The Micro Anatomy of Macro Consumption Adjustments*

Rafael Guntin
New York University

Pablo Ottonello
University of Michigan and NBER

Diego J. Perez
New York University and NBER

March 12, 2021

Abstract

We study crises characterized by large adjustments of aggregate consumption through their microlevel patterns. We show that leading theories designed to explain aggregate consumption dynamics differ markedly in their cross-sectional predictions. Guided by theory, we use microlevel data on several crisis episodes to document consumption adjustments along the income distribution. Rich households with liquid assets significantly adjust their consumption, challenging theories based on tightening of financial frictions. Additionally, we show that the distribution of consumption responses is largely consistent with theories based on contractions of aggregate permanent income. We discuss our findings' implications for the effectiveness of stabilization policies.

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

*Guntin (rg3128@nyu.edu): New York University, Department of Economics. Ottonello (pottonel@umich.edu): University of Michigan, Department of Economics and NBER. Perez (diego.perez@nyu.edu): New York University, Department of Economics and NBER. We thank Mark Aguiar, Pierre-Olivier Gourinchas, Loukas Karabarbounis, Brent Neiman, Fabrizio Perri, Luigi Pistaferri, and seminar and conference participants at the University of Maryland; Princeton; Michigan; NYU; Saint Louis Fed; Federal Reserve Board; Paris School of Economics; Stockholm School of Economics; Central Bank of Uruguay; Universidad de Montevideo; University of Albany; NBER IFM 2020 Fall Meetings; the Chicago Booth International Macro-Finance Conference; the Fifth Annual Conference on International Economics; and the 2020 Econometric Society World Congress for useful comments and suggestions.

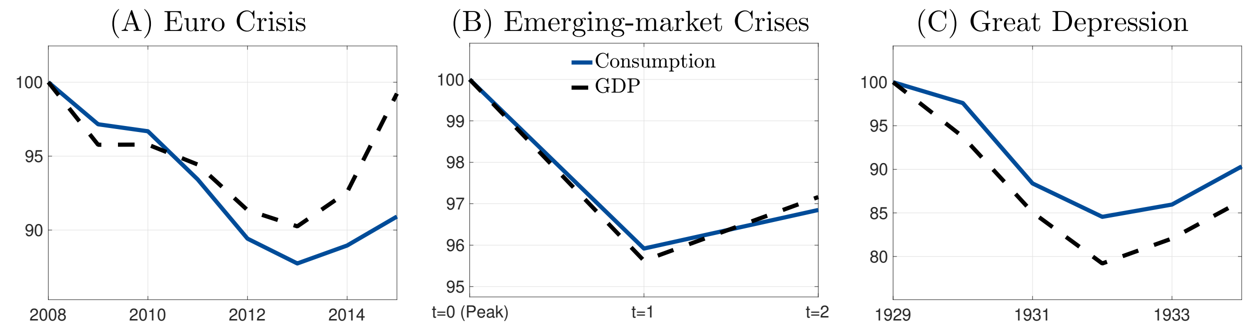
1. Introduction

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 of the lack of consumption smoothing relative to income, in apparent contrast to the predictions of canonical business-cycle theories.

Two main hypotheses have been proposed to date to explain the aggregate-consumption dynamics observed during these crises. One is a neoclassical view, which links consumption dynamics to changes in permanent income. This view argues that these crises involve a large contraction of households' permanent income, which leads to a sharp contraction of desired levels of consumption (Aguiar and Gopinath, 2007; Barro, 2006). The other view hinges on financial frictions, and argues that the tightening of credit market conditions prevents consumption smoothing during crises. For instance, theories based on collateral constraints argue that even transitory negative income shocks, when followed by a tightening of borrowing constraints, preclude households' consumption smoothing (see, for example, Eggertsson and Krugman, 2012; Mendoza, 2005). Distinguishing between these views plays a central role in policy design: Though stabilization policies can be effective in the credit-tightening view of crises, their role is more limited when aggregate consumption dynamics are primarily driven by permanent income.

In this paper, we reassess this central debate in macroeconomics by studying the microlevel anatomy of large consumption adjustments. The central idea of the paper is that the two main classes of theories that explain aggregate consumption dynamics differ substantially in their microlevel cross-sectional predictions. On one hand, theories based on credit tightening 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. On the other hand, theories based on large and persistent fluctuations of income predict that rich households could experience large consumption adjustments during

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 in Calvo and Ottonello (2016). Data source: WDI. Panel (c) shows the average of 16 Great Depression episodes starting in 1929, identified in Barro (2006). Data source: Barro and Ursua (2008). In all episodes, consumption and income are set to 100 at the peak before the recession.

crises, potentially similar to those of poor households. Using household microlevel data that cover several episodes of large consumption adjustment, we find that, consistent with the permanent-income view, households with high income and liquid assets adjust their consumption severely. This lack of consumption smoothing is ubiquitous across all types of households, which indicates that it would be hard to understand the dynamics of aggregate consumption in the absence of permanent income shocks during these episodes.

We begin by constructing a tractable heterogeneous-agents model of optimal consumption under income fluctuations in a small open economy. Households can borrow from the rest of the world using non-state-contingent bonds and face borrowing constraints. In addition, households face idiosyncratic income risk, which gives rise to heterogeneity that can be linked to the microdata. We then conduct two crisis experiments in this economy that capture the two main views on aggregate-consumption adjustments. The first experiment captures the permanent-income view of crises and consists of a permanent contraction in the expected path of aggregate income. The second experiment captures the credit-tightening view of crises and consists of a transitory contraction in aggregate income accompanied by a tightening of borrowing constraints.

We show that these two views of crises differ sharply in their cross-sectional predictions. We first illustrate this with a particular case that can be solved analytically, and characterize the consumption responses of all households to a contractionary aggregate income shock. In the permanent-income-view experiment, the consumption responses of all households have a unitary consumption-income elasticity. Since the aggregate shock is permanent, all households suffer a drop in their permanent income and adjust their consumption accordingly. This behavior stands in contrast to the consumption response of households in the credit-tightening-view experiment. In this case, consumption-income elasticities differ across households. Income-rich households display low elasticities that depend on the persistence of the aggregate shock. Income-poor households are more likely to be borrowing-constrained, and their consumption elasticities are determined by the tightening of the borrowing constraint during the crisis. Therefore, the behavior of income-rich households in response to an aggregate income shock differs across the two types of theories.

Motivated by the different predictions of the two views of aggregate consumption adjustments, we use microlevel expenditure and income data to document the cross-sectional patterns of consumption adjustment during these episodes. We focus on five episodes of large aggregate consumption adjustment over the last decades with available microlevel data on expenditure and income. The first two episodes are from the recent Euro crisis, a widely studied crisis in the international macro literature over the last decade. We focus on Italy and Spain, which were at the epicenter and have available microlevel data on households' expenditure, income, and assets. The other three episodes are from emerging-markets sudden stops. One corresponds to the Tequila crisis in Mexico, and the other two are the 2008-09 crises in Mexico and Peru, in the context of the global financial crisis. These episodes are also widely studied events in the sudden-stop literature and have available microlevel data. For each of these five crisis episodes, we measure consumption-income elasticities, from the peak to the trough of the crisis, for households with different levels of income. All data sets contain disaggregated expenditure information, which allows us to measure nondurable consumption, and households' characteristics, which allow us to follow the standard practice in the consumption literature and residualize expenditure and income from observable characteristics.

Our main empirical result is the large consumption adjustment for top-income households. In all episodes, top-income households (e.g., top 10% or 5%) exhibit a consumption-income elasticity similar to or larger than the average consumption-income elasticity in the economy and close to 1. These large elasticities of high-income households are also observed within households with high levels of liquid assets and are ubiquitous: They are observed in young, middle-aged, and old households; households with different levels of education; households that are non-business owners and those that are; households engaged in all economic activities; and households in different geographic regions of the countries under analysis. Overall, our results indicate no consumption-smoothing behavior for any household type, which makes it difficult to explain the microlevel household behavior during episodes of macro consumption adjustment based on tightened credit conditions.

We then perform a quantitative analysis of the crisis experiments calibrated to the Italian economy. To facilitate comparison of the two views, we perform the experiments as two different types of aggregate shocks that hit an economy with the same microlevel structure. The permanent-income-view experiment consists of a contraction of aggregate income that is expected to be of a permanent nature, with borrowing constraints unaffected. The credit-tightening-view experiment consists of a contractionary shock to aggregate income that is expected to be transitory, but borrowing constraints are tightened as a consequence of the shock. In both cases, we parameterize the aggregate shocks to match the observed aggregate contraction in income and the average consumption-income elasticity in the episode. Therefore, both experiments are deliberately designed to explain the macro data.

Our main quantitative exercise consists of comparing the consumption-income elasticities along the income distribution for the two views of crises with that observed in the data. In the Italian data, the crisis is characterized by a flat pattern of consumption adjustments, with consumption-income elasticities close to one for all income deciles. These data patterns are in sharp contrast to model predictions under the credit-tightening-view experiment, in which there is a decaying pattern of elasticities along the income distribution, with richer households exhibiting more consumption smoothing. However, the data patterns are closely aligned with predictions under the permanent-income-view experiment, in which all households adjust their desired level of consumption in response to changes in their permanent income.

We conduct several extensions of our baseline model which show that the comparison between crisis views and the data is robust to key features of the environment. First, we show that our results are robust to: (i) introducing heterogeneous loadings on the aggregate income shock that account for the differential impact of the crisis on households; (ii) accounting for the observed negative revaluation of liquid assets that happened during the crisis, which is stronger for income-rich households and could in principle explain the large consumption adjustment of those households; and (iii) accounting for the observed increase in uncertainty in idiosyncratic income. Second, we show that the permanent-income view can also explain the patterns 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 argue that discerning between the views of macro adjustments has relevant implications for policy. We illustrate this by analyzing the effects of stabilization policies under the different crisis experiments. We show that the effects of these policies is significantly smaller under the permanent-income view of crises than under the credit-tightening view. Our findings suggest the difficulty stabilization policies can encounter in dealing with crises that involve macro-consumption adjustments.

Related Literature Our paper contributes to three strands of the literature. First, to the literature that studies episodes of large aggregate consumption adjustments, which includes consumption disasters (Barro, 2006; Barro and Ursua, 2008); sudden stop episodes (Calvo, 1998, 2005); financial crises (Reinhart and Rogoff, 2009); and economic depressions (Kehoe and Prescott, 2007). Recent work has studied the heterogeneous impacts of crises on households' consumption (see, for example, Petev, Pistaferri and Saporta, 2012; Chetty, Friedman, Hendren, Stepner *et al.*, 2020, for the Great Recession and Covid-19 crisis, respectively). We contribute to this literature by analyzing how the micro-anatomy of various episodes of aggregate consumption adjustment can shed light on theories that explain aggregate dynamics.

Second, our paper contributes to 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). A strand of this literature literature analyzes how business cycle models can shed light on the observed excess sensitivity of aggregate consumption, a pattern that is most stark in emerging economies (see, for example, Neumeyer and Perri, 2005; Aguiar and Gopinath, 2007; Mendoza, 2010; Garcia-Cicco, Pancrazi and Uribe, 2010; Chang and Fernández, 2013; Hong, 2020). We contribute to this literature by using a heterogeneous-agents model combined with microlevel data to show that the excess sensitivity of consumption during crises episodes can largely be understood through changes in permanent income. In this sense, our paper is methodologically closer to studies in international macroeconomics that analyze micro-aspects of business cycles related to firm dynamics and misallocation, such as Gopinath and Neiman (2014) and Gopinath, Kalemli-Özcan, Karabarbounis and Villegas-Sanchez (2017).[1]

Our paper is also related to the large body of literature that studies households' heterogeneity. 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), as well as on macro models that incorporate incomplete markets and households' heterogeneity (see, for example, Kaplan and Violante, 2014; Werning, 2015; Guerrieri and Lorenzoni, 2017).[2] 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. We identify a set of moments — namely, the distribution

[1]Other related papers include Gourinchas, Philippon and Vayanos (2017) and Chodorow-Reich, Karabarbounis and Kekre (2019), who study the Greek economic depression.

[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).

of consumption responses — that can help distinguish between broad classes of theories of adjustments during crises.[3]

Finally, our findings do not imply that financial frictions are not relevant for crisis dynamics. Rather, they suggest that their importance can primarily come 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, Mendoza, 2010; Bocola, 2016; Benigno and Fornaro, 2018; Queralto, 2020; Ates and Saffie, 2020).

The rest of the paper is organized as follows. Section 2 presents the theory and characterizes the consumption responses of households in response to an aggregate shock. Section 3 presents the empirical analysis. Section 4 performs a quantitative analysis of the baseline model and other model extensions. Section 5 analyzes the macroeconomic effects of stabilization policies. Section 6 concludes.

2. Theoretical Framework

In this section we lay out a model of large consumption adjustments with heterogeneous agents that serves as a guide to our empirical analysis.

2.1. 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

[3] In this sense, our approach is related to the 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 about consumption-savings theories.

endowment of tradable goods y_{it}, given by

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

where h is a non-decreasing function in both arguments, μ_{it} is the idiosyncratic component of endowment, and Y_t is the aggregate endowment. We assume that μ_{it} is a stochastic process and, for the moment, we do not impose any structure to this process. We assume that Y_t follows a deterministic path, and study the effects of unexpected aggregate shocks.[4]

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 the following borrowing constraint:

$$a_{it+1} \geq -\kappa f(Y_t), \tag{3}$$

where $\kappa > 0$ and $f(Y_t) \geq 0$ is a non-decreasing function. This general functional form associated with the borrowing constraint nests various cases commonly used in the literature. The case of $f(Y_t) = 1$ corresponds to a fixed debt limit typically used in Bewley models. The case of $f(Y_t)$ strictly increasing captures a financial amplification mechanism by which a recession tightens access to credit due to a fall in asset prices in general equilibrium. This mechanism has been widely studied in the macro-finance literature (see, for example, Kiyotaki and Moore, 1997; Bernanke, Gertler and Gilchrist, 1999; Mendoza, 2010).[5]

[4]As we show later, our results are unaffected if we study an economy with aggregate risk in which Y_t also follows a stochastic process.

[5]In Appendix E, 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).

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.

This model setup is well suited to conduct crisis experiments that capture the two central views of macro consumption adjustments described in the introduction. On the one hand, by varying only aggregate income, we can capture theories that have attributed the large response of aggregate consumption during crises to changes in permanent income. On the other hand, by tightening borrowing constraints together with income, we can capture the view that attributes macro consumption adjustments to debt-deflation theories through which recessions reduce the value of collateral and tighten access to borrowing. We define these two crisis experiments in the context of our model below, and study the cross-sectional implications of the two views.

2.2. Consumption Dynamics During Output Contractions: An Analytical Case

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

Assumption 1a. *The period utility is given by* $u(c) = ac - bc^2$*, where* $a, b > 0$.

Assumption 1b. *The individual endowment is given by* $h(\mu_{it}, Y_t) = \mu_{it} Y_t$.

Assumption 1c. $\beta(1 + r) = 1$.

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. The main results do not rely on these assumptions. In Section 4, we relax them and show that the quantitative results are aligned with the analytical characterization of this section. Given these assumptions, the Euler equation simplifies to

$$c_{it} = \mathbb{E}_t \left[c_{it+1}\right] - \lambda_{it},$$

where λ_{it} is the Lagrange multiplier associated with the borrowing constraint (3). Solving for consumption by iterating forward on the Euler equation and using the budget constraint, we obtain

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

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).

Permanent-income view We first study a permanent aggregate income shock that does not affect the borrowing constraint, which we label the permanent-income view of crises (*PI-view*). 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 that characterizes the consumption behavior of all households when the interest rate is sufficiently small. 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 4 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.

Define the consumption-income elasticity 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 $a_{it+1} = -\kappa f(Y_t)$, and permanently unconstrained households as those with $\lambda_{it+s} = 0$, for all $s \geq 0$ in equation (4).

***Proposition* 1.** *Suppose that $f(Y_t) = 1$ and aggregate income is at its steady-state level Y_{ss}. Assume that in period t the economy experiences an unexpected shock to aggregate income that is expected to be permanent, i.e., $Y_{t+h} = Y_t < Y_{ss}$.*

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 A. The proposition states that there are unitary 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 a 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}. In Appendix A, we also characterize predictions for the marginal propensity to consume (MPC), which depend on the stochastic properties of μ_{it}, and explain why we focus on consumption-income elasticities in the main analysis.

Credit-tightening view We then study a mean-reverting aggregate income shock that also tightens borrowing constraints, which we label the credit-tightening view of crises (*CT-view*). In this case, the consumption response of households to a mean-reverting income shock is heterogeneous. Whereas unconstrained households are able to smooth their consumption adjustment in response to the income shock, households that are borrowing-constrained have to adjust their consumption because their credit access is tightened.

We formalize this result in the following proposition. Denote the elasticity of the borrowing constraint to aggregate income as $\varepsilon_{fY} \equiv f'(Y)\frac{Y}{f(Y)}$.

***Proposition* 2.** *Suppose that aggregate income is at its steady-state level Y_{ss}. 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 $0 < \rho < 1$.*

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 evaluated at initial debt at the borrowing constraint,* $\varepsilon_{cy} > 1$*.*

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.

The case of a high ε_{fY} captures the main mechanism through which financial-frictions models can account for episodes of large consumption adjustments. These theories endogenize how these episodes have associated contractions in asset prices, which tighten access to credit through a lower value of collateral. The main difference is that prior theories, by working under the representative-agent framework, were able to account for aggregate consumption patterns with this mechanism. What we stress in our heterogeneous-agents theory is that if present, this mechanism is more likely to affect the agents that are close to the borrowing constraint.

Finally, the following proposition argues that income-rich households are more likely to be permanently unconstrained.

***Proposition* 3.** *If* μ_{it} *is mean-reverting and bounded below, households with high enough* μ_{it} *are permanently unconstrained.*

Distinguishing between the two views A corollary of this analysis is that predictions of consumption responses across the distribution of households differ across theories, particularly for income-rich households. Under the PI-view, the consumption-income elasticity of income-rich households is as large as the average elasticity, while under the CT-view it is lower than the average elasticity. We study these predictions in the empirical analysis of the next section.

3. Empirical Analysis

We now document households' microlevel patterns during episodes of large adjustments of aggregate consumption. Section 3.1 describes the sample of episodes, data, and measurement strategy. Section 3.2 presents our main empirical results. Section 3.3 presents additional empirical analyses and discusses alternative interpretations of the results.

3.1. Data Description

Sample of episodes and data sources 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. In the case of Italy, these data come from a single consolidated survey (*Survey on Household Income and Wealth*). In the case of Spain, they come from two surveys collected by the National Statistical Institute and the Bank of Spain (*Encuesta de Prespuestos Familiares* and *Encuesta Financiera de las Familias*).

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.[6] For Mexico, the data come from the survey *Encuesta Nacional de Ingresos y Gastos de los Hogares*, and for Peru from the survey *Encuesta Nacional de Hogares*.

[6] 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%.

Appendix B provides a detailed description of variables, frequency, and coverage of the data. To further characterize the data in our empirical analysis, Appendix C follows the method of Blundell *et al.* (2008) to provide estimates of partial consumption insurance coefficients for the countries with panel data in our sample, Italy and Peru. For both countries we obtain partial insurance coefficients for transitory shocks larger than those estimated for the U.S. in Blundell *et al.* (2008) (0.05), with estimates of 0.30 for Italy and 0.20 for Peru. In Italy, the partial insurance coefficient for permanent shocks is 0.66, which is close to that in the U.S. In Peru this coefficient is larger, close to 0.78. Our estimates from Italy are similar to those obtained by Jappelli and Pistaferri (2011) using the same dataset. Overall, our results suggest that the countries in our sample exhibit less consumption insurance than the U.S., which makes them interesting laboratories to study the role of credit conditions potentially driving aggregate consumption crises.

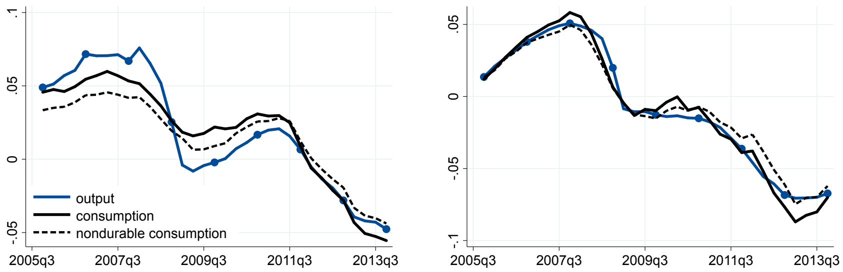
Measurement We are interested in analyzing consumption-income elasticity for households with different incomes (as in our theoretical framework in Section 2). For this, we follow standard practices in the consumption literature (e.g., Blundell *et al.*, 2008) and residualize the measures of consumption and income by projecting these variables onto households' observable characteristics: number of family members, number of children in the household, gender, age, education of the household head, and geographic dummies (for details, see Appendix B.2). We also include time trends to detrend the series. 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.

Our theoretical results in Section 2 show that a useful statistic for distinguishing between different theories of aggregate consumption adjustments is the consumption-income elasticity for different households in response to the aggregate shock. In the data, consumption and income move in response to aggregate and idiosyncratic shocks. To isolate the movements in response to the aggregate shock, we compute consumption-income elasticities by averaging consumption and income for households in different income groups. To the extent that the idiosyncratic component of these variables can be averaged out in each group, this

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

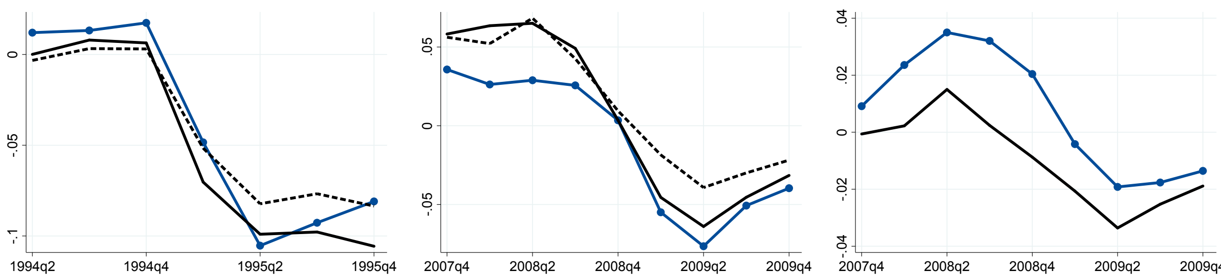
Euro Crisis

(a) Italy (b) Spain



EMs Sudden Stops

(a) Mexico '94 (b) Mexico '08 (c) Peru '08



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 B. Data sources: OECD, FRED, Bank of Italy, INE Spain, INEGI Mexico, and INEI Peru.

statistic approximates the theoretical object of interest. More specifically, we measure the consumption-income elasticities of households in income group j as $\hat{\varepsilon}^j_{cy} = \frac{\Delta_h \log \overline{c}_{j,\tau+h}}{\Delta_h \log \overline{y}_{j,\tau+h}}$, where $\overline{c}_{j,t} \equiv \frac{1}{n_{j,t}} \sum_{i \in \mathcal{I}_{j,t}} c_{i,t}$ and $\overline{y}_{j,t} \equiv \frac{1}{n_{j,t}} \sum_{i \in \mathcal{I}_{j,t}} y_{i,t}$ 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.[7] In the next section we analyze other measures of consumption responses, which

[7]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 GFC; and 2007 to 2010 for the Peruvian GFC. 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.

include elasticities with fixed groups of households, individual elasticities, and marginal propensities to consume.

3.2. Consumption Adjustment Across the Income Distribution

Panel (a) of Table 1 provides summary statistics of the adjustments in income, consumption, and consumption-income elasticity, comparing the average across all income deciles with those of the top income decile. In all crisis episodes, income and consumption exhibit an average negative adjustment. Average elasticity across episodes ranges from 0.73 to 1.19, with a mean across episodes of 0.91. This implies large adjustments of consumption relative to income in these episodes, consistent with the behavior reported in the macro data. The main takeaway from this table is that income-rich households exhibit high consumption-income elasticities, which are close to the average consumption-income elasticity across all households. These range from 0.78 to 1.15, with a mean across episodes of 0.98. Therefore, income-rich households exhibit little consumption smoothing—a finding that appears to challenge the CT-view of crises presented in Section 2, in which the consumption income-elasticity of income-rich households is lower than the average elasticity. However, the reported adjustment of income-rich households is consistent with the PI-view of crises, in which their consumption-income elasticity is the same as the average.

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

		Euro Crisis		Emerging-market Crises			
		Italy	Spain	Mexico '94	Mexico '08	Peru '08	Average
All Households							
$\Delta \log Y$	Average	-0.15	-0.15	-0.38	-0.16	-0.09	-0.19
	Top-income	-0.08	-0.12	-0.42	-0.19	-0.13	-0.19
$\Delta \log C$	Average	-0.18	-0.15	-0.29	-0.11	-0.08	-0.16
	Top-income	-0.08	-0.14	-0.33	-0.17	-0.14	-0.17
Elasticity	Average	1.19	0.97	0.77	0.73	0.90	0.91
	Top-income	1.00	1.15	0.78	0.89	1.10	0.98
Households with Liquid Assets							
$\Delta \log Y$	Average	-0.11	-0.13	-0.40	-0.12	-0.30	-0.21
	Top-income	-0.12	-0.11	-0.43	-0.18	-0.21	-0.21
$\Delta \log C$	Average	-0.13	-0.13	-0.33	-0.07	-0.20	-0.17
	Top-income	-0.12	-0.16	-0.35	-0.14	-0.19	-0.19
Elasticity	Average	1.15	1.00	0.83	0.65	0.68	0.86
	Top-income	1.00	1.51	0.81	0.81	0.87	1.00
N Observations		7,060	21,802	13,138	27,105	21,170	90,275

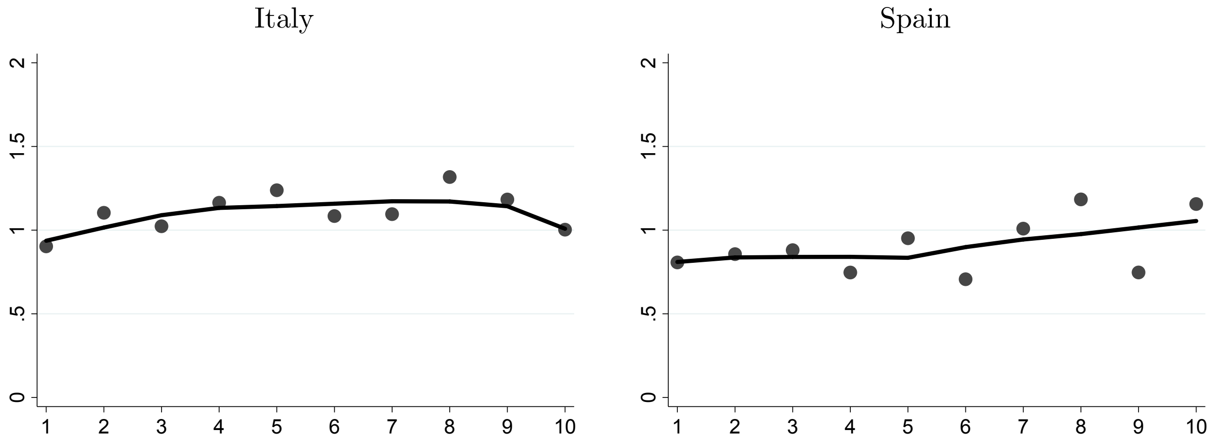
Notes: Income (Y) is defined as monetary after-tax nonfinancial income. Consumption (C) is defined as consumption of nondurable goods and services. Both variables are deflated by the CPI and residualized from households' observable characteristics and time trends (see empirical model (11) in Appendix B 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 B. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Figure 3 complements this analysis by showing the consumption-income elasticity for different income deciles during the different crisis episodes. Panel (a) shows that Italy and Spain, during the Euro crisis, exhibit a flat pattern for consumption-income elasticity across the income distribution: For all deciles, consumption-income elasticities are close to one. This pattern of consumption-income elasticity is remarkably aligned with the prediction of the PI-view, derived analytically in Proposition 1 and studied quantitatively in the next section. Panel (b) shows the patterns of adjustments during emerging-market sudden stops. In these cases, the consumption-income elasticity is increasing in the income level. In Section 4.3, we show that the differential pattern of emerging markets can be explained in the context of the PI-view of crises, if we extend the model to nonhomothetic preferences and account for the share of households that are close to subsistence levels of consumption in these economies.

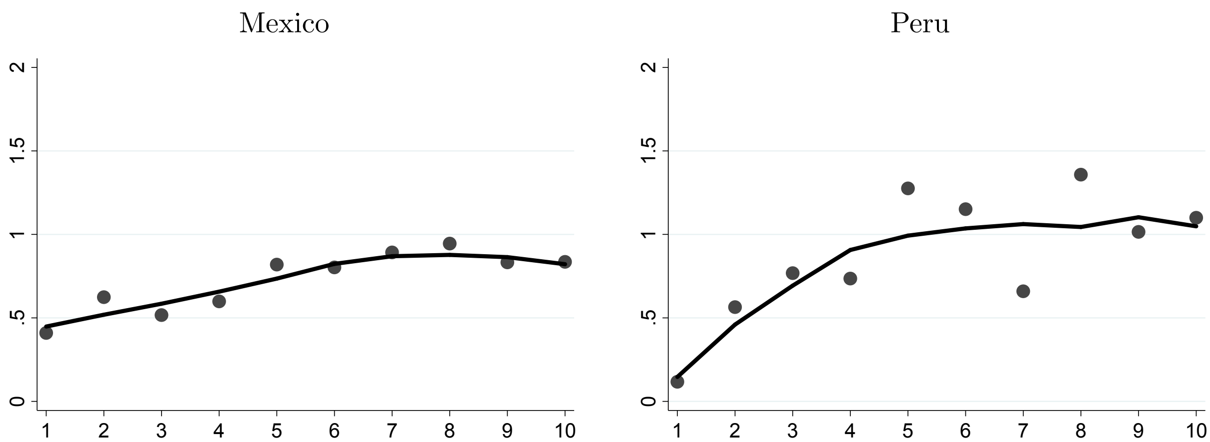
Figure D.1 shows the two components of the elasticity —namely, the change in log income and consumption for different income deciles. There is heterogeneity in the impact of crises on income and consumption. In the case of the Euro crisis episodes, income-poor households saw their income and consumption drop by more than those of income-rich. However, the recoveries of income were similar along the income distribution (see Figure D.2).

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 (11) in Appendix B 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. Elasticities for Mexico are the simple average of its two episodes in the sample (1994 and 2008). Further details in Appendix B. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Appendix Tables D.1 and D.2 show that the results presented so far are robust to several variants in the baseline measurement of the variables of interest. Panel (a) of Table D.1 extends the baseline measures of elasticities for households in the top 5% of the income distribution. Panel (b) of Table D.1 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 (b) of Table D.2 reports elasticities when we include all of the monetary components of consumption and income (our baseline measure excludes durable consumption and financial income). Finally, Panel (c) of Table D.2 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.

Other measures of consumption responses Table D.3 reports the MPCs, which are smaller for the top income decile than for the average. This fact is qualitatively consistent with the analytical characterization of MPCs under both views of crises (see Appendix A). Therefore, using observed MPCs to distinguish between theories requires a quantitative analysis of both theories, which we conduct in Section 4. Table D.4 reports consumption-income elasticities similar to the baseline ones when we compute them with fixed income groups across time for countries with available panel data.

Finally, Table D.5 reports median individual elasticities and MPCs for the countries with panel data. Individual elasticities and MPCs range between 0.2 and 0.4, significantly lower than the baseline elasticities computed for average households in different income groups. The reason is that individual elasticities are more informative about the response of consumption to the idiosyncratic component of income, since this is an order of magnitude more volatile than the aggregate shock. In fact, these statistics are more in line with MPCs from transitory income rebates (Johnson *et al.* (2006); Parker *et al.* (2013)). The analysis of these different statistics provides empirical support for large consumption responses to the aggregate shock, together with reassuring evidence of smaller consumption responses to individual income shocks that is in line with previous studies.

3.3. Additional Empirical Results

Liquid assets The challenge our empirical results raise for the CT-view of crises is that income-rich households, which in principle could smooth consumption, seem to choose not to do so. We further strengthen this point by analyzing the consumption adjustment of households with substantial amounts of liquid assets. 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 B. Panel (b) of Table 1 shows that income-rich households with liquid assets exhibit a consumption-income elasticity of one and close to average elasticity. This corroborates the claim that our results are not driven by the behavior of the "wealthy hand-to-mouth."

Another important point linked to asset holdings is that if households have sufficiently high levels of wealth, their consumption adjustment during crises could reflect changes in the returns on wealth. Appendix Table D.6 shows that households with low income-to-wealth ratios, whose primary source of income is arguably not the returns on wealth, also exhibit elasticities close to one.

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 D.7 and D.8 report the elasticities for durable and nondurable, luxury and non-luxury and tradable and non-tradable goods. Appendix B.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 D.9 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.

Permanent heterogeneity 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 D.10 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 once we compare households with similar permanent unobserved heterogeneity.

Where are the smoothers? Given the lack of consumption smoothing for the top-income households documented in previous subsections, we now ask more broadly whether there exists any type of household in the data that exhibits the consumption-smoothing behavior a model with transitory aggregate shocks would predict. Table 2 reports consumption-income elasticities for households with different levels of education, age, sector, geographic location, and business ownership. We find high consumption-income elasticities for young, middle-aged, and old households; for households with low and high levels of education; for households that are non–business owners and for those that are; for households working in all economic activities; and for households living in all geographic regions of the countries we analyze. We conclude our empirical analysis of crises by asking, if macro crises of aggregate consumption adjustment are driven by transitory shocks, where are the households' smoothers these models predict?

Table 2: Where Are the Smoothers?
Consumption-income Elasticities by Household Characteristics

	Euro Crisis		Emerging-market Crises			Average
	Italy	Spain	Mexico '94	Mexico '08	Peru '08	
Age Group						
≤ 35	1.22	0.79	0.71	0.70	1.05	0.87
$35 >$ and ≤ 50	1.30	0.96	0.82	0.76	0.93	0.96
> 50	0.96	1.19	0.77	0.69	0.69	0.87
Education Level						
Low	1.31	0.91	0.77	0.70	1.32	1.00
High	1.10	1.02	0.70	0.75	0.76	0.87
Firm Ownership						
Yes	1.49	1.74	0.69	0.96	1.32	1.24
No	1.13	0.93	0.79	0.59	0.83	0.86
Home Ownership						
Yes	1.41	1.05	0.80	0.70	0.87	0.97
No	0.92	0.80	0.65	0.76	0.80	0.79
Geographic Location						
Large Population	1.43	0.87	0.82	0.78	0.81	0.94
Low Population	0.95	1.10	0.68	0.59	0.98	0.86
Sector						
Primary	1.10	0.92	0.71	0.68	0.77	0.87
Industry	1.13	0.92	0.75	0.68	0.79	0.85
Services	1.19	1.03	0.80	0.75	0.97	0.99
N Observations	7,060	21,802	13,138	27,105	21,170	90,275

Notes: This table shows consumption-income elasticities by age, education, ownership, geography, and sector. 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 (11) in Appendix B 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. Further details in Appendix B. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

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 micro-data 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 D.3 reports the estimates of β_q, which are close to one 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.

To put this result into perspective, we also analyze the case of the United States, 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.[8] Estimates for the US, shown in Figure D.3, are lower than those of 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 US exhibits more consumption smoothing than the countries of our sample.

4. Quantitative Analysis

So far, our comparison of the two views of crises has been qualitative. In this section we perform a quantitative analysis of the model and contrast its predictions with observed data. We show that the permanent-income view of crises can account for the observed patterns of consumption adjustment, and that this is robust to various model extensions.

[8] Our treatment of the CEX follows standard practices in the literature. We refer to Dauchy, Navarro-Sanchez and Seegert (2020) for further details.

4.1. Quantitative Strategy

Our quantitative strategy proceeds in two steps. We first calibrate the steady state of the model described in Section 2 to match key features of the micro data. Second, we introduce aggregate shocks that capture the macro dynamics in each of the two views of crises. We focus on unexpected aggregate shocks that hit the same economy in the steady state, which facilitates comparison of the two views of crises. In Appendix E, we show that similar results are obtained if we analyze economies with aggregate risk. Our main calibration is for Italy, which is the country in our sample with the richest micro data. In Section 4.3 we also perform the quantitative analysis for an emerging economy.

Steady-state calibration 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:

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

In the steady state, since there are no aggregate shocks, we normalize $f(Y_{ss}) = 1$. 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 estimate the parameters that drive the idiosyncratic income process, ρ_μ and σ_μ, using micro-level data and obtaining values of $\rho_\mu = 0.88$ and $\sigma_\mu = 0.26$. We then calibrate the discount factor β and the fixed borrowing limit κ to target the average wealth-to-income ratio and the proportion of hand-to-mouth (HtM) consumers. Values for these data moments are detailed in Table 4. The model approximates these moments fairly well, with $\beta = 0.90$ and $\kappa = 0.23$.

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. The frequency of the calibration is annual. Y is normalized to 1.

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.

Table 4: Targeted and Untargeted Moments

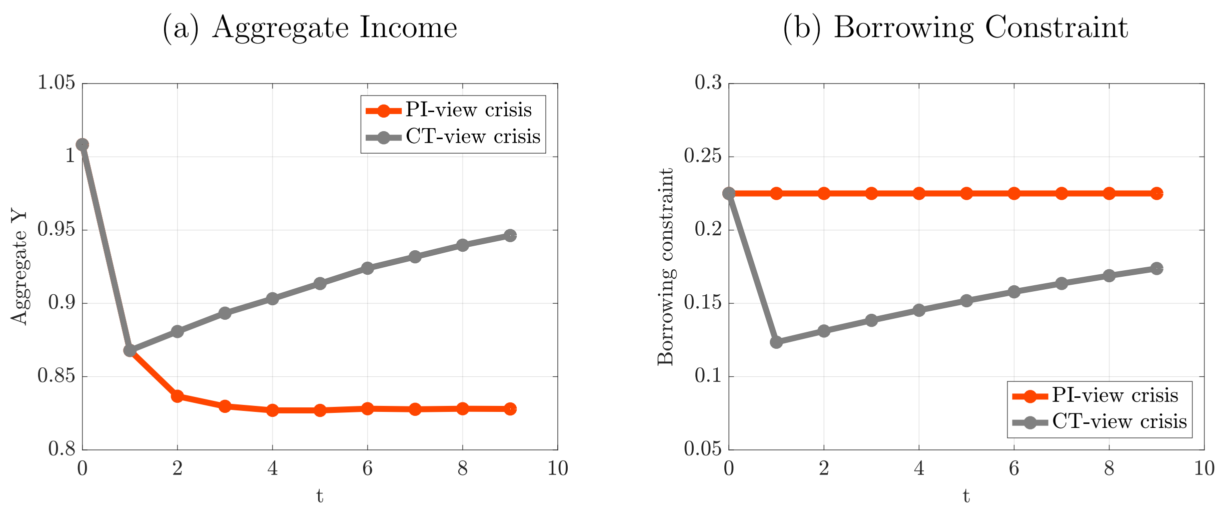
Variable	Model	Data
Targeted		
Wealth-to-income ratio	0.87	0.87
Hand-to-mouth share	0.23	0.23
Non-Targeted		
Gini index income	0.30	0.34
Income share bottom 75	0.49	0.56
Income share top 10	0.24	0.23
Income share top 5	0.15	0.13
Gini index wealth	0.58	0.74
Wealth share bottom 75	0.09	0.14
Wealth share 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.

Crisis experiments We perform two experiments that capture the two views of crises described in the theory section, each as an unexpected aggregate shock. We design both experiments to mimic the same macro dynamics of the crises and study the implied untargeted micro-level responses. In both experiments, the economy at $t = 0$ experiences a contraction in aggregate income of the same magnitude, ϵ_Y, which we calibrate to match the contraction of income during the crisis.[9] The two experiments differ in the expected persistence of this shock and in how it affects individuals' access to credit markets.

Figure 4 shows the dynamics of aggregate income and borrowing constraints in both crisis experments. In the PI-view crisis experiment, the shock to aggregate income is expected to be of a permanent nature and borrowing constraints are unaffected. This experiment 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. In particular, in this economy the expected evolution of aggregate income follows $\log Y_t = \log Y_{t-1} + \rho_g^t \epsilon_Y$. 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. Panel (a) of Figure E.1 shows how the persistence of the growth shock is identified by the aggregate consumption-income elasticity. The calibrated values are $\epsilon_0^g = -0.15$ and $\rho_g = 0.24$.

Figure 4: Crisis Experiments: Aggregate Shocks



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 on each experiment, see Section 4.

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

In the CT-view crisis experiment, the shock to aggregate income is expected to be transitory but borrowing constraints are tightened as a consequence of the shock. This experiment is akin to those considered in theories of sudden-stops driven by endogenous borrowing constraints on consumption (see Appendix E 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.[10] 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 E.1 shows how the income elasticity of the borrowing constraint is identified by the aggregate consumption-income elasticity.

It is worth pointing out that the focus on unexpected aggregate shocks is aimed at facilitating comparison of the two views of crises by analyzing different perturbations of an economy that has the same micro-structure. In Appendix E, we extend our analysis to economies with aggregate risk.

4.2. The Micro Anatomy of Consumption Responses: Model and Data

We now analyze the cross-sectional implications for the behavior of consumption in each of the crisis experiments 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. We provide further details on these computations in Appendix E, and report the model's predictions for alternative ways to compute the consumption-income elasticities and obtain results similar to those reported in this section. We also report the model's predictions for marginal propensities to consume—which, we argue, are not as informative as the elasticities for distinguishing between the different views of aggregate consumption crises.

Figure 5 shows how the crisis experiments significantly differ in their cross-sectional predictions. In the PI-view experiment, the elasticities are close to 1 for all income deciles,

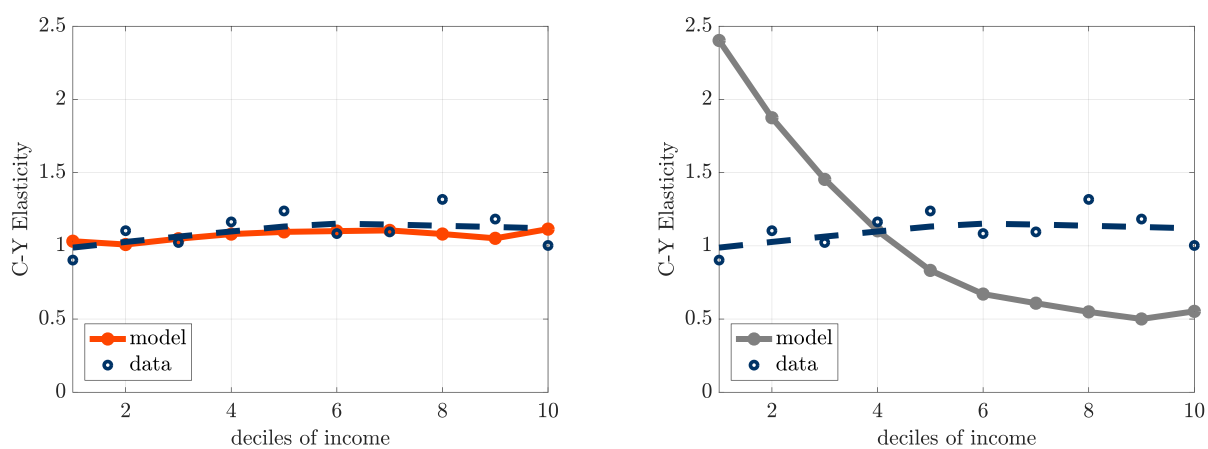
[10] This persistence is estimated following the standard procedure in the business-cycle literature of estimating an autoregressive process on detrended output at an annual frequency.

because the aggregate shock is permanent and affects the permanent income of all households. These elasticities are in line with those predicted in Proposition 1, even after relaxing the assumptions made for tractability. In the CT-view experiment, consumption-income elasticity is 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.

Figure 5: Consumption-income Elasticities: Model Analysis

(a) PI-view Experiment

(b) CT-view Experiment



Notes: This figure shows the consumption-income elasticities for different income deciles in the Italian crisis (described in Section 3) and in the crisis experiments of the model calibrated for Italy (described in Section 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 B. Data sources: SHIW-BI Italy.

Figure 5 also compares the model predictions with the data. The PI-view experiment is remarkably close to the data, particularly in its ability to predict the large consumption-income elasticities of income-rich households. In this dimension, the CT-view experiment faces a challenge in explaining the micro-level patterns.

In Appendix E we analyze the robustness of the main quantitative results. First, we consider alternative specifications for the CT-view experiment by analyzing different combinations of persistent and transitory joint shocks to income and the borrowing constraint. Second, we consider crisis experiments that last for 6 years. Third, we solve alternative versions of our baseline model. These include a version of the model with aggregate risk, a closed-economy version in which the interest rate adjusts to clear the asset market, and a version with income-based borrowing constraints. 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.

4.3. Model Extensions

In this subsection, we extend the baseline model in key dimensions. We further assess the role of heterogeneity by allowing for heterogeneous income processes and nonhomothetic preferences. We also introduce additional features that are common to crisis episodes by accounting for wealth valuations and increases in uncertainty and interest rates. We show that in these extensions, the predictions of the PI-view experiment are still aligned with the observed data and conclude that the PI-view can go a long way toward explaining the micro- and macro-level patterns of consumption during crises.[11]

Heterogeneous loadings to aggregate income As shown in Figure D.1, 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 E describes how we estimate

[11] Our conclusions of crises having associated a contraction in permanent income are consistent with the evidence documented in Cerra and Saxena (2008).

the function $\Gamma(\mu_{it})$ using data on the income dynamics of each income-decile. We estimate higher loadings on the aggregate shock for income-poor households.

Panels (a) and (b) of Figure 6 show the cross-sectional consumption-income elasticities that result from performing the two crisis experiments 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 for both crisis experiments. 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. We conclude that our main results are invariant to considering alternative income processes.

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 particular, we now introduce wealth revaluation to each of the crisis experiments. In addition to the aggregate negative income shock and tightening of borrowing constraints (the later in the CT-view experiment), 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.

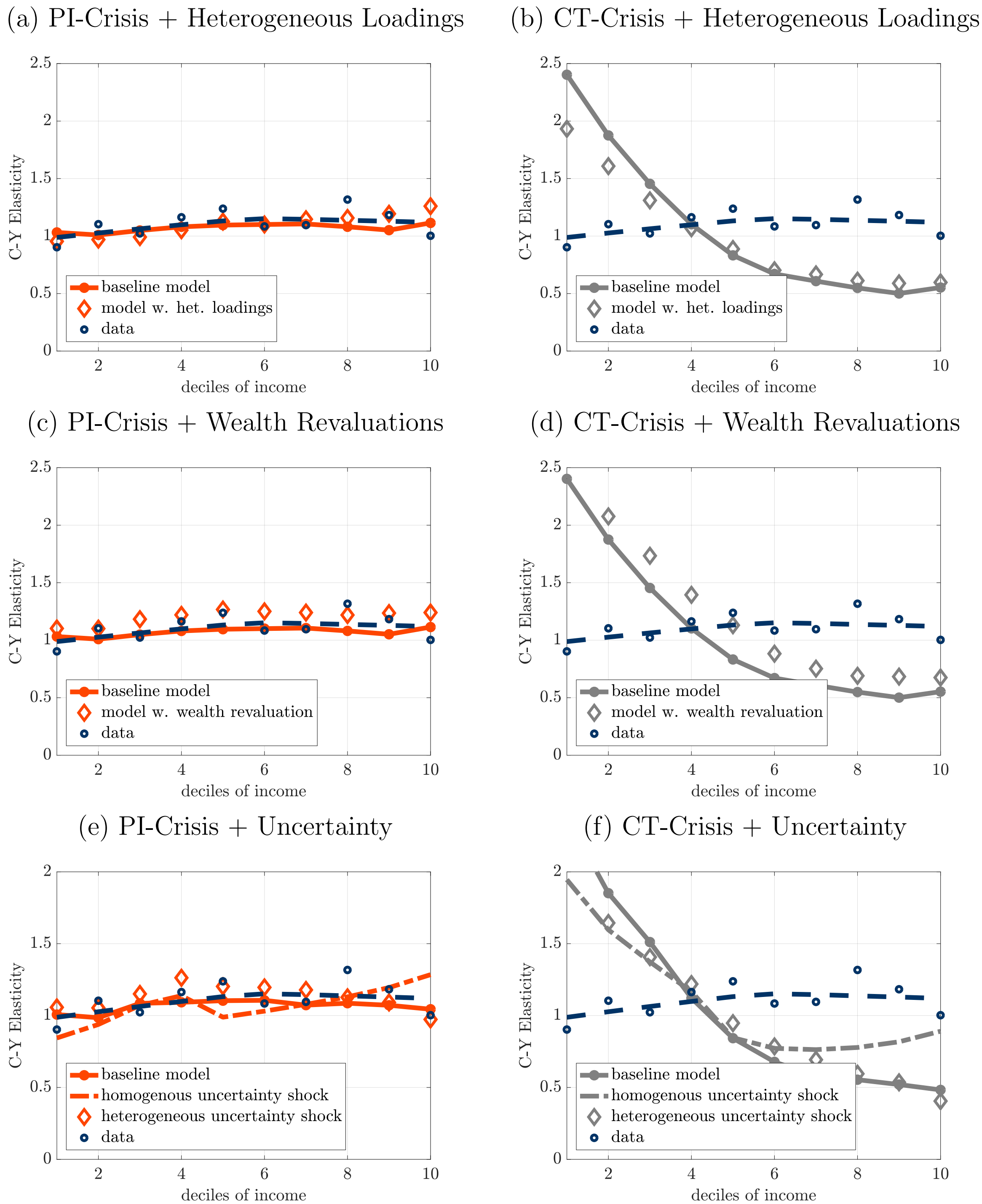
We take the level of initial financial wealth from the observed data. To estimate household-specific asset price changes, we first measure the portfolio of financial assets and separate assets into bank deposits, fixed income and mutual funds, and equity. We then compute the dynamics of the prices of these three asset classes. Given that income-rich households have a larger incidence of equity in their wealth, they suffer larger wealth revaluations (see Figure E.2). We then impose the estimated wealth revaluations as an unexpected drop in assets for each household, and compute consumption-income elasticities.

Panels (c) and (d) of Figure 6 show 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. This, combined with the fact that households optimally choose to consume a flow out of their wealth, implies that the consumption effect of wealth revaluations is small, in spite of the revaluations being large. These exercises indicate that our main conclusions regarding the ability of the two views of macro crises to account for micro-level patterns is not affected by asset revaluations.

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 in each of the crisis experiments. 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.[12] 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

[12]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.

Figure 6: Consumption-income Elasticities in Model Extensions



Notes: This figure shows the consumption-income elasticities for different income deciles in the Italian crisis (described in Section 3) and in the crisis experiments of the model calibrated for Italy (described in Section 4). All left panels show the permanent-income-view experiment and all right panels the credit-tightening-view experiment. Panels (a) and (b) show the elasticities in the model extended with asset revaluations. Panels (c) and (d) show the elasticities in the model extended to include heterogeneous income processes. Panels (e) and (f) show the elasticities in the model extended with homogeneous and heterogeneous uncertainty shocks. Elasticities are computed using the average income and consumption by decile, and 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 B. Data source: SHIW-BI Italy.

$\Sigma(\mu_{it})\sigma_{\mu,t}$, 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 E 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.

Panels (e) and (f) of Figure 6 show the model-implied consumption-income elasticities for households in different income deciles, after we incorporate the homogeneous and heterogeneous increase in uncertainty. In both exercise, the elasticities are, on average, higher in both crisis experiments 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 nonhomotheticicities So far, our quantitative exercises have focused on the case of Italy. In this section, we study the extent to which our conclusions on the two views of crises extend to emerging markets. 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 both models, 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 nonhomoteticities 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 nonhomotheticicities introduces a strong desire to smooth consumption for households with close-to-subsistence levels of consumption, and has therefore 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 there is a large share of households close to the subsistence level.

We perform two calibrations of the extended model with nonhomoteticities: 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 E.

We then reproduce both crisis experiments in the two calibrated economies with nonhomotheticities.[13] The results, shown in Figure E.4, indicate that the model-predicted elasticities in the PI-view are consistent with those observed in the data for both countries. Figure E.4 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.

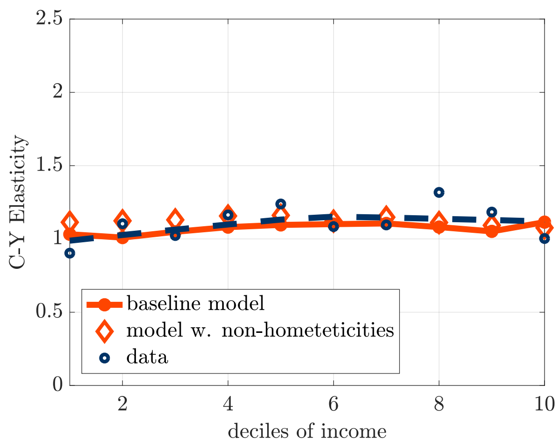
We conclude that the introduction of nonhomotheticities can help explain the distribution of consumption responses to shocks to permanent income, as previously emphasized by Straub (2018).

Interest rate shocks Episodes of consumption are often accompanied by increases in interest rates. In this section we assess the effects of including shocks to the interest rate as part of the crisis experiments. Figure E.3 shows that interest rates exhibited differential behavior in the Italian and Mexican crisis episodes: They remained roughly unchanged during the Italian crisis episode, and increased during the Mexican crisis episodes.

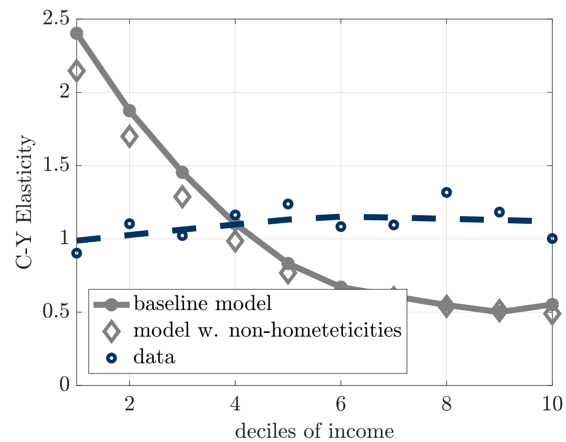
[13] Following the baseline calibration strategy, in both economies we recalibrate the aggregate shocks to match the same targeted moments—namely, the aggregate consumption-income elasticity and the drop in aggregate income.

Figure 7: Consumption-income Elasticities in Model Extensions: Nonhomotheticities

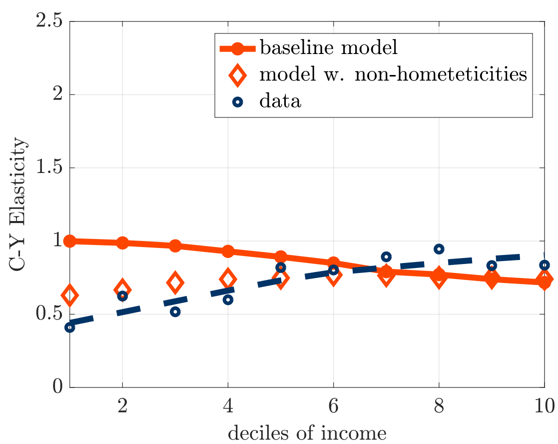
(a) PI-Crisis + Nonhomotheticities: Italy



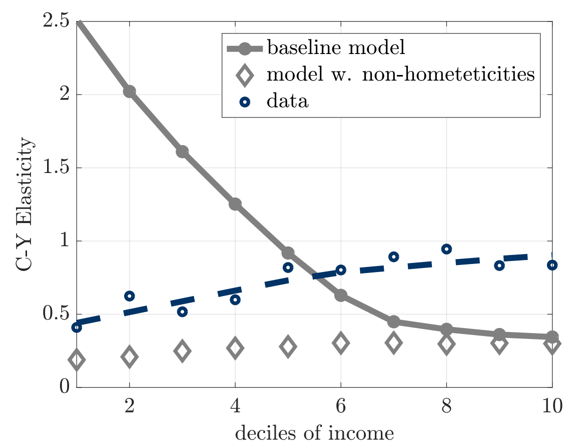
(b) CT-Crisis + Nonhomotheticities: Italy



(c) PI-Crisis + Nonhomotheticities: Mexico



(d) CT-Crisis + Nonhomotheticities: Mexico



Notes: This figure shows the average consumption-income elasticities for different income deciles in the Italian and Mexican crises (described in Section 3) and in the crisis experiments of the model calibrated for Italy and Mexico (described in Section 4). All left panels show the permanent-income-view experiment and all right panels the credit-tightening-view experiment. All panels show the elasticities in the baseline model and in the model extended with nonhomothetic preferences. Panels (a) and (b) show the elasticities for Italy, and panels (c) and (d) the elasticities 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 Appendices B and E.4. Data sources: ENIGH-INEGI Mexico.

We focus on the case of Mexico, which had increases in interest rates, and analyze the effects of including in both crisis experiments an additional shock that increases the interest rate by the same magnitude as the one observed in the data.[14] Figure E.4 shows the consumption-income elasticities along the income distribution for each crisis experiment, which now include an increase in the interest rate, jointly with the contraction in income and the tightening of borrowing constraints (the latter only in the case of the CT-view experiment). 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.

5. Policy Implications

In this section we assess the effects of stabilization policies through fiscal transfers under each of the 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 F, 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.

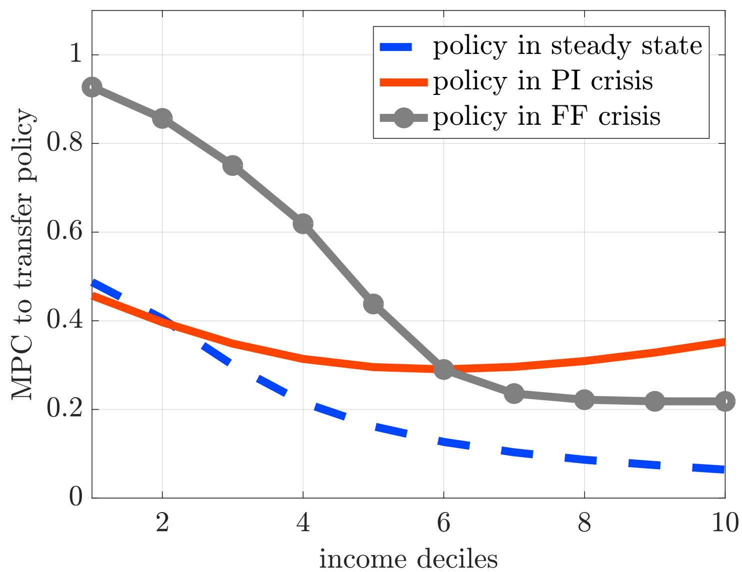
We study the response of households' consumption to this policy under the PI-view experiment and the CT-view experiment, and compare their effects with the effect the policy would have, starting from the steady state. The logic of this comparison is to analyze whether "stabilization policies," defined as policies that are conducted during crises, have a larger effect on consumption than they would during normal times. Figure 8 shows responses to the transfer for different households in the income distribution.[15] In all policy experiments, the

[14] 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 increasing 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.

[15] We define the consumption response as the percent difference in consumption with and without the policy.

consumption response is decreasing in the level of households' income, because the response is governed by the proximity of households to the borrowing constraint. In the PI-view, the response during crises is similar to the steady-state response. In the CT-view, the response during crises is larger than the steady-state response because the aggregate shock tightens the constraint. Overall, these results show remarkable differences in how effective stabilization policies are depending on the nature of crises, which highlights the relevance of distinguishing between the two 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, the solid orange line to MPCs when the policy is conducted during the PI-view crisis experiment, and the gray line when the policy is conducted during the CT-view crisis experiment.

6. Conclusion

In this paper, we study the microlevel anatomy of crisis episodes characterized by large adjustments of aggregate consumption, including the recent Euro debt crisis and emerging-market sudden stops. These episodes have received wide attention in both policy and academic circles due to their lack of consumption smoothing, which is in sharp contrast to the predictions of canonical business-cycle theories.

Our starting point is the two main theories that have emerged from this fruitful but far from settled debate: One theory argues that negative income shocks are followed by a tightening of credit, which hamper these economies' consumption smoothing in bad times. The other theory argues that crises are characterized by large and persistent fluctuations in permanent income, which cause households to optimally adjust consumption even in the absence of a tightening of financial conditions. Constructing a heterogeneous-agents version of these theories, we show that whereas the two are similar in their aggregate patterns, they differ substantially in their microlevel cross-sectional predictions. We then use household microlevel data during several crisis episodes and find that, consistent with the permanent-income view, households with high income and liquid wealth severely adjust their consumption. Our findings do not imply that financial frictions are not relevant for crisis dynamics. Rather, they suggest that their importance can primarily come through how they persistently affect income, since the dynamics of consumption at the micro and macro levels can be understood to a large extent through the permanent-income view of crises.

References

Aguiar, M. and Bils, M. (2015). Has consumption inequality mirrored income inequality? *American Economic Review*, **105** (9), 2725–56.

— and Gopinath, G. (2007). Emerging market business cycles: The cycle is the trend. *Journal of political Economy*, **115** (1), 69–102.

— and Hurst, E. (2007). Measuring trends in leisure: The allocation of time over five decades. *The Quarterly Journal of Economics*, **122** (3), 969–1006.

Aguiar, M. A., Bils, M. and Boar, C. (2020). *Who Are the Hand-to-Mouth*. Tech. rep., National Bureau of Economic Research.

Ates, S. and Saffie, F. (2020). Fewer but better: Sudden stops, firm entry, and financial selection. *American Economic Journal: Macroeconomics*, (forthcoming).

Attanasio, O., Battistin, E. and Ichimura, H. (2004). *What really happened to consumption inequality in the US?* Tech. rep., National Bureau of Economic Research.

Backus, D. K., Kehoe, P. J. and Kydland, F. E. (1992). International real business cycles. *Journal of political Economy*, **100** (4), 745–775.

Barro, R. J. (2006). Rare disasters and asset markets in the twentieth century. *The Quarterly Journal of Economics*, **121** (3), 823–866.

— and Ursua, J. F. (2008). Consumption disasters in the twentieth century. *American Economic Review*, **98** (2), 58–63.

Baxter, M. and Crucini, M. J. (1993). Explaining saving–investment correlations. *The American Economic Review*, pp. 416–436.

Benigno, G. and Fornaro, L. (2018). Stagnation traps. *The Review of Economic Studies*, **85** (3), 1425–1470.

Berger, D. W., Bocola, L. and Dovis, A. (2019). *Imperfect Risk-Sharing and the Business Cycle*. Tech. rep., National Bureau of Economic Research.

Bernanke, B. S., Gertler, M. and Gilchrist, S. (1999). The Financial Accelerator in a Quantitative Business Cycle Framework. *Handbook of Macroeconomics*, **1**, 1341–1393.

Bils, M. and Klenow, P. J. (2004). Some evidence on the importance of sticky prices. *Journal of political economy*, **112** (5), 947–985.

Blundell, R., Pistaferri, L. and Preston, I. (2008). Consumption inequality and partial insurance. *American Economic Review*, **98** (5), 1887–1921.

— and Preston, I. (1998). Consumption inequality and income uncertainty. *The Quarterly Journal of Economics*, **113** (2), 603–640.

Bocola, L. (2016). The pass-through of sovereign risk. *Journal of Political Economy*, **124** (4), 879–926.

Calvo, G. A. (1998). Capital flows and capital-market crises: the simple economics of sudden stops. *Journal of applied Economics*, **1** (1), 35–54.

— (2005). *Emerging Capital Markets in Turmoil: Bad Luck or Bad Policy?* MIT Press.

— and Ottonello, P. (2016). Systemic sudden stops: Crises and recoveries in emerging markets. In *Macroeconomics in times of liquidity crises: Searching for economic essentials*, MIT Press.

Campbell, J. and Deaton, A. (1989). Why is consumption so smooth? *The Review of Economic Studies*, **56** (3), 357–373.

Carroll, C. D. (1997). Buffer-stock saving and the life cycle/permanent income hypothesis. *The*

Quarterly journal of economics, **112** (1), 1–55.

Cerra, V. and Saxena, S. C. (2008). Growth dynamics: the myth of economic recovery. *American Economic Review*, **98** (1), 439–57.

Chang, R. and Fernández, A. (2013). On the sources of aggregate fluctuations in emerging economies. *International Economic Review*, **54** (4), 1265–1293.

Chetty, R., Friedman, J. N., Hendren, N., Stepner, M. *et al.* (2020). *How did covid-19 and stabilization policies affect spending and employment? a new real-time economic tracker based on private sector data*. Tech. rep., National Bureau of Economic Research.

Chodorow-Reich, G., Karabarbounis, L. and Kekre, R. (2019). *The macroeconomics of the Greek Depression*. Tech. rep., National Bureau of Economic Research.

Cochrane, J. H. (1994). Permanent and transitory components of gnp and stock prices. *The Quarterly Journal of Economics*, **109** (1), 241–265.

Cravino, J. and Levchenko, A. A. (2017). The distributional consequences of large devaluations. *American Economic Review*, **107** (11), 3477–3509.

Dauchy, E., Navarro-Sanchez, F. and Seegert, N. (2020). Taxation and inequality: Active and passive channels. *Review of Economic Dynamics*.

Eggertsson, G. B. and Krugman, P. (2012). Debt, deleveraging, and the liquidity trap: A fisher-minsky-koo approach. *The Quarterly Journal of Economics*, **127** (3), 1469–1513.

Fernandez-Villaverde, J. and Krueger, D. (2007). Consumption over the life cycle: Facts from consumer expenditure survey data. *The Review of Economics and Statistics*, **89** (3), 552–565.

Fuchs-Schündeln, N. and Schündeln, M. (2005). Precautionary savings and self-selection: Evidence from the german reunification "experiment". *The Quarterly Journal of Economics*, **120** (3), 1085–1120.

Garcia-Cicco, J., Pancrazi, R. and Uribe, M. (2010). Real business cycles in emerging countries? *American Economic Review*, **5**, 2510–31.

Gopinath, G., Kalemli-Özcan, Ş., Karabarbounis, L. and Villegas-Sanchez, C. (2017). Capital allocation and productivity in south europe. *The Quarterly Journal of Economics*, **132** (4), 1915–1967.

— and Neiman, B. (2014). Trade Adjustment and Productivity in Large Crises. *The American Economic Review*, **104** (3), 793–831.

Gourinchas, P.-O. and Parker, J. A. (2002). Consumption over the life cycle. *Econometrica*, **70** (1), 47–89.

—, Philippon, T. and Vayanos, D. (2017). The analytics of the greek crisis. *NBER macroeconomics Annual*, **31** (1), 1–81.

Guerrieri, V. and Lorenzoni, G. (2017). Credit crises, precautionary savings, and the liquidity trap. *The Quarterly Journal of Economics*, **132** (3), 1427–1467.

Guvenen, F., Ozkan, S. and Song, J. (2014). The nature of countercyclical income risk. *Journal of Political Economy*, **122** (3), 621–660.

— and Smith, A. A. (2014). Inferring labor income risk and partial insurance from economic choices. *Econometrica*, **82** (6), 2085–2129.

Hong, S. (2020). *Emerging Market Business Cycles with Heterogeneous Agents*. Tech. rep.

Huggett, M. (1996). Wealth distribution in life-cycle economies. *Journal of Monetary Economics*, **38** (3), 469–494.

Jappelli, T. and Pistaferri, L. (2010). Does consumption inequality track income inequality in italy? *Review of Economic Dynamics*, **13** (1), 133–153.

— and — (2011). Financial integration and consumption smoothing. *The Economic Journal*, **121** (553), 678–706.

— and — (2017). *The economics of consumption: theory and evidence*. Oxford University Press.

Johnson, D. S., Parker, J. A. and Souleles, N. S. (2006). Household expenditure and the income tax rebates of 2001. *American Economic Review*, **96** (5), 1589–1610.

Kaplan, G. and Violante, G. L. (2014). A model of the consumption response to fiscal stimulus payments. *Econometrica*, **82** (4), 1199–1239.

— and — (2018). Microeconomic heterogeneity and macroeconomic shocks. *Journal of Economic Perspectives*, **32** (3), 167–94.

—, — and Weidner, J. (2014). The wealthy hand-to-mouth. *Brookings Papers on Economic Activity*, pp. 139–153.

Kehoe, T. J. and Prescott, E. C. (2007). *Great depressions of the twentieth century*. Citeseer.

Kiyotaki, N. and Moore, J. (1997). Credit Cycles. *Journal of Political Economy*, **105** (2), 211–248.

Krueger, D. and Perri, F. (2006). Does income inequality lead to consumption inequality? evidence and theory. *The Review of Economic Studies*, **73** (1), 163–193.

Kueng, L. (2018). Excess sensitivity of high-income consumers. *The Quarterly Journal of Economics*, **133** (4), 1693–1751.

Kydland, F. E. and Prescott, E. C. (1982). Time to build and aggregate fluctuations. *Econometrica: Journal of the Econometric Society*, pp. 1345–1370.

Lewis, D. J., Melcangi, D. and Pilossoph, L. (2019). Latent heterogeneity in the marginal propensity to consume. *FRB of New York Staff Report*, (902).

Ludvigson, S. (1999). Consumption and credit: a model of time-varying liquidity constraints. *Review of Economics and Statistics*, **81** (3), 434–447.

Ludvigson, S. C. and Michaelides, A. (2001). Does buffer-stock saving explain the smoothness and excess sensitivity of consumption? *American Economic Review*, **91** (3), 631–647.

Mendoza, E. G. (1991). Real business cycles in a small open economy. *The American Economic Review*, pp. 797–818.

— (2005). Real exchange rate volatility and the price of nontradables in sudden-stop-prone economies. *Economia*, **6** (1), 103–148.

— (2010). Sudden stops, financial crises, and leverage. *American Economic Review*, **100** (5), 1941–66.

Nakamura, E. and Steinsson, J. (2018). Identification in macroeconomics. *Journal of Economic Perspectives*, **32** (3), 59–86.

Neumeyer, P. A. and Perri, F. (2005). Business Cycles in Emerging Economies: the Role of Interest Rates. *Journal of Monetary Economics*, **52** (2), 345–380.

Parker, J. A., Souleles, N. S., Johnson, D. S. and McClelland, R. (2013). Consumer spending and the economic stimulus payments of 2008. *American Economic Review*, **103** (6), 2530–53.

Petev, I., Pistaferri, L. and Saporta, I. (2012). Consumption in the great recession. *The Russell Sage Foundation and the Stanford Center on Poverty and Inequality*, pp. 2–3.

Quadrini, V. and Ríos-Rull, J.-V. (2015). Inequality in macroeconomics. In *Handbook of Income*

Distribution, vol. 2, Elsevier, pp. 1229–1302.

Queralto, A. (2020). A model of slow recoveries from financial crises. *Journal of Monetary Economics*, **114**, 1–25.

Reinhart, C. M. and Rogoff, K. (2009). *This Time Is Different: Eight Centuries of Financial Folly*. Princeton University Press.

Straub, L. (2018). Consumption, savings, and the distribution of permanent income. *Unpublished manuscript, Harvard University*.

Uribe, M. and Schmitt-Grohé, S. (2017). *Open economy macroeconomics*. Princeton University Press.

Werning, I. (2015). *Incomplete markets and aggregate demand*. Tech. rep., National Bureau of Economic Research.

Appendices

A. Omitted Proofs and Results

A.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

$$c_{it} = ra_{it} + \frac{r}{1+r}\sum_{s=0}^{\infty}\frac{\mathbb{E}_t\left[\mu_{it+s}\right]Y_{t+s}}{(1+r)^s}. \tag{6}$$

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

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} = \frac{\frac{r}{1+r}\sum_{s=0}^{\infty}\frac{\mathbb{E}_t[\mu_{it+s}]\frac{\partial Y_{t+s}}{\partial Y_t}}{(1+r)^s}}{\mu_{it}}. \tag{7}$$

This implies that the elasticity is given by

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}}\frac{y_{it}}{c_{it}} = \frac{\frac{r}{1+r}\sum_{s=0}^{\infty}\frac{\mathbb{E}_t[\mu_{it+s}]\frac{\partial Y_{t+s}}{\partial Y_t}}{(1+r)^s}}{\mu_{it}}\frac{\mu_{it}Y_t}{\left(ra_{it} + \frac{r}{1+r}\sum_{s=0}^{\infty}\frac{\mathbb{E}_t[\mu_{it+s}]Y_{t+s}}{(1+r)^s}\right)}. \tag{8}$$

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

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} = \frac{\mu_{it} + \kappa f'(Y_t)}{\mu_{it}}. \tag{9}$$

The consumption-income elasticity is given by

$$\frac{\frac{\partial c_{it}}{\partial Y_t}}{\frac{\partial y_{it}}{\partial Y_t}} \frac{y_{it}}{c_{it}} = \frac{\mu_{it} + \kappa f'(Y_t)}{\mu_{it}} \frac{\mu_{it} Y_t}{\mu_{it} Y_t + (1+r) a_{it} + \kappa f(Y_t)}, \tag{10}$$

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 $\varepsilon_{cy} = 1$.

A.2. Proof of Proposition 2

We start by showing the first result. The consumption-income elasticity of a permanently unconstrained household is given by (8). 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 (10), 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

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

A.3. Proof of Proposition 3

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 (6). 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.

A.4. 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* 4.** *Suppose that $f(Y_t) = 1$, that μ_{it} is mean-reverting, and that aggregate income is at its steady-state level Y_{ss}. Assume that in period t the economy experiences an unexpected shock to aggregate income that is expected to be permanent, i.e., $Y_{t+h} = Y_t < Y_{ss}$.*

1. *The MPC of permanently unconstrained households is decreasing in income.*

2. *The MPC of constrained households is one.*

Proof. We start by showing the first result. The MPC of permanently unconstrained households is given by (7), 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 (9), 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 one 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 propostion characterizes MPCs under the credit-tightening view of crises.

***Proposition* 5.** *Suppose that μ_{it} is mean-reverting and aggregate income is at its steady-state level Y_{ss}. 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 $0 < \rho < 1$.*

1. *The MPC of permanently unconstrained households is decreasing in income.*

2. *The MPC of constrained households is also decreasing in income.*

Proof. We start by showing the first result. The MPC of permanently unconstrained households is given by (7), 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 (9), where $f'(Y_t) > 0$ under the credit-tightening view of crises. □

B. Data Description

B.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.

B.2. Microlevel Data

In this section we describe the data sources, sample selection criteria, and variable definitions for our empirical analysis in Section 3. 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 3, our empirical results are robust to several variants of the baseline measurement.

B.2.1. Italy

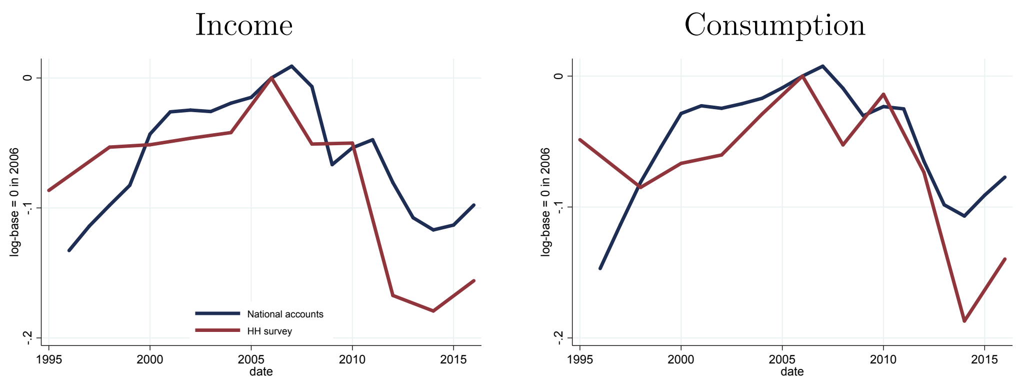
The source of household-level data for Italy is the *Survey on Household Income and Wealth* (SHIW), conducted by the Bank of Italy. The SHIW is representative of the Italian resident population, and contains detailed cross-sectional and panel data on households' income, consumption, wealth, and demographics. We use data 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).[16] Jappelli and

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

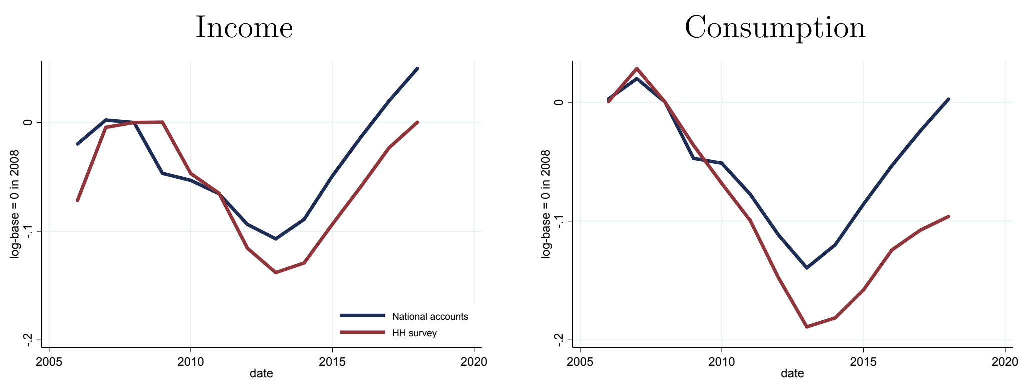
Pistaferri (2010) provide a detailed description of the survey design and analysis of the quality of these data. Following their approach, Panel (a) of Figure B.1 compares the dynamics of per capita disposable income and total consumption from the microlevel data with their counterparts from National Accounts for our period of analysis.

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

(a) Italy – SHIW



(b) Spain – EPF-INE



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 3 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 B.2.1 and B.2.2. Sources for the National Accounts data are described in Section B.1. Moments from the microlevel data are computed using sample weights.

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 B.1 details the observations dropped from each of these filters, which results in a sample of 42,286. Our analysis of consumption-income elasticities uses observations from consumption and income data during the peak and trough of the 2006-2014 crisis, involving 7,060 observations. We compute moments with these data using sample weights provided by the SHIW unless otherwise noted.

Table B.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	1,219	42,286
Crisis episode (2006 and 2014)		7,060

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 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 3 are, respectively, nondurable monetary consumption —defined as non durable 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 3, 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

$$\ln\left(X_{it}\right) = \mathbf{Z}'_{it}\boldsymbol{\beta} + t\mathbf{D}'_{it}\boldsymbol{\gamma} + t\eta + \hat{x}_{it}, \tag{11}$$

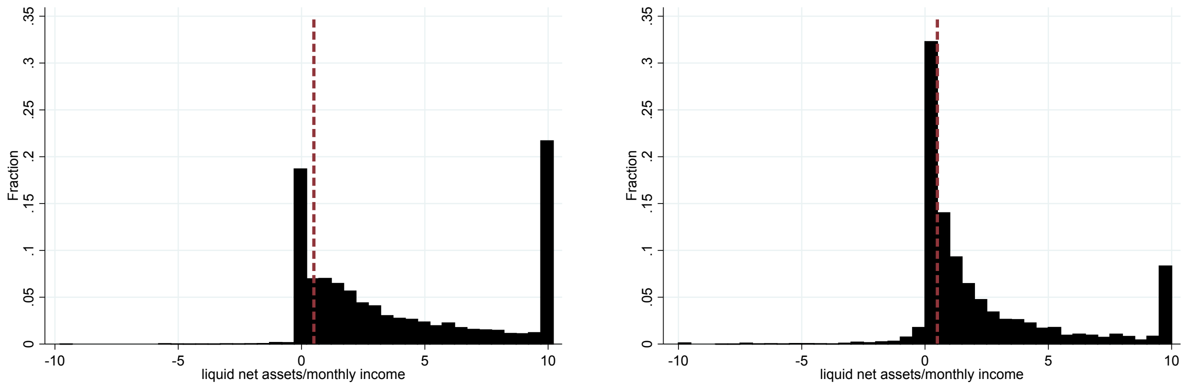
where X_{it} is either the consumption or income of household i at period t, $\mathbf{Z}_{it}$ and $\mathbf{D}_{it}$ are vectors of household demographics, and $\hat{x}_{i,t}$ is the residualized consumption and income of household i in period t. We include in the vector $\mathbf{Z}_{it}$ a quadratic 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 an indicator for the NUTS 2 - Italy regions where household members reside. The vector $\mathbf{D}_{it}$ includes the education and gender of the household's head and is interacted with linear time trends.

Section 3.3 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 household's 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 less assets worth than 2 weeks of income.[17] Panel (a) of Figure B.2 shows the distribution of net liquid assets to monthly income in the Italian data.

[17]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 B.2: Net Liquid Asset-to-monthly Income Distribution: Italy and Spain

(a) Italy (b) 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 financial assets minus credit card debt. 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.

B.2.2. Spain

The source of household-level data on consumption and income for Spain is 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 household's income, consumption, and demographics. The survey is available at an annual frequency since 1997. We use data for the period 2006-2018, which uses a consistent methodology. Panel (b) of Figure B.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 282,873 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 B.2 details the observations dropped from each of these filters, which results in a sample of

137,708. 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 B.2: Sample Selection EPF-Spain

	Obs. Dropped	Obs. in Sample
All units, 2006-2018		282,873
Excluding residents in small locations	69,794	213,079
Excluding age < 25 or > 60	73,050	140,029
Excluding outliers	2,321	137,708
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 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 3 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 11. We include in the vector $\mathbf{Z}_{it}$ a quadratic function of household head's age, gender of 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 an indicator for the Spanish autonomous community in which household members reside. 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 3.3, we complement the EPF —which, unlike the Italian SHIW, does not contain data on wealth— 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 B.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 household's income and characteristics with the following empirical model:

$$\mathrm{HtM}_{it} = f(X_{it}'\beta_t) + \varepsilon_{it}, \tag{12}$$

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 household's position in the income distribution. We estimate model (12) 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 3.3 we identify high-liquidity households as those with a predicted probability smaller than 0.5 of being HtM using the estimated coefficients of model (12).

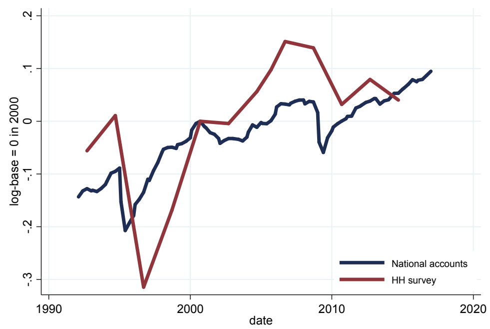
B.2.3. Mexico

The source of household-level data on consumption and income for Mexico is the *Encuesta Nacional de Ingresos y Gastos de los Hogares* (ENIGH), conducted by *INEGI* from Mexico. The ENIGH is representative of the Mexican resident population, and contains cross-sectional data on household's income, consumption, and demographics. The survey is 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 B.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.

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

(a) Mexico – ENIGH

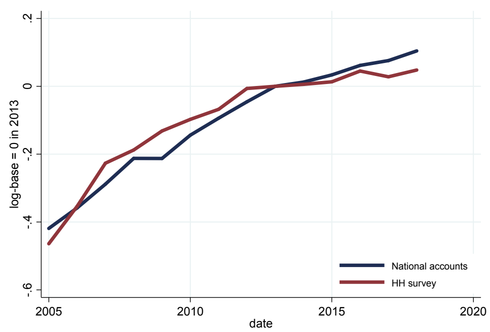
Income



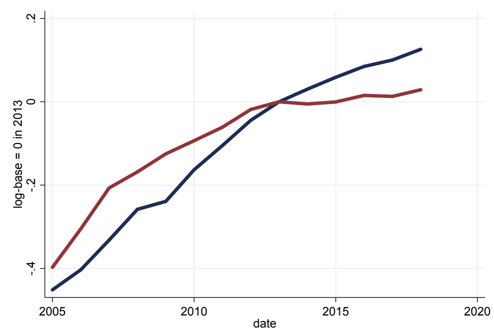
Consumption

(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 3 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 B.2.3 and B.2.4. Sources for National Accounts data are described in Section B.1. Moments from the microlevel data are computed using sample weights.

The original sample of the ENIGH for the period 1992-2014 contains 227,862 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 B.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 121,162. Our analysis of consumption-income elasticities uses observations from consumption and income data during the peak and trough of crisis episodes, involving 13,138 observations for the 1992-1994 Tequila crisis and 27,105 observations for the 2006-2010 GFC crisis. We compute moments with these data using sample weights provided by the ENIGH unless otherwise noted.

Table B.3: Sample Selection ENIGH-Mexico

	Obs. Dropped	Obs. in Sample
All units, 1992-2014		227,862
Excluding units with missing data	3,616	224,246
Excluding age <25 or >60	56,490	167,756
Excluding outliers	2,238	165,518
Excluding residents in small locations	44,356	121,162
Crisis episode 1 (1992 and 1994)		13,138
Crisis episode 2 (2006 and 2010)		27,105

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 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 3 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 D we use alternative definitions such as nontradable (proxy as services) and tradable (proxy as durable and nondurable goods), or including rent 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 11. We include in the vector $\mathbf{Z}_{it}$ a quadratic function of household head's age, gender of household's head, indicator of 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 household's size, and controls for the household's region of residence. 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 3.3, 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.

B.2.4. Peru

The source of household-level data on consumption and income for Peru is the *Encuesta Nacional de Hogares* (ENAHO), conducted by *Instituto Nacional de Estadística e Informatica* (INEI) of Peru. The ENAHO is representative of the Peruvian resident population, and contains cross-sectional and panel data on household's income, consumption, and demographics. The survey is conducted annually since 1995, with its quality significantly improving after 2007.[18] 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 B.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 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 B.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

[18] 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).

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 B.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 3 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 11. We include in the vector $\mathbf{Z}_{it}$ a quadratic function of household head's age, gender of 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. 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 3.3, 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.

C. 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's consumption to idiosyncratic permanent and transitory income shocks. We assume that 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 $\zeta_{i,t} \sim^{iid} (0, \sigma^2_\zeta)$ and $\nu_{i,t} = \varepsilon_t + \theta\varepsilon_{t-1}$ is an MA(1) process with $\varepsilon_{i,t} \sim^{iid} (0, \sigma^2_\varepsilon)$. Then income growth is

$$\Delta y_{i,t} = \zeta_{i,t} + \varepsilon_{i,t} + (\theta - 1)\varepsilon_{i,t-1} - \theta\varepsilon_{i,t-2}, \tag{13}$$

and we postulate that consumption growth is

$$\Delta c_{i,t} = \phi\zeta_{i,t} + \varphi\varepsilon_{i,t} + \epsilon_{i,t}, \tag{14}$$

with $\epsilon_{i,t} \sim^{iid} (0, \sigma^2_\epsilon)$ 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 (14) and (13). 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.[19] The sample periods used for our estimation are 2007-2018 for Peru and 1998-2016 for Italy.

[19] 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.

Table C.1: Partial Insurance Coefficients

		U.S.	*Italy*	*Peru*
Persistent shocks	ϕ	0.642	0.662	0.786
Transitory shocks	φ	0.053	0.297	0.204

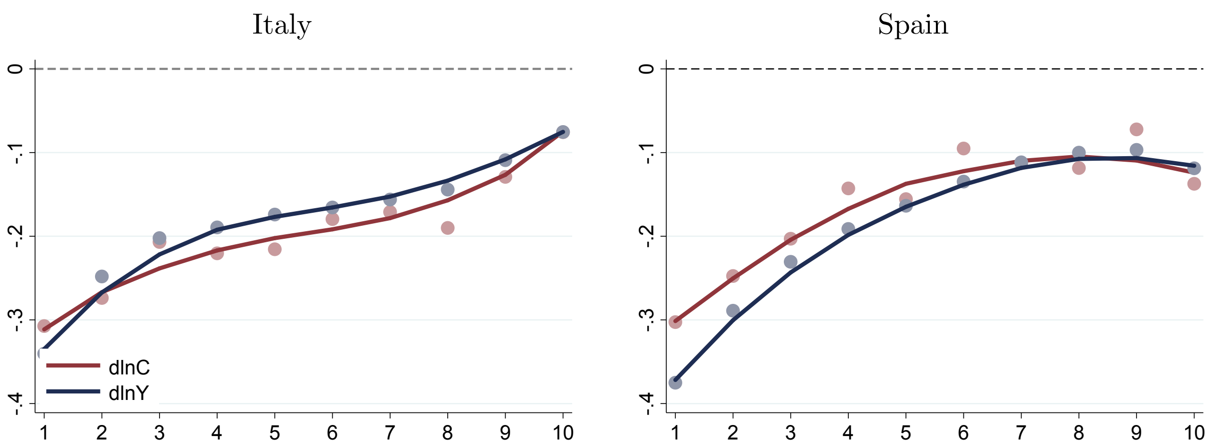
Notes: Estimates for the U.S. are from Blundell *et al.* (2008). Estimates for Italy and Peru are our own computations following the method of Blundell *et al.* (2008), further described in Section C. Data source: SHIW for Italy and ENAHO for Peru.

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

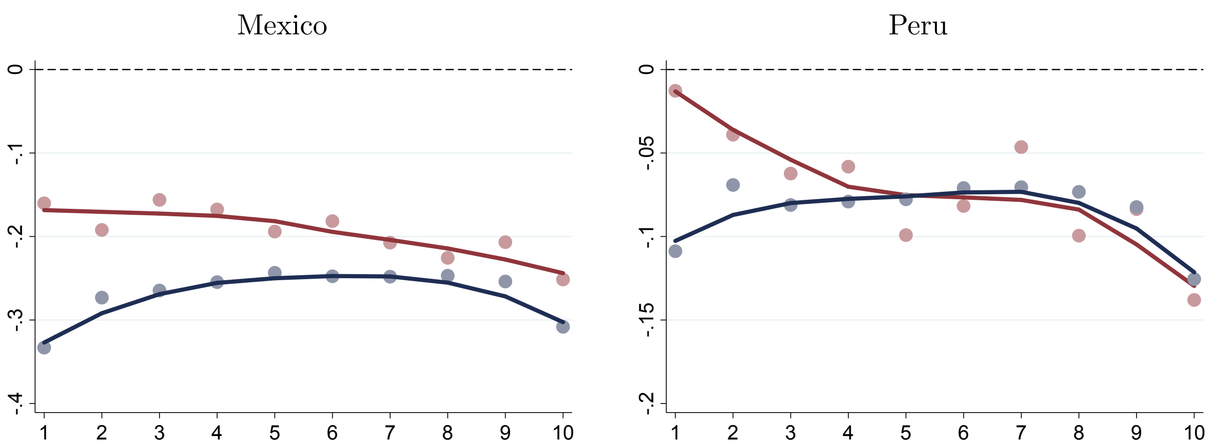
D. Empirical Analysis: Further Results

Figure D.1: Consumption-income Elasticities Across the Income Distribution

(a) Euro Crisis

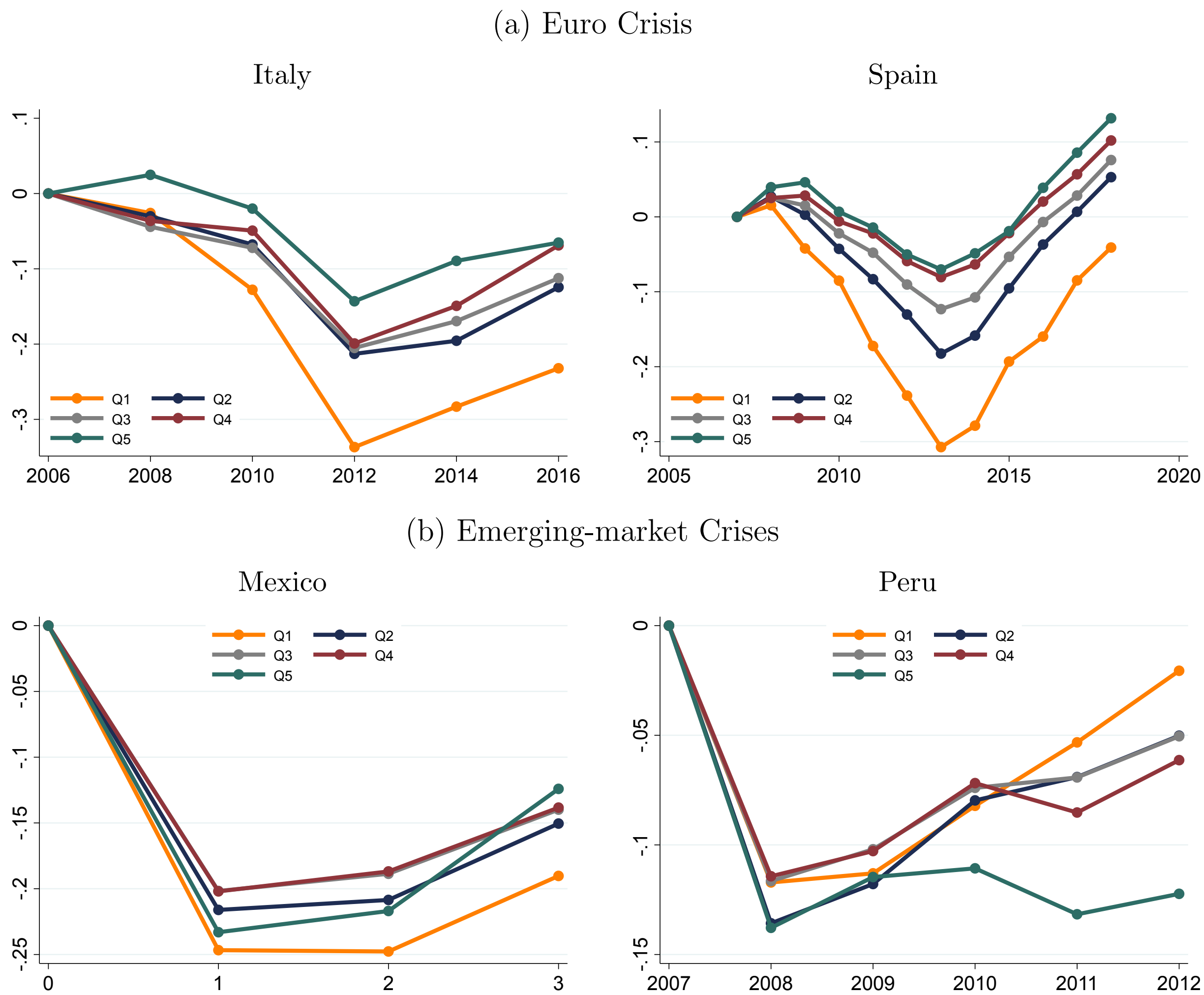


(b) Emerging-market Crises



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 household's observable characteristics and time trends (see empirical model (11) in Appendix B for details). Dots correspond to observed values, and the solid line is the locally weighted smoothing of observed values. Changes are calculated as the log-. Elasticities for Mexico are the simple average of its two episodes in the sample (1994 and 2008). Further details in Appendix B. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Figure D.2: Income Dynamics by Income Quintiles



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. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table D.1: Consumption-income Elasticities: Average and Top-income Households, by Residualized and Non-residualized Income and Consumption

		Euro Crisis		Emerging-market Crises			Average
		Italy	Spain	Mexico '94	Mexico '08	Peru '08	
a. Baseline							
$\Delta \log Y$	Average	-0.15	-0.15	-0.38	-0.16	-0.09	-0.19
	Top 10-income	-0.08	-0.12	-0.42	-0.19	-0.13	-0.19
	Top 5-income	-0.07	-0.13	-0.43	-0.22	-0.15	-0.20
$\Delta \log C$	Average	-0.18	-0.15	-0.29	-0.11	-0.08	-0.16
	Top 10-income	-0.08	-0.14	-0.33	-0.17	-0.14	-0.17
	Top 5-income	-0.10	-0.15	-0.30	-0.21	-0.16	-0.19
Elasticity	Average	1.19	0.97	0.77	0.73	0.90	0.91
	Top 10-income	1.00	1.15	0.78	0.89	1.10	0.98
	Top 5-income	1.53	1.12	0.71	0.96	1.07	1.08
b. Non-residualized							
$\Delta \log Y$	Average	-0.14	-0.18	-0.40	-0.15	-0.12	-0.20
	Top 10-income	-0.11	-0.14	-0.46	-0.20	-0.18	-0.22
	Top 5-income	-0.10	-0.15	-0.48	-0.21	-0.18	-0.22
$\Delta \log C$	Average	-0.15	-0.21	-0.31	-0.07	-0.10	-0.17
	Top 10-income	-0.10	-0.21	-0.40	-0.13	-0.19	0.21
	Top 5-income	-0.07	-0.25	-0.39	-0.15	-0.18	-0.21
Elasticity	Average	1.09	1.18	0.77	0.48	0.80	0.87
	Top 10-income	0.89	1.54	0.88	0.65	1.08	1.04
	Top 5-income	0.77	1.60	0.82	0.72	1.04	0.99
N Observations		7,060	21,802	13,138	27,105	21,170	90,275

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 (see empirical model (11) in Appendix B for details). Panel (b) shows the same calculations without residualizing variables. Top 10-income (Top 5-income) households are those above the 90th (95th) percentile of income. Further details in Appendix B. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table D.2: Consumption-income Elasticities: Average and Top-income Households, by Income and Consumption Definitions

		Euro Crisis		Emerging-market Crises			Average
		Italy	Spain	Mexico '94	Mexico '08	Peru '08	
a. Baseline							
$\Delta \log Y$	Average	-0.15	-0.15	-0.38	-0.16	-0.09	-0.19
	Top 10-income	-0.08	-0.12	-0.42	-0.19	-0.13	-0.19
	Top 5-income	-0.07	-0.13	-0.43	-0.22	-0.15	-0.20
$\Delta \log C$	Average	-0.18	-0.15	-0.29	-0.11	-0.08	-0.16
	Top 10-income	-0.08	-0.14	-0.33	-0.17	-0.14	-0.17
	Top 5-income	-0.10	-0.15	-0.30	-0.21	-0.16	-0.19
Elasticity	Average	1.19	0.97	0.77	0.73	0.90	0.91
	Top 10-income	1.00	1.15	0.78	0.89	1.10	0.98
	Top 5-income	1.53	1.12	0.71	0.96	1.07	1.08
b. Including All Monetary Items							
$\Delta \log Y$	Average	-0.14	-0.15	-0.37	-0.15	-0.09	-0.18
	Top 10-income	-0.07	-0.12	-0.39	-0.18	-0.15	0.18
	Top 5-income	-0.06	-0.13	-0.37	-0.21	-0.18	-0.19
$\Delta \log C$	Average	-0.21	-0.18	-0.28	-0.13	-0.08	-0.18
	Top 10-income	-0.10	-0.18	-0.26	-0.18	-0.16	-0.18
	Top 5-income	-0.11	-0.19	-0.23	-0.20	-0.17	-0.18
Elasticity	Average	1.52	1.18	0.76	0.88	0.86	1.04
	Top 10-income	1.46	1.51	0.68	1.01	0.96	1.12
	Top 5-income	1.90	1.44	0.61	1.00	1.08	1.21
c. Including All Monetary and Nonmonetary Items							
$\Delta \log Y$	Average	-0.15	-0.13	-0.37	-0.14	-0.09	-0.18
	Top 10-income	-0.08	-0.10	-0.38	-0.18	-0.16	-0.18
	Top 5-income	-0.08	-0.12	-0.37	-0.21	-0.19	-0.19
$\Delta \log C$	Average	-0.17	-0.16	-0.30	-0.13	-0.08	-0.17
	Top 10-income	-0.10	-0.15	-0.27	-0.20	-0.16	0.18
	Top 5-income	-0.11	-0.14	-0.25	-0.19	-0.19	-0.18
Elasticity	Average	1.18	1.16	0.81	0.88	0.87	0.98
	Top 10-income	1.35	1.41	0.71	1.07	1.01	1.11
	Top 5-income	1.40	1.18	0.66	0.89	0.98	1.02
N Observations		7,060	21,802	13,138	27,105	21,170	90,275

Notes: Income (Y) and Consumption (C) are deflated by the CPI and residualized from household's observable characteristics and time trends (see empirical model (11) in Appendix B for details). 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 is defined as monetary after-tax nonfinancial income and consumption includes nondurable goods and services. Panel (b) shows the same calculations including all of the monetary components of consumption and income. Panel (c) shows the same calculations including all of the monetary and nonmonetary components of consumption and income. Top 10-income (Top 5-income) households are those above the 90th (95th) percentile of income. Further details in Appendix B. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table D.3: Consumption-income Elasticities and MPCs

		Euro Crisis		Emerging-market Crises			Average
		Italy	Spain	Mexico '94	Mexico '08	Peru '08	
Elasticity	Average	1.19	0.97	0.77	0.73	0.90	0.91
	Top 10-income	1.00	1.15	0.78	0.89	1.10	0.98
	Top 5-income	1.53	1.12	0.71	0.96	1.07	1.08
MPC	Average	1.12	0.98	0.75	0.69	0.78	0.87
	Top 10-income	0.77	0.87	0.59	0.65	0.61	0.70
	Top 5-income	1.11	0.78	0.49	0.64	0.53	0.71
N Observations		7,060	21,802	13,138	27,105	21,170	90,275

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. Marginal propensities to consume (MPC) are calculated as the change in consumption levels to the change in income levels. Top 10-income (Top 5-income) household's are those above the 90th (95th) percentile of income. Further details in Appendix B. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table D.4: Elasticities with Fixed Households' Groups

		Euro Crisis Italy	EM Crises Peru '08	Average
$\Delta \log Y$	Average	-0.06	-0.07	-0.07
	Top-income	-0.04	-0.09	-0.07
	High-liquid Wealth	-0.05	-0.25	-0.15
$\Delta \log C$	Average	-0.08	-0.11	-0.10
	Top-income	-0.06	-0.16	-0.11
	High-liquid Wealth	-0.05	-0.33	-0.19
Elasticity	Average	1.40	1.65	1.53
	Top-income	1.34	1.75	1.55
	High-liquid Wealth	1.11	1.32	1.21
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 (11) in Appendix B 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 with residualized income higher than a country-specific threshold. High-liquid Wealth households are those with liquid assets greater than a country-specific threshold. Further details in Appendix B. Data sources: SHIW-BI Italy, ENAHO-INEI Peru.

Table D.5: Consumption Responses: Individual Elasticities and MPCs

		Euro Crisis Italy	EM Crises Peru '08	Average
Elasticity	Average	1.40	1.65	1.53
	Top-income	1.34	1.75	1.55
Individual Elasticity	Average	0.48	0.35	0.42
	Top-income	0.37	0.33	0.35
MPC	Average	1.30	1.43	1.37
	Top-income	1.18	1.27	1.23
Individual MPC	Average	0.45	0.31	0.38
	Top-income	0.31	0.23	0.27
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 (11) in Appendix B for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. Marginal propensities to consume (MPC) are calculated as the change in consumption levels to the change in income levels. Individual moments are computed as the median elasticity and MPC to individual household income. Top-income households are those with residualized income higher than a country-specific threshold. Income categories using panel data are defined by the average income position during the episode. Further details in Appendix B. Data sources: SHIW-BI Italy, ENAHO-INEI Peru.

Table D.6: Consumption-income Elasticities for Low and High Liquid Wealth Households

		Italy - Euro Crisis			
		Liquid	Non-liquid	Debt	Net Wealth
Wealth-to-income	Low	0.18	1.45	0.22	1.90
	High	1.75	11.26	2.48	12.53
$\Delta \log Y$	Low	-0.19	-0.19	-0.19	-0.20
	High	-0.07	-0.11	-0.15	-0.10
$\Delta \log C$	Low	-0.21	-0.19	-0.20	-0.20
	High	-0.10	-0.15	-0.18	-0.15
Elasticity	Low	1.14	1.05	1.10	1.02
	High	1.48	1.39	1.23	1.47
N Observations		6,025	7,067	2,338	7,067

Notes: Wealth-to-income is the median ratio of wealth to annual income by wealth category. 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 (11) in Appendix B for details). Elasticities are calculated as the ratio of the log change in consumption to the log change in income. 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. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table D.7: Consumption-income Elasticities: Durable and Nondurable Goods

		Euro Crisis		Emerging-market Crises			Average
		Italy	Spain	Mexico '94	Mexico '08	Peru '08	
$\Delta \log Y$	Average	-0.15	-0.15	-0.38	-0.16	-0.09	-0.19
	Top 10-income	-0.08	-0.12	-0.42	-0.19	-0.13	-0.19
a. Nondurable							
$\Delta \log C$	Average	-0.18	-0.15	-0.29	-0.11	-0.08	-0.16
	Top 10-income	-0.08	-0.14	-0.33	-0.17	-0.14	-0.17
Elasticity	Average	1.19	0.97	0.77	0.73	0.90	0.91
	Top 10-income	1.00	1.15	0.78	0.89	1.10	0.98
b. Durable							
$\Delta \log C$	Average	-0.30	-0.18	-0.27	-0.26	-0.19	-0.24
	Top 10-income	-0.25	-0.22	-0.23	-0.29	-0.21	-0.24
Elasticity	Average	2.05	1.21	0.71	1.65	2.12	1.55
	Top 10-income	3.27	1.86	0.53	1.53	1.71	1.78
N Observations		7,060	21,802	13,138	27,105	21,170	90,275

Notes: This table shows various moments related to household's 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 household's observable characteristics and time trends (see empirical model (11) in Appendix B 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 B. Data sources: SHIW-BI Italy, EPF-INE Spain, ENIGH-INEGI Mexico, ENAHO-INEI Peru.

Table D.8: 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 10-income	-0.12	-0.42	-0.19	-0.24
a. Tradable					
$\Delta \log C$	Average	-0.18	-0.23	-0.06	-0.16
	Top 10-income	-0.14	-0.14	-0.16	-0.15
Elasticity	Average	1.19	0.60	0.41	0.73
	Top 10-income	1.21	0.33	0.81	0.78
b. Non-Tradable					
$\Delta \log C$	Average	-0.17	-0.37	-0.26	-0.27
	Top 10-income	-0.21	-0.40	-0.27	-0.29
Elasticity	Average	1.16	0.98	1.66	1.27
	Top 10-income	1.74	0.95	1.38	1.36
c. Luxury					
$\Delta \log C$	Average	-0.63	-0.36	-0.31	-0.34
	Top 10-income	-0.62	-0.29	-0.33	-0.31
Elasticity	Average	4.19	0.94	1.97	1.46
	Top 10-income	5.24	0.69	1.73	1.21
d. Non-Luxury					
$\Delta \log C$	Average	-0.11	-0.26	-0.05	-0.16
	Top 10-income	-0.10	-0.23	-0.09	-0.16
Elasticity	Average	0.75	0.67	0.34	0.51
	Top 10-income	0.87	0.55	0.48	0.52
N Observations		21,802	13,138	27,105	40,243

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 (11) in Appendix B 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 B. Data sources: EPF-INE Spain, ENIGH-INEGI Mexico.

Table D.9: Consumption-Income Elasticities Adjusted by Inflation Heterogeneity

		Emerging-market Crises			Average
		Mexico '94	Mexico '08	Peru '08	
Average - Top-income Inflation		2.0%	0.9%	1.3%	1.4%
$\Delta \log Y$	Average	-0.38	-0.16	-0.09	-0.21
	Top-income	-0.42	-0.19	-0.13	-0.25
$\Delta \log C$	Average	-0.29	-0.11	-0.08	-0.16
	Top-income	-0.33	-0.20	-0.13	-0.22
Elasticity	Average	0.77	0.73	0.90	0.80
	Top-income	0.78	1.02	1.05	0.95
N Observations		13,138	27,105	21,170	61,413

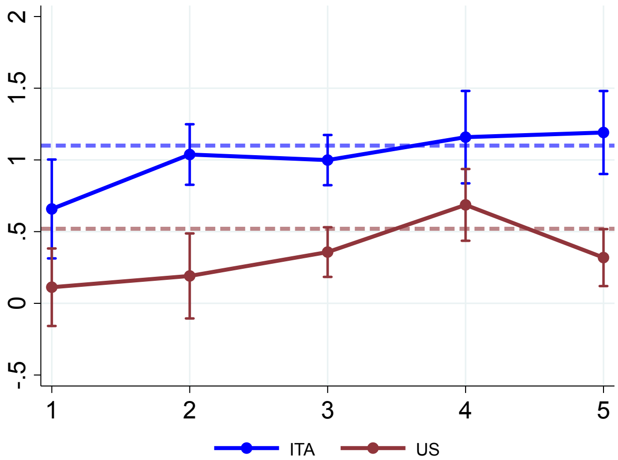
Notes: The first row refers to the difference between the average inflation and the inflation of households in the top income decile. Inflation for both groups is computed using log-differences from the peak (CPI = 100) to trough of each episode. Income (Y) is defined as monetary after-tax nonfinancial income. Consumption (C) is defined as consumption of nondurable goods and services. Both variables are residualized from household's observable characteristics and time trends (see empirical model (11) in Appendix B 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 D.10: Robustness: Permanent Heterogeneity

		Euro Crisis Italy	EM Crises Peru '08	Average
Low-Elasticity HHs				
$\Delta \log Y$	Average	-0.12	-0.14	-0.13
	Top-income	-0.06	-0.16	-0.11
$\Delta \log C$	Average	-0.11	-0.09	-0.10
	Top-income	-0.04	-0.12	-0.08
Elasticity	Average	0.87	0.63	0.75
	Top-income	0.61	0.73	0.67
High-Elasticity HHs				
$\Delta \log Y$	Average	-0.11	-0.12	-0.12
	Top-income	-0.11	-0.12	-0.12
$\Delta \log C$	Average	-0.13	-0.17	-0.15
	Top-income	-0.11	-0.19	-0.15
Elasticity	Average	1.15	1.46	1.30
	Top-income	0.98	1.61	1.30
N Observations		1,463	2,537	4,000

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 household's observable characteristics and time trends (see empirical model (11) in Appendix B 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 high (low) elasticity are those with individual estimated elasticities above (below) the median. Further details in Appendix B. Data sources: SHIW-BI Italy, ENAHO-INEI Peru.

Figure D.3: Consumption-income Elasticities: Italy and U.S. Business Cycles

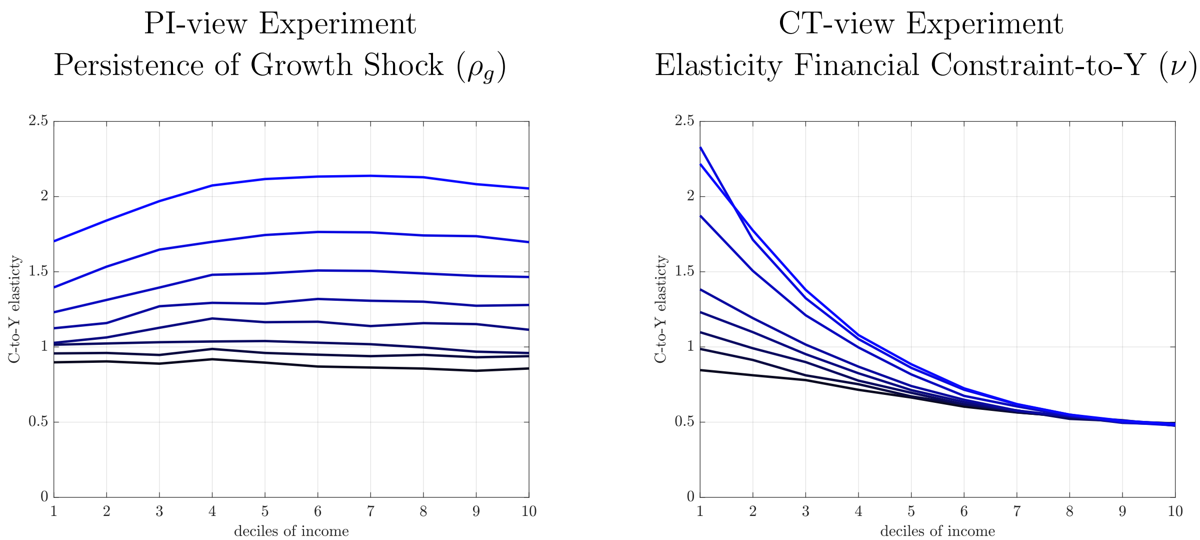


Notes: This figure shows consumption-income elasticities (β_q) estimated using the following specification: $\Delta \ln c_{q,t} = \alpha_q + \beta_q \Delta \ln y_{q,t} + \varepsilon_{q,t}$ for the U.S. and Italy business cycles. Vertical lines correspond to the estimates' confidence intervals at the 90% level. The dotted horizontal lines corresponds to the estimates using aggregate data from National Acccounts. Details in Section 3.3. Data sources: SHIW-BI Italy and CEX-US based on Dauchy *et al.* (2020).

E. Quantitative Analysis: Further Results

E.1. Additional Figures

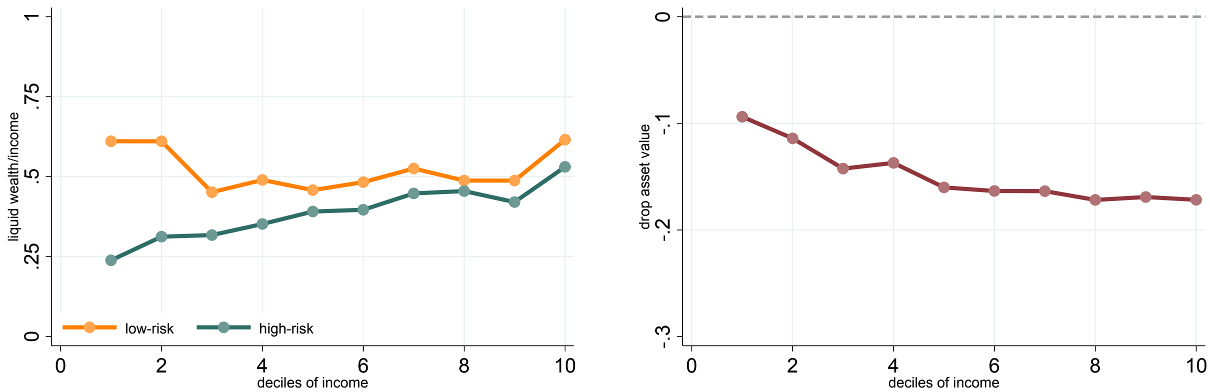
Figure E.1: Model Analysis: Identification of Main Parameters



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

Figure E.2: Liquid Asset Revaluation in Italy

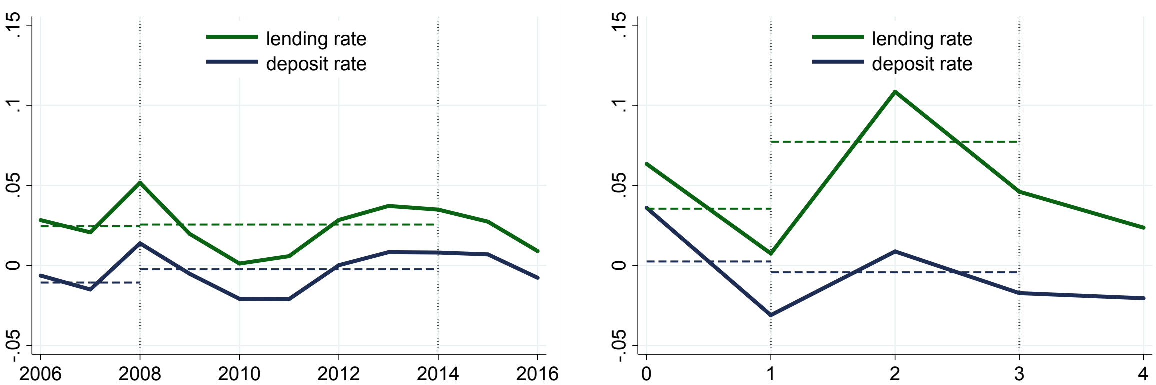
(a) Liquid Wealth Composition (b) Liquid Wealth Revaluation



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 E.3: Interest Rates during Crises Episodes

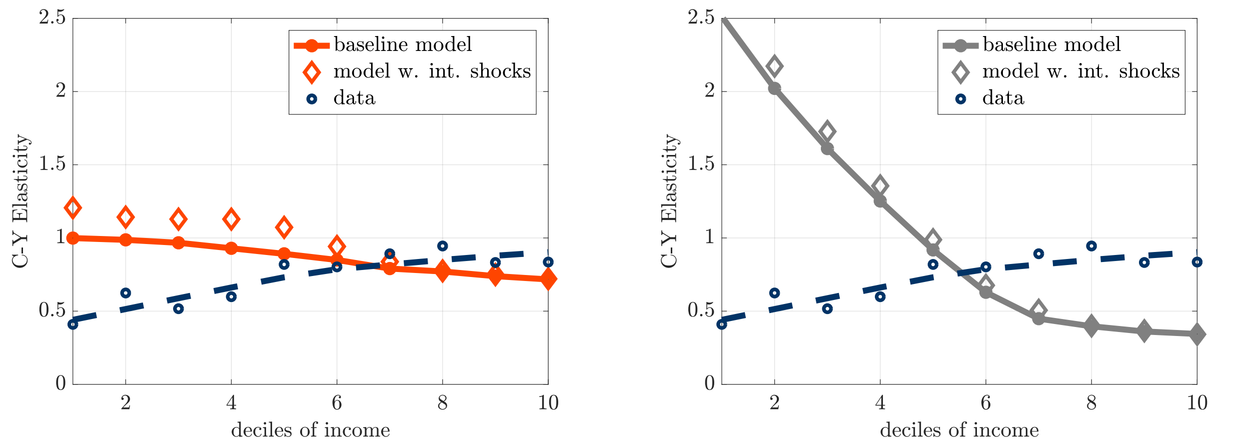
(a) Italy (b) Mexico



Notes: Panel (a) shows the deposit and lending real rate to the private sector in Italy during the Euro Crisis episode. Panel (b) shows the deposit and lending real rate to the private sector in Mexico for the average of the Tequila and Global Financial Crises. Interest rates are in real terms, and calculated deflating by ex post inflation. Dotted lines indicate the crisis period and dashed lines the pre-crisis and crisis average yields. Further details in Appendix B. Data sources: World Bank, IFS, Bank of Italy, and FRED.

Figure E.4: Consumption-income Elasticities in Model: Interest Rate Shocks

(a) PI-Crisis + Interest Rate Shock: Mexico (b) CT-Crisis + Interest Rate Shock: Mexico



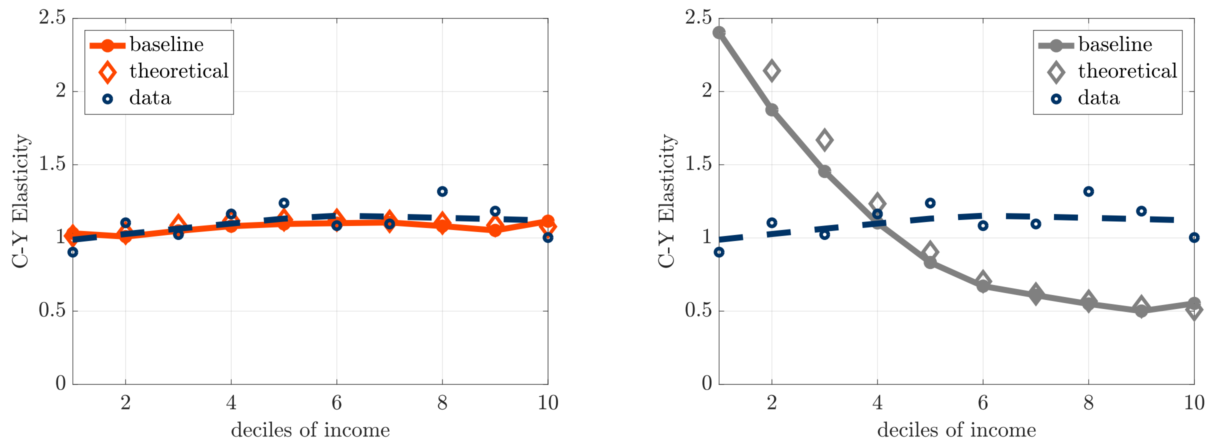
Notes: This figure shows the average consumption-income elasticities for different income deciles in the Mexican crises (described in Section 3) and the crisis experiments of the model calibrated for Mexico (described in Section 4). Panel (a) shows the permanent-income-view experiment and panel (b) the credit-tightening-view experiment. Both panels show the elasticities in the baseline model and in the model that includes interest rate shocks in both crisis experiments. The interest rate shock is simulated such that it replicates the interest rate dynamics in Figure E.3 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 B Data sources: ENIGH-INEGI Mexico.

E.2. 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 2. 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. Figure E.5 shows similar results for both methods of computing the elasticities.

Figure E.5: Consumption-income Elasticities in the Model: Theoretical Elasticities

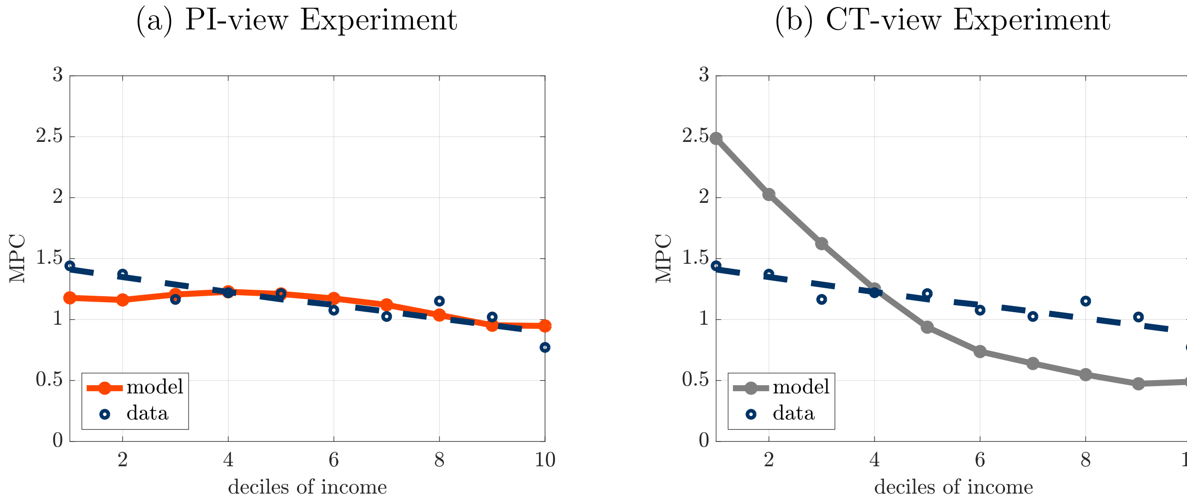
(a) PI-view Experiment (b) CT-view Experiment



Notes: This figure shows consumption-income elasticities for different income deciles in the Italian crisis (described in Section 3) and the crisis experiments of the model calibrated for Italy (described in Section 4). Panel (a) shows the permanent-income-view experiment and Panel (b) the credit-tightening-view experiment. Each panel shows the elasticities from the baseline experiments, presented in Figure 5 (labeled *baseline*) 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*). 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. The dashed line corresponds to locally weighted smoothed data. Further details in Appendix B. Data source: SHIW-BI Italy.

Second, we analyze the MPCs in response to the aggregate shocks. As shown in Figure E.6, both experiments exhibit a decreasing shape across the income distribution. This result is consistent with the theoretical analysis in Appendix A. Figure E.6 also shows that the model is able to correctly fit the shape and level of the MPCs under the PI-crisis experiment.

Figure E.6: MPCs: Model Analysis

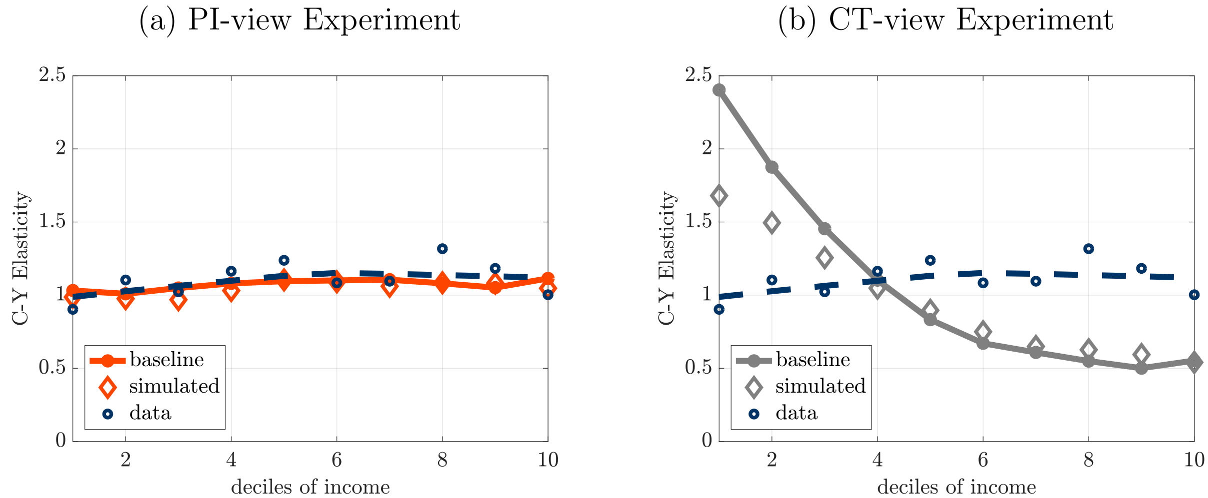


Notes: This figure shows the marginal propensities to consume (MPCs) for different income deciles in the Italian crisis (described in Section 3) and the crisis experiments of the model calibrated for Italy (described in Section 4). Panel (a) shows the permanent-income-view experiment and Panel (b) the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

E.3. Alternative crisis experiments

This section analyzes alternative crisis experiments. First, we introduce crisis experiments that last for 6 years, as in the Italian data. We compute these variants by introducing 6 consecutive negative income shocks with an expected persistence that is the same as in the baseline crisis experiments. That is, in the PI-view experiment, households face shocks for 6 consecutive years that are expected to be permanent, and in the CT-view experiment, households face income and borrowing constraint shocks for 6 consecutive years that are expected to be mean-reverting. We then compute the consumption-income elasticities by computing the peak-to-trough change in log consumption and income. Figure E.7 shows that the consumption-income elasticities preserve the same shape in both crisis experiments.

Figure E.7: Consumption Response: Protracted Crisis Simulation

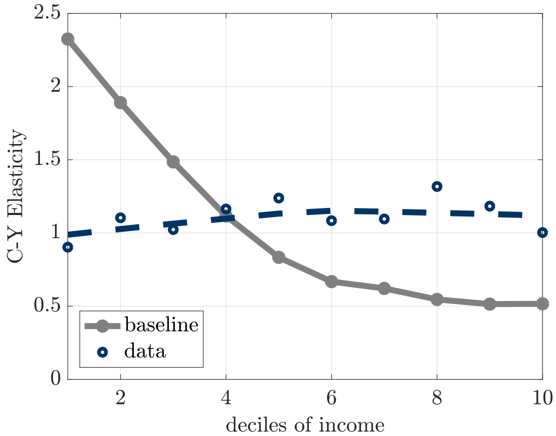


Notes: This figure shows the consumption-income elasticities simulating the same income path as in the data for Italy. Panel (a) and (b) shows the income path for Italy in the data, and the simulated path for the permanent-income and credit-tightening experiments. Panel (c) and (d) show the elasticities for the permanent-income-view experiment and credit-tightening-view experiment, respectively. Elasticities are computed using average income and consumption by decile, and are 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 B. Data sources: SHIW-BI Italy.

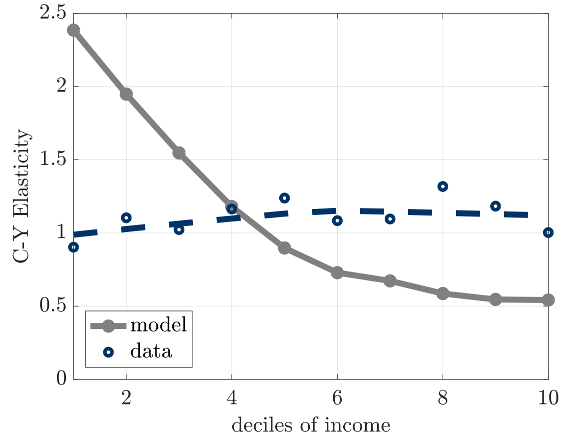
Second, we consider different variants of the CT-view crisis experiment, in which we vary the persistence of the shocks to income and the borrowing constraint separately. Panel (a) of Figure E.8 shows the baseline CT-view experiment, in which both shocks are temporary. The remaining panels show different cases in which we make each of the shocks permanent one at a time. As can be seen in Panels (c) and (d), making the income shock permanent captures well the responses of the income rich, but the model overpredicts those of the income poor. The conclusion from this analysis is that the CT-view still faces a challenge in explaining the distribution of consumption responses.

Figure E.8: Alternative Credit-Tightening Crisis Experiments

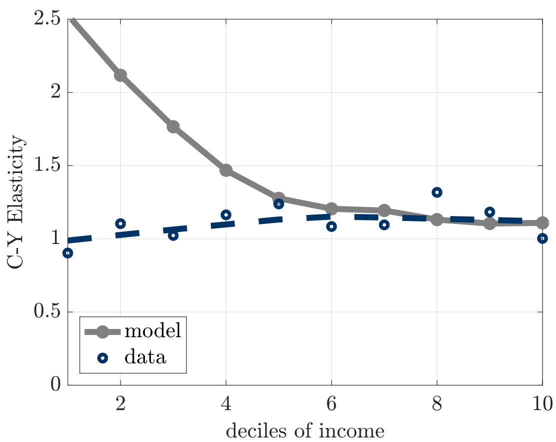
(a) Y transitory and κ transitory



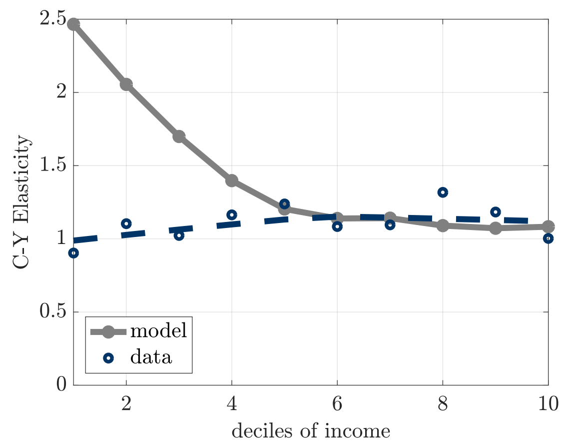
(b) Y transitory and κ permanent



(c) Y permanent and κ transitory



(d) Y permanent and κ permanent



Notes: This figure shows the consumption-income elasticities for different income deciles for our baseline calibration for Italy. We simulate four shocks: Panel (a) aggregate income drops temporarily and the borrowing constraint tightens temporarily; Panel (b) aggregate income drops temporarily and the borrowing constraint tightens permanently; Panel (c) aggregate income drops permanently and the borrowing constraint tightens temporarily; Panel (d) aggregate income drops temporarily and the borrowing constraint tightens temporarily. 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 the locally weighted smoothed data. Further details in Appendix B. Data sources: SHIW-BI Italy.

E.4. Model extensions

E.4.1. 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)[20] and assume that $Y_t = Z_t \Gamma_t$, where Z_t is the transitory component that follows the stochastic process

$$\ln Z_t = \rho_z \ln Z_{t-1} + \sigma_z \epsilon_t^z, \qquad \epsilon_t^z \sim N\left(-\frac{\sigma_z}{2(1+\rho_z)}, 1\right), \tag{15}$$

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

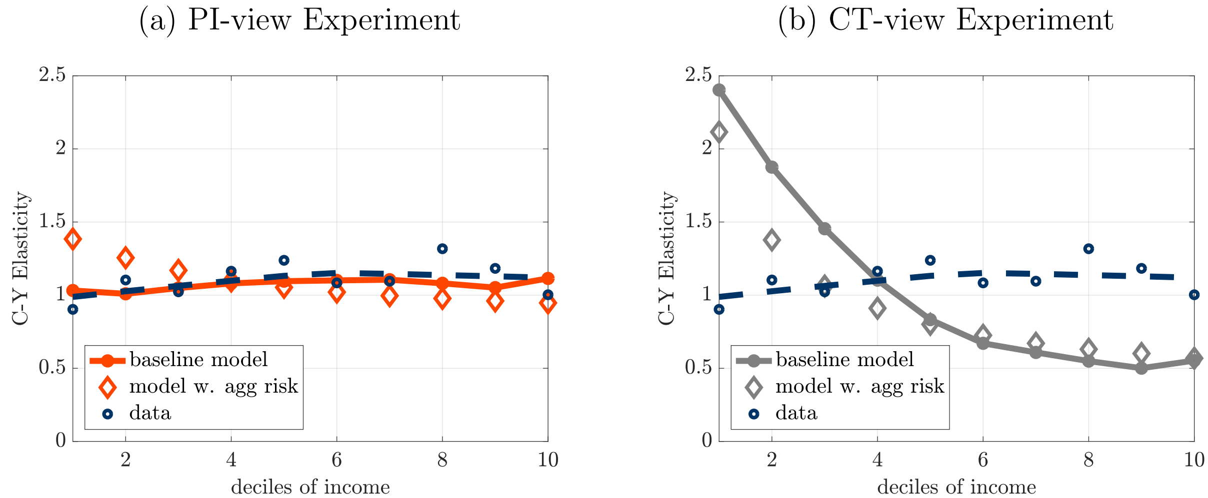
$$g_t = (1-\rho_g)\alpha_g + \rho_g g_{t-1} + \sigma_g \epsilon_t, \qquad \epsilon_t^g \sim N\left(-\frac{\sigma_g}{2(1+\rho_g)}, 1\right). \tag{16}$$

We parameterize the model following two main calibrations of the Italian economy. The first calibration, which we label *PI*, assumes $f(Y_t) = 1$ and targets the same moments as in our baseline calibration by calibrating the relative relevance of aggregate permanent and transitory shocks. The second calibration, labeled *CT*, focuses on the economy with aggregate transitory shocks and calibrates the borrowing constraint $f(Y_t) = Y_t^{\nu}$ to target the same aggregate moments. We deliberately do not target individual consumption responses to a crisis, and leave this behavior as a means to test the validity of both theories in explaining the micro-anatomy of consumption adjustments.

Figure E.9 shows the consumption-income elasticities in the model with aggregate risk under both crisis experiments, and compares them with the data and the baseline model. The main quantitative conclusions —that the PI-view crisis experiment delivers elasticities that are closer to those observed in the data— still hold in the model with aggregate risk.

[20] 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 E.9: Consumption-income Elasticities: Model with Aggregate Risk



Notes: This figure shows the consumption-income elasticities for different income deciles in the Italian crisis (described in Section 3) and in the crisis experiments of the model calibrated for Italy (described in Section 4). Panel (a) shows the permanent-income-view experiment and Panel (b) the credit-tightening-view experiment. Each panel shows the experiments from the baseline model, presented in Figure 5 (labeled *baseline*), and those from the model with aggregate risk (labeled *aggregate risk*), described in Appendix E. 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 B. Data sources: SHIW-BI Italy.

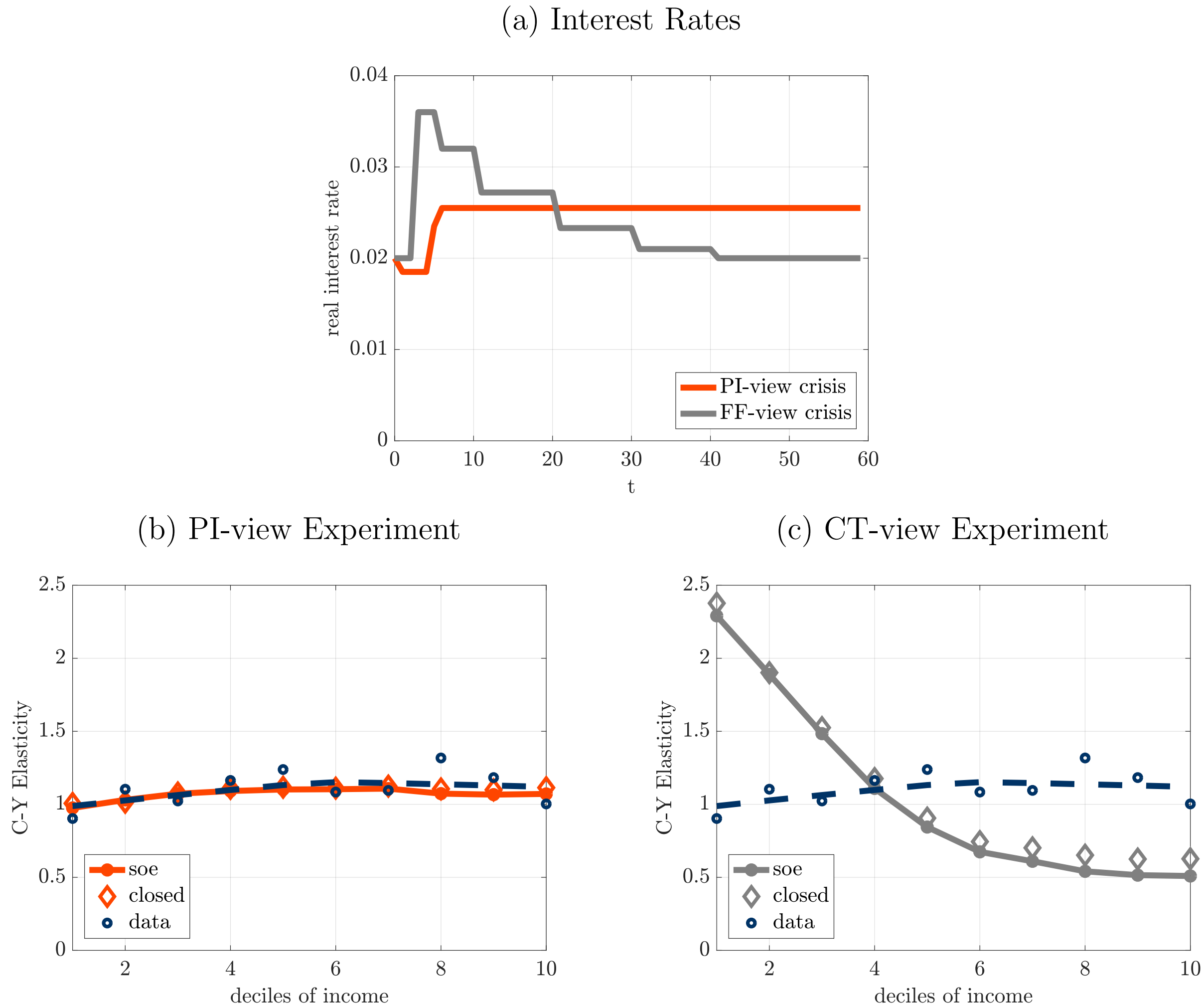
E.4.2. Closed-economy model

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 E.10 shows the dynamics of the interest rates and the consumption-income elasticities under both crisis experiments. Under the PI-view crisis experiment, 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. Under the CT-view crisis experiment, the interest rate increases initially in response to the shocks because income-rich households want to cut their savings to smooth consumption. This effect predominates quantitatively over the deleveraging from constrained households. This effect implies higher consumption-income elasticities for income-rich households, but is not quantitatively strong enough to replicate the observed responses.

Figure E.10: Consumption Response in a Closed Economy



Notes: This figure shows the consumption-income elasticities in a closed economy. Panel (a) shows the interest rate that closes the asset market at the initial steady state aggregate level of net assets holdings. Panels (b) and (c) 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 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 B. Data sources: SHIW-BI Italy.

E.4.3. Model with income-based borrowing constraints

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

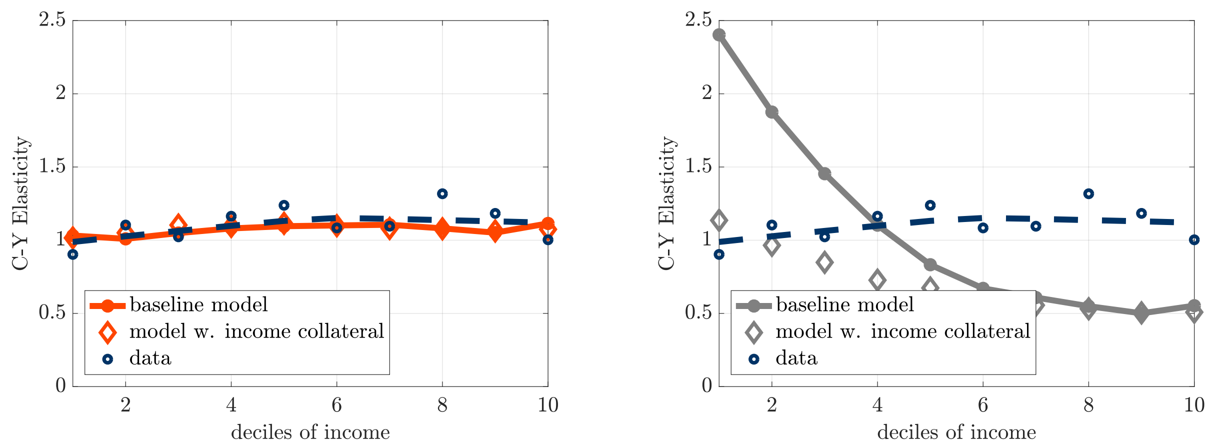
$$a_{it+1} \geq -\kappa \mu_{it} f(Y_t).$$

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 as in the baseline model, and analyze the effects of both crisis experiments in this model.

Figure E.11 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 E.11: Consumption-income Elasticities: Income-based borrowing constraints

(a) PI-View Experiment (b) PI-View Experiment



Notes: This figure shows consumption-income elasticities using an extension of the model that includes idiosyncratic income as part of the collateral. Panel (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 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 B. 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 $\frac{\partial c_{it}^T}{\partial Y_t^T} \geq 0$.

E.4.4. Model with heterogeneous loadings

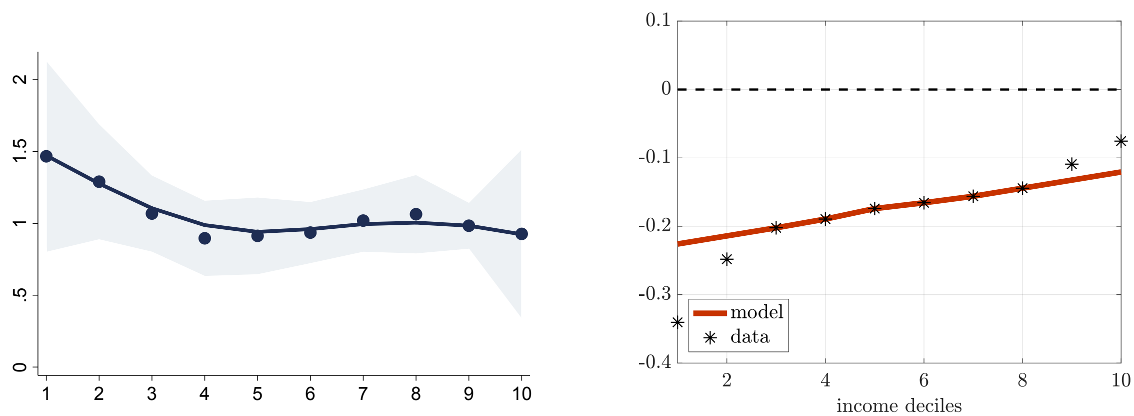
This section provides details on how we estimate the function $\Gamma(\mu_{it})$, which governs the heterogeneity in loadings to the aggregate income shock. We proceed in two steps. First, using the full time period for which we have microdata available, we estimate the following regression for each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

E.4.5. Model with uncertainty shock

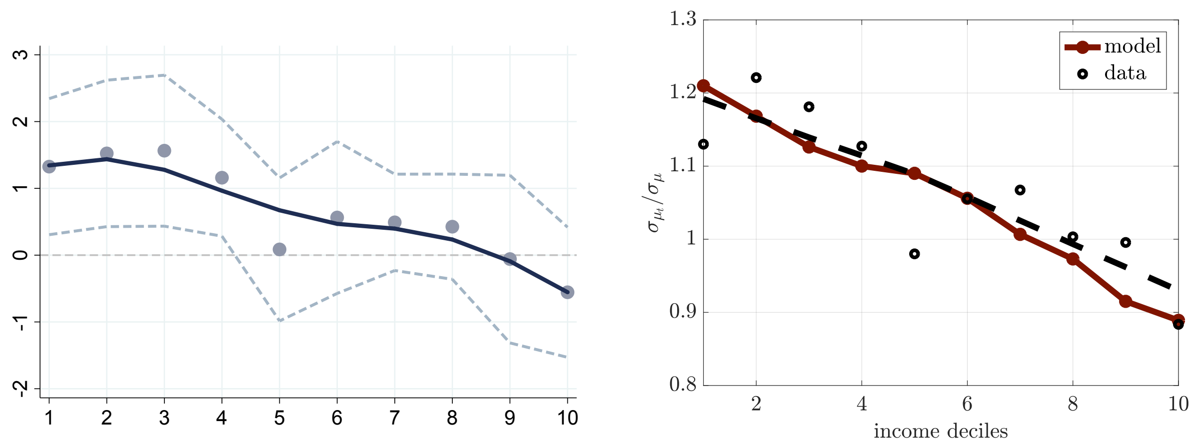
In this section we provide details on the model extension that features uncertainty shocks. The uniform increase in uncertainty is computed as the increase in the cross-sectional standard deviation of log income, which in the data increases from 0.54 in 2006 to 0.62 in 2014. In the case of heterogeneous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

$$\ln(\sigma_{d,t+1}) = \alpha_d + \Sigma_d \ln(\sigma_t) + \varepsilon_{d,t+1}, \tag{17}$$

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 E.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 E.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 17. 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.

E.4.6. Model with nonhomotheticities

Table E.1 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 E.2 shows targeted and untargeted moments for the Mexican calibration.

Table E.1: Model with Nonhomotheticities: Italy and Mexico

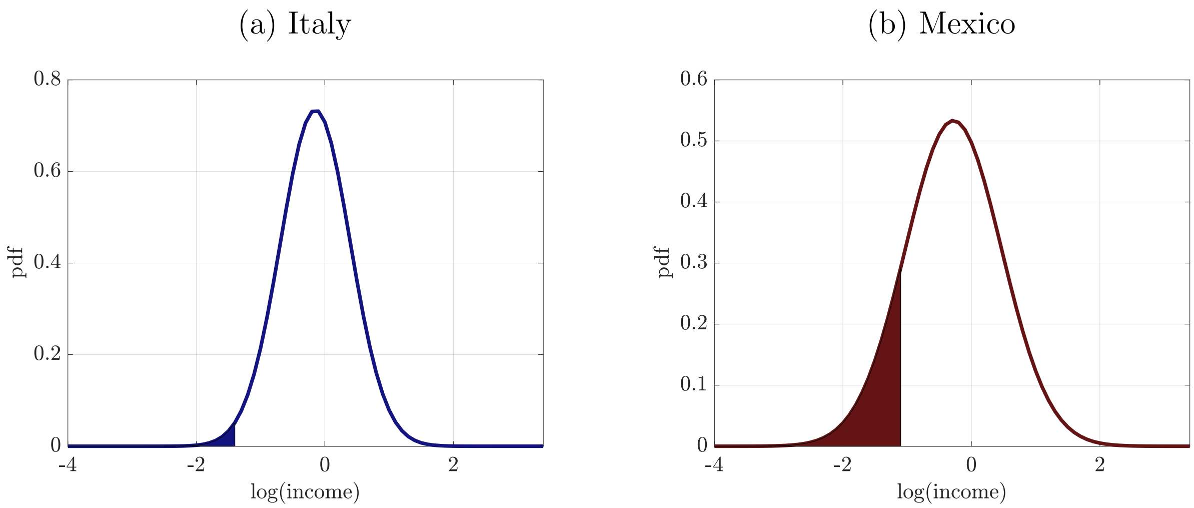
Parameter		Italy	Mexico
Country-Specific			
Discount factor	β	0.90	0.91
Persistence of idiosyncratic process	ρ_μ	0.88	0.97
Volatility of idiosyncratic process	σ_μ	0.26	0.18
Financial constraints	κ	0.23	0.18
Assigned Parameters			
Risk-aversion coefficient	γ	2.00	2.00
Risk-free interest rate	$r*$	0.02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

Table E.2: 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 E.14 shows the distribution of income in both calibrations and the share of households with income below the subsistence level of consumption.

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



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 B. Data source: World Bank.

F. Policy Experiments: Further Results

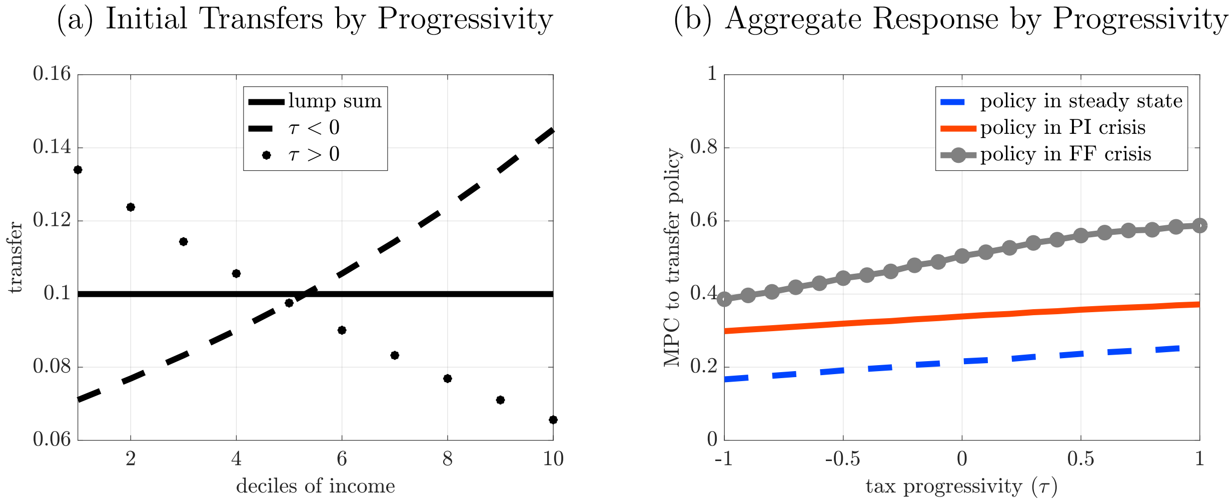
F.1. Policies with Different Progressivity

We now study the effects of the stabilization policies analyzed in Section 5, which differ in the degree of progressivity. In particular, we consider an initial transfer that takes the form

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

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 5 (see Panel (a) of Figure F.1). 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 F.1: 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 corresponds to the MPCs when the policy is conducted during the PI-view crisis experiment, and the gray line when it is conducted during the CT-view crisis experiment.

Panel (b) of Figure F.1 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.