The dollar and the global price of risk

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Features of the dollar as world's foremost reserve currency

1. Dollar is strong when risk-bearing capacity low
2. Carry trades short the dollar have countercyclical exp. returns
3. Dollar depreciation rebalances U.S. NFA via valuation effects
4. U.S. monetary shocks affect global risk pricing

Existing frameworks unable to jointly account for these patterns:

- Dollar convenience yield: link between dollar and risk premia
- U.S.' risk-bearing capacity: dollar depreciates in bad times

Our paper: bridges these perspectives + quantitatively fits data.

Overview

Shocks to demand for dollar bonds account for empirical patterns in NK model w/ heterog. risk-bearing capacity, incomplete markets

- Effects of a positive dollar demand shock:
  - Incomplete markets $\Rightarrow$ dollar appreciates
  - Nominal frictions $\Rightarrow$ global recession
  - Heterog. risk tolerance $\Rightarrow$ risk tolerant short \$, risk premia rise
  - U.S. more risk tolerant $\Rightarrow$ U.S. NFA fall
- Mechanism generates three patterns consistent with data:
  - Countercyclical returns on dollar carry trade
  - Valuation effects in U.S. NFA adjustment
  - Monetary policy asymmetries in "global financial cycle"
- Ongoing: analysis of alternative policy rules

Related literature

- Convenience yields and safe assets

  Caballero-Farhi (18), Caballero-Farhi-Gourinchas (20), Engel (16), Engel-Wu (20), Jiang-Krishnamurthy-Lustig (19 a,b), Valchev (20)

  Here: link dollar and risk premia through redistribution

- Risk-sharing with heterogeneity between U.S. and ROW

  Chien-Naknoi (15), Dou-Verdelhan (15), Gourinchas-Rey-Govillot (17), Maggiori (17)

  Here: overcome reserve currency paradox

- Risk premia, exchange rates, and incomplete markets

  Alvarez-Atkeson-Kehoe (09), Bruno-Shin (15), Gabaix-Maggiori (15), Chien-Lustig-Naknoi (19), Itskhoki-Mukhin (19)

  Here: quantitative application w. production

Overview of model - structure

- {Home,Foreign} with home bias, capital, sticky nominal wages

+ Heterogeneous risk aversion (Epstein-Zin preferences)
    - Two groups within each country: bankers and workers
    - Perpetual youth (stationarity)

+ Incomplete markets: capital, Home and Foreign bonds
    - Baseline: no borrowing in Foreign-denom. bond $\Rightarrow$ only priced
    - Results robust to allowing trade in both nominal bonds

- Driving forces: productivity, prob(disaster), dollar demand
    - Pref. for dollar bond: $\mathbb{E}_t\left[m^j_{t,t+1}(1+\omega_t)(1+r_{t+1})\right]=1$

Overview of model - parameterization

- Target portfolios within and across countries
  - Leverage of U.S. non-fin corps + fin bus
  - Domestic wealth of U.S. non-fin corps + fin bus
  - Negative U.S. NFA position / wealth
  - Positive U.S. NFA in capital / wealth

  $\Rightarrow$ Risk-tolerant bankers leveraged in both countries

  $\Rightarrow$ U.S. leveraged relative to ROW

- Discipline ω_t with stochastic properties of dollar convenience yields (vs. G10) estimated by Du-Im-Schreger (18)
- Quantitative, global, non-linear solution Details

Remainder of the talk

- Redistributive effects of any shock
- Disaster risk shock: reserve currency paradox
- Dollar demand shock: intuition & impulse responses
- Quantitative applications

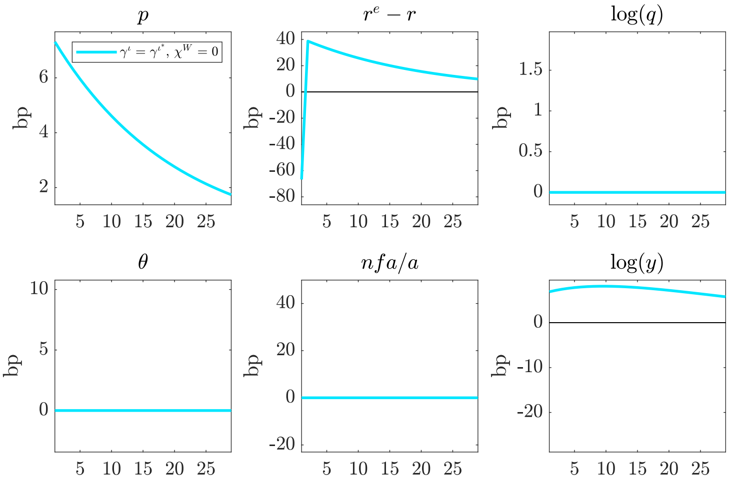
Redistributive effects of any shock

$$\boxed{d \log \theta_t \propto -\left(\frac{b_H}{a}\right)\left(dr_t^k - dr_t\right) + predet_{t-1}}$$

- Suppose Home is levered in capital ($-b_H/a > 0$)
- Then θ_t rises if:
  1. r_t^k rises: real profits or real price of capital rise at t
  2. r_t falls: dollar price level rises at t
- W/ foreign bond trading: holding fixed P_t, E_t also redistributes

Effects of disaster probability shock

▸ More IRFs



Effects of disaster probability shock

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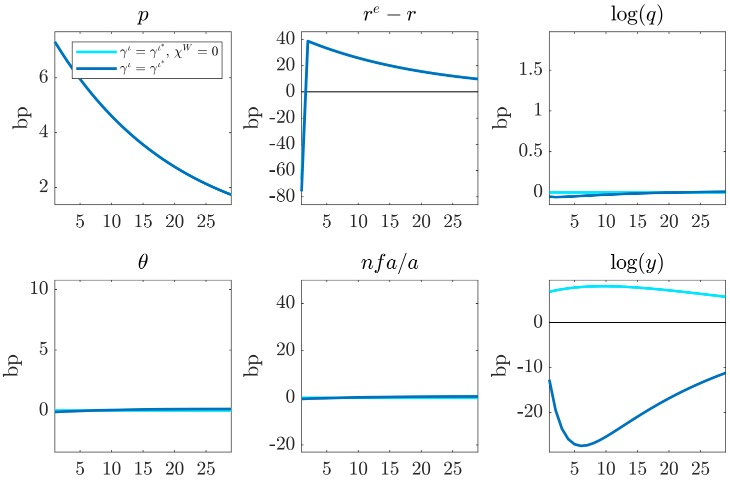

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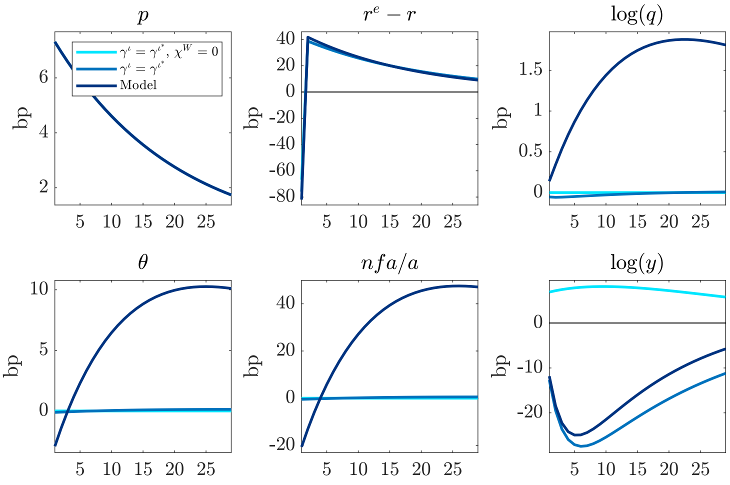

- Dollar counterfactually appreciates when excess returns high and output rises (Maggiori (17)'s "reserve currency paradox")

Intuition on dollar demand shocks

- Dollar bond vs. foreign bond:

$$\mathbb{E}_t\left[m^j_{t,t+1}(1+\omega_t)(1+r_{t+1})\right] = \mathbb{E}_t\left[m^j_{t,t+1}(1+r^*_{t+1})\frac{q_t}{q_{t+1}}\right]$$

$$\Rightarrow \hat{\omega}_t + \mathbb{E}_t\left[\hat{r}_{t+1} - \hat{r}^*_{t+1}\right] = -\Delta\mathbb{E}_t\hat{q}_{t+1}$$

If $\hat{\omega}_t > 0$ and response in real rates is muted:

$\Rightarrow$ Dollar must be expected to depreciate $\Rightarrow$ appreciates today

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- Dollar bond vs. capital:

$$\mathbb{E}_t\left[m^j_{t,t+1}(1+\omega_t)(1+r_{t+1})\right] = \mathbb{E}_t\left[m^j_{t,t+1}(1+r^k_{t+1})\right]$$

$$\Rightarrow \hat{\omega}_t = \mathbb{E}_t \hat{r}^k_{t+1} - \mathbb{E}_t \hat{r}_{t+1}$$

If $\hat{\omega}_t > 0$ and response in real rates is muted:
higher expected return on capital

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  $\Rightarrow \hat{\omega}_t + \mathbb{E}_t \left[\hat{r}_{t+1} - \hat{r}^*_{t+1}\right] = -\Delta \mathbb{E}_t \hat{q}_{t+1}$

  $\Rightarrow$ Dollar must be expected to depreciate $\Rightarrow$ appreciates today

- Dollar bond vs. capital:

  $\Rightarrow \hat{\omega}_t = \mathbb{E}_t \hat{r}^k_{t+1} - \mathbb{E}_t \hat{r}_{t+1} \Rightarrow$ higher expected return on capital

- Consumption/savings (e.g. $M^j_{t,t+1} = \beta c^j_t / c^j_{t+1}$):

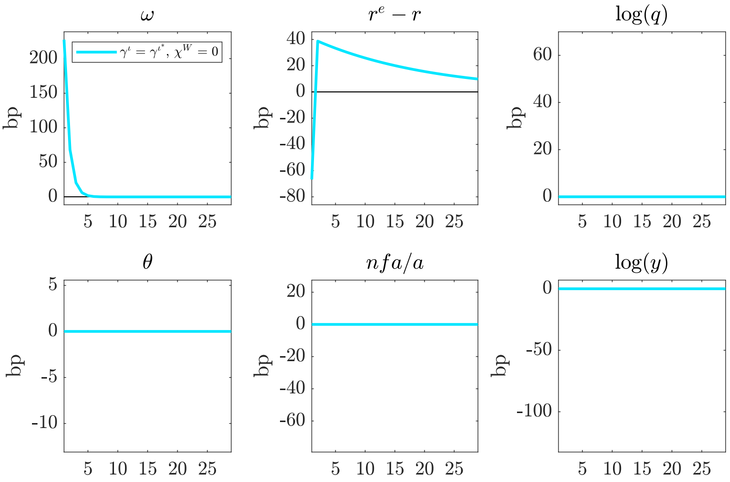
  $\mathbb{E}_t M^j_{t,t+1}(1+\omega_t)(1+r_{t+1}) = 1 \quad \Rightarrow \quad \hat{\omega}_t + \mathbb{E}_t \hat{r}_{t+1} = \Delta \mathbb{E}_t \hat{c}^j_{t+1}$

  $\Rightarrow$ consumption must be expected to rise $\Rightarrow$ falls today

Effects of dollar demand shock

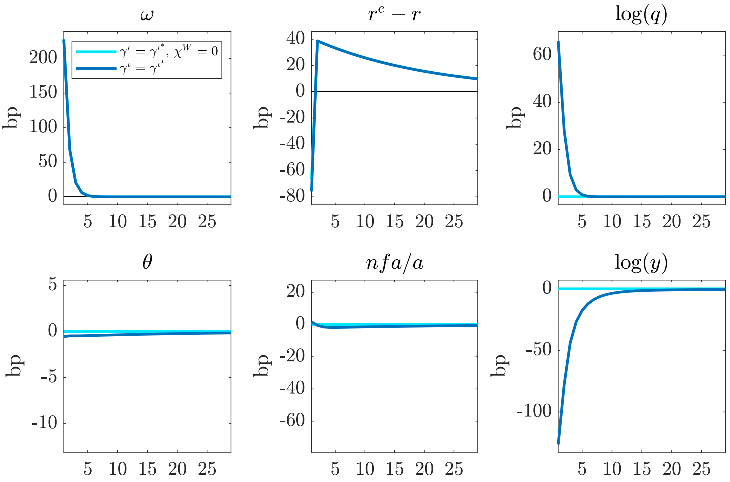
More IRFs

Demand k



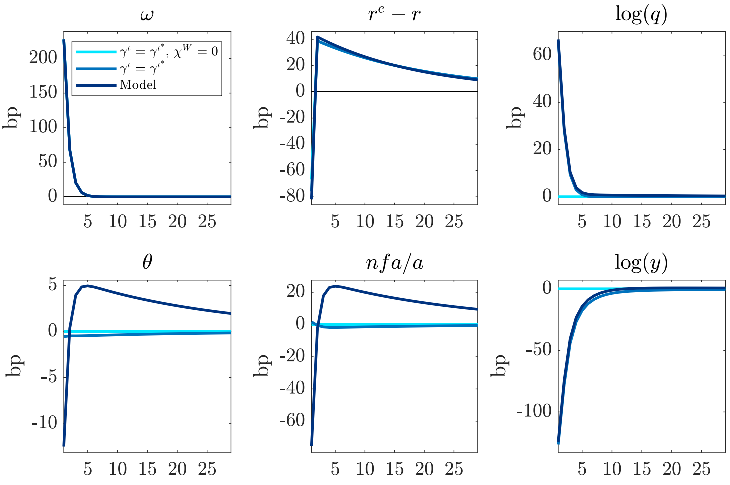
Effects of dollar demand shock

More IRFs



Effects of dollar demand shock

More IRFs



- Dollar depreciates when excess returns high, output rises, and U.S. NFA rise, as in the data

Comovements

▸ Addl moments ▸ IRFs

	Data	Model	No ω
$\beta(\sum_{\tau=1}^{4}\left[r^e_{t+\tau}-r_{t+\tau}\right],\sum_{\tau=1}^{4}\Delta\log y_{t+\tau})$	5.7	2.4	0.8
	(1.0)		
$\beta(\sum_{\tau=1}^{4}\left[r^e_{t+\tau}-r_{t+\tau}\right],\sum_{\tau=1}^{4}\Delta nfa_{t+\tau}/a_{t+\tau})$	9.7	5.0	5.9
	(1.0)		
$\beta(\sum_{\tau=1}^{4}\Delta\log q_{t+\tau},\sum_{\tau=1}^{4}\Delta\log y_{t+\tau})$	-0.2	-0.5	0.0
	(0.4)		
$\beta(\sum_{\tau=1}^{4}\Delta\log q_{t+\tau},\sum_{\tau=1}^{4}\Delta nfa_{t+\tau}/a_{t+\tau})$	-2.1	-0.7	0.0
	(0.5)		
$\beta(\sum_{\tau=1}^{4}\left[r^e_{t+\tau}-r_{t+\tau}\right],\sum_{\tau=1}^{4}\Delta\log q_{t+\tau})$	-0.6	-5.6	124.2
	(0.2)		

Quantitative applications

Comovements + portfolio exposures rationalize properties of:

1. Dollar carry trade
2. Valuation channel in U.S. external adjustment
    - Forecasting returns and the dollar with U.S. external position
    - Fluctuations in U.S. external position
3. Monetary policy asymmetries in "global financial cycle"

Dollar carry trade

- Consider return to borrowing in dollars, investing in foreign:

$$i^{uip}_{t\to t+4} \equiv (1+i^{4*}_t)\frac{E_t}{E_{t+4}} - (1+i^4_t),$$

	Data		Model		No ω	
	$i^{uip}_{t\to t+4}$	$i^{uip}_{t\to t+4}$	$i^{uip}_{t\to t+4}$	$i^{uip}_{t\to t+4}$	$i^{uip}_{t\to t+4}$	$i^{uip}_{t\to t+4}$
$i^{4*}_t - i^4_t$	2.8		1.1		0.4	
	(0.5)					
$\log y_t - \log y_{t-4}$		-0.7		-0.8		0.0
		(0.1)				

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- Countercyclical exp. returns à la Lustig-Roussanov-Verdelhan (14)

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Valuation channel in adjustment: forecasting

- $nxa_t \equiv$ net external position, as in Gourinchas-Rey (07) Details
- Consider in-sample forecasting with nxa_t:

	Data			Model			No ω		
h	1	4	20	1	4	20	1	4	20
	$\frac{1}{h}\sum_{\tau=1}^{h}[r^e_{t+\tau} - r_{t+\tau}]$								
nxa_t	-0.35	-0.45	-0.17	-0.77	-0.12	-0.03	-0.36	-0.35	-0.24
	(0.17)	(0.08)	(0.03)						
	$\frac{1}{h}\sum_{\tau=1}^{h}\Delta \log E_{t+\tau}$								
nxa_t	0.08	0.10	0.01	0.21	0.05	0.01	0.00	0.00	0.00
	(0.08)	(0.05)	(0.02)						

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- Lower nxa_t rebalanced via high equity returns and weaker dollar

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- $\hat{\omega}_t > 0 \Rightarrow nxa_t$ falls, future excess returns high + \$ depreciates

Valuation channel in adjustment: decomposition

- Decompose variance of nxa_t as in Gourinchas-Rey (07) ▸ Details
  - news about future net-export growth vs. future excess returns
- $\beta_r \equiv$ share due to news about future returns

	Data	Model	No ω
$\sigma(nxa_t)$	0.14	0.07	0.01
β_r	31%	27%	

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- Gourinchas-Rey-Sauzet (19): roughly one third of variation in nxa_t is due to news about future excess returns

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- Model matches U.S.' levered portfolio and features time-varying expected excess returns

$\Rightarrow$ 27% of variance in nxa_t due to news about future returns

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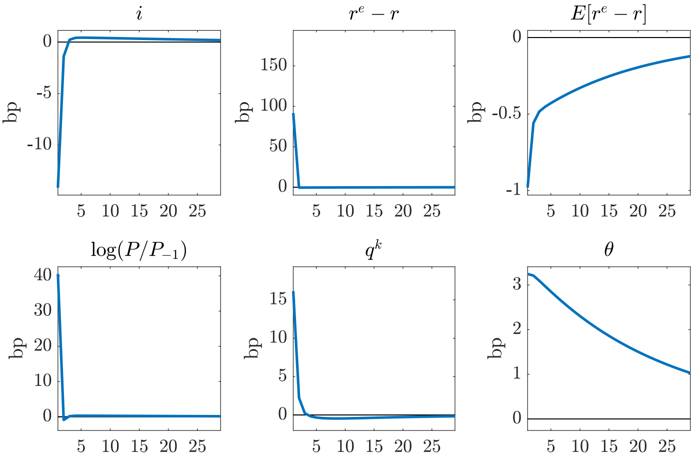
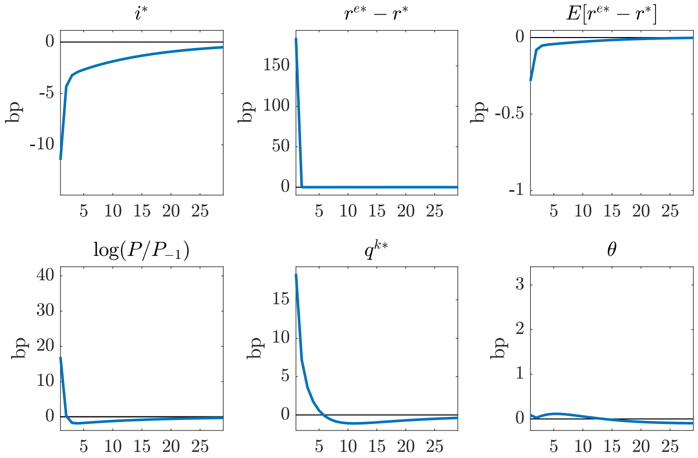
$\Rightarrow$ Variation in nxa_t falls more than 5x absent \$ demand shocks

Monetary asymmetries: Home easing



Monetary asymmetries: Foreign easing



- Asymmetric redistribution via $P \Rightarrow$ asymmetric effects on RP
- Application of Kekre-Lenel (20) to international context

Monetary asymmetries: Campbell-Shiller

▸ Details on estimates

- Summarize + compare to data using Campbell-Shiller decomp:

	Data		Model	
	U.S.	Euro area	Home	Foreign
Dividend growth	26%	111%	64%	77%
	[-15%,60%]	[43%,182%]		
− Real rates	13%	8%	25%	23%
	[0%,29%]	[-2%,19%]		
− Excess returns	60%	-19%	11%	0%
	[23%,102%]	[-98%,55%]		

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- SVAR-IV w/ surprises in Jarocinski-Karadi (19), Altavilla et al (19)
- U.S. easing lowers global equity premium unlike easing abroad
  Rey (13,16), Bruno-Shin (15), Jorda et al (19), Miranda-Agrippino-Rey (19), ...

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	[23%,102%]	[-98%,55%]		

- Model generates this asymmetry
- With foreign bond trading: \$ demand shocks crucial because bankers endogenously borrow in dollars Details

Ongoing: effects of alternative policy rules

1. Monetary: Taylor rules which respond to ω_t
2. Fiscal: government debt policy which responds to ω_t
   - Generalized model $\Rightarrow 1 = \mathbb{E}_t m^j_{t,t+1} \frac{1+\omega_t}{\exp(\lambda b^j_{Ht})}(1+r_{t+1})$
     (à la Gabaix-Maggiori (15), Itskhoki-Mukhin (19), Jiang et al (19)...)

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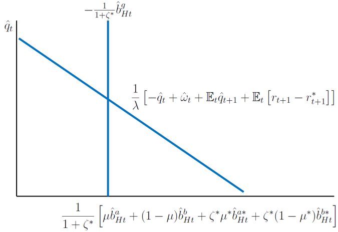
   - Up to first order, equilibrium in the dollar bond market:



   - $\lambda > 0$: b^g_{Ht} will affect the allocation (e.g., dollar swap lines)

Conclusion

Rationalize unique features of dollar in NK model w/ heterog. risk-bearing capacity, incomplete markets, + shocks to dollar demand.

- Flight to dollars $\Rightarrow$
  - Dollar appreciation
  - Global recession
  - Rise in risk premia
  - Decline in U.S. NFA
- Mechanism key for:
  - Countercyclical expected returns on the dollar carry trade
  - Valuation channel in U.S. external adjustment
  - Monetary policy asymmetries in "global financial cycle"
- Ongoing: analysis of alternative policy rules

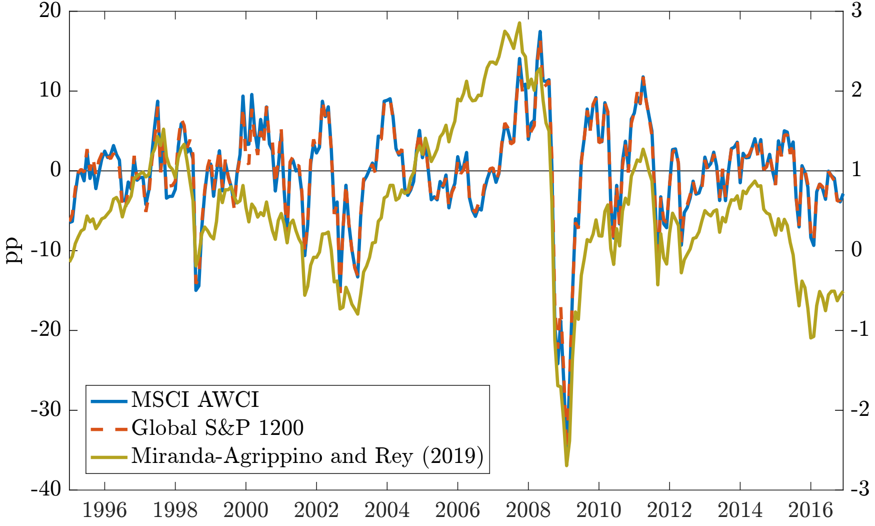
APPENDIX

Data

	Source	Period used	Notes
GDP and components	OECD	Q1/95-Q4/16	
Working age population	OECD	Q1/95-Q4/16	
3-month govt bond yields	Bloomberg	1/95-11/16	
MSCI AWCI index	Bloomberg	1/95-11/16	Comparison
Exchange rates	Fed Board	1/99-11/16	
Consumer price indices	OECD	1/99-11/16	
U.S. aggregate wealth	FA	Q1/95-Q4/16	
U.S. net foreign assets	FA	Q1/95-Q4/16	Comparison

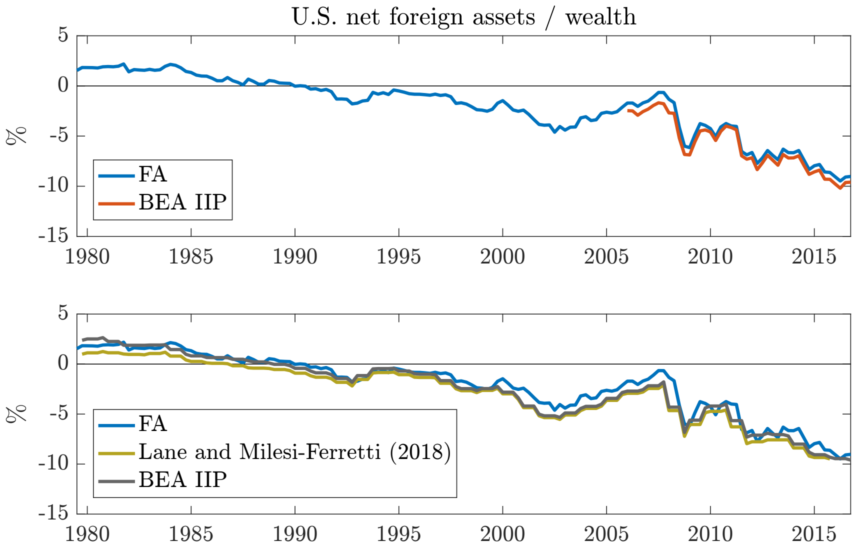
Measures of global risky asset prices

Back



U.S. net foreign assets to wealth

Back



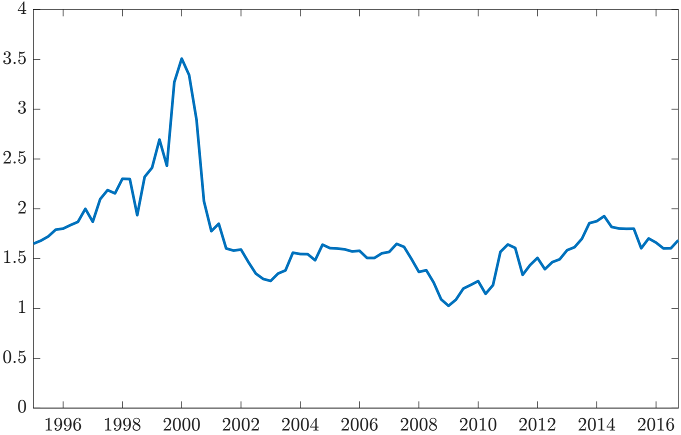
Decomposing net foreign assets to wealth (1/3)

Back

1. Decompose external assets and liabilities into bonds and equity
   - Only bonds: SDRs; currency and deposits; debt securities; short-term loans; money market fund shares; insurance, pensions, and standardized guarantees; and accounts payable/receivable
   - Only equity: corporate equities; government equity in IBRD; and FDI
   - Both bonds and equity: foreign mutual fund shares in U.S.
     - Decompose using ratio of corporate equity assets in mutual funds / total financial assets in mutual funds
2. Decompose equity into capital and bonds using aggregate leverage of U.S. non-financial corporates + financial business

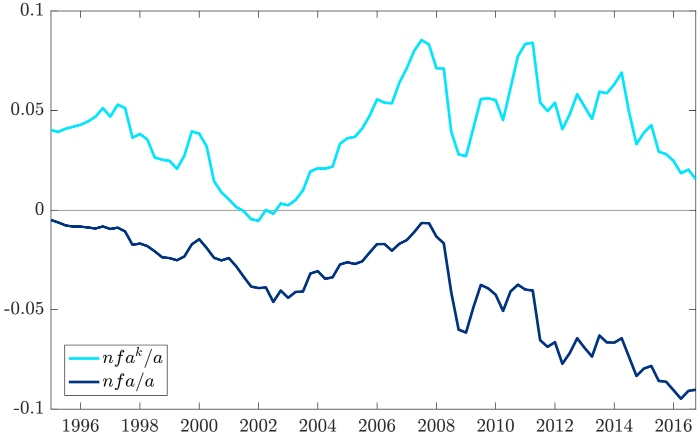
Decomposing net foreign assets to wealth (2/3)

Back



Decomposing net foreign assets to wealth (3/3)

Back



Additional second moments (1/2)

Back

	Data	Model	No ω
$\sigma(r_{t+1})$	1.5%	2.6%	0.4%
$\sigma(\left[r^e_{t+1} - r_{t+1}\right])$	16.2%	5.1%	1.5%
$\sigma(\Delta \log q_t)$	3.9%	0.8%	0.0%
$\rho(\Delta \log q_t)$	0.12	0.50	0.17
$\rho(\Delta \log E)$	0.16	-0.02	0.21
$\rho(\Delta \log q_t, \Delta \log c^*_t - \Delta \log c_t)$	0.1	-1.0	-0.3

Households (1/2)

- Home household j:

$$v_t^j = \left((1-\beta) \left(c_t^j \Phi(\ell_t^j) \Omega_t^j(\omega_t) \right)^{1-1/\psi} + \beta \mathbb{E}_t \left[\left(v_{t+1}^j \right)^{1-\gamma^j} \right]^{\frac{1-1/\psi}{1-\gamma^j}} \right)^{\frac{1}{1-1/\psi}}$$

- CES aggregator c_t^j in $\{c_{Ht}^j, c_{Ft}^j\}$ with home bias ς, e.o.s. σ

- Shimer (10) disutility: $\Phi(\ell_t^j) = \left(1 + (1/\psi - 1) \bar{\nu} \frac{(\ell_t^j)^{1+1/\nu}}{1+1/\nu} \right)^{\frac{1/\psi}{1-1/\psi}}$

- Resource constraint:

$$P_{Ht} c_{Ht}^j + E_t^{-1} P_{Ft}^* c_{Ft}^j + B_{Ht}^j + E_t^{-1} B_{Ft}^j + Q_t^k k_t^j \leq W_t \ell_t^j +$$
$$(1+i_{t-1}) B_{Ht-1}^j + E_t^{-1}(1+i_{t-1}^*) B_{Ft-1}^j + (\Pi_t + (1-\delta) Q_t^k) k_{t-1}^j$$

- $\Omega_t^j(\omega_t) = \exp\left(\frac{\omega_t}{1+\omega_t} \frac{B_{Ht}^j - \bar{B}_{Ht}^j}{P_t c_t^j} \right)$, where ω_t is pref. for dollar bond

Households (2/2)

- Analogous problem for Foreign households
- Two types in each country:
  - Bankers (a, a^*) and workers (b, b^*)
  - Bankers more risk tolerant than workers: $\gamma^a = \gamma^{a*} < \gamma^b = \gamma^{b*}$
  - Relative measure of bankers may differ across countries
- For now: $B^j_{Ft} \geq 0, \ \ j \in \{a, b, a^*, b^*\}$
- Perpetual youth keeps wealth distribution stationary

Supply-side

- Differentiated labor varieties, Rotemberg wage costs (ψ^W)
- Representative Home and Foreign producers earning

$$P_{Ht}\left(z_t \ell_t\right)^{1-\alpha}\left(\kappa_t\right)^{\alpha} - W_t \ell_t - \Pi_t \kappa_t,$$
$$P^*_{Ft}\left(z_t \zeta^* \ell^*_t\right)^{1-\alpha}\left(\kappa^*_t\right)^{\alpha} - W^*_t \zeta^* \ell^*_t - E_t \Pi_t \kappa^*_t$$

  - ζ^*: relative size of Foreign vs. Home
  - Free mobility of capital across countries $\Rightarrow$ common Π_t
- Global capital goods producer with unbiased expenditures on consumption goods and aggregate adjustment costs (χ^x)

Policy and summary of driving forces

- Taylor rules:

$$1 + i_t = (1 + \bar{i}) \left(\frac{P_t}{P_{t-1}} \right)^{\phi} m_t,$$

$$1 + i_t^* = (1 + \bar{i}^*) \left(\frac{P_t^*}{P_{t-1}^*} \right)^{\phi} m_t^*$$

- Driving forces:
  - $\log z_t = \log z_{t-1} + \sigma^z \epsilon_t^z + \varphi_t$
  - $\varphi_t = \{\underline{\varphi} < 0, 0\}$ with prob. $\{p_t, 1 - p_t\}$
  - $\log p_t = \rho^p \log p_{t-1} + \sigma^p \epsilon_t$
  - $\log \omega_t = \rho^\omega \log \omega_{t-1} + \sigma^\omega \epsilon_t$
  - $\{m_t, m_t^*\}$ "MIT" shocks
- Global solution building on Kekre-Lenel (20)

Recurring notation on the following slides

- Prices and interest rates:
  - Real exchange rate: q_t (Foreign bundles per Home bundle)
  - Real interest rates: r_t, r_t^*
  - Real return on capital: r_t^k
  - Real dividend, price, and return on equity: d_t^e, p_t^e, r_t^e
- Wealth and portfolios:
  - Home's global wealth share (beginning of t): θ_t
  - Real wealth at Home (end of t): a_t
  - Real NFA at Home (end of t): nfa_t

Externally set parameters

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	Description	Value	Notes
ψ	IES	0.75	
σ	trade elasticity	1.5	Backus et al (94)
ς	home bias	0.6	Eaton et al (16)
ν	Frisch elasticity	0.9	Chetty et al (11)
ξ	death probability	0.05	
α	1 - labor share	0.33	
δ	depreciation rate	0.025	
ϵ	elast. of subs. across workers	10	
χ^W, χ^{W*}	Rotemberg wage adj. costs	200	$\approx \mathbb{P}(\text{adjust}) = 5$ qtrs
$\phi = \phi^*$	Taylor coeff. on inflation	1.5	Taylor (93)
p	avg disaster probability	0.005	Barro (06)
$\underline{\varphi}$	disaster shock	-0.15	Nakamura et al (13)
ρ^ω	autocorr. dollar demand	0.3	Du et al (18)

Key calibration targets

Details

- U.S. NFA / wealth: -3.8% ($\Rightarrow \theta$)
- Leverage of U.S. non-fin corps + fin bus: 1.7 ($\Rightarrow \gamma^{b} = \gamma^{b*}$)
- Domestic wealth sh of U.S. non-fin corps + fin bus: 30% ($\Rightarrow \mu$)
- U.S. NFA in capital / wealth: 3.9% ($\Rightarrow \mu^{*} < \mu$)

Targeted moments and calibration

	Description	Value	Moment	Target	Model
ζ^*	rel. pop.	4	$y^*/(sy)$	3.9	4.1
σ^z	std. dev. prod.	0.001	$\sigma(\Delta \log c)$	0.5%	0.9%
χ^x	capital adj cost	1	$\sigma(\Delta \log x)$	1.7%	1.3%
β	discount factor	0.97	$4\mathbb{E}r_{+1}$	0.4%	0.8%
$\gamma^b = \gamma^{b*}$	RRA workers	28	$4\mathbb{E}\left[r^e_{+1} - r_{+1}\right]$	3.5%	3.3%
σ^ω	std. dev. \$ dem.	0.025	$\sigma(\Delta \log E)$	4.0%	2.1%
σ^p	std dev. dis. prob.	0.0025	$\sigma(d^e/p^e)$	0.6%	2.5%
ρ^p	persist. dis. prob.	0.95	$\rho(d^e/p^e)$	0.91	0.42
θ	init. endow. U.S.	0.16	nfa/a	-3.8%	-6.3%
$\gamma^b = \gamma^{b*}$	RRA bankers	15	k^a/a^a	1.7	4.0
μ	Home a share	0.3	$\mu a^a/a$	0.3	0.3
μ^*	Foreign a^* share	0.2	nfa^k/a	3.9%	26.8%
$\bar{\eta}$	init. endow. a	0.04	a^a/a^b	1	1.0
$\bar{\eta}^*$	init. endow. a^*	0.02	a^{a*}/a^{b*}	1	1.0

Additional second moments (2/2)

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	Data	Model	No ω
$\beta(\sum_{\tau=1}^{4}\left[r^e_{t+\tau} - r_{t+\tau}\right], \sum_{\tau=1}^{4}\Delta \log y^*_{t+\tau})$	4.9	1.4	0.4
	(1.2)		
$\beta(\sum_{\tau=1}^{4}\Delta \log q_{t+\tau}, \sum_{\tau=1}^{4}\Delta \log y^*_{t+\tau})$	-0.9	-0.7	0.0
	(0.6)		
$\beta(\sum_{\tau=1}^{4}\Delta \log E_{t+\tau}, \sum_{\tau=1}^{4}\Delta \log y_{t+\tau})$	-0.2	-1.4	0.0
	(0.6)		
$\beta(\sum_{\tau=1}^{4}\Delta \log E_{t+\tau}, \sum_{\tau=1}^{4}\Delta \log y^*_{t+\tau})$	-1.3	-4.3	0.0
	(0.6)		
$\beta(\sum_{\tau=1}^{4}\Delta \log E_{t+\tau}, \sum_{\tau=1}^{4}\Delta nfa_{t+\tau}/a_{t+\tau})$	-3.3	-0.7	0.0
	(0.6)		
$\beta(\sum_{\tau=1}^{4}\left[r^e_{t+\tau} - r_{t+\tau}\right], \sum_{\tau=1}^{4}\Delta \log E_{t+\tau})$	-0.7	-0.1	-22.9
	(0.2)		

Productivity shock (1/2)

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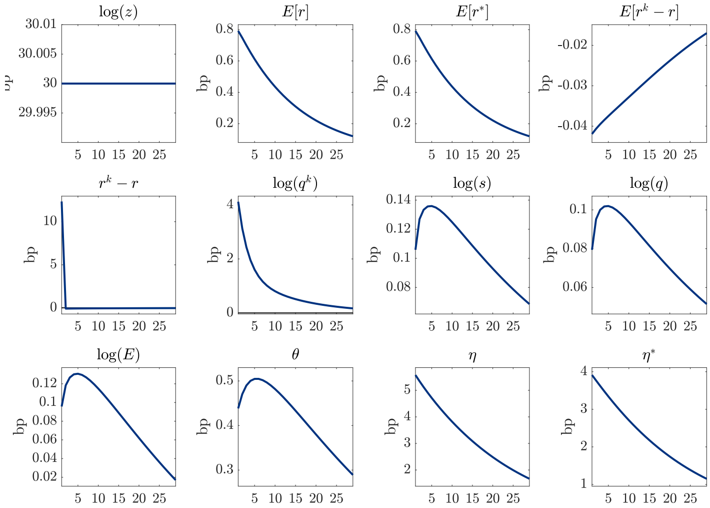

Productivity shock (2/2)

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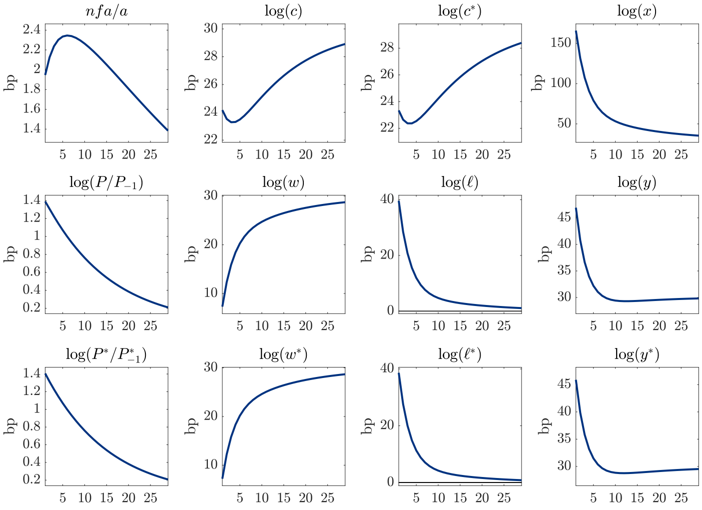

Disaster probability shock (1/2)

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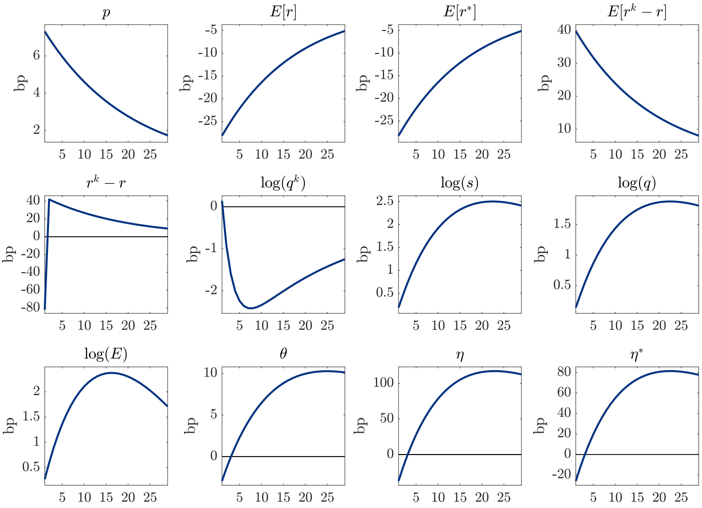
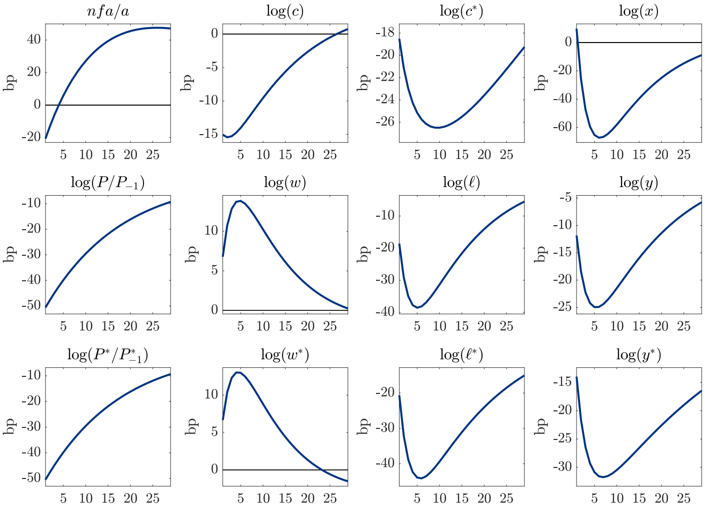


Disaster probability shock (2/2)

Back



Disaster realization (1/2)

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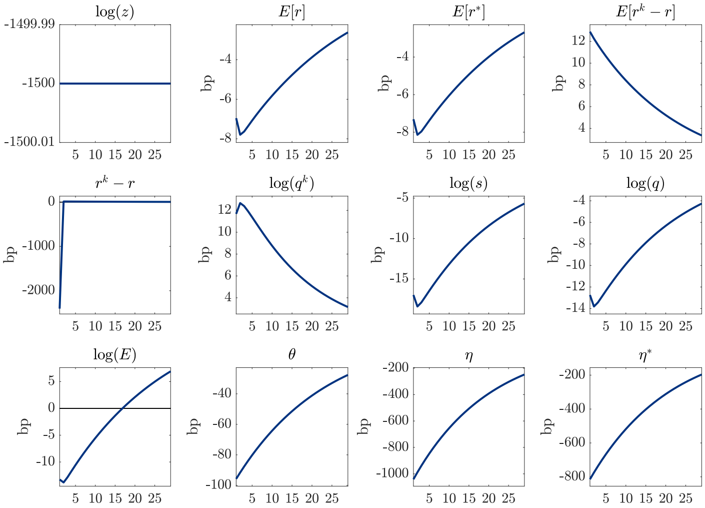
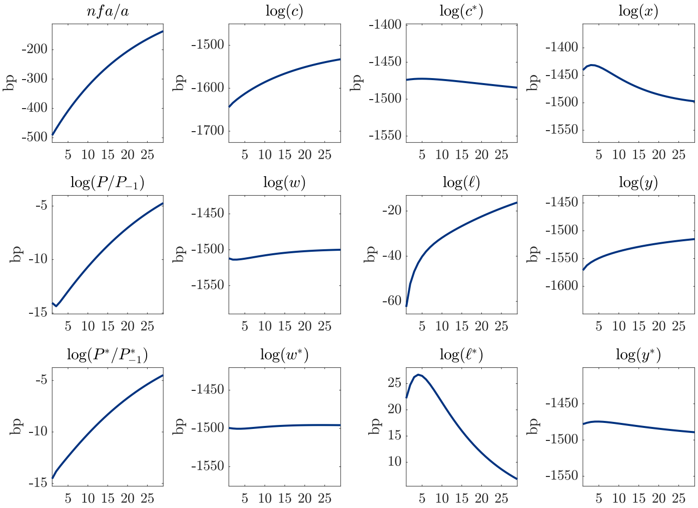


Disaster realization (2/2)

Back



Home monetary shock (1/2)

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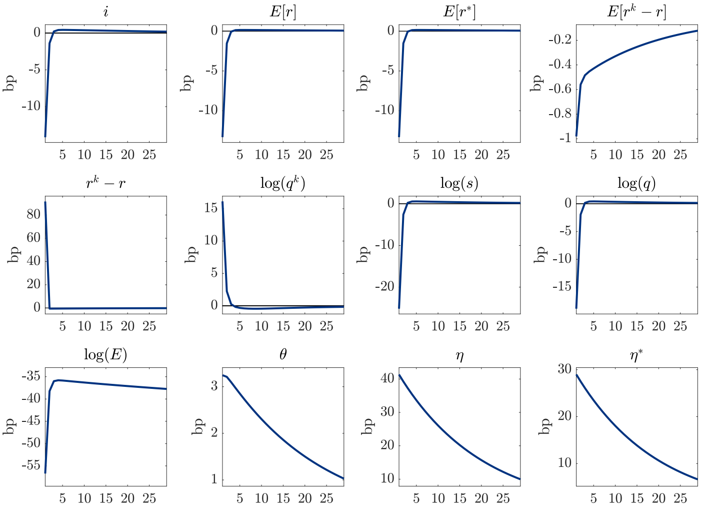

Home monetary shock (2/2)

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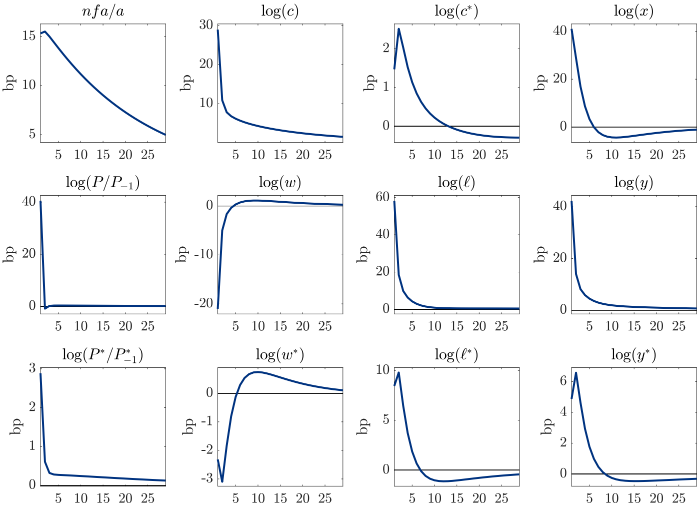

Foreign monetary shock (1/2)

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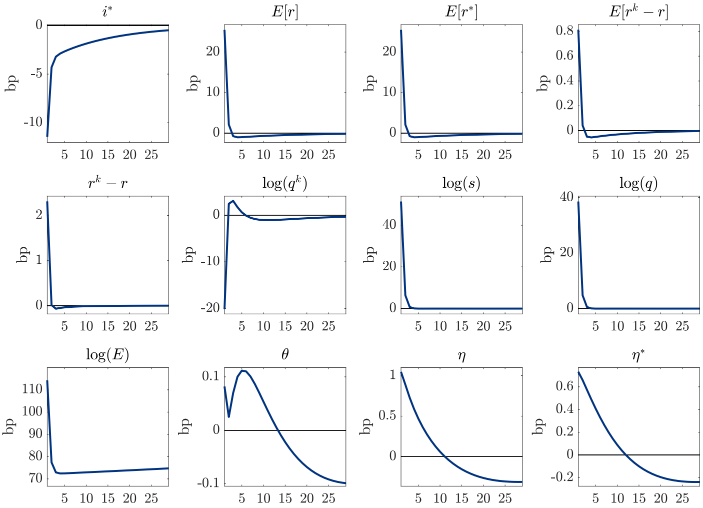
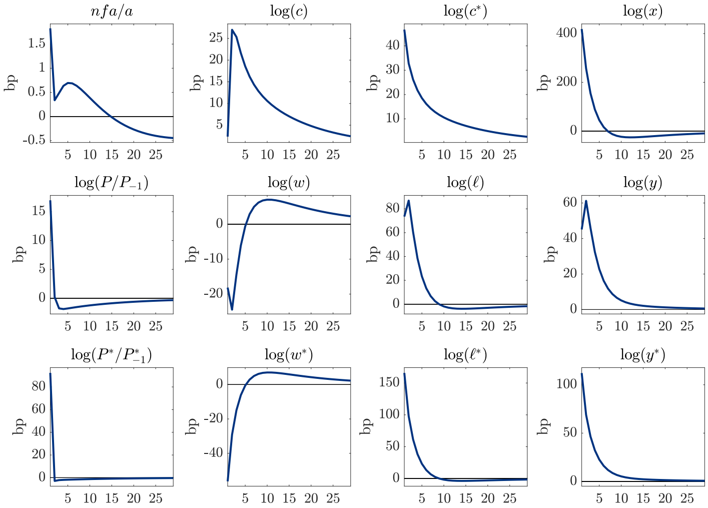


Foreign monetary shock (2/2)

Back



Dollar demand shock (1/2)

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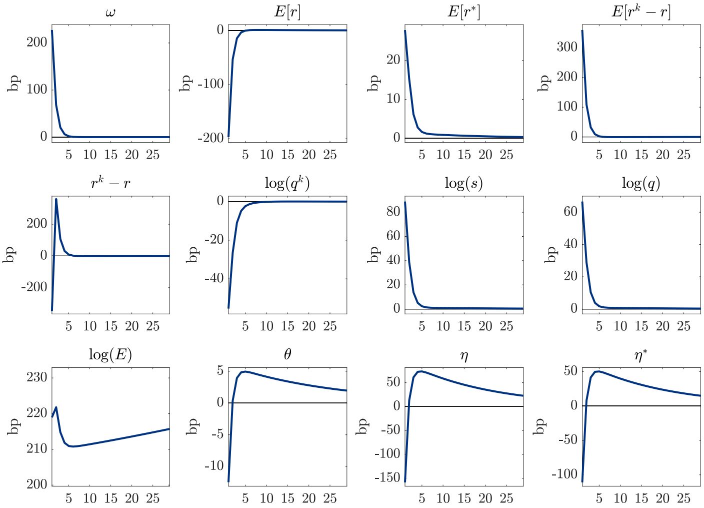
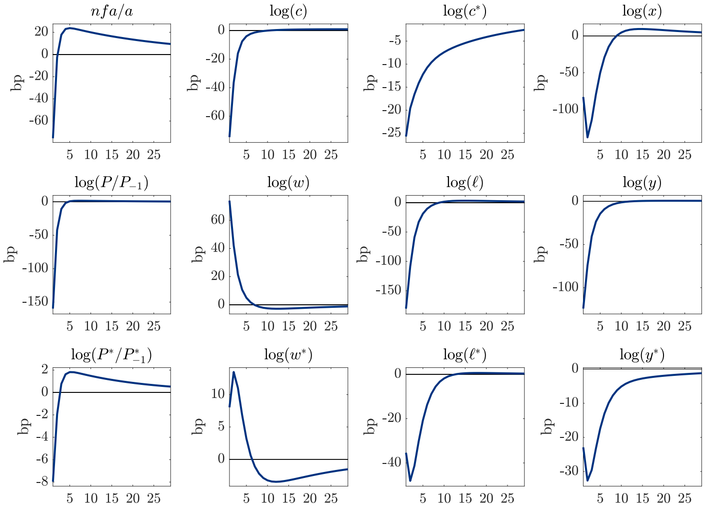


Dollar demand shock (2/2)

Back



Valuation channel in adjustment: overview

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- Aggregate budget constraint:

$$a_t - l_t = a_{t-1} - l_{t-1} + ex_t - im_t + t_{Ht} - t_{Ft}$$
$$r_t b_{Ht} + \left(\frac{q_{t-1}}{q_t}(1 + r_t^*) - 1\right) q_{t-1} b_{Ft-1} + r_t^k q_{t-1}^k (k_{t-1} - \kappa_t)$$

- Following Gourinchas-Rey (07), define

$$nxa_t \equiv \mu_a \hat{a}_t - \mu_l \hat{l}_t + \mu_{ex} \widehat{ex}_t - \mu_{im} \widehat{im}_t + \mu_{tH} \hat{t}_{Ht} - \mu_{tF} \hat{t}_{Ft},$$
$$\Delta nx_t \equiv \mu_{ex} \Delta \widehat{ex}_t - \mu_{im} \Delta \widehat{im}_t + (\mu_{ex} - \mu_{im}) \Delta \hat{z}_t,$$
$$\Delta t_t \equiv \mu_{tH} \Delta \hat{t}_{Ht} - \mu_{tF} \Delta \hat{t}_{Ft} + (\mu_{tH} - \mu_{tF}) \Delta \hat{z}_t,$$
$$r_t^{nfa} \equiv \mu_{bH} \hat{r}_t + \mu_{bF} (\hat{r}_t^* - \Delta \hat{q}_t) + \mu_{k-\kappa} \hat{r}_t^k$$

$$\boxed{nxa_t = -\sum_{\tau=1}^{\infty} \rho^{\tau-1} \mathbb{E}_t \Delta nx_{t+\tau} - \sum_{\tau=1}^{\infty} \rho^{\tau-1} \mathbb{E}_t \Delta t_{t+\tau} - \sum_{\tau=1}^{\infty} \rho^{\tau-1} \mathbb{E}_t r_{t+\tau}^{nfa}}$$

Valuation channel in adjustment: definitions (1/2)

Back

$$
\begin{aligned}
nxa_t \equiv \frac{a}{|a-l|}\log(a_t/z_t) - \frac{l}{|a-l|}\log(l_t/z_t) + \\
\frac{ex}{|ex-im+t_H-t_F|}\log(ex_t/z_t) - \frac{im}{|ex-im+t_H-t_F|}\log(im_t/z_t) + \\
\frac{t_H}{|ex-im+t_H-t_F|}\log(t_{Ht}/z_t) - \frac{t_F}{|ex-im+t_H-t_F|}\log(t_{Ft}/z_t)
\end{aligned}
$$

Valuation channel in adjustment: definitions (2/2)

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$$\Delta nx_t \equiv \frac{ex}{|ex - im + t_H - t_F|}\Delta \log(ex_t/z_t) - \frac{im}{|ex - im + t_H - t_F|}\Delta \log(im_t/z_t) + \frac{ex - im}{|ex - im + t_H - t_F|}\left(\sigma^z \hat{\epsilon}^z_t + \hat{\varphi}_t\right)$$

$$\Delta t_t \equiv \frac{t_H}{|ex - im + t_H - t_F|}\Delta \log(t_{Ht}/z_t) - \frac{t_F}{|ex - im + t_H - t_F|}\Delta \log(t_{Ft}/z_t) + \frac{t_H - t_F}{|ex - im + t_H - t_F|}\left(\sigma^z \hat{\epsilon}^z_t + \hat{\varphi}_t\right)$$

$$r^{nfa}_t \equiv \frac{b_H}{|a - l|} r_t + \frac{q^{-1} b_F}{|a - l|}\left(r^*_t - \Delta \log q_t\right) + \frac{k - \kappa}{|a - l|}\left(r^k_t - \varphi_t\right)$$

Valuation channel in adjustment: decomposition

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- Can decompose variance of nxa_t:

$$
\begin{aligned}
1 &= \frac{Cov(nxa_t, nxa_t)}{Var(nxa_t)}, \\
&= \frac{Cov(-\sum_{\tau=1}^{\infty} \rho^{\tau-1}\mathbb{E}_t \Delta nx_{t+\tau}, nxa_t)}{Var(nxa_t)} \\
&\quad \left.+ \frac{Cov(-\sum_{\tau=1}^{\infty} \rho^{\tau-1}\mathbb{E}_t r^{nfa}_{t+\tau}, nxa_t)}{Var(nxa_t)} \right\}\beta_r \\
&\quad + \frac{Cov(-\sum_{\tau=1}^{\infty} \rho^{\tau-1}\mathbb{E}_t \Delta t_{t+\tau}, nxa_t)}{Var(nxa_t)}
\end{aligned}
$$

Estimating effects of monetary policy shocks

Back

- U.S. structural VAR + external IV:
  - Four-lags, 1/95-11/16
  - IV: 3-mo ahead FF futures surprises in Jarocinski-Karadi (19)
- Euro area structural VAR + external IV:
  - Four-lags, 1/99-11/16
  - IV: timing factor in Altavilla et al (19) $\times$ Stoxx 50e resp.
- Campbell-Shiller (88) decompositions of return innovations

Effects of a U.S. monetary policy easing

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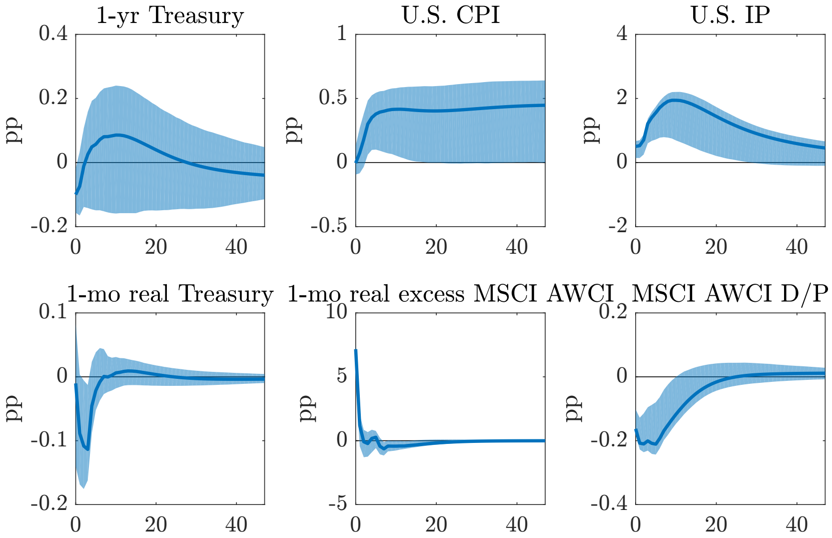
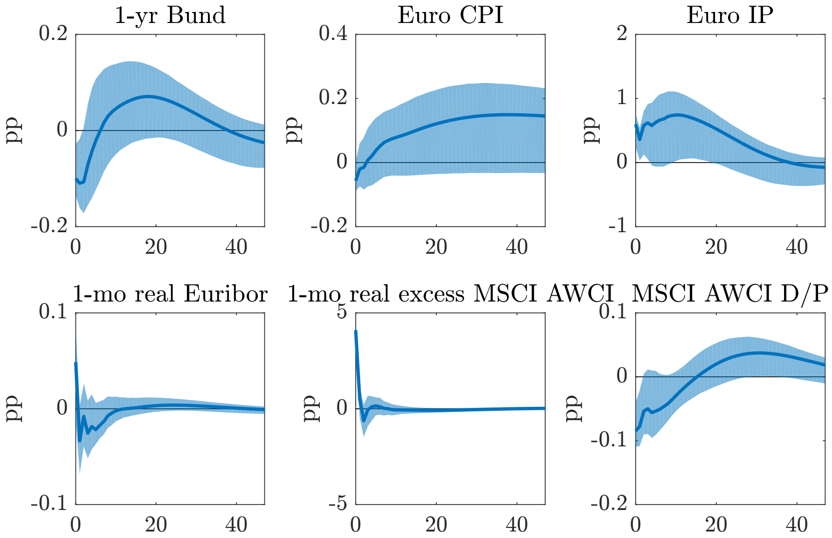


Effects of a Euro area monetary policy easing

Back



Campbell-Shiller decompositions

Back

- Decomposition of U.S. monetary policy shock:

$$r_t^e - \mathbb{E}_{t-1} r_t^e = (\mathbb{E}_t - \mathbb{E}_{t-1}) \sum_{j=0}^{\infty} \kappa^j \Delta \log d_{t+j}^e$$
$$- (\mathbb{E}_t - \mathbb{E}_{t-1}) \sum_{j=1}^{\infty} \kappa^j r_{t+j} - (\mathbb{E}_t - \mathbb{E}_{t-1}) \sum_{j=1}^{\infty} \kappa^j (r_{t+j}^e - r_{t+j})$$

- Decomposition of Euro area monetary policy shock:

$$\frac{q_t}{q_{t-1}}(1 + r_t^e) - \mathbb{E}_{t-1} \frac{q_t}{q_{t-1}}(1 + r_t^e) = (\mathbb{E}_t - \mathbb{E}_{t-1}) \sum_{j=0}^{\infty} \kappa^j \Delta \log q_{t+j} d_{t+j}^e$$
$$- (\mathbb{E}_t - \mathbb{E}_{t-1}) \sum_{j=1}^{\infty} \kappa^j r_{t+j}^* - (\mathbb{E}_t - \mathbb{E}_{t-1}) \sum_{j=1}^{\infty} \kappa^j \left(\frac{q_{t+j}}{q_{t+j-1}}(1 + r_{t+j}^e) - (1 + r_{t+j}^*) \right)$$

Campbell-Shiller with foreign bond trading

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	Model		No ω	
	Home	Foreign	Home	Foreign
Dividend growth	64%	78%	67%	75%
– Real rates	26%	24%	32%	21%
– Excess returns	10%	-2%	1%	5%

Effects of demand shock for \$ and k

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