Heterogeneous Impact of the Global Financial Cycle

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motivation

In global downturns

- investors sell foreign assets (retrenchment)
- prices fall more in emerging markets
- outward flows fall more in advanced economies

evidence

This paper: a multiple-country model to study

- joint determination of gross capital flows and asset price responses
- heterogeneity in exposure to global shocks

model

Global intermediaries + multiple countries

Main experiment: shock to risk-bearing capacity of global intermediaries

- countries issue risky assets
- local agents and global intermediaries trade these assets
- intermediaries borrow from local agents

In equilibrium: heterogeneity in wealth, different exposure to foreign demand shocks

mechanism and key results

Intermediaries seek to sell risky assets in all countries

- rich countries: domestic investors absorb sales by foreigners
- poor countries: low wealth $\longrightarrow$ unable to replace foreign demand

Equilibrium implications:

- assets issued in rich countries appreciate $\longrightarrow$ good substitutes for safe assets
- rich countries insure poor ones
- wealth inequality between countries rises in downturns
- global intermediaries become relatively richer in downturns

explaining the data

Data: outward flows and risky assets prices procyclical in both AE and EM

Estimate that financial and real shocks positively correlated
- real shocks (output) explain procyclicality
- financial shocks induce countercyclical asset prices in AE

Financial shocks explain 1/3 of variation in relative performance AE vs EM

Correlation of wealth with global aggregates is 3 times lower in AE

literature

Evidence of the global financial cycle and heterogeneous exposures:

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

Models of the global financial cycle and retrenchment:

- Caballero Simsek 2020, Jeanne Sandri 2023, 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

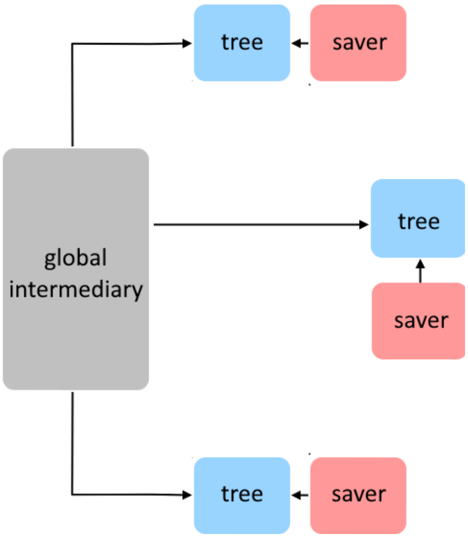
outline

— model

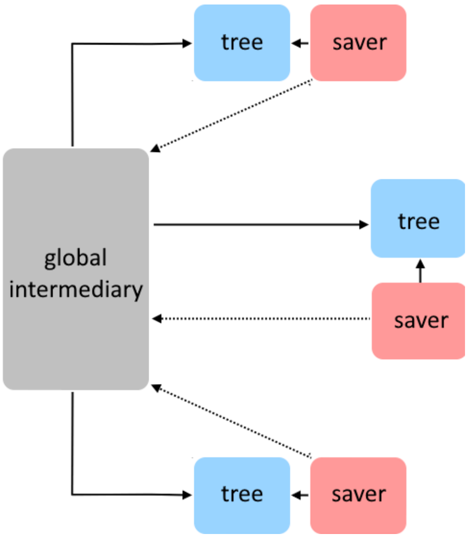
— shock to risk-taking capacity of global intermediaries

— quantitative evaluation and empirical evidence model

model map



model map



regular countries

Countries $i \in [0,1]$

- Lucas tree with price p_{it}, fixed supply of 1
- cumulative yield up to t denoted by y_{it}
- flow yield $dy_{it} = \nu_t dt + \sigma dZ_{it}$

problem of local savers

$$\max_{\{c_{it},\theta_{it}\}_{t\geq 0}} \mathbb{E}\left[\rho \int_0^\infty e^{-\rho t} \ln(c_{it}) dt\right] \tag{1}$$

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

- share $1 - \theta_{it}$ to intermediary's debt, interest rate $r_t dt$
- allocate share θ_{it} to tree, excess returns dR_{it}

$$dR_{it} = \frac{1}{p_{it}}(dy_{it} + dp_{it}) - r_t dt \equiv \mu_{it}^R dt + \sigma_{it}^R dZ_{it} \tag{3}$$

- solution:

$$\theta_{it} = \frac{\mu_{it}^R}{(\sigma_{it}^R)^2} \tag{4}$$

intermediaries

Invest in trees in all countries, borrow from all savers

- assign portfolio weight $\hat{\theta}_{it}$ to country i
- issue debt m_t, pay interest $r_t dt$
- consume $\hat{c}_t$

$$d\hat{w}_t = \int_0^1 \hat{\theta}_{it}\hat{w}_t(dR_{it} + r_t dt)di - m_t r_t dt - \hat{c}_t dt \tag{5}$$

Limited risk-taking capacity: cannot fully diversify their portfolio:

- non-trivial portfolio in equilibrium
- time-varying capacity to take risk

intermediary's problem

VAR-type constraint bounds total amount of risk:

foundation

$$\int_0^1 \mathbb{V}_t[\hat{\theta}_{it} dR_{it}]di \leq \gamma_t \int_0^1 \mathbb{E}_t[\hat{\theta}_{it} dR_{it}]di \tag{6}$$

Portfolio and consumption choice

$$\max_{\{\hat{c}_t, m_t, f_t\}_{t\geq 0}} \mathbb{E}\left[\hat{\rho} \int_0^\infty e^{-\hat{\rho} t} \ln(\hat{c}_t) dt\right] \tag{7}$$

Cost parameter γ_t governs risk-taking capacity:

$$\hat{\theta}_{it} = \gamma_t \frac{\mu_{it}^R}{(\sigma_{it}^R)^2} \tag{8}$$

equilibrium

Prices $\{p_{it}\}$, interest rate r_t, wealth distribution, and $\{c_{it}, \hat{c}_t, \theta_{it}, \hat{\theta}_{it}, m_t\}$ such that markets clear:

$$1 = \frac{\hat{\theta}_{it}\hat{w}_t}{p_{it}} + \frac{\theta_{it} w_{it}}{p_{it}} \quad \text{all } i \in [0,1] \tag{9}$$

$$m_t = \int_0^1 w_{it}(1-\theta_{it})di \tag{10}$$

$$\nu = \hat{c}_t + \int_0^1 c_{it}di \tag{11}$$

equilibrium characterization

Solve for country-specific variables as functions of w and aggregate states

Prices only depend on $r(t)$ and a global factor $\varphi(t) = \gamma(t)\hat{w}(t)$

Time-varying risk premium:

$$\mu_R(w,t) = \sigma_R(w,t)^2 \cdot \frac{p(w,t)}{\varphi(t) + w} \tag{12}$$

shock to risk-taking capacity $\gamma(t)$

Impulse response to an unanticipated jump in $\gamma(t)$ for illustration:

$$\gamma(t) = \gamma - e^{-\mu_\gamma t}\Delta_\gamma \tag{13}$$

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

- demand for risky assets falls
- interest rate falls

shock to $\gamma(t)$: prices

Changes in asset prices on impact can be decomposed into

- response to interest rate $r(t)$
- response to global factor $\varphi(t)$

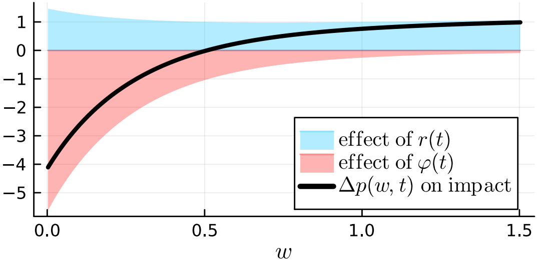


Figure: percentage changes in $p(w,t)$ on impact.

shock to $\gamma(t)$: holdings

Tree holdings of domestic agents $\theta(w,t)w$

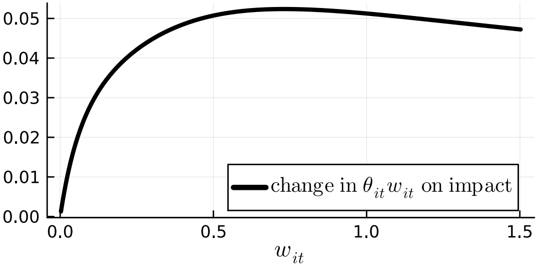


Figure: change in tree holdings on impact.

adding a portfolio constaint

Now suppose there is a constraint on portfolio allocation:

$$\theta_{it} \leq \overline{\theta} \tag{14}$$

Risky holdings cannot exceed $\overline{\theta} w_{it}$

Binds for poor countries with high returns and low wealth

time-varying risk premium

Excess returns depend on whether the constraint is binding

stochastic dynamics

- unconstrained countries:

$$\mu_R(w,t) = \sigma_R(w,t)^2 \cdot \frac{p(w,t)}{\varphi(t) + w} \tag{15}$$

- constrained countries:

$$\mu_R(w,t) = \sigma_R(w,t)^2 \cdot \frac{p(w,t) - \overline{\theta} w}{\varphi(t)} \tag{16}$$

inelastic markets

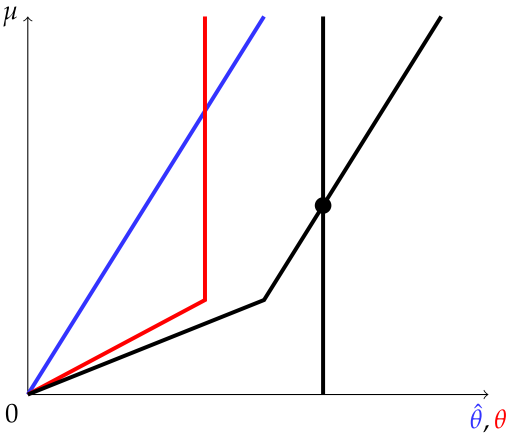
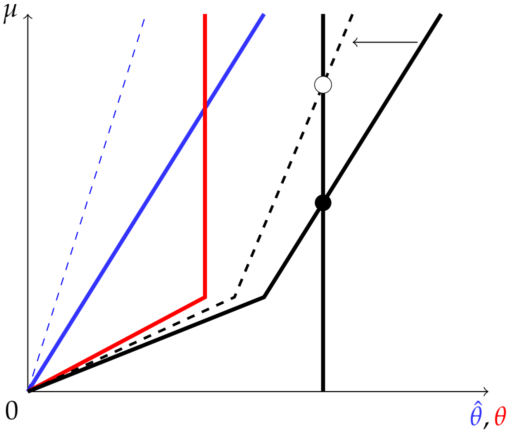


Figure: Supply is vertical. Demand $\hat{\theta}$ from global banks in blue, from local savers θ in red.

inelastic markets



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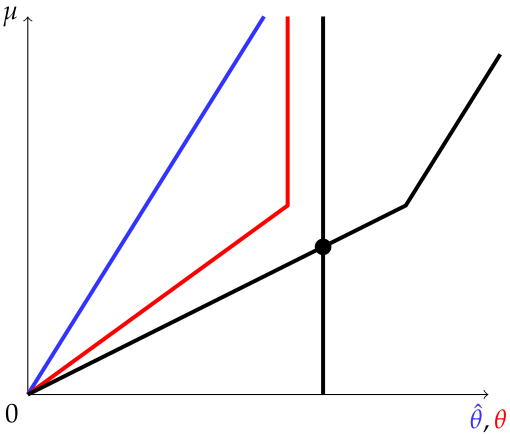
elastic markets



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elastic markets

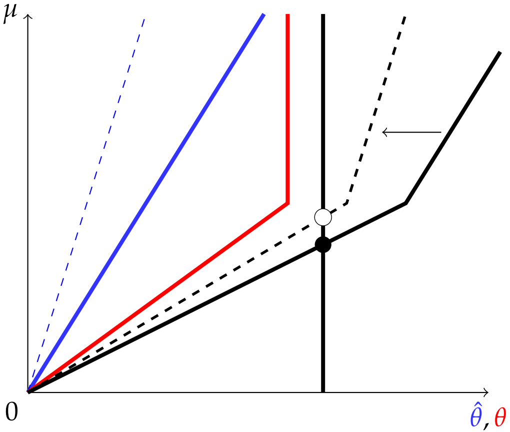


Figure: Supply is vertical. Demand $\hat{\theta}$ from global banks in blue, from local savers θ in red.

adding US assets

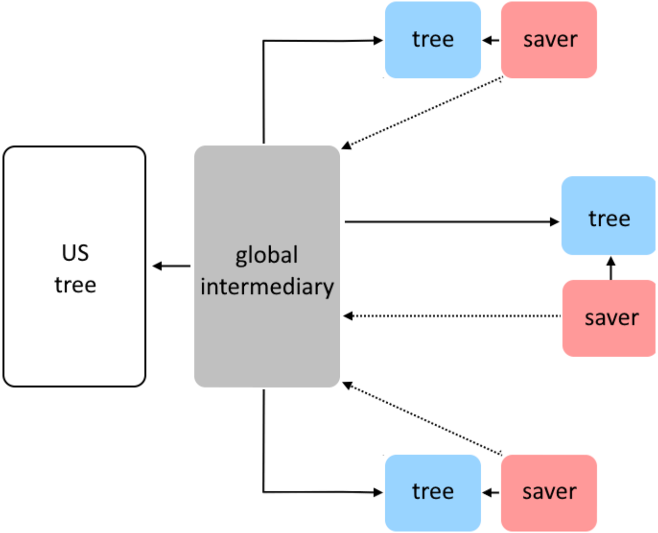
Lucas tree in the dominant country, fixed supply $\hat{q}$, held by intermediaries: share $\hat{\theta}(t)$

Price of tree $\hat{p}(t)$, pays νdt:

$$d\hat{R}(t) = \frac{d\hat{p}(t) + \nu dt}{\hat{p}(t)} - r(t)dt \tag{17}$$

No risk in dividends, no associated ambiguity

adding US assets



market clearing

New market clearing conditions:

$$\hat{q} = \frac{\hat{\theta}(t)\hat{w}(t)}{\hat{p}(t)} \tag{18}$$

$$1 = \frac{\hat{\theta}(w,t)\hat{w}(t)}{p(w,t)} + \frac{\theta(w,t)w}{p(w,t)} \qquad \text{for all } w \tag{19}$$

$$m(t) = \int_0^1 w(1-\theta(w,t))dG(w,t) \tag{20}$$

$$(1+\hat{q})\nu = \hat{c}(t) + \int_0^1 c(w,t)dG(w,t) \tag{21}$$

solving for prices

Expressions for risk premium turn into non-linear PDE for prices $p(w, t)$ equations

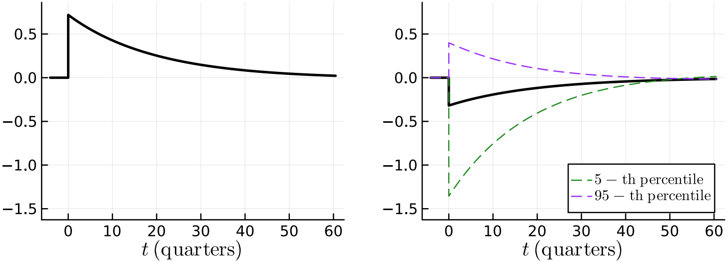
- use definition of returns to turn equilibrium conditions into PDE for prices
- PDE has unknown coefficients (μ^p, σ^p)
- use Itô's lemma to characterize (μ^p, σ^p) in terms of (μ^w, σ^w)
- use budget constraints to get (μ^w, σ^w)

At the end: asset prices $p(w, t)$ and wealth density $g(w, t)$ that solved a coupled system shock to risk-taking capacity

shock to $\gamma(t)$: prices

- safe asset price $\hat{p}(t)$ increases on impact
- risky asset prices $p(w,t)$ move in different directions

quantities



(a) percentage change in $\hat{p}(t)$ (b) percentage change in $p(w,t)$

shock to $\gamma(t)$: holdings

Tree holdings $h(w,t)$ defined as

$$h(w,t) = \frac{\theta(w,t)w}{p(w,t)} \tag{22}$$

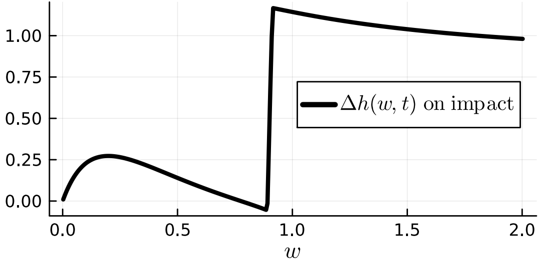
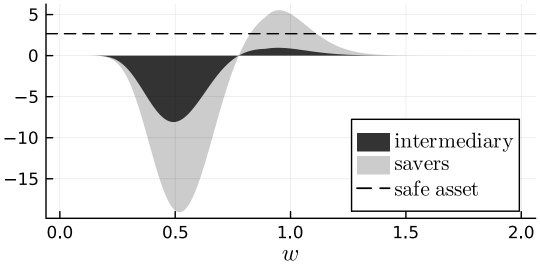


Figure: change in tree holdings on impact.

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**

macro adjustment excess returns

calibration and estimation

calibration

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

	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)

parameter values

estimation

Estimate parameters of aggregate shocks: $(\mu_\gamma, \mu_\nu, \sigma_\gamma, \sigma_\nu)$

Simulate the model, compute moments of first-order deviations $\tilde{m}(t)$ and $\tilde{p}(t)$

- total external assets

$$m(t) = \int w(1 - \theta(w,t))dG(w,t) \tag{23}$$

- average risky asset price

$$p(t) = \int p(w,t)dG(w,t) \tag{24}$$

moments

Data: quarterly returns on MSCI ex-US index for $\tilde{p}_t$, total outflows from IMF data for $\tilde{m}_t$

Table: targets

	$\text{std}(\tilde{p}_t)$	$\text{std}(\tilde{m}_t)$	$\text{corr}(\tilde{p}_t, \tilde{m}_t)$	$\text{corr}(\tilde{p}_t, \tilde{p}_{t-1})$	$\text{corr}(\tilde{m}_t, \tilde{m}_{t-1})$
data	0.048	0.049	0.738	0.785	0.828
model	0.048	0.049	0.740	0.779	0.839

estimated parameters

untargeted moments

Associate AE to unconstrained countries

inpulse responses

Gross outflows relative to assets are more volatile in AE:

	std$(\tilde{m}_t^{AE})$	std$(\tilde{m}_t^{EM})$
data	0.045	0.035
model	0.074	0.027

Asset prices are less volatile in AE:

	std$(\tilde{p}_t^{AE})$	std$(\tilde{p}_t^{EM})$
data	0.042	0.059
model	0.030	0.048

untargeted moments: cyclicality

- cyclicality of outflows stronger in AE
- cyclicality of prices is stronger in EM
- relative performance negatively correlated with relative outflows

	$\mathrm{corr}(\tilde{m}_t^{AE} - \tilde{m}_t^{EM}, \tilde{m}_t)$	$\mathrm{corr}(\tilde{p}_t^{AE} - \tilde{p}_t^{EM}, \tilde{m}_t)$	$\mathrm{corr}(\tilde{p}_t^{AE} - \tilde{p}_t^{EM}, \tilde{m}_t^{AE} - \tilde{m}_t^{EM})$
data	0.67	-0.16	-0.17
model	0.13	-0.55	-0.59

output shocks

shock to output in ROW and US

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

$$\rho \int_0^1 w dG(w,t) + \hat{\rho}\hat{w}(t) = \nu(t)(1+q) \tag{25}$$

Isolated shock to $\gamma(t)$ necessarily redistributive

Data: prices go up and down together

shocks to $\nu(t)$

Interest rate rises, all prices fall

Poor countries more exposed to foregin demand $\hat{w}(t) \longrightarrow$ prices fall more prices

Loss distribution very similar for shocks to $\nu(t)$ in ROW and US losses

variance decomposition

Financial shocks explain

- 1/4 of variance in m_t
- 1/3 of variance in $p_t^{AE} - p_t^{EM}$

Table: standard deviations of first-order responses

	data	full model	only γ	only ν
m_t	0.049	0.049	0.024	0.044
p_t	0.048	0.048	0.007	0.044
p_t^{AE}	0.042	0.030	0.009	0.033
p_t^{EM}	0.059	0.048	0.010	0.042
relative performance				
p_t^{AE} - p_t^{EM}	0.035	0.026	0.019	0.010

cyclicality of prices

Shocks to γ generate countercyclical returns in AE, procyclical in EM

Shocks to ν make returns procyclical everywhere

Table: correlations of first-order responses with total outflows $\tilde{m}_t$

	full model	only γ	only ν
$\hat{p}_t$	0.43	-0.96	0.66
p_t^{AE}	0.52	-0.97	0.58
p_t^{EM}	0.69	0.93	0.48
r_t	-0.62	0.97	-0.57
relative performance			
$p_t^{AE} - p_t^{EM}$	-0.55	-0.95	-0.18

cyclicality of wealth

Shocks to γ generate countercyclical wealth dynamics in AE, procyclical in EM

Table: Correlations of wealth with total outflows $\tilde{m}_t$

	full model	only γ	only ν
wealth			
$\hat{w}_t$	0.30	-0.95	0.11
w_t^{AE}	0.32	-0.89	0.97
w_t^{EM}	0.94	0.97	0.99

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
- wealth redistribution: regressive

Thank you for your attention

outflows in AE and EM

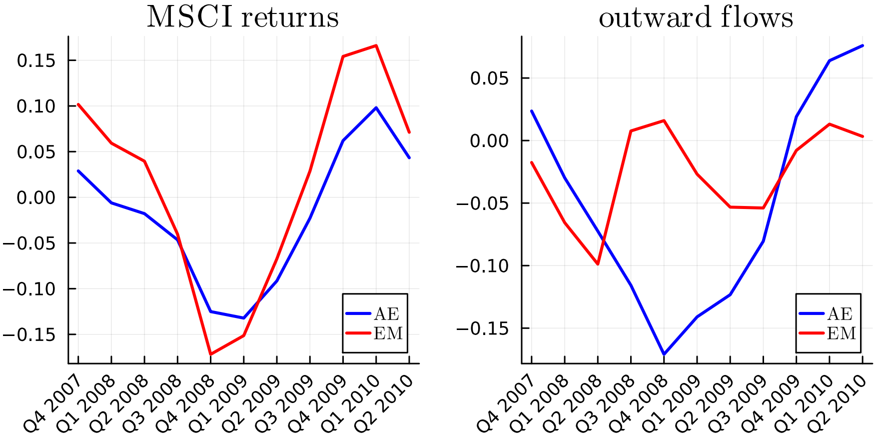
- net acquisition of foreign assets (flows): f_{it}
- principal component F_t
- total foreign assets (stock) A_{it}
- position-adjusted flows: $m_{it} = f_{it} / A_{i,t-1}$

Table: dependent variables expressed as percentage

	m_t^{AE}	m_t^{EM}	$m_t^{AE} - m_t^{EM}$
F_t	3.87	1.44	**2.43**
	(0.25)	(0.42)	(0.61)

global financial crisis taper tantrum trade wars back

example: 2008



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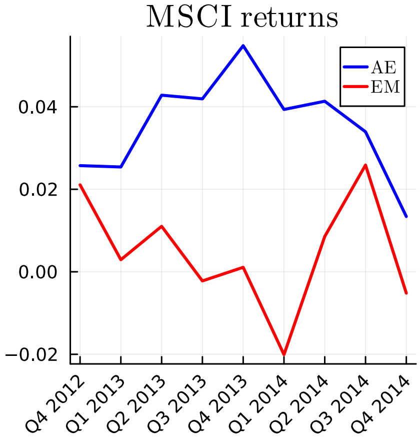
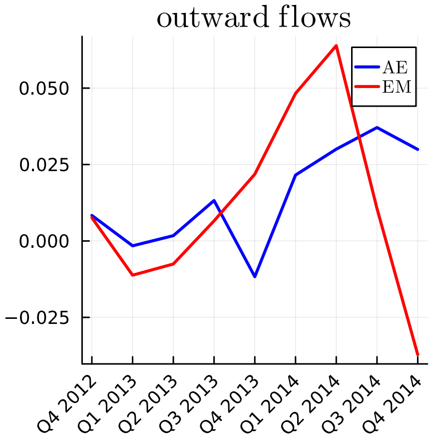
example: 2013





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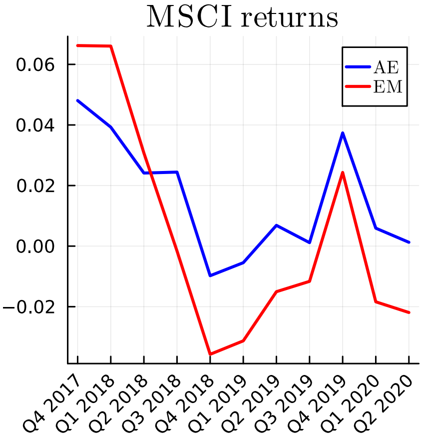
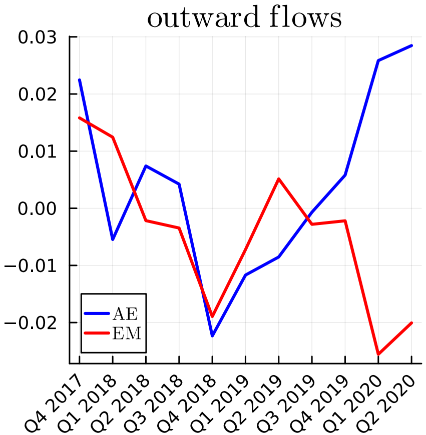
example: 2018





back

3 facts about gross capital flows

data

Gross outflows f_{it}: acquisition of external assets by country i in quarter t (net of sales)

- includes portfolio debt, equity, and bank flows

data construction

Measure of aggregate flows: principal component F_t

Asset prices: global asset price index p_t from MSCI, quarterly returns $Q_t = p_t / p_{t-1}$

fact 1: gross flows are correlated with asset prices

Correlation of gross outflows and asset prices:

$\mathrm{corr}(Q_t, F_t)$	0.76
	(0.07)
$N = 84$	

alternative average time path

fact 2: correlation with aggregates is higher in AE

- run $f_{it} = \alpha_i + \beta_i F_t + \epsilon_{it}$, compute R-squared for every country i
- measure difference between AE and EM:

$$R_i^2 = r + \beta \mathbb{1}\{i \in \text{AE}\} + \epsilon_i \tag{26}$$

Table: dependent variable r_i expressed as percentage

	8.90
	(1.70)
$\mathbb{1}\{i \in \text{AE}\}$	**25.36**
	(4.33)
$R^2 = 0.37$, $N = 67$	

alternative average correlations

fact 3: portfolio shifts have larger magnitudes in AE

- take **position-adjusted** outflows $\overline{f}_{it} = f_{it} / A_{i,t-1}$
- measure difference in loadings for **position-adjusted** flows:

$$\overline{f}_{it} = \alpha_i + \gamma F_t + \beta \mathbb{1}\{i \in \text{AE}\} F_t + \epsilon_{it} \tag{27}$$

Table: dependent variable $\overline{f}_{it}$ expressed as percentage

F_t	1.50
	(0.43)
$\mathbb{1}\{i \in \text{AE}\} F_t$	**2.15**
	(0.60)
$R^2 = 0.02$, $N = 6223$	

alternative average | overall synchronization

data construciton

Gross outflows f_{it}: acquisition of external assets by country i in quarter t (net of sales)

- includes portfolio debt, equity, and bank flows
- raw data f_{it}^{raw} smoothed using the procedure from Forbes and Warnock 2012, 2021:

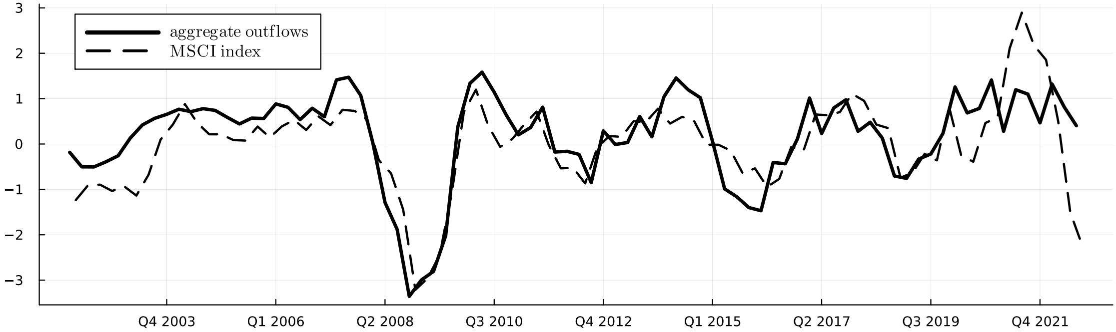
$$f_{it} = \sum_{t-3}^{t} f_{is}^{\text{raw}} - \sum_{t-7}^{t-4} f_{is}^{\text{raw}} \tag{28}$$

Asset prices: global asset price index p_t from MSCI, smoothed quarterly returns Q_t:

$$Q_t = \sum_{t-3}^{t} \frac{p_s}{p_{s-1}} \tag{29}$$

back

time path of outflows and prices



back

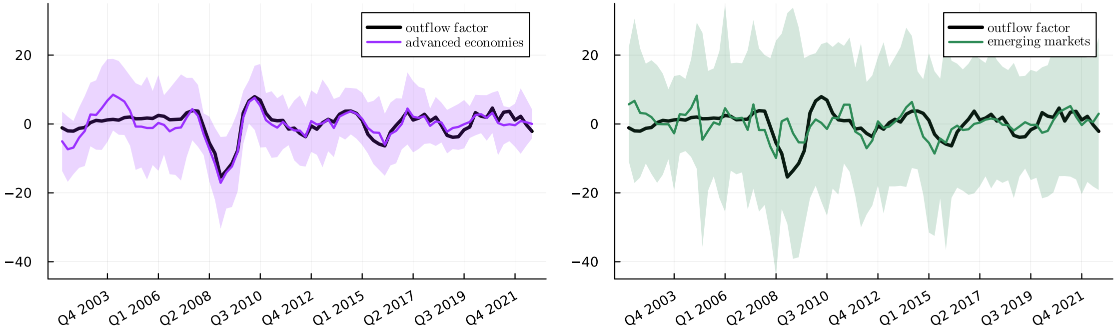
measures of global risk-taking capacity

Table: correlations (95% confidence bands) back

	$\overline{f}_t^{AE}$	$\overline{f}_t^{EM}$	$\overline{f}_t^{AE} - \overline{f}_t^{EM}$
principal component F_t	0.86	0.34	**0.53**
	(0.08)	(0.23)	(0.15)
VIX (negative)	0.42	0.16	**0.13**
	(0.19)	(0.17)	(0.15)
asset price factor, Miranda-Agrippino Rey 2020	0.27	0.03	**0.15**
	(0.20)	(0.11)	(0.10)
intermediary factor, He et al 2017	0.19	-0.17	**0.26**
	(0.24)	(0.21)	(0.14)
treasury basis, Jiang et al 2021	0.27	0.00	**0.17**
	(0.13)	(0.10)	(0.09)

synchronization

Figure: average outflows $\bar{a}_t^{AE}$ and $\bar{a}_t^{EM}$ and outflow factor F_t



Volatility of in-group averages: $std(\bar{a}_t^{AE}) = 4.5\%$ vs $std(\bar{a}_t^{EM}) = 3.5\%$

back

data (averages)

Gross outflows f_{it}: acquisition of external assets by country i in quarter t (net of sales)

- includes portfolio debt, equity, and bank flows

data construction

Measure of aggregate flows: weighted average F_t

- weights $s_i = 1/\text{std}(f_{it})$ for each i

$$F_t = \frac{1}{N} \sum_i s_i f_{it} \tag{30}$$

Asset prices: global asset price index p_t from MSCI, quarterly returns $Q_t = p_t / p_{t-1}$

fact 1: gross flows are correlated with asset prices (averages)

Correlation of gross outflows and asset prices:

$\text{corr}(Q_t, F_t)$	0.73
	(0.08)
$N = 84$	

back

fact 2: correlation with aggregates is higher in AE (averages)

- run $f_{it} = \alpha_i + \beta_i F_t + \epsilon_{it}$, compute R-squared for every country i
- measure difference between AE and EM:

$$R_i^2 = r + \beta \mathbb{1}\{i \in \text{AE}\} + \epsilon_i \tag{31}$$

Table: dependent variable r_i expressed as percentage

	8.05
	(1.55)
$\mathbb{1}\{i \in \text{AE}\}$	**24.56**
	(3.82)
$R^2 = 0.37$, $N = 67$	

back

fact 3: portfolio shifts have larger magnitudes in AE (averages)

- take **position-adjusted** outflows $\overline{f}_{it} = f_{it} / A_{i,t-1}$
- measure difference in loadings for **position-adjusted** flows:

$$\overline{f}_{it} = \alpha_i + \gamma F_t + \beta \mathbb{1}\{i \in \text{AE}\} F_t + \epsilon_{it} \tag{32}$$

Table: dependent variable $\overline{f}_{it}$ expressed as percentage

F_t	1.77
	(0.42)
$\mathbb{1}\{i \in \text{AE}\} F_t$	**1.67**
	(0.69)
$R^2 = 0.02$, $N = 6223$	

back

intermediary's problem (ambiguity)

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

$$dR_{it} = (\mu_{it}^R - \xi_{it}\sigma_{it}^R)dt + \sigma_{it}^R d\hat{Z}_{it} \tag{33}$$

Minmax problem: first choose corrections ξ_t, then portfolio and consumption

$$\max_{\{\hat{c}_t, m_t, f_t\}_{t\geq 0}} \min_{\{\xi_t\}_{t\geq 0}} \mathbb{E} \int_0^\infty e^{-\hat{\rho}t} \left(\hat{\rho} \ln(\hat{c}_t) + \frac{\gamma_t}{2} \int_0^1 \xi_{it}^2 di \right) dt \tag{34}$$

Cost parameter γ_t governs risk-taking capacity:

back

$$\hat{\theta}_{it} = \gamma_t \frac{\mu_{it}^R}{(\sigma_{it}^R)^2} \tag{35}$$

premium for aggregate risk

Intermediaries take the following positions: back

$$\hat{\theta}_{it} = \gamma_t \frac{\mu_{it}^R - \tilde{\sigma}_{it}^R x_t}{(\sigma_{it}^R)^2} \tag{36}$$

Here the aggregate risk premium x_t is

$$x_t = \frac{\gamma_t \int_0^1 \frac{\mu_{it}^R \tilde{\sigma}_{it}^R}{(\sigma_{it}^R)^2} di}{1 + \gamma_t \int_0^1 \frac{(\tilde{\sigma}_{it}^R)^2}{(\sigma_{it}^R)^2} di} \tag{37}$$

intermediaries with a VAR constraint

Issue short-term riskless liabilities m_t, invest $(\hat{\theta}_{it})_i$ in regular country trees:

$$d\hat{w}_t = \int_0^1 \hat{\theta}_{it}\hat{w}_t(dR_{it} + r_t dt)di - m_t r_t dt - \hat{c}_t dt \tag{38}$$

$$\int_0^1 \hat{\theta}_{it}\hat{w}_t di = \hat{w}_t + m_t \tag{39}$$

$$\int_0^1 \mathbb{V}_t[\hat{\theta}_{it}(dR_{it} - \tilde{\sigma}_{it}^R \cdot dW_t)]di \leq \gamma_t \int_0^1 \mathbb{E}_t[\hat{\theta}_{it}(dR_{it} - \tilde{\sigma}_{it}^R x_t)]di \tag{40}$$

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

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

back

$$\hat{\theta}_{it} = \gamma_t \frac{\mu_{it}^R - \tilde{\sigma}_{it}^R x_t}{(\sigma_{it}^R)^2} \tag{41}$$

equilibrium with aggregate shocks

Given the process for excess returns

$$dR(w,\mathcal{S}) = \mu_R(w,\mathcal{S})dt + \sigma_R(w,\mathcal{S})dZ + \tilde{\sigma}_R(w,\mathcal{S}) \cdot dW \tag{42}$$

In equilibrium, excess returns satisfy

back

$$\mu_R(w,\mathcal{S}) = x(\mathcal{S}) \cdot \tilde{\sigma}_R(w,\mathcal{S}) + \tag{43}$$

$$\sigma_R(w,\mathcal{S})^2 \cdot \max\left\{ \frac{p(w,\mathcal{S})(\sigma_R(w,\mathcal{S})^2 + |\tilde{\sigma}_R(w,\mathcal{S})|^2) - wx(\mathcal{S}) \cdot \tilde{\sigma}_R(w,\mathcal{S})}{\varphi(\mathcal{S})(\sigma_R(w,\mathcal{S})^2 + |\tilde{\sigma}_R(w,\mathcal{S})|^2) + w\sigma_R(w,\mathcal{S})^2}, \frac{p(w,\mathcal{S}) - \bar{\theta}w}{\varphi(\mathcal{S})} \right\}$$

Here $x(\mathcal{S})$ is the aggregate risk premium

$$x(\mathcal{S}) = \frac{\gamma \int \frac{\mu_R(w,\mathcal{S})\tilde{\sigma}_R(w,\mathcal{S})}{(\sigma_R(w,\mathcal{S}))^2} dG(w,\mathcal{S})}{1 + \gamma \int \frac{|\tilde{\sigma}_R(w,\mathcal{S})|^2}{(\sigma_R(w,\mathcal{S}))^2} dG(w,\mathcal{S})} \tag{44}$$

solving for prices and distributions

Shut down aggregate shocks, $\sigma_\gamma = \sigma_\nu = (0, 0)$ back

Given initial conditions, prices $p(w,t)$ and density $g(w,t)$ solve

$$r(t)p(w,t) - \partial_t p(w,t) = y(w,t) + \mu_w(w,t)\partial_w p(w,t) + \frac{1}{2}\sigma_w(w,t)^2\partial_{ww}p(w,t) \tag{45}$$

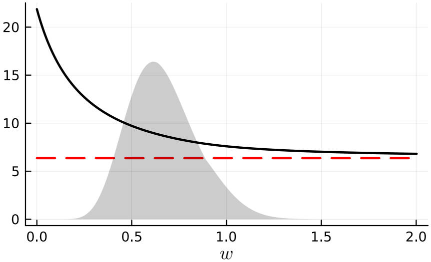
$$\partial_t g(w,t) = -\partial_w[\mu_w(w,t)g(w,t)] + \frac{1}{2}\partial_{ww}[\sigma_w(w,t)^2 p(w,t)] \tag{46}$$

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

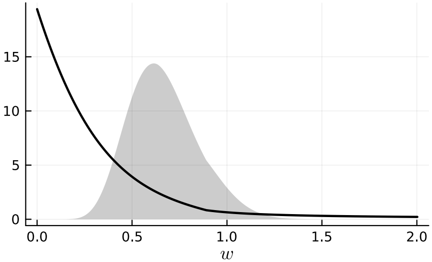
$$y(w,t) = \nu(t) - \left(\frac{\sigma}{1-\epsilon(w,t)\theta(w,t)}\right)^2 \max\left\{\frac{1}{w+\varphi(t)}, \frac{1}{\varphi(t)}\left(1 - \frac{\bar{\theta}w}{p(w,t)}\right)\right\} \tag{47}$$

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

steady state



(a) Dividend to price ratio and r



(b) Elasticity of μ_R/σ_R to φ

back

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

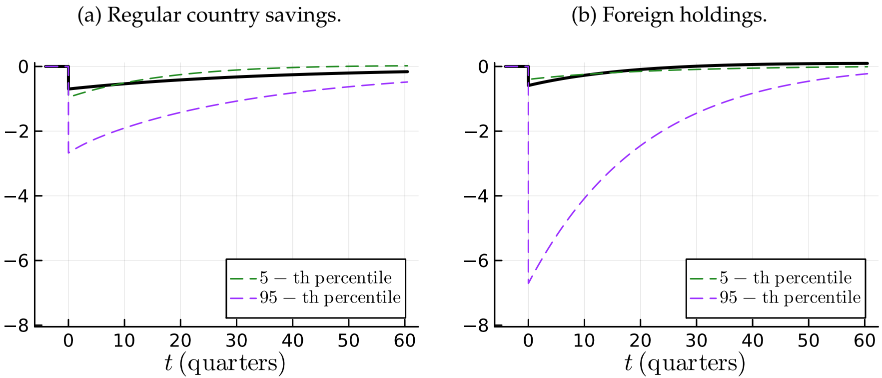


Figure: 5-th percentile of wealth distributions in green, 95-th percentile in purple. back

parameters

parameter	value	meaning
regular countries		
ρ	0.0793	discount rate
λ	0.0177	emigration rate
ν	0.0600	output rate
σ	0.0647	output volatility
$\overline{\theta}$	0.7059	upper limit on risky asset share
special country		
$\hat{\rho}$	0.0844	discount rate
$\hat{\lambda}$	0.0384	emigration rate
$\hat{\nu}$	0.0600	output rate
$\hat{q}$	0.3096	asset stock
ζ	0.3824	country weight intercept
γ	0.6698	risk-taking capacity

back

estimation results

Estimate 5 parameters: persistence (μ_γ, μ_ν) and loadings $(\sigma_{\gamma 1}, \sigma_{\gamma 2}, \sigma_{\nu 2})$

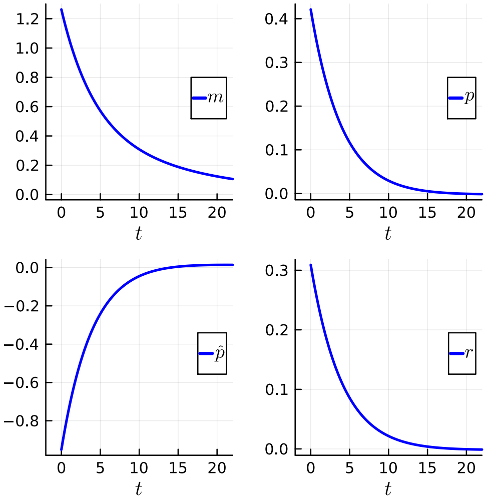
$$\begin{pmatrix} d\gamma_t \\ d\nu_t \end{pmatrix} = \begin{pmatrix} \mu_\gamma & 0 \\ 0 & \mu_\nu \end{pmatrix} \begin{pmatrix} \overline{\gamma} - \gamma_t \\ \overline{\nu} - \nu_t \end{pmatrix} dt + \begin{pmatrix} \sigma_{\gamma 1} & \sigma_{\gamma 2} \\ 0 & \sigma_{\nu 2} \end{pmatrix} \begin{pmatrix} dW_1 \\ dW_2 \end{pmatrix} \tag{48}$$

Results:

μ_γ	μ_ν	$\sigma_{\gamma 1}$	$\sigma_{\gamma 2}$	$\sigma_{\nu 2}$
0.2445	0.7757	-0.1258	-0.0843	-0.0039
(0.0450)	(0.0356)	(0.0098)	(0.0056)	(0.00006)

back

IRF: shock to $\gamma(t)$, aggregates



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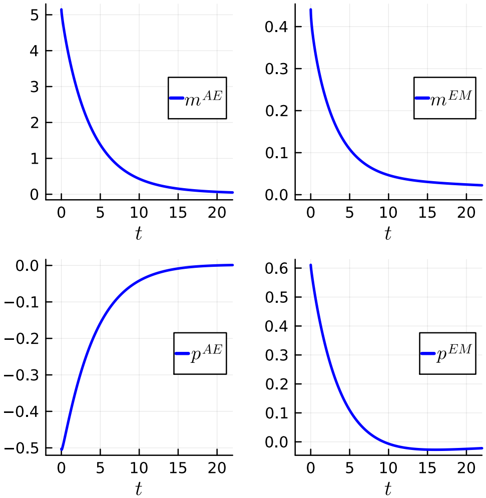
IRF: shock to $\gamma(t)$, AE and EM



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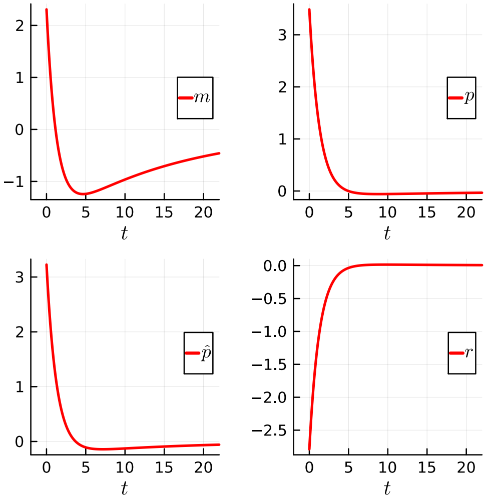
IRF: shock to $\nu(t)$, aggregates



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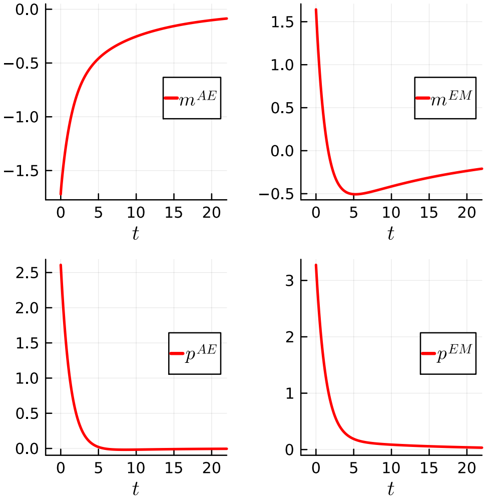
IRF: shock to $\nu(t)$, AE and EM



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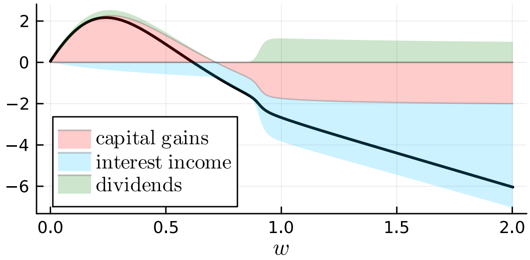
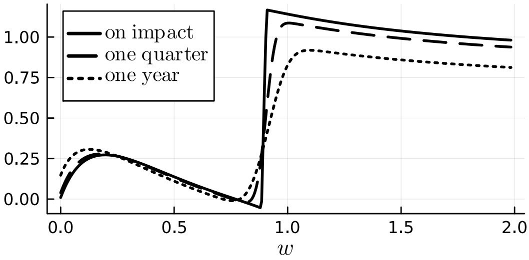
shock to $\gamma(t)$: adjustment

(a) Net income components.



(b) Domestic asset holdings.



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

US adjustment

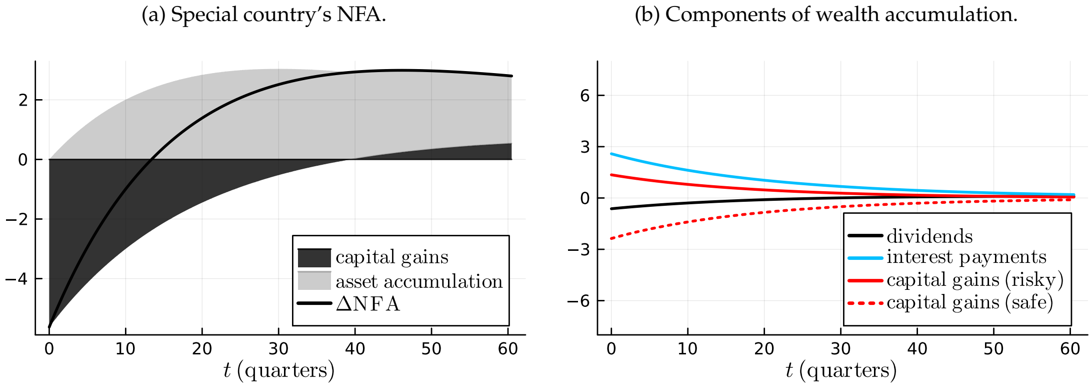


Figure: Responses of the special country's NFA and components of net income, percent of GDP.

back

evidence on prices and flows

Model: relative performance of AE vs EM

AE and EM separately

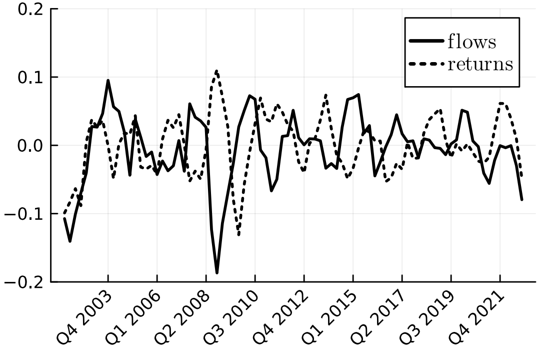
- negatively correlated with aggregate outflows
- negatively correlated with Δ = AE outflows - EM outflows

Define R_t as returns on MSCI for AE and EM

Table: pairwise correlations

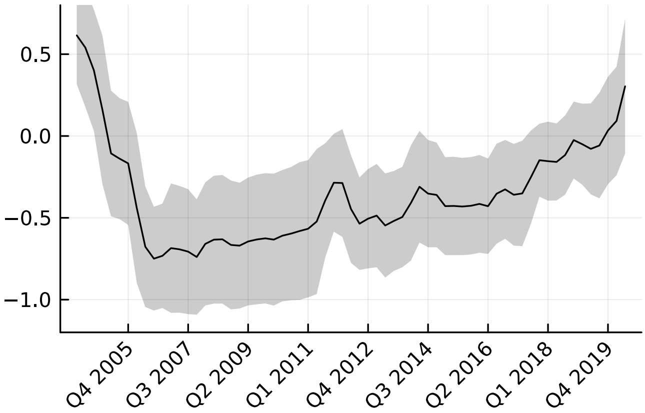
	$\bar{f}_t^{AE} - \bar{f}_t^{EM}$	$R_t^{AE} - R_t^{EM}$
F_t	0.53	-0.28
$\bar{f}_t^{AE} - \bar{f}_t^{EM}$		-0.13

Figure: returns $R_t^{AE} - R_t^{EM}$ and flows $\bar{f}_t^{AE} - \bar{f}_t^{EM}$



relative performance over time

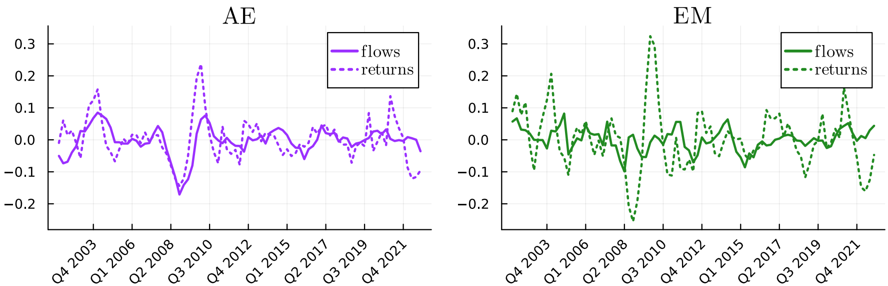
Figure: 5-year rolling-window correlation between $\overline{a}_t^{AE} - \overline{a}_t^{EM}$ and $R_t^{AE} - R_t^{EM}$



AE and EM separately

evidence: AE and EM separately

Figure: R_t^{AE} and $\bar{a}_t^{AE}$ on the left, R_t^{EM} and $\bar{a}_t^{EM}$ on the right



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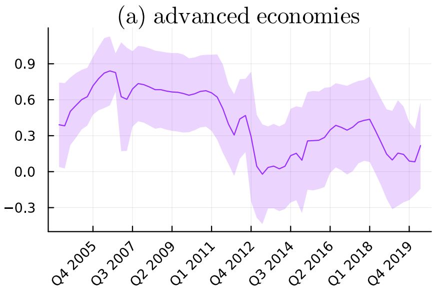
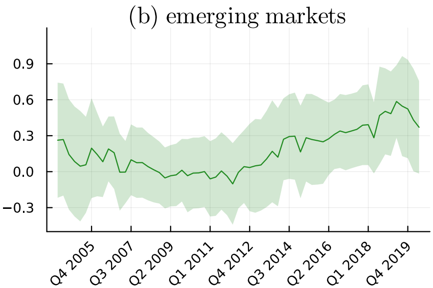
evidence: AE and EM separately

Figure: R_t^{AE} and $\bar{a}_t^{AE}$ on the left, R_t^{EM} and $\bar{a}_t^{EM}$ on the right





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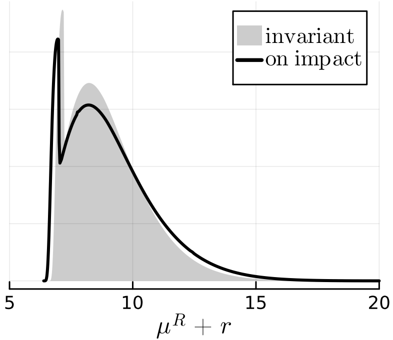
distribution of required returns

Figure: required excess returns. back



output shocks: price responses

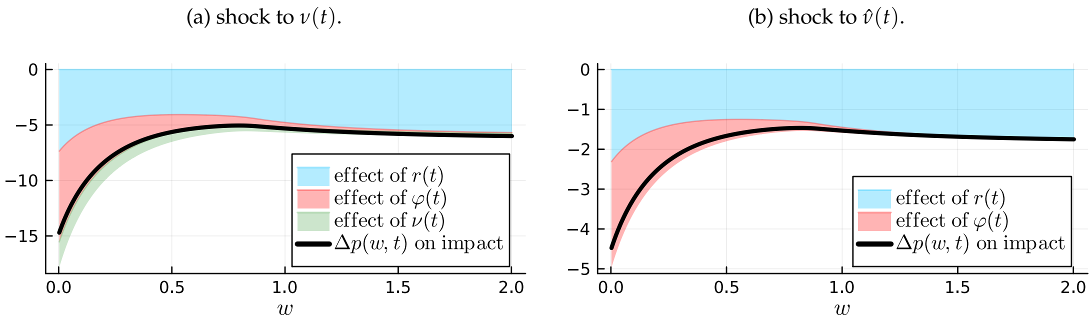
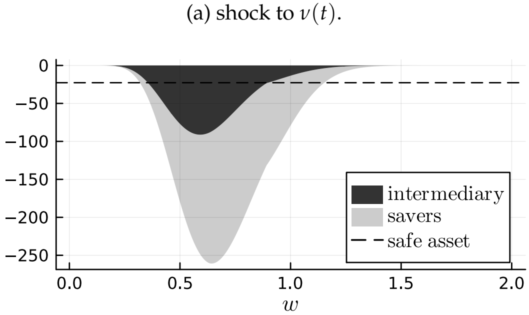


Figure: cross-section of the changes in risky asset prices on impact.

- 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

back

output shocks: distribution of losses



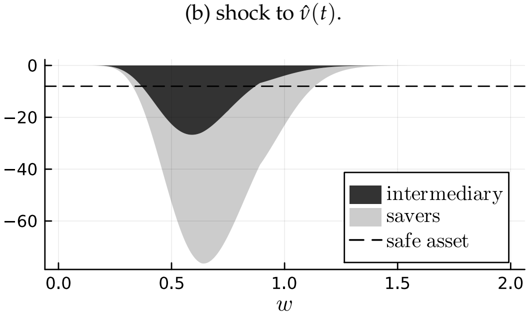


Figure: gains and losses on impact in percent of global GDP, weighted by density.

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

back