Sudden stops and consumption inequality with nonhomothetic preferences

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Disclaimer: The views expressed here are mine and do not represent the views of the Federal Reserve Bank of Chicago or the Federal Reserve System
Emerging markets have higher levels of income and consumption inequality.

Emerging markets are also subject to sudden-stop crises, characterized by sharp real exchange rate depreciation.

Recent evidence of differences in income elasticities of demand for tradables and nontradables goods (non-homothetic preferences), and it’s important for macro aggregates.

**Implication:** Changes in the consumption bundle across the income distribution could have an impact on the real exchange rate during a current account reversal.
Research questions when preferences are nonhomothetic

1. What happens to consumption inequality during sudden stop crises?

2. Should regulators consider income redistribution when setting macroprudential policies?

3. Is overborrowing uniform across the income distribution?

Results

- Under laissez-faire, consumption inequality moves little during crises.
- Under optimal policies, increasing consumption inequality during crises can reduce the frequency and severity of sudden stops.
- From a social standpoint, high income households overborrow while low income households underborrow.
Continuum of households with access to international credit markets

Agents are heterogeneous on the share of the stochastic aggregate endowment they receive

Every agent’s debt is constrained by market value of their income (credit frictions)

Sudden-stop crisis: Defined as a period where the current account of the economy increases by more than two standard deviations

Preferences: Household have a higher income elasticity for nontradables than for tradables
Two versions

**Decentralized version:** Continuum of competitive households choose individual debt and consumption taking all aggregate laws of motion as given

**Constrained-efficient version:** A planner makes all borrowing decisions but is subject to the same credit constraints as the households in the decentralized version

Households choose their consumption competitively subject to their individual budget constraints

Planner can’t transfer resources across households directly
Inequality and economic cycles
Broer (2020); Primiceri and van Rens (2009); Storesletten, Telmer, and Yaron (2007, 2004); Krebs (2007); Barlevy and Tsiddon (2006);
→ The role of inequality on sudden stops crises in emerging economies

Macroeconomic impact of nonhomothetic preferences
Rojas and Saffie (2021); Comin, Lashkari, Mestieri (2021), Boppart (2014), Buera, and Kaboski (2009)
→ Sectoral consumption reallocation can increase frequency and severity of crises

Sudden Stops and inequality
Villalvazo (2021), Hong (2020), Guntin, Ottonello, and Perez (2021), Kumhof, Ranciere, and Winant (2015);
→ Differential effect on the real exchange rate of households with different income levels
Empirical Motivation
Country focus: Peru 2007 - 2019

From 2007 to 2019, Peru had two CA reversals (2009 and 2016)

We complement the macro data with household survey data (ENAHO)

Repeated cross-sections that are consistent with macro aggregates

**Income**: Net monetary income, includes subsidies and transfers

**Consumption**: Non-durable monetary consumption

**Inequality**: The ratio of consumption expenditures of households with income above to below the median
Decompose annualized monetary consumption expenditures at the household level expenditures into four categories:

- ** Tradable** consumption: Food, Clothing, Energy, Home equipment.
- ** Nontradable** consumption: Restaurants, Services, Education, Health, Transportation.
- ** Durable** consumption: Housing, Cars, Furniture, Electronics
- ** Not classified**: Others

**Consumption**: Tradable + nontradable consumption

Income and consumption are residualized using head of household observables (age, education, gender,…) and time trends.
Homothetic preferences?

Source: Encuesta Nacional de Hogares (ENAHO)

Nonresidualized Consumption inequality T-NТ consumption inequality Arce and Tran-Xuan – Sudden stops and consumption inequality with nonhomothetic preference
Following Comin, Lashkari, and Mestieri (2021), we assume household’s preference in each period $u(c)$, nested generalized CES

c is a composite of tradable $c_T$ and nontradable $c_N$ consumption such that

$$1 = \left[ \omega (c_T)^{-\eta} c_T^{(1+\eta)-1} + (1 - \omega) (c_N)^{-\eta} c_N^{(1+\eta)-1} \right]^{-1/\eta}, \eta > -1, \omega \in (0, 1)$$

Elasticity of substitution T-NT: $\frac{1}{1+\eta}$

Income elasticity of good $j$: $\frac{1}{1+\eta} + \frac{\eta}{1+\eta} \frac{\epsilon_j}{\omega \epsilon_T + (1-\omega) \epsilon_N}$

Preference is homothetic CES if $\epsilon_T = \epsilon_N = 1$
Hicksian approach

Expenditure

\[ E \equiv p_T c_T + p_N c_N \]

Hicksian demand

\[ c_T = \omega \frac{1}{1+\eta} \left( \frac{E}{p_T} \right)^{\frac{1}{1+\eta}} \quad c^{\frac{1}{1+\eta}} \]

\[ c_N = (1 - \omega) \frac{1}{1+\eta} \left( \frac{E}{p_N} \right)^{\frac{1}{1+\eta}} \quad c^{\frac{1}{1+\eta}} \]

Shares of tradable and nontradable expenditures

\[ \bar{\omega}_T = \omega \frac{1}{1+\eta} \left( \frac{E}{p_T} \right)^{\frac{1}{1+\eta}-1} \quad c^{\frac{1}{1+\eta}} \]

\[ \bar{\omega}_N = (1 - \omega) \frac{1}{1+\eta} \left( \frac{E}{p_N} \right)^{\frac{1}{1+\eta}-1} \quad c^{\frac{1}{1+\eta}} \]
Elasticity estimation: Method

We normalize $\epsilon_T = 1$ and estimate parameters $\epsilon_N$ and $\eta$ using GMM

Moment condition:

$$
\log \left( \frac{\bar{\omega}_N^n}{\bar{\omega}_T^n} \right) = \left( \frac{\eta}{1 + \eta} \right) \log \left( \frac{p_{Nt}^n}{p_{Tt}^n} \right) + (\epsilon_N - 1) \log \left( \frac{E_t^n}{p_{Tt}^n} \right) + (\epsilon_N - 1) \left( \frac{1 + \eta}{\eta} \right) \log \bar{\omega}_T^n + \zeta_N^n + \nu_N^n
$$

Data:

- Residualized consumption and expenditure shares
- Effective price faced by each household $p_{it}^n$
  - Expenditure-weighted average of the log-price of each of the expenditure categories belonging to the sector $i$

Instruments
Elasticity estimation: Results

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<tbody>
<tr>
<td>$\eta$</td>
<td>0.225***</td>
<td>0.236***</td>
<td>0.243***</td>
<td>0.278***</td>
<td>0.229***</td>
<td>0.242***</td>
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<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.004)</td>
<td>(0.002)</td>
<td>(0.003)</td>
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<tr>
<td>$\epsilon_N$</td>
<td>1.928***</td>
<td>2.147***</td>
<td>1.859***</td>
<td>1.997***</td>
<td>2.486***</td>
<td>3.317***</td>
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<tr>
<td></td>
<td>(0.028)</td>
<td>(0.057)</td>
<td>(0.025)</td>
<td>(0.045)</td>
<td>(0.046)</td>
<td>(0.176)</td>
</tr>
<tr>
<td>Expenditure re-weighted</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Region FE</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Year FE</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

(1): $\eta = 0.225$ and $\epsilon_N = 1.928$ correspond to

- Elasticity of substitution T-NT is 0.18
- Income elasticity difference of nontradable to tradable is 0.11
Model
Model: Small open endowment economy

**Goods:** Tradable \((y^T)\) and nontradable \((y^N)\). Bonds denominated in units of tradables

**Real exchange rate** \((p^N)\): Relative price of nontradables

**Aggregate shocks:** Tradable income \((y^T)\)

**Agents:** A unitary mass of households, divided in a finite number \(F\) of types \(i \in 1, \ldots, F\)

Equal mass of each type: \(\pi_i = 1/F\)
Each household of type $i$ receives a fraction $s_i$ of the endowment

Starts the period with debt $b_i$ and can issue non-state contingent one-period bonds $b'_i$ at price $q$

Due to imperfect enforcement, the market value of debt issuance cannot exceed a fraction $\kappa$ of current income

The credit constraint is therefore:

$$qb'_i \leq \kappa s_i[y^T + p^Ny^N]$$
Households face agg. state $S = (y^T, B_1, ..., B_F)$

$$V_i(S, b_i) = \max_{b'_i, c^T_i, c^N_i} u(c^T_i, c^N_i) + \beta \mathbb{E}[V_i(S', b'_i)]$$

subject to

$$c^T_i + p^N c^N_i + b_i = s_i(y^T + p^N y^N) + q b'_i$$

Market value of new debt

Pecuniary aggregate demand externality

$$qb'_i \leq \kappa s_i (y^T + p^N y^N)$$

Taking aggregate prices and laws of motion as given

$$p^N = p^N(S) \ ; \ S' = S' \left( y^{T'}, B'_1(S), ..., B'_F(S) \right)$$
**Constrained-efficient version**

**Agents:** Planner and risk-neutral foreign lenders

**Aggregate shocks:** Same as competitive equilibrium \((y^T)\)

**Credit frictions:** For each type \(i\):

\[
qB'_i \leq \kappa s_i \left[ y^T + f \left( \{C_i\}_{i=1}^{F} \right) y^N \right],
\]

Planner’s welfare weights \(\{\Psi_i\}_{i=1}^{F}\)

Planner chooses aggregate borrowing by type but must still satisfy the household budget constraints

Planner can’t transfer resources across households directly

---

Recursive planner problem
Equilibrium price of nontradables

Nonhomothetic preference \((\epsilon_T < \epsilon_N)\)

\[
p^N = (1 - \omega) \left\{ \frac{1}{F} \sum_{i=1}^{F} \left[ \omega \frac{1}{1+\eta} C_i^{\epsilon_T} - \frac{1}{1+\eta} + (1 - \omega) \frac{1}{1+\eta} p^N \frac{\eta}{1+\eta} C_i^{\epsilon_N} - \frac{1}{1+\eta} \right] \frac{1}{\eta} \times C_i^{\epsilon_N} - \frac{1}{1+\eta} \right\}^{1+\eta} \]

Homothetic preference \((\epsilon_T = \epsilon_N = 1)\)

\[
p^N = (1 - \omega) \omega \frac{1}{\eta} \left[ \left( \frac{1}{F} \sum_{i=1}^{F} C_i \right)^{-\eta} - (1 - \omega) \right]^{-\frac{1+\eta}{\eta}}\]
Main mechanism

All types of household make borrowing decisions that ignore the pecuniary externality.

High type households have a larger impact on the evolution of the real exchange.

Low type households have a lower borrowing capacity and higher marginal returns of consumption.

Relative to the decentralized version, the planner decreases borrowing progressively.

When the low types are facing a binding constraint but not the high types, the planner will increase borrowing by the high-types to relax the low-types constraints.

Euler’s equation
Quantitative analysis
Quantitative assumptions

Assume that tradable income follows a discretized AR 1 process, estimated from Peruvian macro data.

Reduce the problem to only two types of households.

Use the estimated parameters from household survey:
- Relative income share
- Share of tradable expenditure
- Elasticity of substitution T-NT (GMM)
- Nontradable income elasticity (GMM)

Calibrated parameters:
- Discount factor
- Credit constraint coefficient
# Parameters

Estimated from the household survey

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
<th>Method</th>
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<tbody>
<tr>
<td>$s^H/s^L$</td>
<td>Relative income share</td>
<td>3.05</td>
<td>Res. income shares</td>
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<tr>
<td>$\omega$</td>
<td>Share of tradable expenditures</td>
<td>0.45</td>
<td>Share of res. tradable consumption</td>
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<tr>
<td>$\epsilon_T$</td>
<td>Tradable income elasticity</td>
<td>1.00</td>
<td>Normalized</td>
</tr>
<tr>
<td>$\eta$</td>
<td>Elasticity of substitution T-NT</td>
<td>0.23</td>
<td>GMM regression</td>
</tr>
<tr>
<td>$\epsilon_N$</td>
<td>Nontradable income elasticity</td>
<td>1.93</td>
<td>GMM regression</td>
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Calibrated

<table>
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<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
<th>Moment</th>
<th>Data</th>
<th>Simulation</th>
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<tr>
<td>$\beta$</td>
<td>Discount factor</td>
<td>0.93</td>
<td>NFA to GDP</td>
<td>31.46</td>
<td>31.50</td>
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<td>$\kappa$</td>
<td>Credit constraint</td>
<td>0.33</td>
<td>Sudden stop probability</td>
<td>5.26</td>
<td>5.27</td>
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</table>
Decentralized vs. constrained efficient at the ergodic

<table>
<thead>
<tr>
<th>Average (in %)</th>
<th>DE</th>
<th>CE</th>
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<tbody>
<tr>
<td>Debt/income</td>
<td>31.5</td>
<td>30.4</td>
</tr>
<tr>
<td>High type</td>
<td>23.8</td>
<td>22.5</td>
</tr>
<tr>
<td>Low type</td>
<td>7.7</td>
<td>8.0</td>
</tr>
<tr>
<td>Prob. of crisis</td>
<td>5.27</td>
<td>2.1</td>
</tr>
<tr>
<td>RER depreciation</td>
<td>-31.9</td>
<td>-26.5</td>
</tr>
<tr>
<td>Welfare gain</td>
<td>–</td>
<td>0.0013</td>
</tr>
</tbody>
</table>
On average high-types overborrow while low-types underborrow
Expenditure inequality around a sudden stop

Under laissez-faire expenditure inequality declines slightly. In the planned economy, large increase
Under laissez-faire expenditure inequality declines slightly. In the planned economy, large increase
Nontradable expenditure inequality around a sudden stop

Under laissez-faire expenditure inequality declines slightly. In the planned economy, large increase
Conclusion

Model of how sudden stop crises affect countries with ex-ante heterogeneity

1. Excessive debt issuances by high income households lead to sudden stops

2. Without government intervention, consumption inequality falls during crises

3. Optimal macroprudential policies would decrease inequality on average but increase it during crises

Next steps

• Finish the calibration of the model and check if the dynamics are quantitatively consistent with the micro data
• Allow for idiosyncratic income shocks or shocks to income inequality
• Analyze simple policy recommendations that can approach the CE economy
Conclusion

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Arce and Tran-Xuan – Sudden stops and consumption inequality with nonhomothetic preference
Appendix
Decentralized vs. constrained efficient at the ergodic

<table>
<thead>
<tr>
<th></th>
<th>Benchmark</th>
<th>RA &amp; homothetic</th>
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<tbody>
<tr>
<td></td>
<td>DE</td>
<td>CE</td>
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<tr>
<td><strong>Average (in %)</strong></td>
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<tr>
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<td>–</td>
<td>0.0013</td>
</tr>
</tbody>
</table>
Peru: Income inequality in levels

Source: Encuesta Nacional de Hogares (ENAHO)

Top 50% income share

2008 2010 2012 2014 2016 2018

0.825 0.83 0.835 0.84 0.845 0.85 0.855 0.86 0.865
Peru: Income inequality in levels

Source: Encuesta Nacional de Hogares (ENAHO)
Homothetic preferences?

Source: Encuesta Nacional de Hogares (ENAH0)
Peru: Consumption inequality in levels

Source: Encuesta Nacional de Hogares (ENAHO), and IMF IFS
Peru: Income inequality in levels (non residualized)

Source: Encuesta Nacional de Hogares (ENAHO), and IMF IFS
Peru: Consumption inequality in levels (non residualized)

Source: Encuesta Nacional de Hogares (ENAHO), and IMF IFS
Sudden stops in Peru and Mexico

Source: IMF IFS
## Residualized Income and Consumption

<table>
<thead>
<tr>
<th></th>
<th>(1) Income</th>
<th>(2) Consumption</th>
<th>(3) Tradables</th>
<th>(4) Nontradables</th>
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<td>Age</td>
<td>0.00963***</td>
<td>0.0207***</td>
<td>0.0145***</td>
<td>0.0369***</td>
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<tr>
<td></td>
<td>(4.13)</td>
<td>(12.34)</td>
<td>(8.63)</td>
<td>(13.48)</td>
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<tr>
<td>Female</td>
<td>-0.460</td>
<td>4.359*</td>
<td>1.159</td>
<td>8.788*</td>
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<tr>
<td></td>
<td>(-0.15)</td>
<td>(1.99)</td>
<td>(0.53)</td>
<td>(2.54)</td>
</tr>
<tr>
<td>Year</td>
<td>0.0596***</td>
<td>0.0535***</td>
<td>0.0538***</td>
<td>0.0577***</td>
</tr>
<tr>
<td></td>
<td>(28.30)</td>
<td>(36.47)</td>
<td>(37.06)</td>
<td>(21.90)</td>
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<td>Constant</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Controls for Household Size</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Controls for Education Level</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Controls for Region</td>
<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Interaction Time and Education</td>
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<td>Yes</td>
<td>Yes</td>
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<td>Observations</td>
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<td>171197</td>
<td>171061</td>
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<tr>
<td>$R^2$</td>
<td>0.327</td>
<td>0.421</td>
<td>0.435</td>
<td>0.287</td>
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</tbody>
</table>

$t$ statistics in parentheses

Period: 2007-2019. Least Squares Estimation. **,**,: significant levels of 5%,1%.
Macro vs Micro aggregates

Source: IMF IFS, ENAHO, and ENIGH
Current account reversals in Peru

Source: IMF IFS
Sudden stops in Peru and Italy

Source: IMF IFS
Peru: Consumption inequality and the current account

Source: Encuesta Nacional de Hogares (ENAHO) and IMF IFS
Peru: Tradable and nontradable inequality

Source: Encuesta Nacional de Hogares (ENAH0) and IMF IFS
Elasticity Estimation: Instruments

Instruments on expenditures

- Annual income after taxes
- Income quintile

Instruments on relative price

- Compute the average price for each category across regions excluding the own region
- Sectoral price for a region is constructed using the average region expenditure shares in each sub-component as weights
Planner faces agg. state \( S = (y^T, B_1, ..., B_F) \)

\[
V^{CE}(S) = \max_{\forall i \in \{1, .., F\} B'_i, c_i^T, c_i^N} \sum_{i=1}^{F} \frac{1}{F} u(C(c_i^T, c_i^N)) + \beta \mathbb{E}[V^{CE}(S')] \\
\text{subject to} \\
\forall i \quad \underbrace{c_i^T + p^N c_i^N}_{\text{Consumption}} + \underbrace{B_i}_{\text{Current debt held by } i} = \underbrace{s_i(y^T + p^N y^N)}_{\text{Endowment share}} + q \underbrace{B'_i}_{\text{New debt issued}} \\
\forall i \quad \underbrace{q B'_i}_{\text{Market value of new debt}} \leq \kappa \ s_i \ (y^T + p^N y^N) \\
\]

\[p^N = f \left( \{C_i\}_{i=1}^{F} \right)\]

Where

\[S' = S' \left( y^{T'}, B'_1(S), ..., B'_F(S) \right) \]

Distribution of debt
General equilibrium objects

\[
\bar{X} = \frac{1}{EC_i} \left( \frac{dp_i^N}{dc_i} \psi_i c_i^{-\sigma} - \psi_i^{-1} c_i^{-\sigma} \right)
\]

\[
\bar{Z} = \frac{EC_i}{EC_{-i}} \frac{dp_i^N}{dc_i}
\]

\[
EP_i = (1 - \omega) \left( \frac{1}{1+\eta} \right)^{\epsilon_N} \left( \frac{1}{1+\eta} \right)^{\epsilon_T} \left( \frac{1}{1+\eta} \right)^{\epsilon_N - \frac{1}{1+\eta}} E_i \frac{1}{1+\eta} (p^N)^{-\frac{1}{1+\eta}}
\]

\[
EC_i = \frac{1}{\eta} E_i^{\frac{1}{1+\eta}} \left[ \omega \left( \frac{1}{1+\eta} \right)^{\epsilon_T} (1 + \eta) - 1 \right] \frac{1}{1+\eta} c_i^{\epsilon_N - \frac{1}{1+\eta}} \left( \frac{1}{1+\eta} \right)^{\epsilon_T - 1 - \frac{1}{1+\eta}} + (1 - \omega) \left( \frac{1}{1+\eta} \right)^{\epsilon_N} (1 + \eta) - 1 \right] \frac{1}{1+\eta} c_i^{\epsilon_N - \frac{1}{1+\eta}} \left( p^N \right)^{1 - \frac{1}{1+\eta}}
\]
Constrained-efficient multiplier $\lambda$

Benchmark

$$
\lambda_i = \frac{1}{dP^N_{dc_i}} \Psi_i c_i^{-\sigma} + \tilde{X} (EP_{-i} - s_{-i}) + \kappa (\mu_i s_i + \mu_{-i} s_{-i})
$$

Homothetic preference

$$
\lambda_i = \frac{1}{dP^N_{dc}} \Psi_i c_i^{-\sigma} + \tilde{X} (EP_{-i} - s_{-i}) + \kappa (\mu_i s_i + \mu_{-i} s_{-i})
$$

No inequality

$$
\lambda = \frac{1}{dP^N_{dc}} c^{-\sigma} + \kappa \mu
$$
## Standard parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
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</tr>
</thead>
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<tr>
<td>$r^*$</td>
<td>Risk-free rate</td>
<td>0.04</td>
<td>Standard literature value</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Risk aversion</td>
<td>2</td>
<td>Standard literature value</td>
</tr>
<tr>
<td>$\rho_{yT}$</td>
<td>Tradable output persistence</td>
<td>0.53</td>
<td>Peruvian macro data</td>
</tr>
<tr>
<td>$\sigma_{yT}$</td>
<td>Std. dev. of tradeable shock</td>
<td>0.047</td>
<td>Peruvian macro data</td>
</tr>
</tbody>
</table>
Peru: Consumption inequality and the current account

Source: Encuesta Nacional de Hogares (ENAHO), and IMF IFS
Peru: Tradable and nontradable inequality

Source: Encuesta Nacional de Hogares (ENAHO), and IMF IFS
Euler’s equation

\[ \lambda_i = \frac{\beta}{q} \mathbb{E} [\lambda_i'] + \mu_i \]

- \( \lambda_i \): multiplier on the agent's budget constraint
- \( \mu_i \): multiplier on the agent’s credit constraint

Decentralized version

\[ \lambda_i = c_i^{-\sigma} \]

Constrained-efficient version

\[ \lambda_i = \frac{1}{\frac{dP_N}{dc_i}} \psi_i c_i^{-\sigma} + \tilde{X} \left( EP_{-i} - s_{-i} \right) + \kappa \left( \mu_i s_i + \mu_{-i} s_{-i} \right) \]

redistribution: \( \neq 0 \)

\[ \lambda_i = \left( \frac{EC_i}{\frac{dP_N}{dc_i}} + EP_i - s_i + \tilde{Z} \left( EP_{-i} - s_{-i} \right) \right) \]

nonhomotheticity: \( \neq 1 \)
Hicksian approach

Household’s $i$ consumption Expenditures are defined as

$$E_i = c_i^T + p^N c_i^N$$

It can be shown that $E_i$ can be rewritten in terms of the composite consumption $C_i$ and the price of nontradables $p^N$:

$$E_i = \left[ \omega \frac{1}{1+\eta} C_i^{e_T - \frac{1}{1+\eta}} + (1 - \omega) \frac{1}{1+\eta} C_i^{e_N - \frac{1}{1+\eta}} (p^N)^{\frac{\eta}{1+\eta}} \right]^{\frac{1+\eta}{\eta}}$$

Note that when preferences are homothetic

$$E_i = \left[ \omega \frac{1}{1+\eta} + (1 - \omega) \frac{1}{1+\eta} (p^N)^{\frac{\eta}{1+\eta}} \right]^{\frac{1+\eta}{\eta}} C_i$$

Shadow Price of Composite $\perp i$
Policy function of debt for the high type

Next period debt of the high type

45 degree
Decentralized economy
Constrained-efficient economy

Current debt of the high type
Policy function of debt for the low type
Debt of the high type as a function the current debt of the low type
Relaxing the real exchange rate

![Graph](image-url)

- **Price of nontradables**
- **Current debt of the low type**
- **Next period debt of the high type**

**Lines:**
- **RER in DE**
- **RER in SP**
- **High type DE**
- **High type SP**
Nontradable expenditure inequality around a sudden stop

Under laissez-faire expenditure inequality increases slightly. In the planned economy, large increase
Expenditure inequality around a sudden stop

Under laissez-faire expenditure inequality declines slightly. In the planned economy, large increase
Under laissez-faire expenditure inequality declines slightly. In the planned economy, large increase