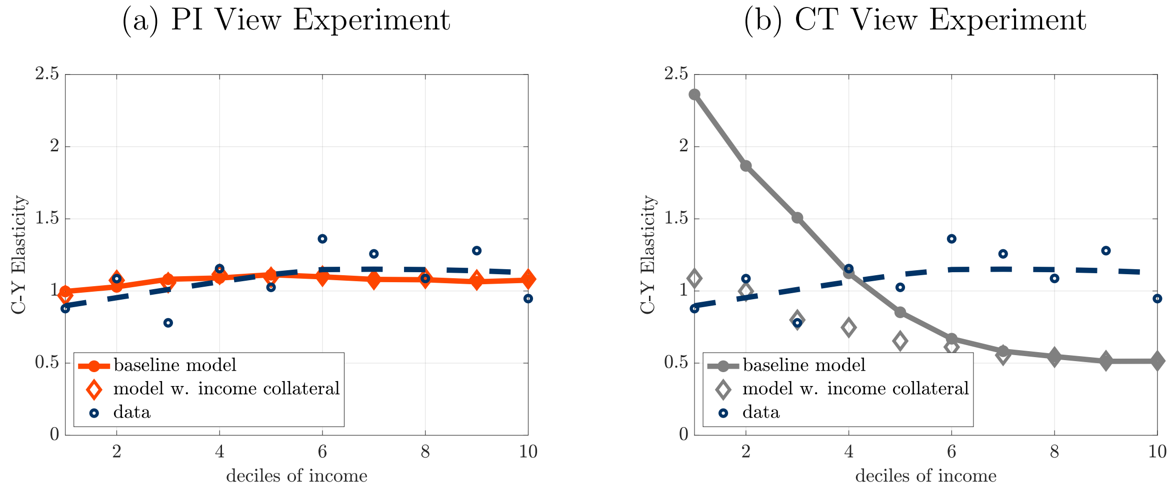
In this version of the model we consider a borrowing constraint of the form

$$a_{it+1} \geq -\kappa \mu_{it} f(Y_t).$$

As we show below, this form of constraints maps onto constraints in which households can pledge part of the value of their income, which in turn depends on equilibrium prices. We parameterize this version of the model following a similar calibration strategy to the baseline model, and analyze the effects of both crisis experiments in this model.

Figure D.17 shows the consumption-income elasticities in this version of the model under both crisis experiments, which are very similar to the baseline ones. This is because even if idiosyncratic income can affect the borrowing constraint, it is the aggregate component of the borrowing constraint that tightens during crises.

Figure D.17: Consumption-income Elasticities: Income-based borrowing constraints



Notes: This figure shows consumption-income elasticities using an extension of the model that includes idiosyncratic income as part of the collateral. Panels (a) and (b) show the elasticities for the permanent-income view experiment and credit-tightening view experiment respectively. Elasticities are computed using average income and consumption by decile, and are the ratio of the log change in consumption to the log change in income. The dashed line corresponds to the locally weighted smoothed data. Further details in Appendix A. Data sources: SHIW-BI Italy.

Mapping with income-dependent borrowing constraints Now we show that this form of collateral constraint maps income-based borrowing constraints as in Mendoza (2005). Consider a heterogeneous-agents version of an endowment economy with tradable and non-tradable goods. The household's problem is given by

$$
\begin{aligned}
&\max_{\{c_{it}^T, c_{it}^N, a_{it+1}\}_{t=0}^{\infty}} \sum_{t=1}^{\infty} \beta^t u(c_{it}) \\
\text{s.t.} \quad & c_{it}^T + p_t c_{it}^N = \mu_{it}\left(Y_t^T + p_t Y^N\right) - a_{it+1} + (1+r)a_{it}, \\
& a_{it+1} \geq -\kappa \mu_{it}\left(Y_t^T + p_t Y^N\right), \\
& c_{it} = \left[\omega \left(c_{it}^T\right)^{1-1/\xi} + (1-\omega)\left(c_{it}^N\right)^{1-1/\xi}\right]^{\frac{\xi}{\xi-1}}
\end{aligned}
$$

where p_t is the relative price of non-tradable goods; μ_{it} is the idiosyncratic component of income that scales both the tradable and non-tradable endowment; Y_t^T is the aggregate tradable endowment; and Y^N is the aggregate non-tradable endowment, which we leave constant. Adding the households' intratemporal first-order conditions and using market clearing for non-tradable goods, we obtain an expression for the equilibrium price of non-tradable goods as a function of aggregate quantities

$$p_t = \frac{1-\omega}{\omega}\left(\frac{\int c_{it}^T \,\mathrm{d}i}{Y^N}\right)^{\frac{1}{\xi}}.$$

Using this expression, we can express the borrowing constraint as $a_{it+1} \geq -\kappa \mu_{it} f_t(Y_t)$, where

$$f_t(Y_t) \equiv Y_t^T + \frac{1-\omega}{\omega}\left(\int c_{it}^T \,\mathrm{d}i\right)^{\frac{1}{\xi}} \left(Y^N\right)^{1-\frac{1}{\xi}},$$

which maps onto our income-based formulation of the borrowing constraint. Additionally, this function is increasing in Y_t^T if $\frac{\partial c_{it}^T}{\partial Y_t^T} \geq 0$.

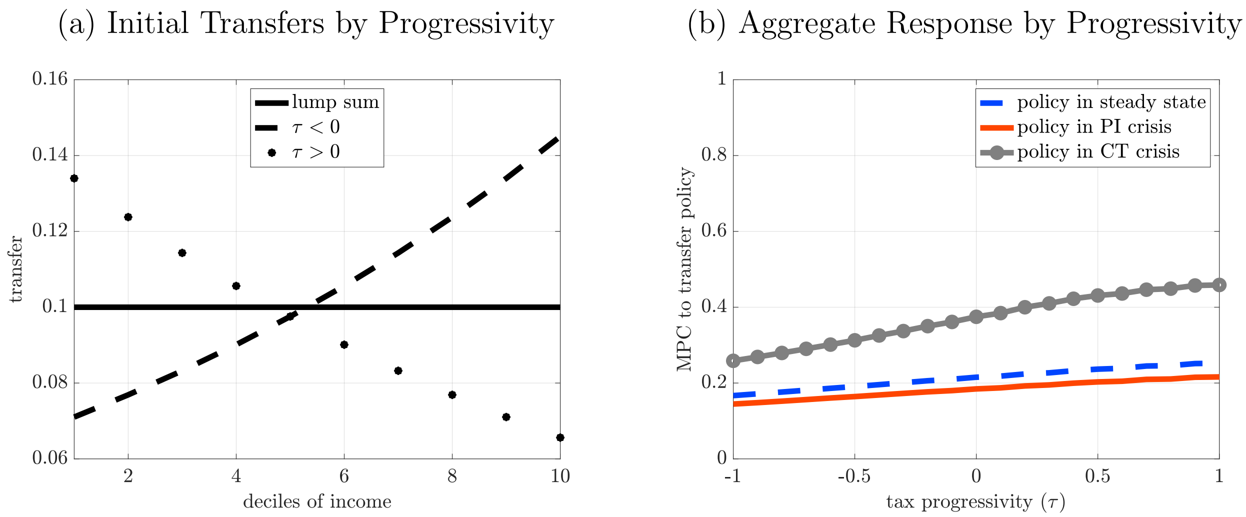
D.4. Additional results on policy analysis

We now study the effects of the stimulus policies analyzed in Section 4.2, which differ in the degree of progressivity. In particular, we consider an initial transfer that takes the form

$$T_0(\mu_{it}) = X e^{\tau \mu_{it}},$$

where the subindex 0 indicates the crisis period, X controls the scale of the program, and τ controls the progressivity. When $\tau < 0$, the transfer is regressive (i.e., larger transfers to income-rich households); when $\tau > 0$ it is progressive; and when $\tau = 0$ it corresponds to the flat lump-sum transfer analyzed in Section 4.2 (see Panel (a) of Figure D.18). Since we are interested in comparing programs with the same scale and varying progressivity, we set $X \int e^{-\tau\mu} \mathrm{d}\phi(\mu) = \eta$, where $\phi(\mu)$ is the cdf of idiosyncratic income.

Figure D.18: Policy Analysis: Fiscal Policies with Varying Progressivity



Notes: Panel (a) shows the income transfer each household in different income deciles receives for different policies that differ in their degree of progressivity τ. Panel (b) shows the ratio of the change in aggregate consumption to the aggregate fiscal transfer for different degrees of progressivity. The dashed blue line corresponds to the MPCs when the policy is conducted in the steady state, the solid orange line to the MPCs when the policy is conducted during the PI view crisis experiment, and the gray line to the MPCs when it is conducted during the CT view crisis experiment.

Panel (b) of Figure D.18 depicts the response of aggregate consumption for fiscal programs that have the same scale but differ in their progressivity, and shows results similar to our baseline experiment. In all policies, higher progressivity leads to a larger effect on aggregate consumption, because it implies redistribution from low- to high-MPC households. In the PI view crisis experiment, the effects are still similar to those in the steady state. However, in the CT view crisis experiment, because the aggregate shock leads to a tightening of the borrowing constraint that is more relevant for low-income households, the effects of increasing progressivity on aggregate consumption are larger.