Heterogeneous Impact of the Global Financial Cycle

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global financial cycle

Co-movement in financial flows and asset prices: global components explain $>$ 25% of variation

- asset prices (Miranda-Agrippino et al 2020, Habib Venditti 2019)
- capital flows (Barrot Serven 2018, Miranda-Agrippino Rey 2022)

Aggregate dynamics: risky asset prices fall, retrenchment in downturns

Heterogeneity: US vs rest of the world, advanced economies (AE) vs emerging markets (EM)

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This paper:

- shows that AE private flows are better synchronized with the global cycle
- interprets this in a heterogeneous-country model

heterogeneity and its implications

Private flows in AE are better synchronized with global cycle:

- outward flows more strongly correlated with aggregates
- outward flows larger in magnitude (cyclical component)

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Multi-country model with capital flight

Wealth distribution across countries

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Responses in equilibrium

- risky asset prices in rich countries rise, good substitutes for safe assets
- rich countries insure intermediaries and poorer countries
- wealth redistribution: regressive

literature

Evidence of the global financial cycle:

- Miranda-Agrippino Rey 2020,2022, Miranda-Agrippino et al 2020, Barrot Serven 2018, Habib Venditti 2019, Cerutti et al 2019

This paper: suggest a model to study distributional impact

Evidence of heterogeneous impact:

- Chari et al 2020, Eguren-Martin et al 2021, Gelos et al 2022, Kalemli-Ozkan 2019

This paper: analyze heterogeneity as an equilibrium feature in a model

Retrenchment:

- Caballero Simsek 2020, Jeanne Sandri 2023

This paper: add dynamics and study aggregate shocks

Models of the global financial cycle:

- Morelli et al 2023, Bai et al 2019, Dahlquist et al 2023, Gourinchas et al 2022, Davis van Wincoop 2021 2023, Farboodi Kondor 2022, Kekre Lenel 2021, Sauzet 2023, Maggiori 2017

This paper: explain heterogeneity using retrenchment, study risk-sharing

outline

— patterns of synchronization of financial flows

— model

— shock to risk-taking capacity of global intermediaries

— output shocks and differences in responses

AE vs EM: correlations

Define for country i, quarter t

- gross assets position A_{it}
- net asset acquisition a_{it}
- outflows $\overline{a}_{it} = a_{it}/A_{i,t-1}$

Measure synchronization across countries

- extract principal component f_t from a_{it}
- run $\overline{a}_{it} = \alpha_i + \beta_i f_t + \epsilon_{it}$
- compute R-squared for every country

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Result: 28% for AE and 9% for EM

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	$\bar{a}_t^{AE}$	$\bar{a}_t^{EM}$
principal component f_t	**0.86**	0.29
VIX (negative)	**0.38**	0.15
asset price factor, Miranda-Agrippino Rey 2020	**0.32**	0.04
intermediary factor, He et al 2017	**0.21**	-0.16
treasury basis, Jiang et al 2021	**0.27**	0.00

Table: Correlation between aggregate series and averages $\{\bar{a}_t^{AE}, \bar{a}_t^{EM}\}$

AE vs EM: magnitudes

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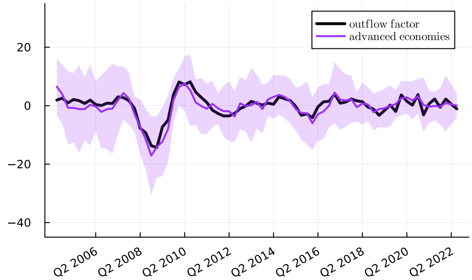
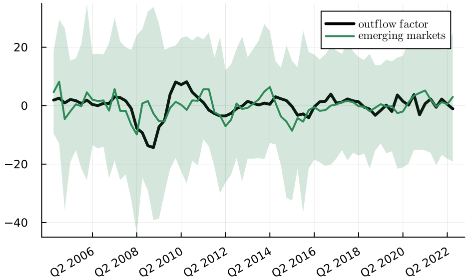
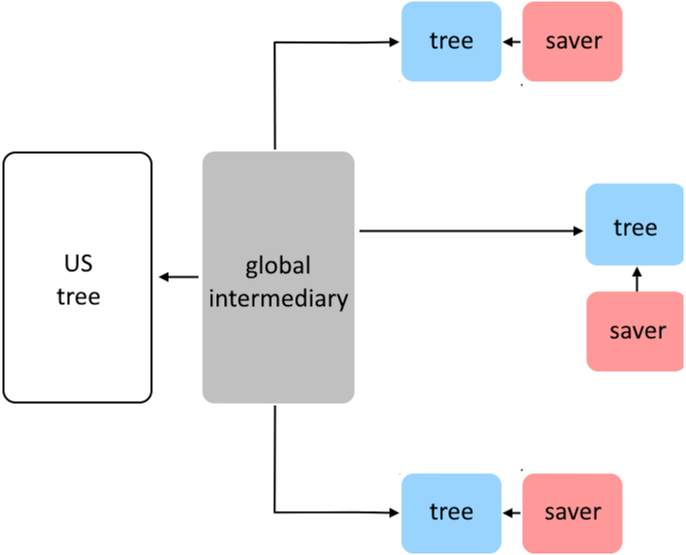




model map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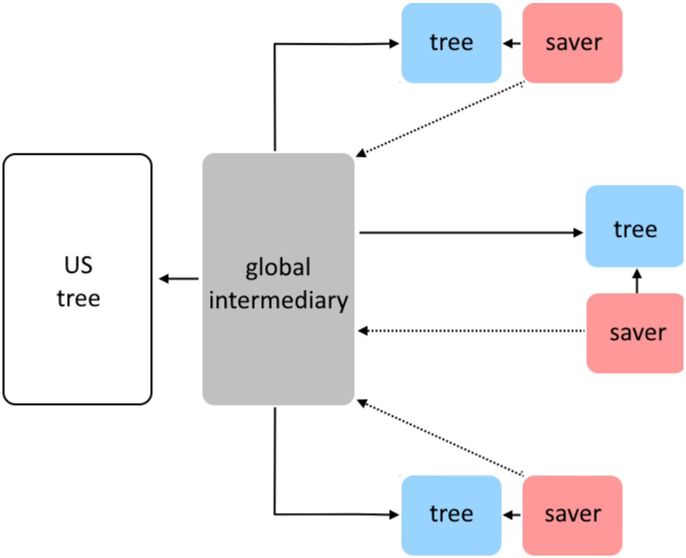
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regular countries

Countries $i \in [0,1]$: Lucas tree with price p_{it}, yield $v_t dt + \sigma dZ_{it}$, representative saver

$$\max_{(c_{it},\theta_{it})} \mathbb{E} \int_0^\infty e^{-\rho t} \ln(c_{it}) dt \tag{1}$$

$$\text{s.t. } dw_{it} = (r_t w_{it} - c_{it})dt + \theta_{it} w_{it} dR_{it} \tag{2}$$

$$\theta_{it} \leq \bar{\theta} \tag{3}$$

Wealth w_{it}: share θ_{it} in domestic tree earning dR_{it}, lending $1 - \theta_{it}$ to intermediaries at r_t:

$$dR_{it} = \frac{1}{p_{it}}(v_t dt + \sigma dZ_{it} + dp_{it}) - r_t dt \tag{4}$$

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<u>Result:</u> denoting $\mu_{it}^R = \mathbb{E}[dR_{it}]/dt$ and $\sigma_{it}^R = \mathbb{E}[dR_{it}^2]/dt$,

$$\theta_{it} = \min\left\{\bar{\theta}, \frac{\mu_{it}^R}{(\sigma_{it}^R)^2}\right\} \tag{5}$$

special country

The US is a special country:

- savers act as intermediaries: invest in other trees, take deposits from other countries
- US tree is a safe asset

Price of tree $\hat{p}_t$, pays $\hat{v}_t dt$:

$$d\hat{R}_t = \frac{1}{\hat{p}_t}(d\hat{p}_t + \hat{v}_t dt) - r_t dt \tag{6}$$

intermediaries

Short-term debt m_t, positions $(f_{it})_i$ in regular country trees, $\hat{f}_t$ in US tree, net worth $\hat{w}_t$:

$$d\hat{w}_t = \int_0^1 f_{it}\hat{w}_t(dR_{it} + r_t dt)di + \hat{f}_t\hat{w}_t(d\hat{R}_t + r_t dt) - m_t r_t dt - \hat{c}_t dt \tag{7}$$

$$\int_0^1 f_{it} di + \hat{f}_t = \hat{w}_t + m_t \tag{8}$$

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Consider misspecified processes $d\tilde{Z}_{it} = dZ_{it} + \xi_{it} dt$ for idiosyncratic shocks:

$$dR_{it} = \mu_{it}^R dt + \sigma_{it}^R dZ_{it} = (\mu_{it}^R - \xi_{it}\sigma_{it}^R)dt + \sigma_{it}^R d\tilde{Z}_{it} \tag{9}$$

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Consumption rate $\hat{c}_t$, log problem with misspecification costs:

$$\max_{\{\hat{c}_t, m_t, \hat{f}_t, \boldsymbol{f}_t\}_{t\geq 0}} \min_{\{\boldsymbol{\xi}_t\}_{t\geq 0}} \mathbb{E}\int_0^\infty e^{-\hat{\rho}t}\left(\hat{\rho}\ln(\hat{c}_t) + \frac{\gamma_t}{2}\int_0^1 \xi_{it}^2 di\right)dt \qquad \text{s.t. (7), (8), and (9)} \tag{10}$$

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<u>Result</u>: constant consumption rate $\hat{c}_t = \hat{\rho}\hat{w}_t$ and

model with VAR constraint

$$f_{it} = \gamma_t \frac{\mu_{it}^R}{(\sigma_{it}^R)^2} \tag{11}$$

market clearing and equilibrium

Prices $(p_{it})_i$ and $\hat{p}_t$, interest rate r_t, wealth distribution, and quantities such that markets clear:

$$\text{tree supply} \longrightarrow 1 = \frac{f_{it}\hat{w}_t}{p_{it}} + \frac{\theta_{it} w_{it}}{p_{it}} \quad \text{all } i \in [0,1] \qquad \longleftarrow \text{total demand} \tag{12}$$

$$\text{liabilities of banks} \longrightarrow m_t = \int_0^1 w_{it}(1-\theta_{it})di \qquad \longleftarrow \text{external savings} \tag{13}$$

$$\text{US tree supply} \longrightarrow q = \frac{\hat{f}_t}{\hat{p}_t} \qquad \longleftarrow \text{US tree holdings} \tag{14}$$

Integrating the budget constraints and market clearing:

$$\hat{c}_t + \int_0^1 c_{it}di = v_t + q\hat{v}_t \tag{15}$$

Exogenous: risk-tolerance γ_t, later output v_t and $\hat{v}_t$

Endogenous: **distribution** $G_t(\cdot)$ of wealth w_{it}, US net worth $\hat{w}_t$

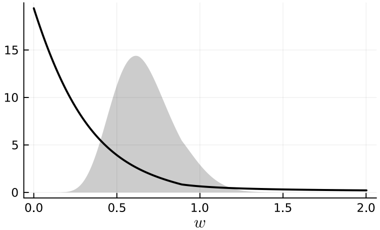
equilibrium characterization

Results:

- can solve for all country-specific variables as functions of (w, t)
- countries are constrained if $w \leq \tilde{w}(t)$

more

Figure: excess returns in steady state, *pp*



equilibrium characterization

Results:

- can solve for all country-specific variables as functions of (w, t)
- prices $p(w, t)$ only depend on $r(t)$, a global factor $\varphi(t) = \gamma(t)\hat{w}(t)$, and the evolution of w

Equilibrium excess returns:

$$\frac{\mu_R(w,t)}{\sigma_R(w,t)} = \sigma_R(w,t) \cdot \max\left\{ \frac{p(w,t)}{\varphi(t) + w}, \frac{p(w,t) - \bar{\theta}w}{\varphi(t)} \right\} \tag{16}$$

- unconstrained countries: total demand is $\gamma(t) \cdot \hat{w}(t) + 1 \cdot w = \varphi(t) + w$
- constrained countries: residual supply is $p(w, t) - \bar{\theta}w$, demand is $\gamma(t) \cdot \hat{w}(t) = \varphi(t)$

elastic markets

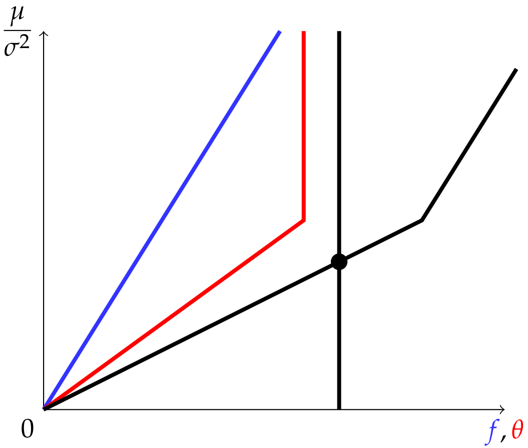
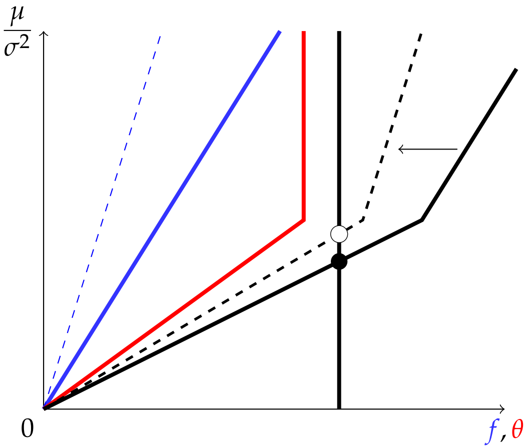


Figure: Supply and demand as functions of μ_R/σ_R^2 for fixed w and p. Supply is vertical. Demand f from global banks in blue, from local savers θ in red.

elastic markets



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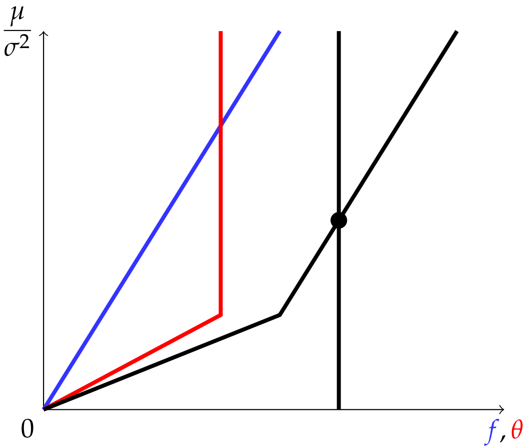

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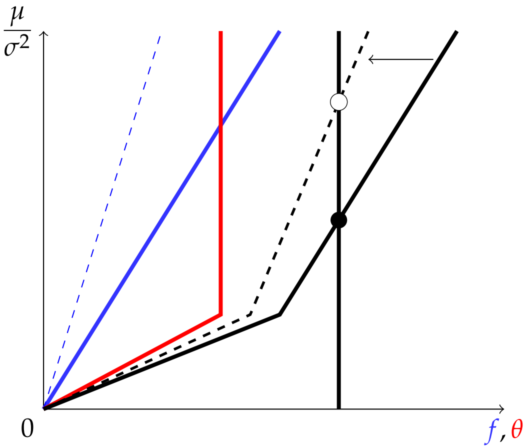

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general equilibrium

Price process $dp(w,t) = \mu_p(w,t)dt + \sigma_p(w,t)dZ$ with

$$\mu_R(w,t) = \frac{\nu(t) + \mu_p(w,t)}{p(w,t)} - r(t) \qquad \sigma_R(w,t) = \frac{\sigma + \sigma_p(w,t)}{p(w,t)} \tag{17}$$

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Prices $p(w,t)$ and density $g(w,t)$ solve

$$r(t)p(w,t) - \partial_t p(w,t) = y(w,t) + \mu_w(w,t)\partial_w p(w,t) + \frac{1}{2}\sigma_w(w,t)^2\partial_{ww} p(w,t) \tag{18}$$

$$\partial_t g(w,t) = -\partial_w[\mu_w(w,t)g(w,t)] + \frac{1}{2}\partial_{ww}[\sigma_w(w,t)^2 p(w,t)] \tag{19}$$

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Risk-adjusted payoff $y(w,t)$:

$$y(w,t) = \nu(t) - \left(\frac{\sigma}{1-\epsilon(w,t)\theta(w,t)}\right)^2 \max\left\{\frac{1}{w+\varphi(t)}, \frac{1}{\varphi(t)}\left(1 - \frac{\bar{\theta}w}{p(w,t)}\right)\right\} \tag{20}$$

with wealth elasticity of price $\epsilon(w,t) = w/p(w,t) \cdot \partial_w p(w,t)$

calibration and estimation

Calibrate steady state to reproduce aggregates, moments of assets/liabilities ratio

targets and fit

Estimate parameters in linearized model:

$$d\gamma(t) = (\overline{\gamma} - \gamma(t))\mu_\gamma dt + \sigma_\gamma \cdot dW \tag{21}$$

$$d\nu(t) = (\overline{\nu} - \nu(t))\mu_\nu dt + \sigma_\nu \cdot dW \tag{22}$$

Use two-dimensional shock $dW = (dW_1, dW_2)$, two series:

- aggregate position-adjusted outflows (BoP data)
- risky asset price factor (Habib Venditti 2019)

Untargeted responses: impulse responses of $\{\overline{a}_t^{AE}, \overline{a}_t^{EM}\}$ to innovations in f_t, principal component in outflows a_{it}

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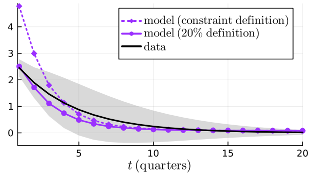
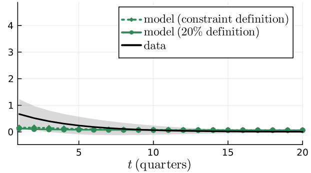
(a) Advanced economies.



(b) Emerging markets.



shock to risk-tolerance $\gamma(t)$

Unanticipated jump in $\gamma(t)$:

$$\gamma(t) = \gamma - e^{-\mu_\gamma t}\Delta\gamma \tag{23}$$

Immediate effect: hit global factor $\varphi(t) = \gamma(t)\hat{w}(t)$.

Equilibrium effects:

- time evolution of prices and quantities
- gains and losses and adjustment in cross-section

shock to risk-tolerance $\gamma(t)$: prices

(a) Interest rate $r(t)$. (b) Safe asset price $\hat{p}(t)$. (c) Risky asset prices $p(w,t)$.

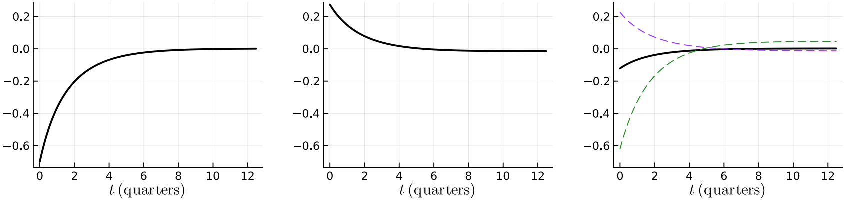
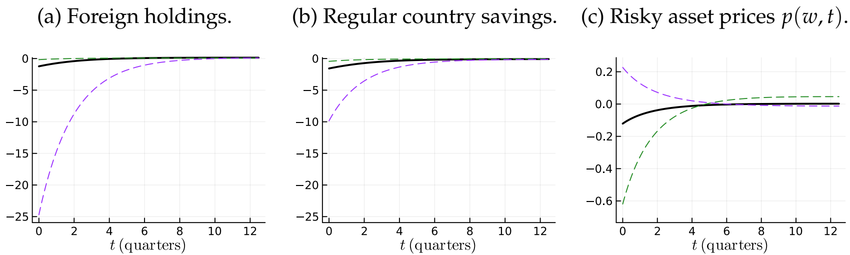


Figure: 5-th percentile of wealth distributions in green, 95-th percentile in purple.

shock to risk-tolerance $\gamma(t)$: quantities



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shock to $\gamma(t)$: prices and holdings

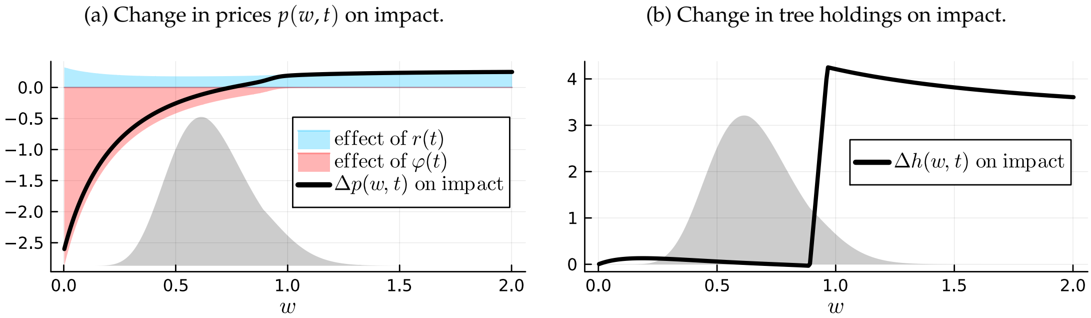


Figure: cross-section of the changes in risky asset prices and domestic asset holdings on impact.

- Chari et al 2020: tail realizations in rosk-off move more than median

evidence

Model: relative performance of AE vs EM

AE and EM separately

- negatively correlated with aggregate outflows $\longrightarrow$ **-0.28** in the data
- negatively correlated with (AE outflows - EM outflows) $\longrightarrow$ **-0.40** in the data

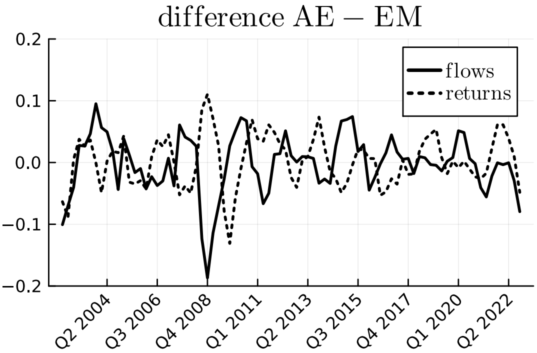
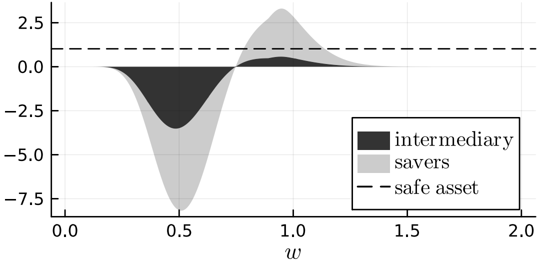


Figure: returns given by MSCI World - MSCI EM. Flows given by $\bar{a}_t^{AE} - \bar{a}_t^{EM}$.

shock to $\gamma(t)$: loss-sharing

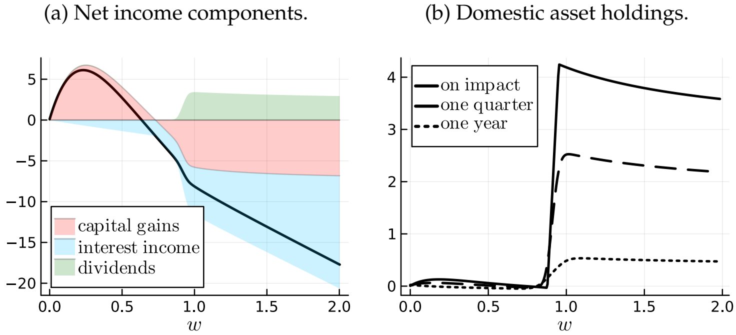
Figure: gains and losses on impact in percent of global GDP, weighted by density



- insurance: AE $\rightarrow$ intermediary $\rightarrow$ EM
- AE and intermediary become **richer**, EM become **poorer**

excess returns

shock to $\gamma(t)$: adjustment



- rich countries sell trees back to finance consumption and accumulate savings

US adjustment

shock to output in ROW and US

IES = 1: shocks to $\gamma(t)$ do not destroy wealth, no swings in aggregate consumption:

$$\rho \int_0^1 w dG(w,t) + \hat{\rho}\hat{w}(t) = \nu(t) + q\hat{\nu}(t) \tag{24}$$

Shock to $\nu(t)$ or $\hat{\nu}(t)$?

- how are losses distributed?
- how different are shocks to global output vs US output?

output shocks: price responses

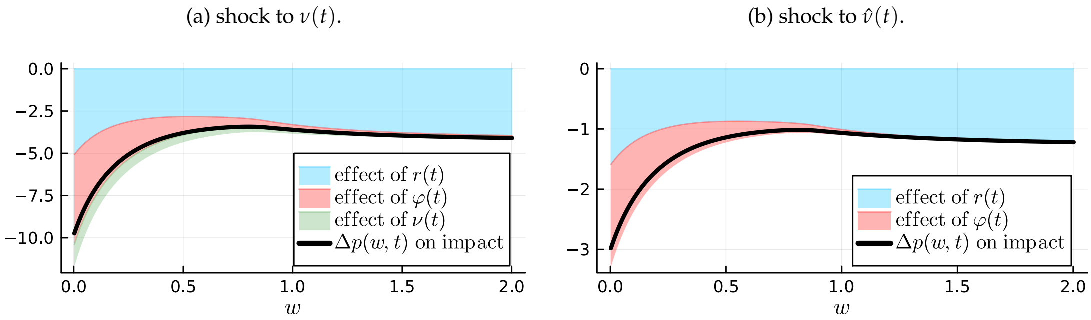


Figure: cross-section of the changes in risky asset prices on impact.

- interest rate rises, asset prices fall everywhere $\rightarrow$ wealth and consumption fall
- prices react to both $r(t)$ and $\varphi(t)$ in EM, only react to $r(t)$ in AE

output shocks: distribution of losses

(a) shock to $\nu(t)$. (b) shock to $\hat{\nu}(t)$.

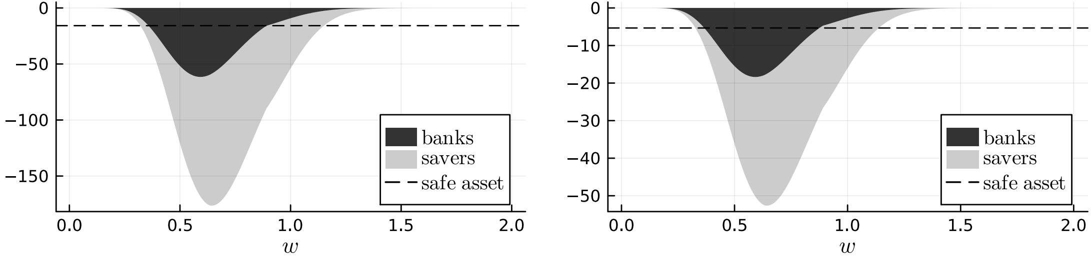


Figure: gains and losses on impact in percent of global GDP, weighted by density.

- loss distributions very similar for shocks of US and ROW origin

signed responses

Table: Summarized qualitative facts about negative shocks to $\gamma(t)$ and $(\nu(t), \hat{\nu}(t))$

	fall in $\gamma(t)$	fall in $\nu(t)$ or $\hat{\nu}(t)$
interest rate	-	+
safe asset	+	-
risky assets, rich countries	+	-
risky assets, poor countries	-	-
retrenchment flows, rich countries	+	0
retrenchment flows, poor countries	0	0

conclusion

Domestic demand in richer countries is more elastic due to size and portfolio constraints

- sudden stops lead to retrenchment that stabilizes prices
- assets issued by richer countries are endogenously safer
- wealth transfers: rich $\rightarrow$ dominant $\rightarrow$ poor

Add

- policy (both local and global, reserves and capital controls)
- nominal layer for monetary policy, aggregate demand link to output
- physical investment, CA dynamics

conclusion

Thank you for your attention

intermediaries with a VAR constraint

Issue short-term riskless liabilities m_t, invest $(f_{it})_i$ in regular country trees, $\hat{f}_t$ in the US tree:

$$d\hat{w}_t = \int_0^1 f_{it}\hat{w}_t(dR_{it} + r_t dt)di + \hat{f}_t\hat{w}_t(d\hat{R}_t + r_t dt) - m_t r_t dt - \hat{c}_t dt \tag{25}$$

$$\int_0^1 f_{it} di + \hat{f}_t = \hat{w}_t + m_t \tag{26}$$

$$\int_0^1 \mathbb{V}_t[f_{it} dR_{it}]di \leq \gamma_t \int_0^1 \mathbb{E}_t[f_{it} dR_{it}]di \tag{27}$$

Net worth $\hat{w}_t$, consumption rate $\hat{c}_t$, log utility

intermediaries with a VAR constraint

Issue short-term riskless liabilities m_t, invest $(f_{it})_i$ in regular country trees, $\hat{f}_t$ in the US tree:

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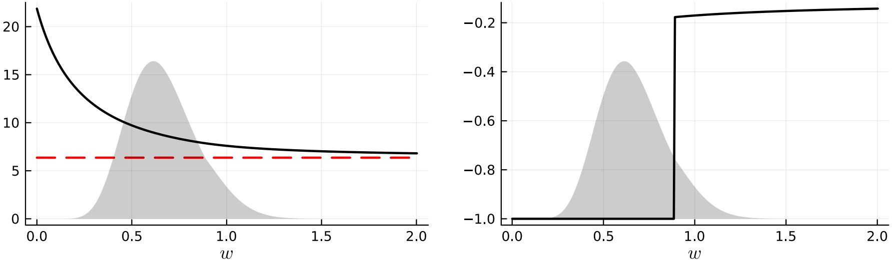
Net worth $\hat{w}_t$, consumption rate $\hat{c}_t$, log utility

Result: constant consumption rate $\hat{c}_t = \hat{\rho}\hat{w}_t$ and

back

$$f_{it} = \gamma_t \frac{\mu_{it}^R}{(\sigma_{it}^R)^2} \tag{28}$$

steady state



(a) Dividend to price ratio and r

(b) Elasticity of μ_R / σ_R to φ

back

US adjustment

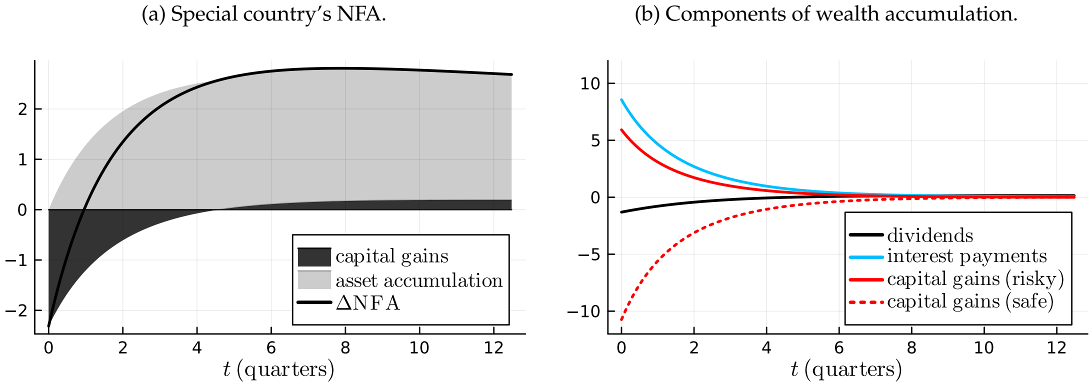


Figure: Responses of the special country's NFA and components of net income, percent of GDP.

back

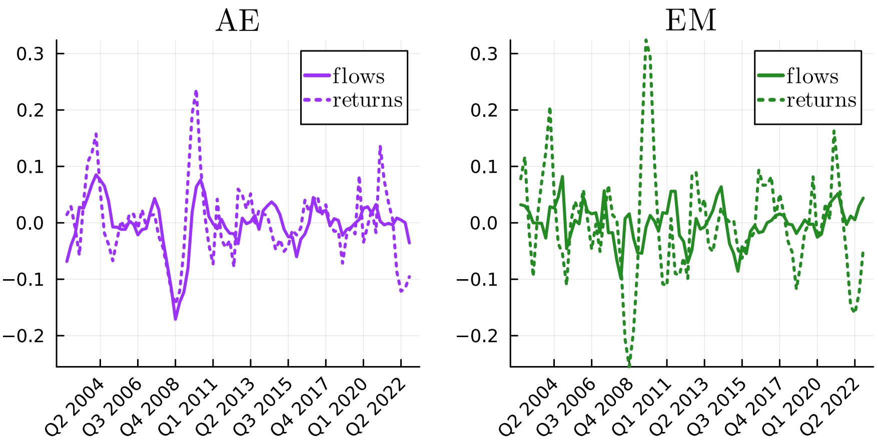
calibration

Table: steady-state calibration. back

	model	target	source
aggregates:			
US wealth share	31.5%	32.3%	Credit Suisse 2022
US output share	23.7%	22.8%	World Bank
average risk premium	$2.62pp$	$2.5pp$	Gourinchas Rey 2022
emerging market premium	$2.22pp$	$2.3pp$	Adler Garcia-Macia 2018
external assets to external liabilities:			
mean	1.071	1.075	IFS (IMF)
standard deviation	0.686	0.685	IFS (IMF)
q25	0.614	0.621	IFS (IMF)
q50	0.849	0.877	IFS (IMF)
q75	1.285	1.249	IFS (IMF)

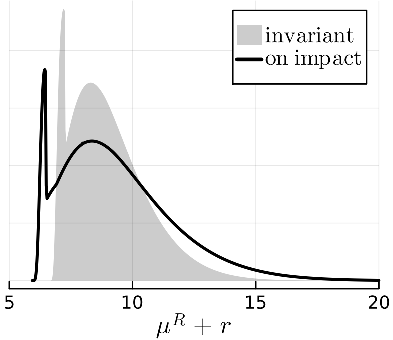
evidence: AE and EM separately

Figure: MSCI World and $\bar{a}_t^{AE}$ for AE, MSCI EM and $\bar{a}_t^{EM}$ for EM. back

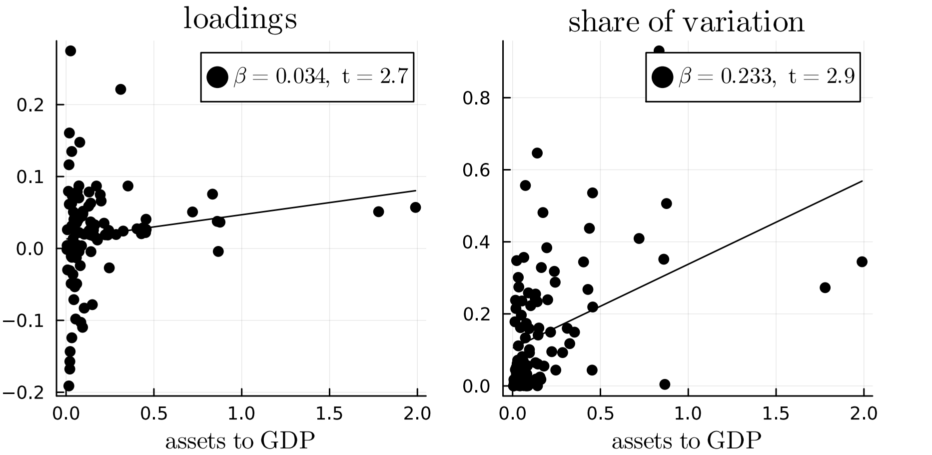


distribution of required returns

Figure: required excess returns. back



assets over GDP



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