Sudden Stops, Inequality, and Macroprudential Policy

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Abstract

We study how inequality shapes sudden stop crises and the design of optimal macroprudential policy in emerging market economies using a heterogeneous-agent small open economy model with nonhomothetic preferences. Private borrowing generates both the standard Fisherian debt-deflation externality and a novel distributional externality operating through the real exchange rate, which disproportionately raises the cost of consumption for poorer households during crises. Although a benevolent social planner internalizes these externalities, the resulting reductions in crisis frequency and severity are quantitatively modest because credit expansions also raise welfare for low-income households. Optimal macroprudential policy is state dependent, featuring borrowing subsidies at low debt levels and taxes when leverage is high, highlighting how distributional considerations reshape the regulation of capital flows.

Keywords: Inequality; Macroprudential policy; Nonhomothetic preference; Sudden Stops

JEL Classifications: E32; F34; F41; H23

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Introduction

Emerging market economies are frequently exposed to sudden stop crises, characterized by abrupt reversals in capital inflows, sharp exchange rate depreciations, and deep contractions in domestic consumption. At the same time, these economies exhibit high and persistent income inequality, with a sizable fraction of households facing tight borrowing constraints and limited access to financial markets. Figure 1 plots the evolution of sudden stop frequency and income inequality, measured by the income share accruing to the bottom 50 percent, for advanced economies and emerging markets. Panel (a) indicates that the incidence of sudden stops is broadly comparable across the two groups. By contrast, Panel (b) shows that emerging markets exhibit significantly higher levels of inequality.

(a) Sudden Stop Frequency (b) Inequality

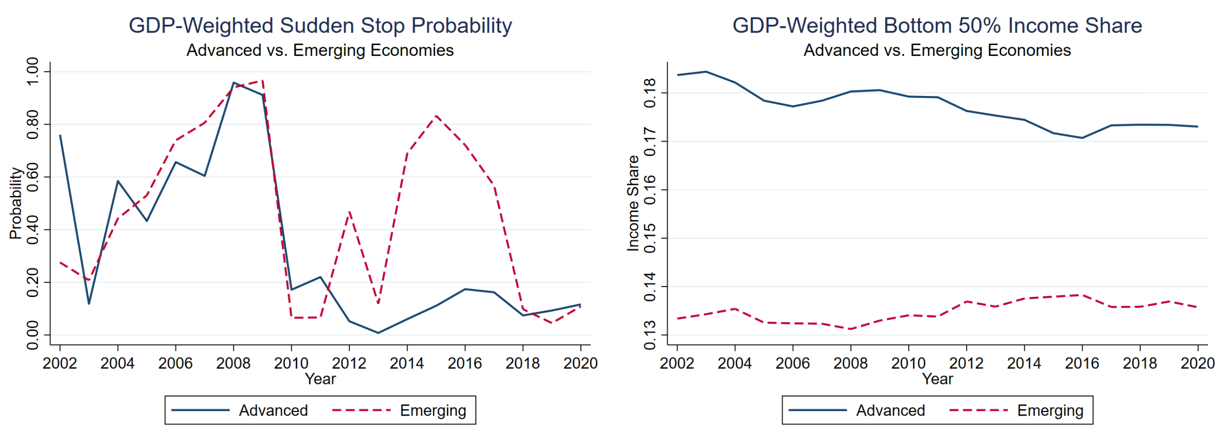

Figure 1: Sudden Stop and Inequality Over Time

Note: Figure 1 plots the GDP-weighted average of sudden stop probability and bottom 50 percent income share for advanced economies and emerging markets. Data on sudden stop probability is taken from Forbes and Warnock (2012), and the bottom 50 percent income share data is given by the World Inequality Database.

Despite the prevalence of high inequality among emerging markets, the role of inequality in shaping the dynamics and welfare costs of external financial crises remains relatively underexplored. In this paper, we study how inequality affects the dynamics and welfare consequences of sudden stop crises, and how it alters the design of optimal macroprudential policy.

We embed household heterogeneity and nonhomothetic preferences into a standard sudden-stop framework to capture distributional channels that are absent from representative-agent models. The economy features two types of households: borrowing households, who receive a larger share of endowment income and have access to international financial markets subject to occasionally binding collateral constraints; and hand-to-mouth households, who receive a smaller share of endowment income and lack access to financial markets. Preferences are nonhomothetic, implying that non-tradable goods have a higher income elasticity than tradable goods. We study both the decentralized equilibrium, in which private households choose borrowing subject to constraints, and the constrained efficiency, in which a benevolent social planner internalizes the general equilibrium and distributional effects of borrowing decisions.

The model features two distinct sources of inefficiency that operate through movements in the real exchange rate. First, as in the standard sudden-stop literature, borrowing households do not internalize the Fisherian debt-deflation externality: higher borrowing today induces future real exchange rate depreciations that tighten collateral constraints, generating excessive leverage in equilibrium. Second, we identify a novel distributional externality arising from household heterogeneity and amplified by non-homothetic preferences. Borrowing by high-income households depreciates the future real exchange rate, raising the cost of tradable consumption faced by low-income hand-to-mouth households, who have a larger share of expenditure to tradables. Because of nonhomotheticity, these price movements disproportionately increase the effective cost of consumption for poorer households. High-income borrowers fail to internalize this distributional consequence, generating an additional inefficiency.

While the heterogeneity-induced externality implies that sudden stop crises are disproportionately costly for low-income households, it also implies that credit expansions that appreciate the real exchange rate disproportionately benefit them. As a result, a benevolent social planner faces a fundamental trade-off: relaxing borrowing constraints can raise contemporaneous welfare for low-income households through exchange rate appreciation and cheaper tradable consumption, but at the cost of increasing the likelihood and severity of future crises. This distributional intertemporal trade-off is central to the design of optimal macroprudential policy in our framework.

Our quantitative results show that inequality and nonhomothetic preferences change crisis dynamics and optimal macroprudential policy. Although the social planner internalizes both the Fisherian debt-deflation and heterogeneity-induced externalities, the resulting reductions in crisis frequency and severity in the constrained efficiency are quantitatively modest, reflecting the cost-benefit tradeoff of credit expansions. Introducing heterogeneity lowers aggregate debt but leaves crisis frequency largely unchanged as borrowing becomes concentrated among high-income households, while nonhomothetic preferences amplify crisis severity through larger exchange rate depreciations and consumption contractions. Constrained efficiency is therefore substantially less effective in heterogeneous-agent economies than in representative-agent models and can even entail more frequent and severe crises when preferences are homothetic. Optimal macroprudential policy is state dependent, featuring borrowing subsidies at low debt levels and borrowing taxes when leverage is high and close to the collateral constraint. Heterogeneity strengthens the case for subsidies, nonhomothetic preferences call for higher taxes, and their interaction yields quantitatively larger policy responses. Around sudden stops, the optimal borrowing tax rises in the run-up to crises and remains persistently low in the aftermath, in contrast to the rapid post-crisis normalization implied by standard sudden-stop models, reflecting the optimality of borrowing subsidies at the low debt levels that prevail following crises.

This paper makes three main contributions. First, we introduce household heterogeneity and nonhomothetic preferences into a standard sudden-stop framework and show that distributional considerations alter crisis dynamics and welfare outcomes. Second, we uncover a novel distributional externality operating through the real exchange rate: borrowing by high-income households imposes disproportionate welfare costs on low-income hand-to-mouth households during crises, beyond the standard Fisherian debt-deflation channel. Third, we characterize the optimal macroprudential policy in this environment and show that the interaction between heterogeneity and nonhomothetic preferences generates state-dependent borrowing taxes that differ sharply from those implied by representative-agent models, highlighting how distributional concerns reshape the optimal regulation of capital flows in emerging economies.

Related Literature. This paper contributes to the sudden stop literature starting with Mendoza (2002) and Bianchi (2011). Relative to this framework, we introduce household heterogeneity and nonhomothetic preferences. Our model highlights the interaction between private external borrowing, financial crises, and redistributive considerations in the design of macroprudential policy. A growing literature studies the distributional consequences of sudden stop crises, including Villalvazo (2021), Hong (2020), Biljanovska and Vardoulakis (2024), and Guntin et al. (2023). Our contribution is to provide a quantitative general-equilibrium framework in which movements in the real exchange rate differentially affect households across the income distribution, and to study how distributional considerations alter optimal macroprudential policy. We depart from Arce and Tran-Xuan (2022), who assume that all agents have access to international borrowing, to highlight how the borrowing decisions of wealthy households affect poorer households that are permanently credit constrained. Consistent with the presence of offsetting distributional trade-offs, we find that optimal macroprudential policy is quantitatively more muted than in representative-agent environments emphasized in the existing literature.

This paper is also related to the literature on inequality over the business cycle, including Broer (2020), Kumhof et al. (n.d.), Primiceri and Van Rens (2009), and Storesletten et al. (2007). In contrast to this literature, which largely focuses on advanced economies and standard business cycle fluctuations, we study emerging market economies and emphasize the role of sudden stop crises as a key source of macroeconomic risk and distributional dynamics.

Finally, by studying the macroeconomic implications of nonhomothetic preferences, this paper relates to Boppart (2014), Rojas and Saffie (2022), and Comin et al. (2021). As in Rojas and Saffie (2022), we show that nonhomothetic preferences amplify the severity of sudden stop crises. Our additional contribution is to show that nonhomotheticity also shapes the sectoral reallocation of consumption over booms and crises and, through this channel, the distributional effects of real exchange rate movements and macroprudential policy.

Outline. The paper is organized as follows. Section 1 describes the model of sudden stop and inequality and define the decentralized equilibrium and the social planner problem. Section 3 presents the quantatitative analysis. Section 4 examines the optimal macroprudential policy. Section 5 then concludes.

1 Model of Sudden Stops and Inequality

This section presents a heterogeneous-agent dynamic model of a small open economy with non-state contingent bonds subject to an occasionally binding credit constraint. We define and characterize the decentralized equilibrium. We then present the constrained efficient allocation that solves a social planner's problem in which the planner directly chooses the debt level subject to the credit constraint.

1.1 Environment

Time is discrete and indexed by $t = 0, 1, \dots, \infty$. There are tradable and nontradable goods sectors. Only tradable goods can be traded internationally, and nontradable goods have to be consumed in the domestic economy. The economy is populated by two types of households $i = \{H, L\}$: borrowing households ($i = H$) and hand-to mouth ($i = L$) households, with population shares $1 - \mu$ and μ, respectively.

The two household types differ along two dimensions: their shares of aggregate income and their access to international credit markets. Borrowing households receive a larger share of endowments and have access to international financial markets, whereas hand-to-mouth households receive a smaller endowment share and are financially excluded from international credit markets. This assumption is motivated by the prevalence of financial exclusion in emerging market economies, where a substantial fraction of households lack access to formal borrowing instruments and financial institutions, as reported in Demirguc-Kunt and Klapper (2012).

Endowment. In each period t, household i receives a fraction s^i of endowment of tradable goods Y_t^T and nontradable goods Y_t^N, where $\mu s^H + (1-\mu)s^L = 1$ and $s^H > s^L$, that is the borrowing household is the richer household than the hand-to-mouth household. Both endowments are drawn from first-order Markov processes independent of each other and of all other stochastic shocks in the model. We assume that numeraire is the tradable good.

Assets. Borrowing households have access to one-period, non-state contingent international bonds denominated in units of tradables. The bond is issued in international competitive credit markets at price Q. We assume that the discount factor and the international bond price are such that $\beta/Q < 1$. In each period t, borrowing households face a collaterial credit constraint such that the market value of debt issuances Qb_{t+1}^H cannot exceed a fraction κ of the market value of current income.

In contrast, hand-to-mouth households lack access to international credit markets.

Allocation. Individual household i's allocation on consumption and borrowing is $c_t^{T,i}, c_t^{N,i}, c_t^i, b_{t+1}^i$. The aggregate allocation is denoted in the uppercase: $X = \mu x^L + (1 - \mu)x^H$

Preference. Each household maximizes a nested CES utility function similar to Comin et al. (2021), that is,

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma}, \quad \sigma > 0, \tag{1}$$

where $\mathbb{E}_t(\cdot)$ is the time-t expectation operator, and $0 < \beta < 1$ is the discount factor. The composite consumption $c_t = c(c_t^T, c_t^N)$ is defined by the implicit function

$$\left[\omega \left(c_t^T\right)^{-\eta} (c_t)^{\epsilon_T(1+\eta)-1} + (1-\omega)\left(c_t^N\right)^{-\eta} (c_t)^{\epsilon_N(1+\eta)-1}\right]^{-\frac{1}{\eta}} = 1, \quad \eta > -1,\ \omega \in (0,1),$$

where ω is a weight parameter, $1/(1+\eta)$ is the elasticity of substitution between c_t^T and c_t^N, and ϵ_j is the nonhomotheticity parameter that affects the income elasticity of good $j \in \{T, N\}$, which is $\nu_j = 1/(1+\eta) + \frac{\eta}{1+\eta}\frac{\epsilon_j}{\omega\epsilon_T + (1-\omega)\epsilon_N}$. We assume that $\epsilon_j > \frac{1}{1+\eta}$,for $j \in \{T, N\}$, such that the utility is strictly increasing in both tradable and nontradable consumption. c_t becomes a homothetic CES aggregator with elasticity of substitution $1/(\eta+1)$ between c_t^T and c_t^N when $\epsilon_T = \epsilon_N = 1$.

1.2 Decentralized equilibrium

Borrowing households Given the price of bond q and the of nontradable goods in units of tradables P_t^N, borrowing households $i = H$ choose allocation $\left\{c_t^{T,H}, c_t^{N,H}, b_{t+1}^H\right\}_{t\geq 0}$ that maximizes utility (1) subject to the budget constraint

$$c_t^{T,H} + P_t^N c_t^{N,H} + b_t^H = s^H\left(P_t^N Y_t^N + Y_t^T\right) + Qb_{t+1}^H, \tag{2}$$

and the credit constraint

$$Qb_{t+1}^H \leq \kappa s^H\left(Y_t^T + P_t^N Y^N\right). \tag{3}$$

This credit constraint can be seen as an implication of incentive-compatibility constraints on borrowers if limited enforcement prevents lenders from collecting more than a fraction κ of the value of current endowment owned by defaulting households.

Hand-to-mouth households Hand-to-mouth households ($i = L$) choose consumption $\left\{c_t^{T,H}, c_t^{N,H}\right\}_{t\geq 0}$ that maximizes utility (1) subject to the budget constraint

$$c_t^{T,L} + P_t^N c_t^{N,L} = s^L\left(P_t^N Y_t^N + Y_t^T\right). \tag{4}$$

Resource constraints The resource constraints in the tradable and nontradable goods sectors are

$$C_t^T + B_t = Y_t^T + QB_{t+1} \tag{5}$$

$$C_t^N = Y_t^N, \tag{6}$$

where C_t^T, C_t^N, B_t are the aggregate tradable consumption, nontradable consumption, and borrowings.

Recursive formulation We consider the optimization problem of borrowing households in the recursive form. Borrowing households make decisions on current consumption and next-period debt based on the current individual debt b and the current exogenous shock on tradables Y^T. The optimization problem of borrowing households can be written as

$$V^H(b, Y^T) = \max_{c^T, c^N, b'} \quad \frac{c\left(c^T, c^N\right)^{1-\sigma}}{1-\sigma} + \beta \mathbb{E} V^H(b', Y^{T'}),$$

subject to

$$\begin{aligned} c^T + P^N c^N + b &= s^H \left(Y^T + P^N Y^N\right) + Qb' \\ Qb' &\leq \kappa s^H \left(Y^T + P^N Y^N\right). \end{aligned}$$

The solution to the household problem gives the individual allocation rule $\left\{c^{T,H}(\cdot), c^{N,H}(\cdot), b'(\cdot)\right\}$. Then we have the following definition for a recursive competitive equilibrium.

Definition 1.1. A *recursive competitive equilibrium* is an individual allocation rule $\left\{c^{T,i}, c^{N,i}, b'\right\}$, value function $V^H(b, Y^T)$, aggregate allocation rule $\left\{C^T, C^N, B'\right\}$, a pricing function P^N such that

- Household optimization: given P^N, $\left\{c^{T,H}, c^{N,H}, b'\right\}$ solves borrowing households' problem and V^H is the associated value function. Also, $\left\{c^{T,L}, c^{N,L}\right\}$ maximizes the utility subject to the hand-to-mouth households' budget constraint (4)
- Aggregation: $C^T = \mu c^{T,L} + (1-\mu) c^{T,H}$, $C^N = \mu c^{N,L} + (1-\mu) c^{N,H}$, and $B' = (1-\mu) b'$
- Market clearance: equations (5)-(6) hold

1.3 Equilibrium price of nontradables

In equilibrium, the intratemporal optimality condition implies that

$$P^N = \frac{1-\omega}{\omega} \left(\frac{c^{T,i}}{c^{N,i}}\right)^{1+\eta} \left(c^i\right)^{(\epsilon_N - \epsilon_T)(1+\eta)}, \ \forall i = \{H, L\} \tag{7}$$

Equation (7) states the static optimality condition equating the relative price of nontradables to tradables with the marginal rate of substitution for each household. This implies an equal marginal rate of substitution across households. Under nonhomothetic preferences, the price of nontradables further depends on composite consumption c^i.

We normalize $Y_t^N = 1, \forall t$. The price of nontradables relates to the tradable consumption levels across households by the following implicit equation:

$$P^N = (1-\omega)\left\{\mu(E^H)^{\frac{1}{1+\eta}}(c^{T,H})^{\epsilon_N - \frac{1}{1+\eta}} + (1-\mu)(E^L)^{\frac{1}{1+\eta}}(c^{T,L})^{\epsilon_N - \frac{1}{1+\eta}}\right\}^{1+\eta}, \tag{8}$$

where $E^i = c^{T,i} + P^N c^{N,i}$ is the consumption expenditure of household $i = \{H, L\}$.

Equation (8) shows that, due to nonhomothetic preferences, higher-income borrowing households disproportionately shape the relative price of nontradables. Their greater demand for nontradables, reflected in higher consumption expenditure E^H, gives them more weight in determining the price. This implies an unequal influence across households in the equilibrium price of nontradables.

When preferences are homothetic ($\epsilon_T = \epsilon_N = 1$), the price of nontradables becomes

$$P^N = \frac{1-\omega}{\omega}\left(\frac{c^{T,i}}{c^{N,i}}\right)^{1+\eta}, \ \forall i = \{H, L\} \tag{9}$$

and in terms of tradable consumptions

$$P^N = (1-\omega)\omega^{\frac{1}{\eta}}\left[\left(\mu c^{T,L} + (1-\mu)c^{T,H}\right)^{-\eta} - (1-\omega)\right]^{-\frac{1+\eta}{\eta}} \tag{10}$$

In contrast, with homothetic preferences, equation (9) shows that the relative price of nontradables is independent of composite consumption, and equation (10) implies no unequal demand effect across households.

2 Constrained Efficiency

We now formulate the problem of an utilitarian social planner that puts equal weights on households' utilities. The social planner can directly choose the level of borrowing subject to the credit constraints, but allows goods markets to clear competitively. In contrast to the competitive equilibrium households that take prices as given, the social planner internalizes the effect of the borrowing decision on the price of nontradables.

The optimization problem of the social planner is choosing individual allocation to maximize

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ \mu \frac{(c_t^L)^{1-\sigma}}{1-\sigma} + (1-\mu) \frac{(c_t^H)^{1-\sigma}}{1-\sigma} \right\}, \tag{11}$$

subject to the households' budget constraints (2) and (4), the credit constraint (3), resource constraints (5)–(6), and the equilibrium price condition (7). We then define this problem in the recursive form as

Recursive social planner's problem

$$\begin{aligned}
V^{SP}(Y^T) = \max_{\{c^{T,i}, c^{N,i}\}_{i=\{H,L\}}, b'} \quad & \mu \frac{c\left(c^{T,L}, c^{N,L}\right)^{1-\sigma}}{1-\sigma} + (1-\mu) \frac{c\left(c^{T,H}, c^{N,H}\right)^{1-\sigma}}{1-\sigma} + \beta \mathbb{E} V^{SP}(Y^{T'}) \\
\text{subject to} \quad & \\
C^T + b \quad &= \quad Y^T + Qb' \\
C^N \quad &= \quad Y^N \\
c^{T,L} + P^N c^{N,L} + b \quad &= \quad s^L \left(Y^T + P^N Y^N\right) \\
c^{T,H} + P^N c^{N,H} + b \quad &= \quad s^H \left(Y^T + P^N Y^N\right) + Qb' \\
Qb' \quad &\leq \quad \kappa s^H \left(Y^T + P^N Y^N\right) \\
P^N \quad &= \quad \frac{1-\omega}{\omega} \left(\frac{c^{T,i}}{c^{N,i}}\right)^{1+\eta} c^{i(\epsilon_N - \epsilon_T)(1+\eta)}, \quad \forall i = \{H, L\}
\end{aligned} \tag{12}$$

Definition 2.1. A *recursive constrained efficiency* is the allocation rule $\left\{c_{SP}^{T,i}(Y^T), c_{SP}^{N,i}(Y^T)\right\}_{i=\{H,L\}}, b'_{SP}(Y^T)$ and the value function $V^{SP}(Y^T)$ that solve (12).

2.1 Sources of inefficiency

The model features two sources of inefficiency that operate through the relative price of nontradables. The first is the standard Fisherian debt-deflation externality: borrowing households fail to internalize that higher current borrowing reduces future consumption, therefore depreciating future real exchange rates and tightening collateral constraints. This mechanism generates overborrowing in line with Bianchi (2011) and Bianchi and Mendoza (2018).

The second is an externality arising from the heterogeneity that is amplified by nonhomothetic preferences. Borrowing by high-income households depreciates the future real exchange rate, but they do not internalize that this raises the cost of tradable consumption for low-income hand-to-mouth households, and the cost is disproportionally higher for the low-income households due to nonhomotheticity. Since these households allocate a larger share of expenditure to tradables, exchange rate depreciation increases the effective cost of their consumption baskets more strongly, imposing a relatively heavier burden on them than on high-income households.

3 Quantitative Analysis

This section presents the quantitative analysis with two objectives. First, we investigate how income inequality and nonhomothetic preferences shape borrowing decisions and the real exchange rate. Second, we assess the severity of sudden stops and their distributional consequences for consumption inequality. We calibrate the model to match data from Peru and compare decentralized equilibrium outcomes with those under the social planner, examining effects on both aggregates and distributions.

3.1 Parameterization and values

Functional forms and assumptions. The endowment of nontradable goods in every period is normalized to $Y_t^N = 1$. The endowment of tradable goods Y_t^T follows a logged first-order autoregressive process:

$$\log Y_t^T = \rho_y \log Y_{t-1}^T + \epsilon_t^y,\ \epsilon_t^y \sim \mathcal{N}(0, \sigma_y),$$

where ρ_z, σ_z are the auto-correlation and the residual standard deviation, respectively. We discretize the tradable endowment process into a Markov chain using Tauchen's method with 20 evenly-spaced nodes.

Parameter values. Table 1 reports the parameter values used in the analysis. The calibration relies on Peruvian macroeconomic time series and the Peruvian household survey ENAHO to discipline the model targets. Parameters governing the risk-free interest rate, risk aversion, and the elasticity of substitution between tradable and non-tradable consumption are set following Bianchi (2011).

Sectoral income elasticities are calibrated as follows. The tradable elasticity, ϵ_T, is normalized to one, while the non-tradable elasticity, ϵ_N, is estimated to match the household-level non-tradable income elasticity observed in the ENAHO. This estimation follows the methodology proposed by Comin et al. (2021). More details are explained in Arce and Tran-Xuan (2022). The preference weight on tradable consumption is chosen so that the model replicates an average tradable output share in the data.

Tradable output is defined as total output from agriculture, fishing, manufacturing, mining, and energy.

Table 1: Parameters and Values

Parameter	Description	Value	Target
r^*	Risk-free rate	0.04	Standard literature value
σ	Risk aversion	2	Standard literature value
η	Elasticity of substitution T-NT	0.205	Elasticity of substitution T-NT = 0.83
ϵ_T	Tradable income elasticity	1	Normalized
ϵ_N	Nontradable income elasticity	2.2	Nontradable income elasticity = 1.043
ω	Preference weight of tradables	0.36	Tradable output share = 37%
ρ_y	Tradable endowment persistence	0.59	Tradable output persistence
σ_y	Std. dev. of tradable shock	0.039	Std. dev. of tradable output=0.048
μ	Share of hand-to-mouth households	0.6	Share of adults borrowing = 40%
s^H/s^L	Relative endowment share	2.25	Top/bottom income= 1.5
β	Discount factor	0.92	NFA of private sector = -20%
κ	Credit constraint coefficient	0.33	Sudden-stop probability = 5.1%

Note: Table 1 reports the parameter values used in the calibration exercise. The targets for the risk-free rate, the risk aversion, and the elasticity of substitution between tradable and nontradable goods are taken from Bianchi (2011). Income elasticities and preference weights are chosen to replicate sectoral income elasticities measured in the ENAHO household survey and sectoral output shares for Peru. The persistence and volatility of tradable endowments match observed moments of Peruvian tradable output (agriculture, fishing, manufacturing, mining, and energy). Household heterogeneity is computed using ENAHO household survey data, and the household borrowing share is taken from the Global Findex Database. The discount factor targets the private sector net foreign asset position, while the credit constraint parameter is chosen to replicate the observed frequency of sudden-stop episodes in Peru.

Parameters governing the tradable endowment process are estimated using an AR(1) specification for the log HP-filtered tradable output series for Peru. The persistence parameter is set equal to the empirical persistence of tradable output, and the standard deviation of the tradable shock is calibrated to match the volatility of the tradable output series. The share of borrowing households is chosen to match statistics from the Global Findex Database on financial inclusion, specifically the share of adults who borrow or have access to financial institutions. The endowment shares s^H and s^L are normalized such that $\sum_{i\in H,L}\pi^i s^i = 1$ and are calibrated to match the average relative income share of top and bottom earners in the ENAHO.

Finally, we calibrate the discount factor to match the net foreign asset position of the private sector in Peru, and the credit constraint coeffcient to match the sudden-stop probability reported in Bianchi (2011).[1]

[1]We use the following formula to calculate the net foreign asset position of the private sector: NFA of

3.2 Debt Issuance and Real Exchange Rate

We first analyze how the social planner's constrained-efficient debt issuance decisions differ from those of borrowing households and examines their implications for real exchange rate.

Figure 2 reports the policy functions for debt issuance and the real exchange rate as functions of the current level of external debt, comparing the decentralized equilibrium (DE) with the constrained-efficient (CE) allocation. In contrast to the canonical sudden-stop framework where private agents systematically overborrow relative to the social planner, we find state-dependent borrowing distortions. Specifically, borrowing households in the decentralized equilibrium underborrow relative to the social planner at low levels of current debt, but overborrow as debt rises and approaches the collateral constraint.

(a) Debt issuance

(b) Real exchange rate

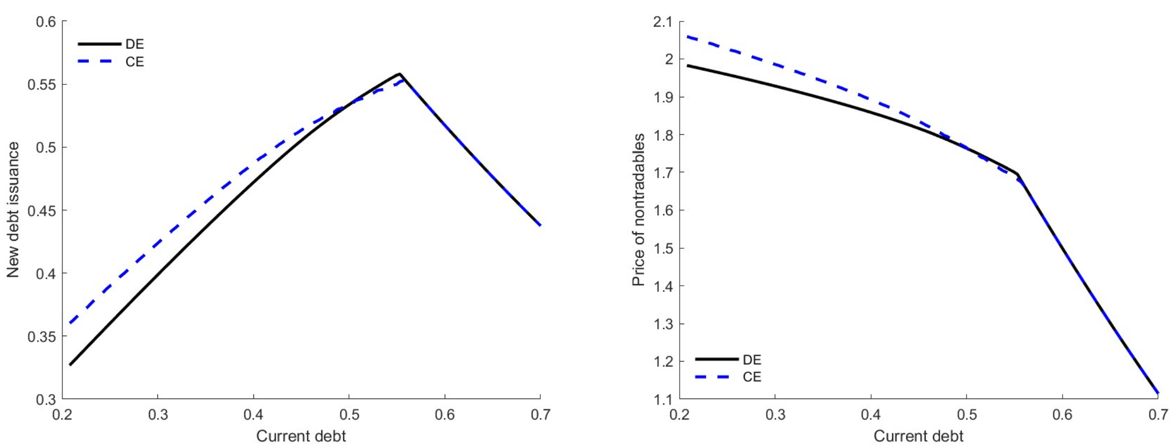

Figure 2: Debt issuance and real exchange rate

Note: Figure 2 shows the policy functions for debt issuance (B') and the real exchange rate (P^N) as functions of current debt (B) under the Decentralized Equilibrium (DE) and Constrained Efficiency (CE).

Panel (a) shows that when the economy is far from the borrowing constraint, decentralized debt issuance lies below its constrained-efficient counterpart. As debt increases and the credit constraint becomes more likely to bind, this ranking reverses, and decentralized borrowing exceeds the planner's allocation. The real exchange rate mirrors this pattern. Relative to the constrained-efficient allocation, the decentralized equilibrium

private sector =NFA of country * private external debt/total external debt. Source: Lane and Milesi-Ferreti (2007) features an undervalued (more depreciated) real exchange rate at low debt levels and an overvalued (more appreciated) real exchange rate when debt is high and the credit constraint is near binding.

These findings differ sharply from the standard results in the sudden-stop literature, in which pecuniary externalities generated by Fisherian debt deflation lead private agents to overborrow in all states, implying an excessively appreciated real exchange rate in the decentralized equilibrium. In our framework, the presence of household heterogeneity introduces an additional externality that alters the incentives of the planner in a state-dependent manner.

When debt is high, borrowing households fail to internalize how additional leverage increases the probability and severity of future binding credit constraints and exchange rate depreciations. Because these depreciations disproportionately reduce the welfare of low-income hand-to-mouth households, the utilitarian social planner prefers lower borrowing than private agents, reproducing the familiar overborrowing result emphasized in the literature. However, when the economy starts from a low level of debt and crisis risk is limited, the planner values exchange rate appreciation as it raises real consumption for hand-to-mouth households with high expenditure shares on tradables. In this region, constrained efficiency calls for larger credit expansions and a stronger real exchange rate than those chosen in the decentralized equilibrium.

3.3 Long-run moments and welfare

We compare the long-run properties and welfare results of the decentralized equilibrium and constrained-efficient economies. We focus on debt, crisis frequency, changes during sudden stops, and welfare gains going from decentralized equilibrium to constrained efficiency.

Table 2 reports the results. A sudden stop is defined as a period in which the current account of the economy increases by more than two standard deviations and the credit constraint is binding. The welfare gain is reported in consumption equivalence units. The first two columns report the statistics for the baseline.

We find that borrowing households overborrow in the decentralized equilibrium, as reflected in a higher debt-to-income ratio relative to the constrained-efficient allocation. As a consequence, the constrained-efficient economy exhibits a lower frequency of sudden stops, smaller exchange rate depreciations, and milder contractions in tradable consumption during crisis episodes. These differences reflect the social planner's internalization of Fisherian debt-deflation and heterogeneity-induced exter-

Table 2: Long-Run Moments and Welfare

	Baseline Heterogeneous Nonhomothetic		**Model 2** Heterogeneous Homothetic		**Model 3** Representative Nonhomothetic Rojas and Saffie (2022)		**Model 4** Representative Homothetic Bianchi (2011)	
	DE	CE	DE	CE	DE	CE	DE	CE
Average (%)								
Debt/income	20.1	19.9	20.1	20	32.6	31.9	32.6	32.1
Prob. of sudden stop	5.1	3.7	5.3	6.0	4.7	1.2	5.1	1.5
Change in sudden stop (%)								
Real exchange rate	-18.8	-17.7	-16.1	-16.2	-29.8	-18.2	-25.0	-16.4
Tradable consumption	-14.7	-13.7	-13.5	-13.6	-23.7	-14.3	-21.3	-13.9
Welfare gain (%)	–	0.0091	–	0.021	–	0.63	–	2.4

Note: Table 2 reports long-run moments and welfare gains from the simulations across the different model specifications, under the Decentralized Equilibrium (DE) and Constrained Efficiency (CE). The baseline features heterogeneous agents and nonhomothetic preferences. Model 2 includes heterogeneous agents with homothetic preferences. Model 3 features a representative agent with nonhomothetic preferences, following Rojas and Saffie (2022). Model 4 corresponds to a representative-agent economy with homothetic preferences, as in Bianchi (2011). A sudden stop is defined as a period in which the current account of the economy increases by more than two standard deviations and the credit constraint is binding. Welfare gain is calculated in consumption equivalent units.

nalities. However, quantitatively, the gaps in debt accumulation, exchange rate dynamics, and consumption responses across the two allocations are modest. This attenuation arises because the social planner must trade off the welfare gains from credit expansions, which disproportionately benefit low-income households, against the increased risk and severity of crises. As a result, the welfare gains from the constrained efficiency are limited.

3.4 Role of heterogeneity and nonhomotheticity

We compare the baseline economy with alternative model specifications to isolate the roles of household heterogeneity and nonhomothetic preferences. Table 2 also reports long-run moments and welfare gains for three variants: Model 2 (heterogeneous agents with homothetic preferences), Model 3 (representative agent with nonhomothetic preferences), and Model 4 (representative agent with homothetic preferences). Model 3 corresponds to the environment studied in Rojas and Saffie (2022), while Model 4 is analogous to Bianchi (2011).

Three main patterns emerge. First, the introduction of heterogeneity reduces aggregate debt, while leaving the frequency of sudden stops largely unchanged. This reflects the presence of hand-to-mouth households that do not borrow. Nevertheless, borrowing becomes concentrated among high-income agents and continues to generate crises at similar frequencies. Second, nonhomothetic preferences amplify the severity of the crisis, leading to larger exchange rate depreciations and deeper consumption contractions. This pattern is evident when comparing the baseline model with Model 2 and Model 3 with Model 4, consistent with the findings in Rojas and Saffie (2022). Third, constrained efficiency is less effective in reducing both crisis frequency and severity in heterogeneous-agent economies. This attenuation arises because the social planner has incentives to maintain credit expansions that increase the welfare of low-income households, even at the cost of higher crisis exposure. In fact, in Model 2 with heterogeneous agents and homothetic preferences, the constrained efficient allocation features more frequent and severe crises than the decentralized equilibrium. In general, welfare gains under constrained efficiency are substantially smaller in heterogeneous-agent models than in representative-agent economies.

3.5 Inequality dynamics around sudden stops

We then analyze the behavior of consumption inequality around sudden stop episodes. Inequality is measured as the ratio of consumption of high-income households to that of low-income households. Figure 3 reports the average responses of tradable, nontradable, and composite consumption inequality in the periods around a sudden stop.

Consumption inequality declines during the sudden stop and increases in the subsequent period. Relative to the decentralized equilibrium, the social planner mitigates the sharp decline in tradable and nontradable consumption inequality during the sudden stop, but also dampens the subsequent increases of tradable and nontradable consumption one period later. These effects are stronger for nontradable consumption inequality than for tradable consumption inequality, as depicted in Panels (a) and (b).

In contrast, composite consumption inequality exhibits a more muted decline during sudden stop episodes, as shown in Panel (c). The social planner achieves a larger reduction in composite consumption inequality during sudden stops than the decentralized equilibrium. This difference is driven by nonhomothetic preferences, which imply heterogeneous effective prices of the composite good across income groups. High-income households place a higher weight on nontradables than low-income households. As the relative price of nontradables falls during a sudden stop, the effective price

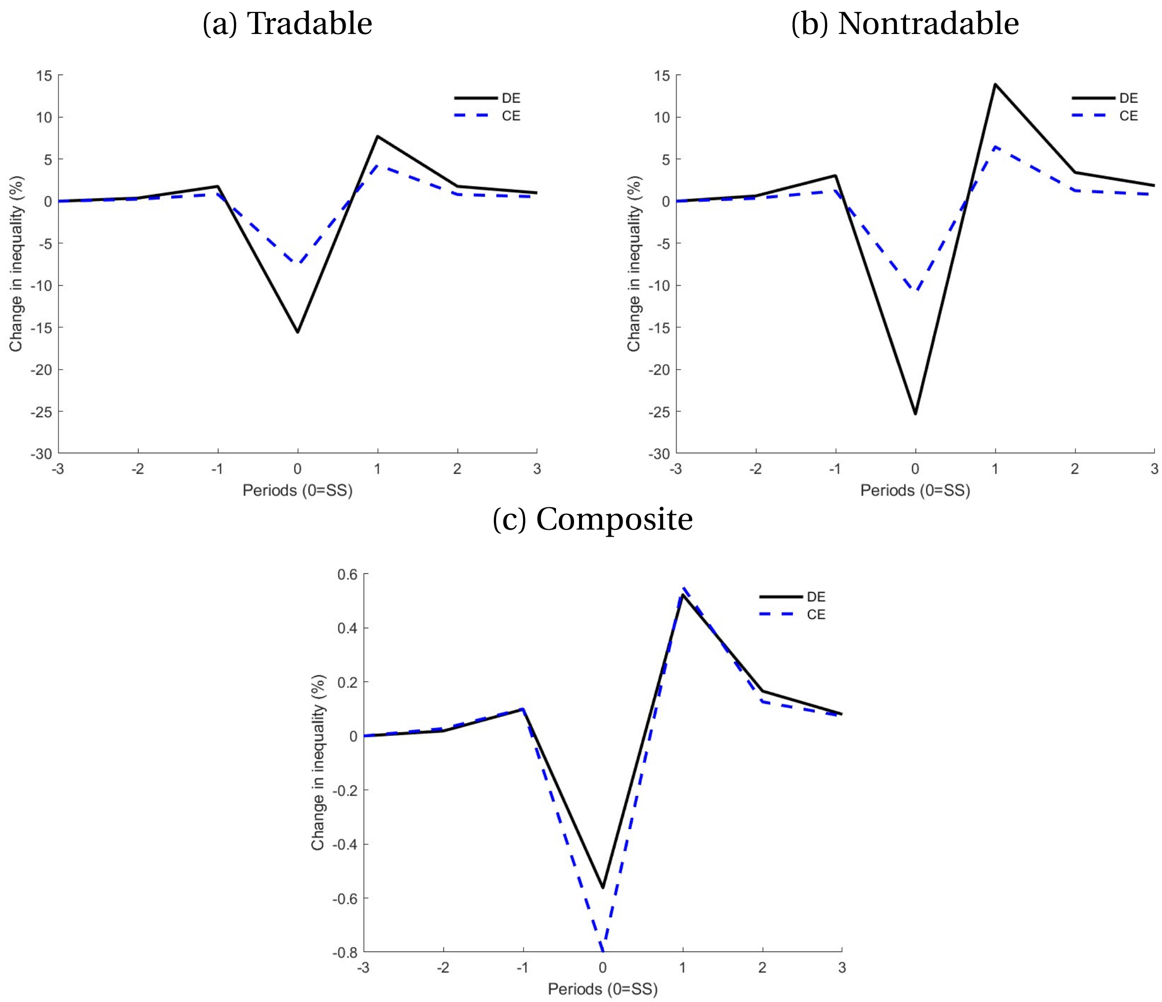

Figure 3: Consumption inequality around sudden stops

Note: Figure 3 plots the consumption inequality around a sudden stop, for Decentralized Equilibrium (DE) and Constrained Efficiency (CE) in the simulation of the baseline. Consumption inequality is the ratio of the consumption of high-income households to that of low-income households. A sudden stop (SS) is defined as a period in which the current account of the economy increases by more than two standard deviations and the credit constraint is binding.

of the composite good declines more for high-income households than for low-income households. This price channel is stronger in the decentralized equilibrium than in the constrained efficiency. Consequently, the fall in the composite consumption inequality is smaller under the constrained efficiency.

4 Optimal Macroprudential Policy

In this section, we characterize the optimal macroprudential policy that decentralizes the constrained efficient allocation. A key feature of the social planner's problem is that the planner is subject to the same budget constraints as private agents in the decentralized equilibrium. In particular, the planner cannot give transfers across households. Redistribution can therefore occur only indirectly through borrowing choices that affect equilibrium prices. As a result, the constrained efficient allocation can be implemented by a tax on borrowing by high-income households.

(a) Optimal tax functions (b) Optimal tax around sudden stops

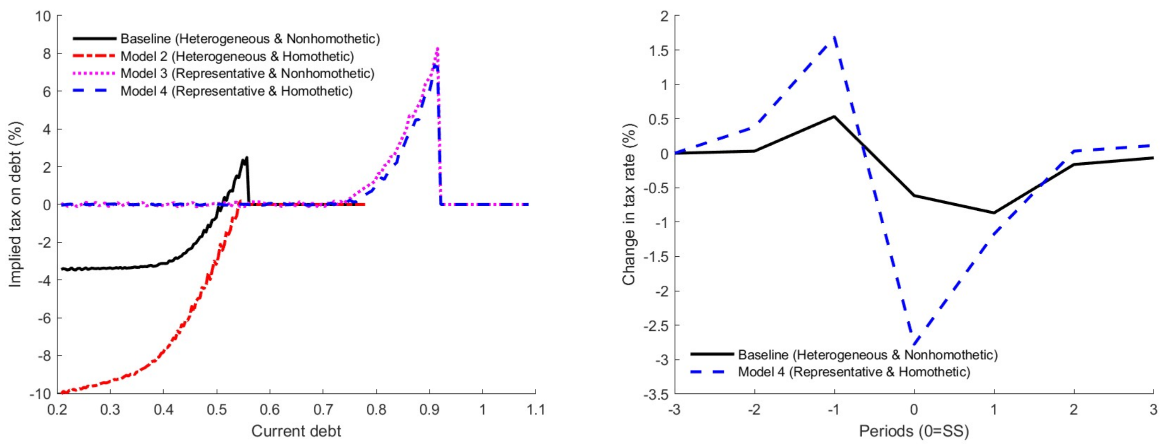

Figure 4: Optimal macroprudential policy

Note: Figure 4 plots the optimal borrowing tax as a function of current debt for the median income shock in Panel (a), and its dynamics around sudden stop episodes in Panel (b). The optimal borrowing tax is defined as the tax on the current debt that implements the constrained efficient allocation. A sudden stop (SS) is defined as a period in which the current account of the economy increases by more than two standard deviations and the credit constraint is binding.

Figure 4 reports the optimal borrowing tax as a function of current debt for the median income shock in Panel (a), and its dynamics around sudden stop episodes in Panel (b) across model variants. In the baseline economy, optimal macroprudential policy features subsidies to borrowing at low levels of debt and taxes on borrowing when debt is high and close to the collateral constraint. Cross-model comparisons highlight the roles of heterogeneity and nonhomothetic preferences in shaping optimal policy. In particular, the presence of hand-to-mouth households calls for stronger borrowing subsidies, whereas nonhomothetic preferences imply higher borrowing taxes. These patterns are consistent with earlier results that underborrowing is optimal in order to induce credit expansions that disproportionately benefit poorer hand-to-mouth households, and with the literature showing that nonhomothetic preferences amplify crisis severity. A novel finding is that the impact of nonhomothetic preferences on optimal borrowing taxes is quantitatively stronger in the heterogeneous-agent economy.

Turning to dynamics around sudden stops, the optimal borrowing tax rises in the period preceding the sudden stop, but then falls and remains persistently low in the aftermath. This contrasts with the standard sudden-stop model (Model 4), in which the borrowing tax increases primarily in the run-up to the sudden stop, drops sharply on impact, and then recovers quickly. The difference reflects that, in the baseline, borrowing subsidies are optimal at the low debt levels that prevail following a sudden stop episode.

5 Conclusion

This paper studies how inequality shapes the dynamics and welfare consequences of sudden stop crises and the design of optimal macroprudential policy in emerging market economies. We develop a heterogeneous-agent small open economy model with nonhomothetic preferences in which high-income households borrow internationally subject to collateral constraints, while low-income households are hand-to-mouth. This framework allows us to analyze how movements in the real exchange rate transmit shocks across the income distribution and how distributional considerations interact with financial stability concerns in the design of policy.

The model features two sources of inefficiency operating through the real exchange rate. In addition to the standard Fisherian debt-deflation externality, we identify a heterogeneity-induced pecuniary externality: borrowing by high-income households affects the real exchange rate in ways that disproportionately raise the cost of consumption for low-income households, who allocate a larger share of expenditure to tradable goods due to nonhomothetic preferences. While sudden stop crises are therefore especially costly for poorer households, credit expansions that appreciate the real exchange rate disproportionately benefit them, generating a fundamental intertemporal trade-off for policy.

Quantitatively, we find that constrained efficiency reduces leverage and crisis severity relative to the decentralized equilibrium, but the welfare gains are modest. The social planner optimally preserves credit expansions that raise contemporaneous welfare for low-income households, even at the cost of higher exposure to future crises. Introducing heterogeneity lowers aggregate debt but leaves the frequency of sudden stops largely unchanged as borrowing becomes concentrated among high-income households, while nonhomothetic preferences amplify the severity of crises by magnifying exchange rate depreciations and consumption contractions. As a result, constrained efficiency is substantially less effective in heterogeneous-agent economies than in representative-agent environments.

These forces have important implications for optimal macroprudential policy. Optimal borrowing taxes are state dependent, featuring subsidies at low levels of debt and taxes when leverage is high and close to binding collateral constraints. Heterogeneity strengthens the case for borrowing subsidies, while nonhomothetic preferences call for higher borrowing taxes, and the interaction between the two generates quantitatively larger policy responses. Around sudden stop episodes, optimal policy tightens in the run-up to crises but remains slack in the subsequent periods, reflecting the optimality of subsidizing borrowing at the low debt levels that prevail following crises.

More broadly, our results highlight that distributional considerations are central to understanding both the dynamics of external financial crises and the design of financial regulation in emerging markets. Policies that stabilize aggregate outcomes can have heterogeneous welfare effects across households, and optimal interventions must balance financial stability against distributional objectives. An important avenue for future research is to extend the framework to incorporate income risks and fiscal redistribution, as well as to explore the interaction between macroprudential policy and redistributive or social insurance policies.

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