OPEN ECONOMY, REDISTRIBUTION, AND THE AGGREGATE IMPACT OF EXTERNAL SHOCKS

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Two important features of emerging market business cycles:

- High consumption volatilities (Aguiar and Gopinath, 2007);
- Subject to international spillovers.

Recent advances in closed-economy literature: important to consider the effect of distribution and heterogeneity (Kaplan, Moll and Violante, 2018; Auclert, 2019).

- Open economy: foreign shocks and exchange rate fluctuations introduce additional layers of exposure.
- Aggregate stabilization policy: need micro-level empirical/quantitative support.

This paper: The role of household heterogeneity and redistribution in the transmission of foreign shocks.

Unequal exposure to shocks has aggregate implications through redistribution: (Auclert, 2019)

- Redistribution channels: systematic relationships between household exposure and **marginal propensity to consume** (MPC).
- High-MPC households lose more from adverse shocks ⇒ aggregate impact amplified.

This paper: redistribution channels in the open economy.

Example: currency devaluation puts downward pressure on consumption through:

- Pass-through to constrained households' consumption basket.
- Revaluation of constrained households' foreign-currency debt.

ROADMAP

1. Analytical decomposition: aggregate consumption response to external shocks.
   - Key sufficient statistics for redistribution channels: $\mathbf{Cov}(\text{MPC}_i, \text{Exposure}_i)$.

2. Document heterogeneity in exposure; measure redistribution channels in data.
   - Estimate covariances from Uruguay household survey data.

3. Quantitative model: general equilibrium impact.
   - Heterogeneous agent New Keynesian (HANK) model for a small open economy.
   - Key features: partially dollarized balance sheet and consumption basket.
   - Calibrate model to macro and micro moments of Uruguay.
   - Quantify the role of redistribution channels via counterfactual comparisons.

Uruguay data: redistribution through foreign-currency assets – most important.

- Highly concentrated dollar savings on wealthy (unconstrained) households.
- More even distribution of dollar borrowings.
- $\mathbf{Cov}(\text{constrained}_i, \text{net dollar wealth}_i) = \mathbf{-0.645}$.
- Other channels: covariance ≈ 0.

Quantitative model: currency depreciates after foreign monetary tightening.

- Redistribution through asset revaluation: substantial amplification.
  - Baseline calibration (Uruguay 2017): 25 bps $\uparrow \mathbf{i}^*$ $\Rightarrow$ 26 bps $\downarrow \mathbf{C}$.
  - "Heavy dollarization" experiment (Hungary 2008): **1.8** times larger decline of **C**.
- Constrained households' consumption more exposed to devaluation.
  - Moderate amplification relative to homothetic model.

Extension of analytical closed-economy HANK literature:

- Analytical decomposition of consumption to highlight the role of redistribution.
  Auclert (2019); Clayton, Jaravel and Schaab (2018)
- Heterogeneous incidence from aggregate shocks.
  Alves, Kaplan, Moll and Violante (2020); Broer, Kramer and Mitman (2021)

Heterogeneous agents and international macro

- Redistribution channels in the open economy:
  Kekre and Lenel (2021); Guo, Ottonello and Perez (2021).
  This paper: amplification/dampening effect through interaction with MPC

- HANK models in the open economy:
  De Ferra, Mitman and Romei (2020); Hong (2020); Auclert, Rognlie, Souchier and Straub (2021); Ferrante and Gornemann (2021)
  This paper: tightly calibrates model to household balance sheet data; focuses on the contribution of redistribution

Identifying redistribution channels: Analytical decomposition

Measuring redistribution channels: Empirical analysis using micro-data

Understanding GE impact: Quantitative model

Two periods ($t \in \{0, 1\}$), perfect foresight. (Permanent) heterogeneity in:

- **Consumption** of tradable ($-priced) and nontradable goods.
- **Asset** endowed at period 0: peso- (a) and dollar-denominated nominal bond (b).
- **Income** sourced from tradable ($-denominated T) and nontradable (N) sectors.

Household i: maximize CRRA utility over consumption subject to

$$c_{i0}^N + q_0 c_{i0}^T + \frac{c_{i1}^N + q_1 c_{i1}^T}{R} = \underbrace{\gamma_i^N y_0^N + q_0 \gamma_i^T y_0^T + \frac{\gamma_i^N y_1^N + q_1 \gamma_i^T y_1^T}{R} + \frac{a_{i0}}{p_0^N} + q_0 b_{i0}}_{y_i\text{: PV of disposable income}} \tag{1}$$

with consumption bundle $c_{it} = (c_{it}^T)^{1-\alpha_i}(c_{it}^N)^{\alpha_i}$; $R \equiv (1 + i_1)/(p_1^N/p_0^N)$.

Consider a perturbation in the form of

$$\{ \overbrace{dq}^{\text{RER: Peso depreciates}}, \underbrace{dp}_{\text{Nontradable price} \uparrow}, \overbrace{dR}^{\text{Real domestic interest rate} \uparrow}, \underbrace{dy_0^j}_{\text{Income from sector j} \uparrow} \}, j \in \{N, T\}.$$

Assumptions: $q_0 = q_1 = q$; y_1^j determined in the "long run".

- Ultimate sources of the perturbation: flexible.
- Leads to perturbation in household consumption policy dc_{i0}.
- Perturbation has aggregate impact $dC_0 (\equiv \mathbb{E}_i[dc_{i0}])$.

Household heterogeneity reflected in:

- Marginal propensity to consume ($\mathbf{MPC}_i \equiv \partial c_{i0}/\partial \overbrace{y_i}^{\text{PV disposable income}}$).
- Expenditure on tradables (pass-through of $\mathrm{d}q$).
- Dollar and peso legacy wealth (revaluation due to $\mathrm{d}q$ and $\mathrm{d}p$).
- Income composition from each sector (directly affected by $\mathrm{d}y_0^j$, revalued by $\mathrm{d}q$).
- Unhedged interest rate exposure (to $\mathrm{d}R$) (Auclert, 2019).

... and results in different behavioral responses $\mathrm{d}c_{i0}$. ▸ Equations

Aggregate up consumption decision at HH level: ▸ Simplifying assumptions and definitions ▸ Equations

$$dC_0 = \overline{MPC}_0 \times \underbrace{\overline{\mathcal{E}}_0}_{\text{Average exposure}} + \underbrace{Cov_i(MPC_{i0}, \mathcal{E}_{i0})}_{\text{Redistribution channel: sufficient statistic}} .$$

Open-economy redistribution channels:

(+: Positive covariance $\Rightarrow$ dC_0 increase under a positive perturbation)

$$\mathcal{E}_{i0}: \begin{cases} + & \text{Sector income share}_i \times dy_0^j & \text{[Earnings heterogeneity]} \\ + & \text{Tradable income share}_i \times dq & \text{[Foreign-currency earnings]} \\ + & \text{Nominal \$ wealth}_i \times dq & \text{[Fisher (foreign-currency)]} \\ - & \text{Nominal peso wealth}_i \times dp & \text{[Fisher (local-currency)]} \\ - & \text{Tradable expenditure}_i \times dq & \text{[Consumption expenditure]} \end{cases}$$

Identifying redistribution channels: Analytical decomposition

Measuring redistribution channels: Empirical analysis using micro-data

Understanding GE impact: Quantitative model

Measuring covariances: Combined Uruguay household surveys

- Currency composition of assets and liabilities.
- Product-level consumption expenditure.
- Socio-demographic information, income, employment.

Why Uruguay? Beyond data availability...

- Financial dollarization: **70%** of all deposits; **50%** of all loans. (Toscani, 2018)
- Goods-market dollarization: **14%** share in CPI basket. (Toscani, 2018; Drenik and Perez, 2021)

Goal: Estimate Cov(MPC_i, $Exposure_i$) $\Rightarrow$ Cov(HtM_i, $Exposure_i$)

- Infer (poor and wealthy) hand-to-mouth (HtM) status. ▸ Procedure
  - HtM: Liquid wealth (cash + savings account) less than 0.5$\times$monthly income. (Kaplan, Violante and Weidner, 2014)
  - Distinguish between poor and wealthy HtM based on net illiquid wealth.
- Impute hand-to-mouth label in consumption expenditure data. ▸ Details
  - Objective household characteristics (logit model) + relevant interview questions.
- Manually identify tradable goods/industries.
  Cravino and Levchenko (2017); Drenik and Perez (2021). ▸ Criteria
- Currency breakdown available for:
  - liquid assets (cash + savings account).
  - illiquid debt (mortgage, auto, personal loan).

REDISTRIBUTION CHANNELS: KEY HOUSEHOLD CHARACTERISTICS

- Large share of hand-to-mouth households. Details
  - Both datasets (balance sheet and consumption expenditure): $\sim$ **75%**.
  - Of all households: less than 30% with positive liquid wealth.
- Unbalanced distribution of dollar wealth. Breakdown
  - Dollar savings increasingly concentrated at wealthy households.
  - Similar propensity to take on dollar debt across households. Plot
- Consumption of tradable goods basket: Lowest for poor-HtM households.
  - Major non-tradable expenditure: housing and utility. Statistics
- Inverted-U pattern between labor income and tradable sector employment.
  - Non-tradable sectors employ both ends of skill spectrum. Plot

Covariate	Shock	Cov (s.e.)	Impact on $\mathrm{d}C$
Net nominal dollar wealth	Devaluation	-0.645 (0.024)	$-$
Net nominal peso wealth	Inflation	-0.005 (0.027)	$+$
Tradable income	Output/Income	-0.011 (0.002)	$-$
Tradable consumption expenditure	Devaluation	-0.045 (0.003)	$+$

$+$: dampen consumption contraction; $-$: amplify consumption contraction.

- \$-Fisher channel covariance driven by liquid dollar wealth (cash + savings account):

$$\mathrm{Cov}\left(\mathrm{HtM}, \mathrm{Wealth}^{\$}\right) = -0.645 = \underbrace{-0.660}_{\text{liquid savings}} - \underbrace{(-0.015)}_{\text{illiquid debt}}$$

- Consumption expenditure channel (<0): low-MPC households more exposed due to high overall expenditure, despite a small tradable share.

- Large proportion of liquidity-constrained households in emerging markets.
  - Explains large average MPC and aggregate consumption volatility (Hong, 2020).
- Measured moments associated with redistribution channels:
  - Unequal foreign-currency wealth revaluation: large; amplify contraction.
  - Unequal ER pass-through to consumption: small; dampen contraction.
  - Other channels: $\sim$ zero effect.
  - Quantitative model: Focus on foreign-currency Fisher and consumption expenditure channel.
- Practical implications:
  - Distribution of dollar hedges matters for agg. consumption response to devaluation.

Identifying redistribution channels: Analytical decomposition

Measuring redistribution channels: Empirical analysis using micro-data

Understanding GE impact: Quantitative model

- A small open economy, populated by ex-ante homogeneous households.
- Stone-Geary preference over T and NT, biased towards tradables.
  - Captures consumption expenditure channel.
- HH works in both sectors, hours and nominal wages decided by labor union.
  - Symmetric, idiosyncratic productivity processes for both sectors (AR1).
  - Labor union aggregates individual preference over tradable/nontradable labor.
- Incomplete asset markets with liquid and illiquid nominal wealth.
  - Within each class: peso/dollar-denominated asset/debt (more later).
  - For both asset classes: Zero net borrowing constraint.
  - Illiquid assets: higher return (firm ownership); pay adjustment cost upon deposit/withdraw.

Structure of liquid (b) and illiquid (a) wealth, determined at time t:

$$b_{it+1} \equiv \underbrace{q_t b^{\$}_{it+1}}_{\text{real dollar savings}} + \underbrace{p_t^{-1} b^{\text{peso}}_{it+1}}_{\text{real peso savings}}$$

$$a_{it+1} \equiv \underbrace{v_{it+1}}_{\text{real asset}} - \underbrace{q_t a^{\$}_{it+1}}_{\text{dollar debt}} - \underbrace{p_t^{-1} a^{\text{peso}}_{it+1}}_{\text{peso debt}}$$

- Return on liquid wealth components: predetermined by domestic and foreign monetary authorities.
- No aggregate risk: Individual components perfectly substitutable.
  - Equilibrium currency composition is indeterminate with no-arbitrage.
  - Study MIT-shock transition: no-arbitrage violated on impact (more later).
  - Accommodates arbitrary composition of steady-state balance sheet (e.g., data).

Firms

- Tradable sector: flexible price; DRS technology with labor as input.
  - World price of tradable goods $\equiv 1\$ \Rightarrow$ price in LC $=$ NER.
- Nontradable sector: same technology as tradable firms; faces downward-sloping demand curve for each variety; sticky price à la Rotemberg.

Policy

- Exogenous nominal interest rate on dollar liquid bond, set by foreign authorities.
- Domestic monetary authority: pre-sets $t+1$ return on peso liquid bond based on current inflation and depreciation.
  - Weight on inflation: ϕ_π; weight on depreciation: ϕ_e.

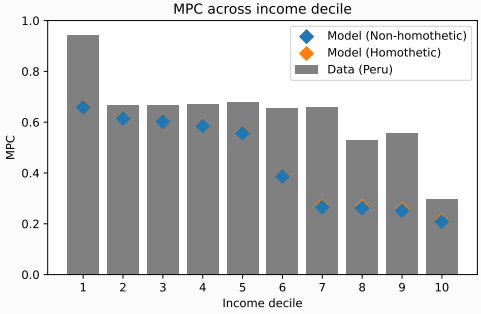
▸ Equilibrium

Targeted moments:

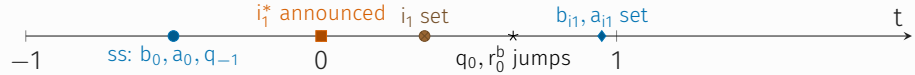
Description	Model	Data	Source
Liquid savings to GDP ratio	0.08	0.10	IMF (2017), De Rosa (2019)
Illiquid wealth to GDP ratio	2.54	2.54	De Rosa (2019)
Hand-to-mouth agent share	0.76	0.77	EFHU-3
Relative hours, tradable vs. nontradable	0.40	0.40	SEDLAC
Tradable share in aggregate consumption	0.44	0.44	ENGIH
Tradable share of top income quintile	0.415	0.416	ENGIH

MODEL VALIDATION: UNTARGETED MOMENTS

- Matches tradable expenditure share across income distribution.
- Pattern of MPC distribution matches comparable Peruvian data (Hong, 2020).
- PE response to wealth revaluation: C ↓ **3.3%** in response to 14% decline in illiquid wealth, in line with Hungarian devaluation experience of 2008. Details (Gyöngyösi, Rariga and Verner, 2021).



Main experiment: foreign monetary tightening (25 bps)



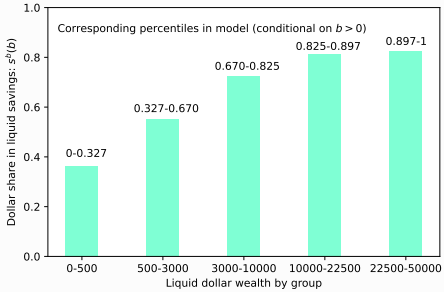
Wealth revaluation: violation of no-arbitrage at time 0

Given dollar share functions $s^b, s^\$$:

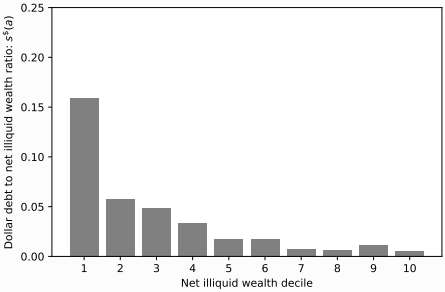
$$\underbrace{1 + r^{b,p}(b_0)}_{\text{Ex-post real return: liquid wealth}} = (1 + r_0^*)\frac{q_0}{q_{-1}} \cdot \underbrace{s^b(b_0)}_{qb_0^\$/b_0} + (1 + r_0^b) \cdot (1 - s^b(b_0))$$

$$\underbrace{1 + r^{a,p}(a_0)}_{\text{Ex-post real return: illiquid wealth}} = (1 + r_0^a)(1 + s^\$(a_0)) - \left[\left((1 + r_0^*)\frac{q_0}{q_{-1}} - r_0^b\right) + r_0^a\right] \underbrace{s^\$(a_0)}_{qa_0^\$/a_0}$$

Illiquid portfolio: assume peso value of real asset v_0 does not respond to revaluation shocks.



(a) Liquid wealth ($s^b(b)$)



(b) Illiquid wealth ($s^\$(a)$)

	HtM covariance		MPC covariance
	Model	Data	Model
$\text{Liquid Saving}_i^\$ - \text{Illiquid Debt}_i^\$$	-0.495	-0.645	-0.171
$\text{Liquid Saving}_i^\$$	-0.541	-0.660	-0.137

Goal: Isolate the contribution of redistribution channels.

Foreign-currency Fisher channel:

- Vary $\text{Cov}(\text{MPC}_i, \text{Net \$ wealth})$ by adjusting initial \$ share distribution.
- Control for aggregate \$ wealth: $\mathbb{E}_l[b_{i0}^{\$} + a_{i0}^{\$}]dq$ constant.
- Compare baseline calibration (Uruguay 2017) with:
  1. Zero dollar borrowing in illiquid wealth.
  2. Large dollar borrowing (Hungary 2008).
  3. Full deposit dollarization (Bocola and Lorenzoni, 2020; Montamat, 2020).

Consumption expenditure channel:

Compare consumption response with recalibrated homothetic model.

FOREIGN-CURRENCY WEALTH REVALUATION: AMPLIFICATION

Variable/Statistic	(1) Baseline	(2) No illiquid dollar
Aggregate $ wealth	0.220	0.220
Cov($MPC_{i,b}$, Liquid Saving$_i^{\$}$)	-0.137	-0.085
Cov($MPC_{i,a}$, Illiquid Debt$_i^{\$}$)	0.003	0
Time-0 deviation from steady state (bps):		
Consumption (C)	-25.93	-22.82
RER (q)	8.55	8.34

- Baseline calibration: real depreciation; consumption contracts (26 bps).
- Shuffling all dollar debt to offset liquid savings weakens FC Fisher channel by 11.7% in relative terms.

FOREIGN-CURRENCY WEALTH REVALUATION: AMPLIFICATION

Variable/Statistic	(1) Baseline	(2) No illiquid dollar	(3) High dollar liability
Aggregate $ wealth	0.220	0.220	0.220
Cov($MPC_{i,b}$, Liquid $Saving_i^{\$}$)	-0.137	-0.085	-0.472
Cov($MPC_{i,a}$, Illiquid $Debt_i^{\$}$)	0.003	0	0.020
Time-0 deviation from steady state (bps):			
Consumption (C)	-25.93	-22.82	-48.02
RER (q)	8.55	8.34	10.04

- "High $ liability": resembles Hungarian environment pre-2008 (HH FX loan at 16.9% GDP).
- FC Fisher channel much stronger, driven by both liquid and illiquid dollar distributions.
- Amplifying impact: **1.8** $\times$ baseline.

FOREIGN-CURRENCY WEALTH REVALUATION: AMPLIFICATION

Variable/Statistic	(1) Baseline	(2) No illiquid dollar	(3) High dollar liability	(4) Deposit & liability dollarization
Aggregate $ wealth	0.220	0.220	0.220	0.220
$\text{Cov}(\text{MPC}_{i,b}, \text{Liquid Saving}_i^{\$})$	-0.137	-0.085	-0.472	-0.184
$\text{Cov}(\text{MPC}_{i,a}, \text{Illiquid Debt}_i^{\$})$	0.003	0	0.020	0.005
Time-0 deviation from steady state (bps):				
Consumption (C)	-25.93	-22.82	-48.02	-28.86
RER (q)	8.55	8.34	10.04	8.74

- Full deposit dollarization, coupled by more liability dollarization.
- Wealthier households save in $ by even more $\Rightarrow$ more unequal dollar insurance distribution.
- Strengthens FC Fisher channel by 11%.

CONSUMPTION EXPENDITURE CHANNEL: BENCHMARK VS. HOMOTHETIC MODEL

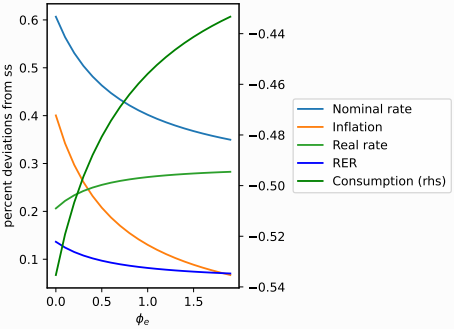
Variable/Statistic	(1) Nonhomothetic	(2) Homothetic
Average MPC	0.642	0.645
Aggregate dollar wealth	0.220	0.220
Aggregate tradable expenditure	0.646	0.724
$\mathrm{Cov}(\mathrm{MPC}_{i,b}, \text{Tradable Spending}_i)$	-0.068	-0.085
$\mathrm{Cov}(\mathrm{MPC}_{i,b}, \text{Liquid Saving}_i^{\$})$	-0.137	-0.122
$\mathrm{Cov}(\mathrm{MPC}_{i,a}, \text{Illiquid Debt}_i^{\$})$	0.003	0.002
Time-0 deviation from steady state (bps):		
Consumption (C)	-25.93	-25.34
RER (q)	8.55	10.82

Homothetic model:

- Larger MPC.
- Larger average ERPT (spending $\times$ depreciation).
- ERPT dist. more pro-poor.
- Shock impact on C dampened by **0.5** bps.

Backward-looking policy rule:

$$(1 + i_{t+1}) = (1 + \bar{r})(1 + \pi_t)^{\phi_\pi}(e_t/e_{t-1})^{\phi_e}.$$



Baseline: $\phi_\pi = 1.5$, $\phi_e = 0.5$.

As weight on NER (ϕ_e) increases:

- Real depreciation muted.
- Smaller drop in consumption.
- No significant inflation-output tradeoffs.

This paper:

- Identifies redistribution channels from theory.
- Evaluates the empirical and quantitative relevance of redistribution channels.

Main findings:

- Uruguay data: lack of dollar insurance by constrained households constitutes the most pronounced redistribution channels.
- Quantitative model: heavy dollarization of balance sheets is an important amplifying force. Homothetic model features weaker redistribution through ERPT.

Practical implications:

- Targeted macroprudential policies in the financial market and de-dollarization policies in the goods market help mute the redistribution channels.

Future research: Optimal policy; bank/firm redistribution channels.

APPENDIX

Assume:

- $i_0 = i_0^* = 0$.
- $\gamma_i^j(y_t^j) = \gamma_i^j \cdot y_t^j, j \in \{T, N\}$ (Werning, 2015; Clayton, Jaravel and Schaab, 2018).

Present-value budget constraint: ($q_t \equiv e_t/p_t^N$)

$$c_0^N + q_0 c_0^T + \frac{c_1^N + q_1 c_1^T}{R} = \underbrace{\gamma_i^N y_0^N + q_0 \gamma_i^T y_0^T + \frac{\gamma_i^N y_1^N + q_1 \gamma_i^T y_1^T}{R} + \frac{a_{i0}}{p_0^N} + q_0 b_{i0}}_{y_i} \tag{2}$$

$R \equiv (1 + i_1/(p_1^N/p_0^N))$: real interest rate from $t = 0$ to 1.

For perturbation:

- Follow CJS to consider period 1 as the long run, to abstract away from perturbations to long-run output y_1^N and y_1^T.
- Further restricted to the case in which $q_0 = q_1 = q$. Back

Proposition 1

Under the posited perturbation:

$$dc_{i0} = \overbrace{-\sigma^{-1}(1-\kappa_i^{-1}q^{1-\alpha_i}MPC_{i0})c_{i0}\frac{dR}{R}}^{\text{Intertemporal substitution}} + MPC_{i0}\cdot\Big[\overbrace{p^{-1}\omega_{i1}\frac{dR}{R}}^{\text{Unhedged interest rate exposure}} + \overbrace{\gamma_i^N dy_0^N + q\gamma_i^T dy_0^T}^{\text{Earnings exposure}} + \underbrace{\Big(qb_{i0}\frac{dq}{q} - p^{-1}a_{i0}\frac{dp}{p}\Big)}_{\text{Valuation effect on nominal assets}} - \Big(\underbrace{\kappa_i^{-1}(1-\alpha_i)q^{1-\alpha_i}(c_{i0}+R^{-1}c_{i1})}_{\text{Exchange rate pass-through to consumption basket}} + \underbrace{\gamma_i^T q(y_0^T + R^{-1}y_1^T)}_{\text{Valuation effect on earnings}} \Big)\frac{dq}{q}\Big] \tag{3}$$

where $MPC_{i0} \equiv \partial c_{i0}/\partial y_i$ and $\kappa_i \equiv (1-\alpha_i)^{1-\alpha_i}\alpha_i^{\alpha_i}$.

Back

Proposition 3

Under the posited perturbation:

$$
\begin{aligned}
dC_0 = & \overbrace{-\sigma^{-1}\mathbb{E}[c_{i0}(1-\kappa_i^{-1}q^{1-\alpha_i}MPC_{i0})]}^{\text{Substitution}}\frac{dR}{R} + p^{-1}[\overline{MPC}\cdot\mathbb{E}[\omega_{i1}] + \overbrace{Cov(MPC_{i0},\omega_{i1})}^{\text{Unhedged interest rate exposure}}]\frac{dR}{R} \\
& + \underbrace{\overline{MPC}\cdot(dy_0^N + q dy_0^T)}_{\text{Aggregate income}} + \underbrace{Cov(MPC_{i0},\gamma_i^N)dy_0^N + qCov(MPC_{i0},\gamma_i^T)dy_0^T}_{\text{Earnings heterogeneity}} \\
& + \Big[q(\overline{MPC}\cdot\mathbb{E}[b_{i0}] + \underbrace{Cov(MPC_{i0},b_{i0})}_{\text{Fisher (foreign currency)}})\frac{dq}{q} - p^{-1}(\overline{MPC}\cdot\mathbb{E}[a_{i0}] + \underbrace{Cov(MPC_{i0},a_{i0})}_{\text{Fisher (domestic currency)}})\frac{dp}{p}\Big] \\
& + (\overline{MPC} + \underbrace{Cov(MPC_{i0},\gamma_i^T)}_{\text{Price of earnings}})q(y_0^T + R^{-1}y_1^T)\frac{dq}{q} - [\overline{MPC}\cdot\Xi + \underbrace{Cov(MPC_{i0},\Xi_{i,0})}_{\text{Consumption expenditure}}]\frac{dq}{q}
\end{aligned}
\tag{4}
$$

where $\Xi_{i,0} \equiv \kappa_i^{-1}q^{1-\alpha_i}(1-\alpha_i)(c_{i0} + R^{-1}c_{i1})$.

▸ Back

AVAILABLE ASSET AND DEBT INFORMATION

Classification	Asset	Debt
Liquid	Cash holding Bank savings account	Credit card balance
Illiquid	Housing Auto Owned businesses	Mortgages Auto debt Bank debt Other credit institution debt Family members and friends

- Non-mortgage, non-credit card debt: back out stock amount from monthly payment share and totals.
- Liquid asset: bunching at specific values (maximum: 30,000 dollars).
- Stock holdings and owned businesses: rare in the data.
- Currency breakdown available for liquid assets and illiquid debt.
  - Peso/Indexed/Readjustable/Dollar for mortgages.
  - Assume credit card debt is taken out in Uruguayan pesos.

In general, following Kaplan, Violante and Weidner (2014):

	Poor-HtM	Wealthy-HtM
Net liquid wealth	≥ 0 and $\leq$ half monthly income or ≤ 0 and $\leq -$half monthly income	
Net illiquid wealth	≤ 0	> 0

- For households with negative net illiquid wealth ($\sim$ 10% of total): assume unobserved illiquid assets; use net housing+auto as individual illiquid state.
  - Robustness: using net housing+auto as illiquid state for all households.
- **Net nominal position**: net liquid wealth $-$ illiquid debt.

Back

A two-step procedure, incorporating additional information from ENGIH:

1. Fit a multinomial logit model to the EFHU data (with households categorized in non-HtM, poor-HtM and wealthy-HtM), on a set of household characteristics. Predict using the model based on the same characteristics in ENGIH data.
2. Adjust HtM prediction, exploiting additional survey questions:
   - **HtM** $\rightarrow$ **N-HtM**: monthly expenses on all categories of consumption are sufficient or more than sufficient for household needs.
   - **N-HtM** $\rightarrow$ **P-HtM**: monthly spending on all categories of consumption are insufficient to meet household needs.
   - **HtM** $\rightarrow$ **N-HtM**: gap between actual income and lower-bound of estimated income that satisfy household needs is more than one half of the actual income (in the spirit of Kaplan, Violante and Weidner (2014)), while no category-specific expenses are insufficient.
   - **N-HtM** $\rightarrow$ **W-HtM**: the gap between actual and estimated lower bound is negative.

▸ Back

Household financial survey:

	Non-HtM	Poor HtM	Wealthy HtM
Population share (%)	23.34	21.24	55.42
Average age	50.23	50.35	50.00
Median monthly income (USD)	2904	1428	1958
Average monthly income (USD)	3619	1639	2357
Has credit cards (% within group)	84.55	43.36	57.64

- Large share of hand-to-mouth households in Uruguay ($>$ **75%**)
  - Likely indicates high average MPC (Hong, 2020).
- Clear distinction between HtM and N-HtM in income, credit card access.

Back

(Unit: US $)	Non-HtM	Poor HtM	Wealthy HtM
Illiquid debt: Median (if > 0)			
All	5000	1500	2666
Peso	3772	1448	2145
US$	3255	625	2500
Net liquid wealth: Median			
All	3000	0	0
Peso	375	0	0
US$	2625	0	0
Net liquid wealth: Average			
All	8845	0.38	50.49
Peso	1937	-17.87	-11.80
US$	6908	18.25	62.29

Back

Large degree of wealth inequality:

- Only **29%** of households have positive liquid wealth.

Currency composition:

- (Wealthy) households predominantly save in $...
- and borrow in pesos / indexed to CPI.
- $ saving rate increasing in wealth. Details
- Distribution of $ wealth highly concentrated.

- Sample selection across datasets:
  - At least one household member answers the survey (no proxy-only households).
  - Household head age between 25 to 79.
- Tradable-nontradable classification: manual assignment.
  - Consumption expenditure channel: takes into account **dollarization** of products. (Cravino and Levchenko, 2017; Drenik and Perez, 2021)
  - Earnings heterogeneity channel: measures sectoral exposure to international **trade**. Label industries appearing in BCU export statistics as tradable.

Examples:

	Product	Industry
Tradable	Electronics, Furniture, Jewelry	Chemicals
Nontradable	Repair of electronics and jewelry	Domestic services

▸ Back

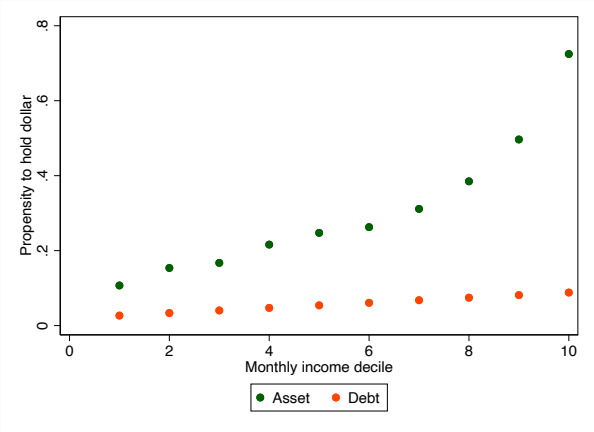


Figure: Propensity to hold dollar asset and debt by income decile

Back

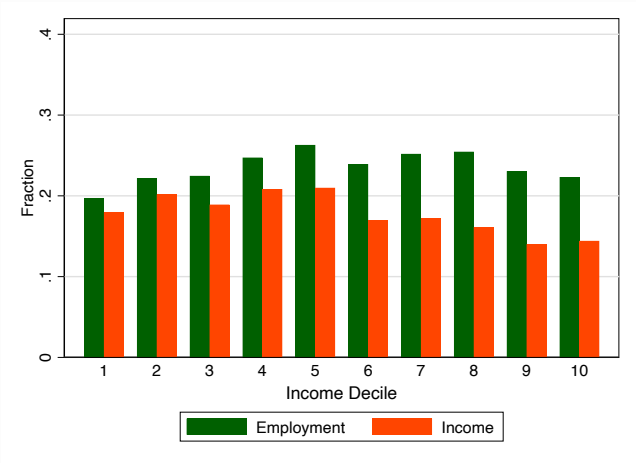
Consumption expenditure survey

(imputed from household financial survey):

	Non-HtM	Poor HtM	Wealthy HtM
Population share (%)	23.31	18.09	58.60
Average age	49.78	49.52	50.57
Median monthly income (USD)	2865	1164	1576
Average monthly income (USD)	3417	1268	1760
Tradable share in consumption expenditure (%)	41.32	40.65	45.50

- Imputation successful in matching aggregate HtM share.
- On average: lower income for all groups.
- Poor HtM has lowest tradable share in expenditure, driven by: Detailed expenditure
  - low spending share on vehicles (tradable);
  - high spending share on housing/utilities (nontradable).

Back



- Inverted-U pattern between income decile and exposure to tradable sector.
- Nontradable sector: workers employed at both ends of skill spetrum.

Back

Hungary: **17.3%** real depreciation over Sep 2008-Mar 2009.

(Gyöngyösi, Rariga and Verner, 2021): Households with FC mortgage cut consumption by 4.5-5.3 percent relative to households with LC debt.

Compute model counterpart:

$$\Delta = \frac{\int c(z, b, \xi \cdot a) d\lambda}{C}.$$

Estimate ξ: Use average LTV of 0.62 from 2004 to 2008 (Verner and Gyöngyösi, 2020) $\Rightarrow \xi = \mathbf{0.859}$.

Policy function: $c(z, b, \xi \cdot a)$ is obtained via interpolation.

▸ Back

An equilibrium consists of prices, quantities, individual policy rule, and a path of distributions $\{\lambda_t(z, b, a)\}$ such that

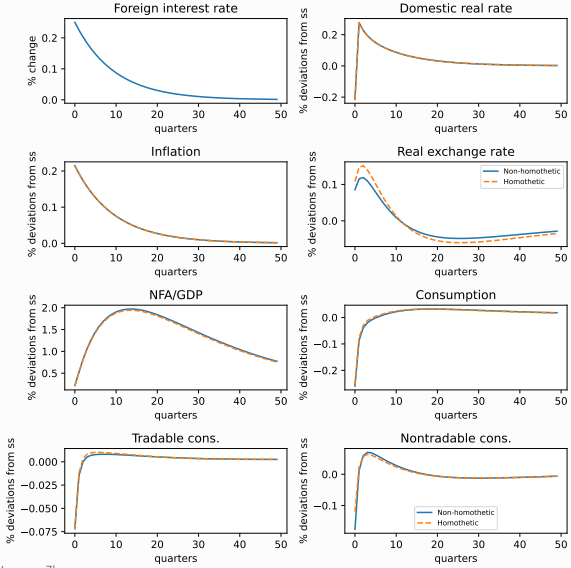
- All agents optimize.
- Central bank follows monetary policy rule.
- Markets clear for labor, nontradable consumption and illiquid assets. In particular, normalize aggregate equity to one, we have

$$Q_t = \int a_t(z, b, a) d\lambda_{t-1} = A_t.$$

- The balance-of-payment equation holds:

$$q_t(C_t^T - Y_t^T + \Phi_t) + B_{t+1} = (1 + r_t^b)B_t + \underbrace{\int (r_t^{b,p}(b) - r_t^b) b d\lambda_t(z, b, a) + \int (r_t^{a,p}(a) - r_t^a) a d\lambda_t(z, b, a)}_{\text{Revaluation}} \tag{5}$$

where $B_{t+1} \equiv \int b_{t+1}(z, b, a) d\lambda_t$. $\Phi_t \equiv \int \Phi(a_{t+1}(z, b, a), a) d\lambda_t$ and $r_t^{b,p}(b) = r_t^b$ and $r_t^{a,p}(a) = r_t^a$ for $t \geq 1$.



Baseline calibration (blue):

- RER depreciation: 8.2 bps.
- Aggregate C: ↓ 26.3 bps.

Homothetic model (red):

- Little qualitative difference.
- Slightly larger depreciation.