Uncertainty Shocks, Capital Flows, and International Risk Spillovers

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Motivation

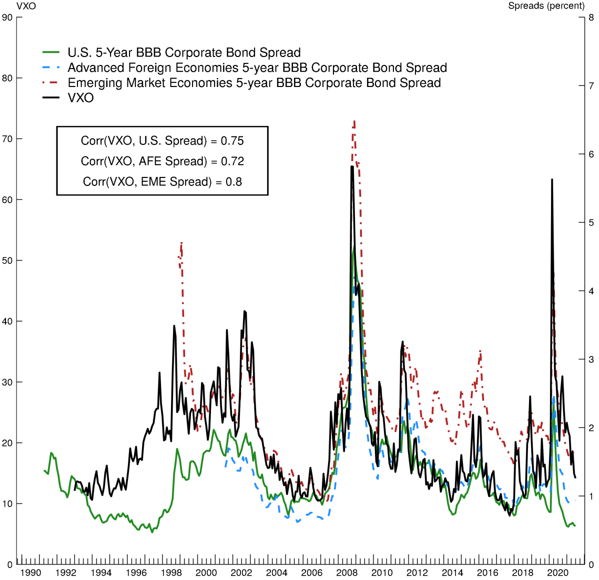
1. Risk sentiment widely seen as playing a central role in macro-finance developments in the global economy

    - Measures of risk aversion and uncertainty strongly related to international risky asset prices (Rey'13; Miranda-Agrippino & Rey'20; Kalemli-Özcan'19)

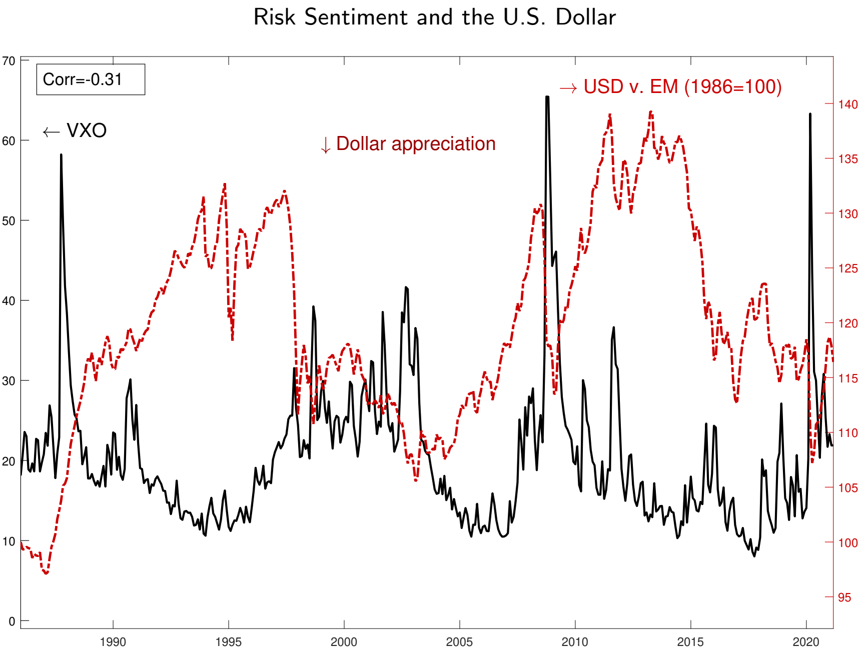
    - Such measures also move together with the USD exchange rate... (Sarno, Schneider, & Wagner'12; Lilley, Maggiori, Neiman, & Schreger'19)

    - ...and with UIP premia and capital flows (Kalemli-Ozcan'19; di Giovanni, Kalemli-Ozcan, Ulu, Baskaya'20; Kalemli-Ozcan & Varela'21)

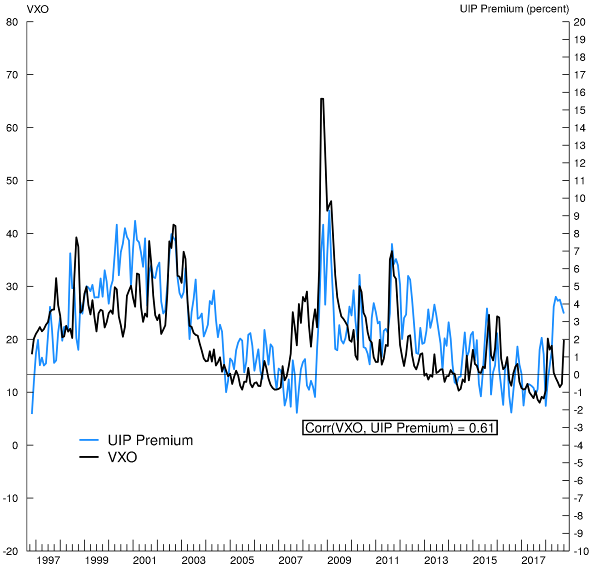
Risk Sentiment and International Corporate Bond Spreads



Source: ICE Data Indices


Risk Sentiment and the U.S. Dollar
Corr=-0.31
← VXO
↓ Dollar appreciation
→ USD v. EM (1986=100)
0
10
20
30
40
50
60
70
95
100
105
110
115
120
125
130
135
140
1990
1995
2000
2005
2010
2015
2020

Risk Sentiment and UIP Premia



Risk Sentiment and Capital Flows

Dependent Variable:	Capital Inflows/GDP$_{c,t}$	
	Emerging Market Economies	Advanced Economies
$\log(\text{VIX})_t$	-0.03***	-0.07***
	(0.01)	(0.02)
Number of Observations	1838	930
Country FE	yes	yes

Notes: Reproduced from Kalemli-Ozcan (2019). Panel regression with country fixed effects for sample including 46 EMEs and 13 AEs from 1996q1 to 2018q4. Other controls: interest rate differentials, growth differentials. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Motivation (cont'd)

2. Large theoretical literature on the effects of uncertainty shocks, focused mostly on closed economies (Bloom'09; Basu & Bundick'17)

3. No framework to date for studying cross-border effects of fluctuations in uncertainty $\Rightarrow$ No model to address GFC facts

What We Do

- Tractable two-country **one-good** exchange economy (Lucas'78)
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  - Only intermediaries can actively trade across borders
  - Face **time-varying uncertainty** in prospective returns on home trees
- Two-country, **two-good** (home / foreign) real economy
  - Home intermediaries hold foreign-currency-denominated gov. bonds
  - Endogenous real exchange rate and UIP wedge

Findings

1. Large effects of uncertainty shocks due to intermediaries' constraint
   - Value of internal funds countercyclical $\rightarrow$ intermediaries very risk averse
   - More-uncertain prospects create deleveraging pressure on intermediaries
2. With financial integration, U.S. uncertainty transmits nearly one-for-one to foreign asset values and risk premia
   - Intermediaries' optimal portfolio implies tight link between home and foreign asset values
3. Higher U.S. uncertainty leads to dollar appreciation, higher UIP premia on foreign currency, and foreign outflows, consistent with the empirical facts
4. Magnitudes also consistent with the empirical evidence

Literature

- Empirical literature on the effects of risk sentiment
  - Bekaert et al.'13, Rey'15, Bruno & Shin'15, Du et al' 18, Morais et al.'19, Kalemli-Ozcan'19, Miranda-Agrippino & Rey'20, di Giovanni et al.' 21, Jiang et al.'21, Degasperi et al.'21
- Macro Models with segmented markets and/or financial frictions
  - Dedola & Giovanni'12, Gabaix & Maggiori'15, Perri & Quadrini'18, Itskhoki & Mukhin'20, Gertler & Kiyotaki'10 , Basu et al.'20
- Intermediary Asset Pricing
  - He & Krishnamurthy'13, Adrian & Shin'14, He et al.'17
- Uncertainty shocks in macro models
  - Bloom'09, Basu & Bundick'17, Bloom et al.'18, Arellano et al.'19, Basu et al.'21

Open Lucas Tree Economy with Constrained Intermediaries

- Two countries: **Home** (United States) and **Foreign** (EM, denoted *)

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- Home capital productivity, Z_t, subject to time-varying volatility:

$$Z_t = (1-\rho_z) + \rho_z Z_{t-1} + \sigma_{zt-1}\varepsilon_{zt}$$
$$\sigma_{zt} = (1-\rho_\sigma)\overline{\sigma}_z + \rho_\sigma \sigma_{zt-1} + \underbrace{\varepsilon_{\sigma t}}_{\downarrow}$$

uncertainty shock

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- Foreign economy similar, except they only hold local risky assets

$$Z_t^* = (1-\rho_z) + \rho_z Z_{t-1}^* + \overline{\sigma}_z \varepsilon_{zt}^*, \quad \varepsilon_{zt}^* \sim iid$$

Financial Intermediaries

- Banker i uses net worth N_{it} and borrowed funds D_{it} to purchase shares on productive assets at home, K_{it}, and abroad, K_{Fit}:

$$Q_t K_{it} + Q_t^* K_{Fit} = D_{it} + N_{it}$$

where Q_t (Q_t^*) = price of claims on home (foreign) capital

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- Net worth evolves as

$$N_{it} = (\underbrace{R_{kt}}_{\equiv \frac{Z_t + Q_t}{Q_{t-1}}} - R_{t-1}) Q_{t-1} K_{it-1} + (\underbrace{R_{kt}^*}_{\equiv \frac{Z_t^* + Q_t^*}{Q_{t-1}^*}} - R_{t-1}) Q_{t-1}^* K_{Fit-1} + R_{t-1} N_{it-1} \tag{1}$$

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- Incentive compatibility constraint:

$$V_{it} \geq \theta (Q_t K_{it} + Q_t^* K_{Fit}) \quad (2)$$

- Banker solves

$$V_{it} = \max_{K_{it}, K_{Fit}, D_{it}} E_t \underbrace{\Lambda_{t+1}}_{\text{household SDF}} [(1-\sigma) N_{it+1} + \sigma V_{it+1}]$$

subject to (1) and (2)

Financial Intermediaries: Key Elements

- Use "augmented" discount factor Ω_{t+1} to value payoffs:
  - $\Omega_{t+1} = \Lambda_{t+1}(1 - \sigma + \sigma\Psi_{t+1})$
  - $\Psi_{t+1} \geq 1$ is the marginal value of net worth, volatile & countercyclical

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$$\phi_t \equiv \frac{Q_t K_{it} + Q_t^* K_{Fit}}{N_{it}} \leq \overline{\phi}_t \equiv \frac{E_t(\Omega_{t+1})R_t}{\theta - E_t[\Omega_{t+1}(\frac{Z_{t+1}+Q_{t+1}}{Q_t} - R_t)]}$$

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- $\overline{\phi}_t$ decreasing in $Cov_t(\Omega_{t+1}, Z_{t+1} + Q_{t+1}) \rightarrow$ higher uncertainty lowers $\overline{\phi}_t$

- Optimal portfolio condition:

$$E_t(\Omega_{t+1}R^*_{kt+1}) = E_t(\Omega_{t+1}R_{kt+1})$$

Market Clearing

- Capital market clearing:

$$K_t = 1$$
$$K_{Ft} + K_{Ft}^* = 1$$

- Aggregate resource constraint for the U.S:

$$C_t + Q_t^* \Delta K_{Ft} = Z_t + Z_t^* K_{Ft-1}$$

- Aggregate resource constraint for the foreign country:

$$C_t^* + Q_t^* \Delta K_{Ft}^* = Z_t^* K_{Ft-1}^*$$

- $\rightarrow$ World resource constraint:

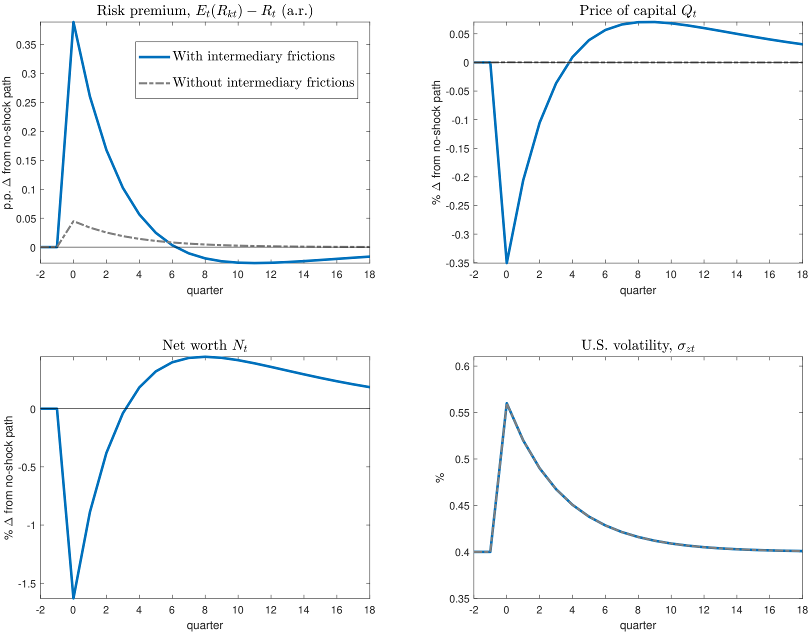
$$C_t + C_t^* = Z_t + Z_t^*$$

Table: Parameter Values

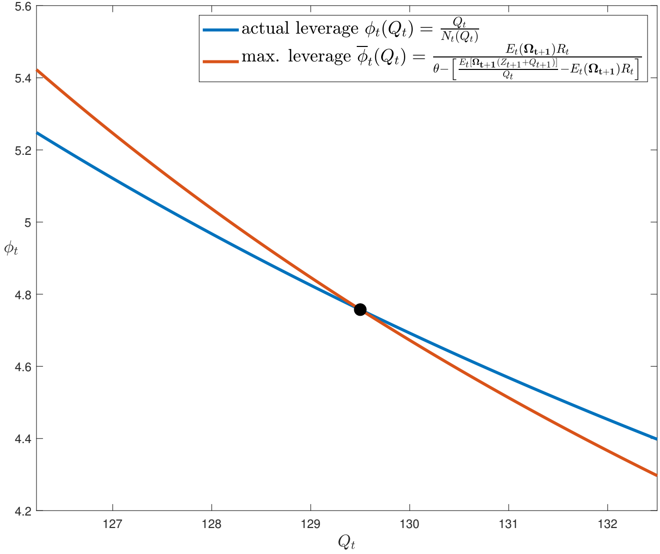
Parameter	Description	Value	Source/Target
ϱ	Risk aversion	3	
β	Discount factor	0.995	Basu & Bundick'17
σ	Survival rate of bankers	0.97	Gertler & Karadi'11
ξ	Transfer to entering bankers	0.09	Lev. = 5 (assets/equity)
θ	Frac. of capital that can be diverted	0.34	Spread = 1 p.p. per year
ω	Home bias (two-good model)	0.95	
ρ_σ	Persistence of uncertainty shock	0.75	Basu & Bundick'17
$\overline{\sigma}_z$	Average SD of productivity shock	0.004	Basu & Bundick'17
ρ_z	Persistence of productivity shock	0.90	

Dynamic Effects of Uncertainty Shock: Autarky

Dynamic effects of uncertainty shock in autarky



Effects of higher uncertainty on equilibrium price Q_t and leverage ϕ_t



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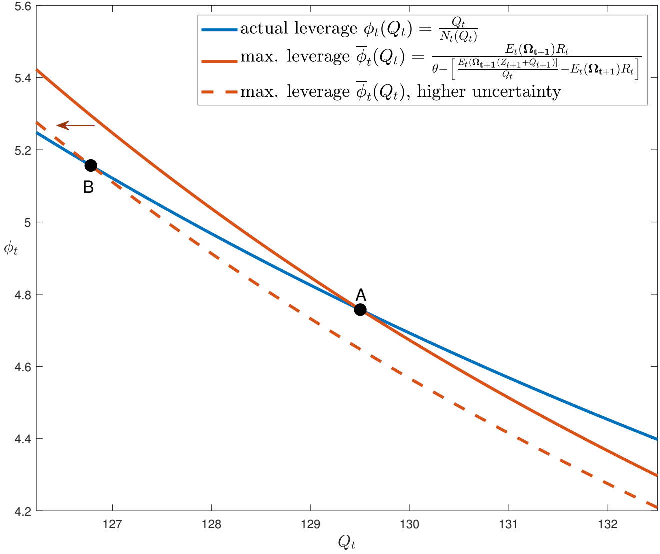


Constrained Intermediaries and the Risk Premium

- With intermediary frictions:

$$E_t(R_{kt+1}) - R_t = \frac{Cov_t(\Omega_{t+1}, -R_{kt+1}) + \theta}{E_t(\Omega_{t+1})} - \phi_t^{-1} R_t$$

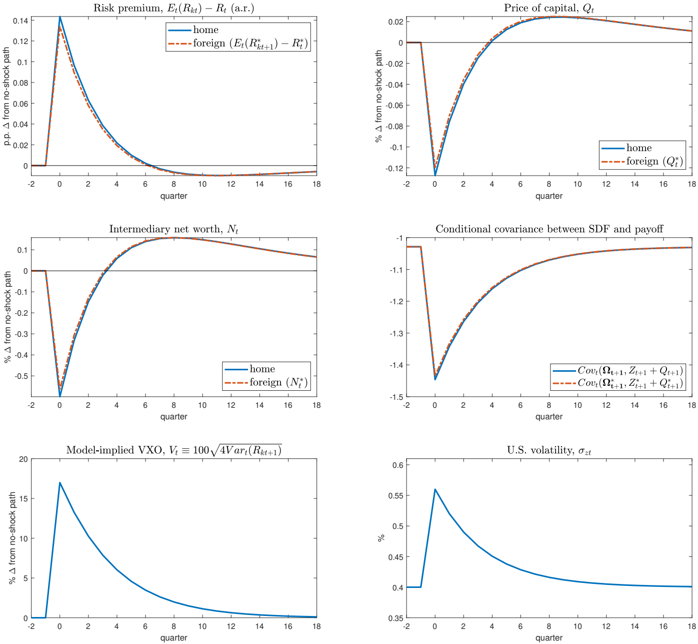
- Without intermediary frictions:

$$E_t(R_{kt+1}) - R_t = \frac{Cov_t(\Lambda_{t+1}, -R_{kt+1})}{E_t(\Lambda_{t+1})}$$

- $Cov_t(\Omega_{t+1}, -R_{kt+1}) \gg Cov_t(\Lambda_{t+1}, -R_{kt+1})$, & more elastic to uncertainty

Dynamic Effects of Uncertainty Shock under Financial Integration

Dynamic effects of uncertainty shock with financial integration



Arbitrage by global banks equalizes asset prices

Banks' arbitrage between home and foreign capital:

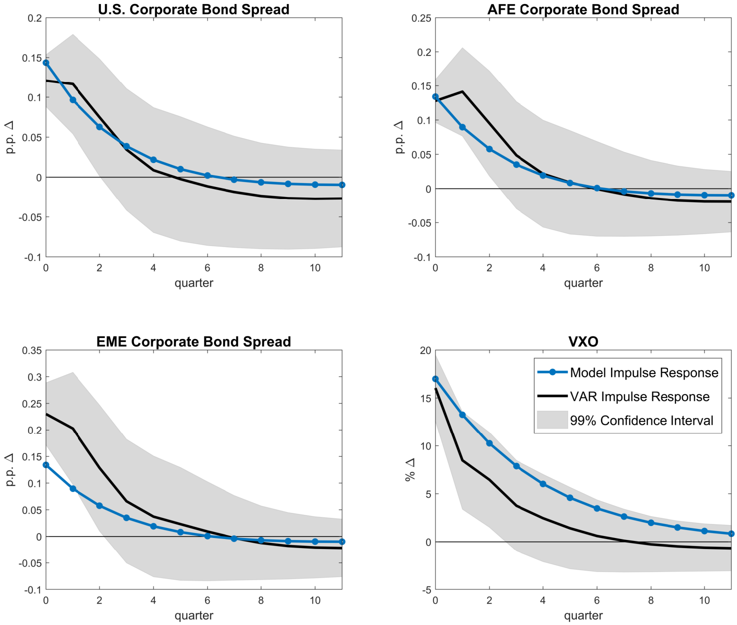
$$\mathbb{E}_t(\Omega_{t+1} \underbrace{R_{kt+1}}_{\frac{Z_{t+1}+Q_{t+1}}{Q_t}}) = \mathbb{E}_t(\Omega_{t+1} \underbrace{R^*_{kt+1}}_{\frac{Z^*_{t+1}+Q^*_{t+1}}{Q^*_t}})$$

$\longrightarrow$ tight link between Q_t and Q_t^*

- More-uncertain Z_{t+i} $\longrightarrow$ both Q_{t+i} and Q^*_{t+i} become more uncertain
- Risk sharing: financial accelerator weakens compared with autarky
  - Autarky: $\downarrow N_t \rightarrow \downarrow Q_t \rightarrow \downarrow N_t$
  - Integration: Q_t^* additional margin of adjustment from weaker N_t

Model policy functions

Effects of uncertainty shock on global credit spreads, VAR v. model



Taking Stock

- Substantial effects of uncertainty shocks largely due to the financial constraint
- With financial integration, uncertainty shocks transmit one-for-one across borders...
- ...but have smaller effects than under autarky

Uncertainty Shocks and Exchange Rates

Two-good Economy with Foreign Government Bond (B^*)

- Two differentiated goods: **Home-produced** (C_{Ht}) and **Foreign** (C_{Ft})

$$C_t = \left(\frac{C_{Ht}}{\omega}\right)^{\omega} \left(\frac{C_{Ft}}{1-\omega}\right)^{(1-\omega)}$$

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- Home intermediaries' balance sheet identity:

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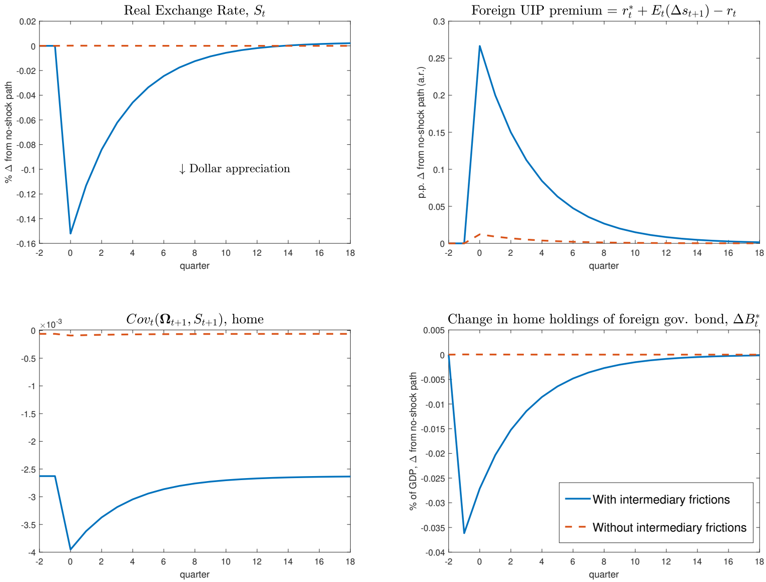
- Assume B^*_{it} *not* subject to incentive problem: constraint is $V_{it} \geq \theta Q_t K_{it}$

  $\longrightarrow$ no limits to arbitrage in B^*_{it}:

$$E_t[\Omega_{t+1}(\frac{\mathcal{S}_{t+1} R^*_t}{\mathcal{S}_t} - R_t)] = 0$$

  $\Omega_{\mathrm{t+1}} \equiv$ *U.S. intermediaries'* SDF

Exchange rate model, effects of increase in U.S. uncertainty



Role of intermediary friction in UIP premium

- UIP premium on the foreign currency:

$$\frac{E_t(\mathcal{S}_{t+1})R_t^*}{\mathcal{S}_t R_t} = \frac{-Cov_t(\Omega_{t+1}, \mathcal{S}_{t+1})\frac{R_t^*}{\mathcal{S}_t R_t}}{E_t(\Omega_{t+1})} + 1$$

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- $Cov_t(\Omega_{t+1}, \mathcal{S}_{t+1}) \ll 0$ & more elastic to σ_{zt} than $Cov_t(\Lambda_{t+1}, \mathcal{S}_{t+1})$
  - Z low $\rightarrow$ constraint tight (Ω large) & $\mathcal{S}$ low (\$ strong); viceversa if Z high
  - Value of net worth Ψ highly elastic to Z

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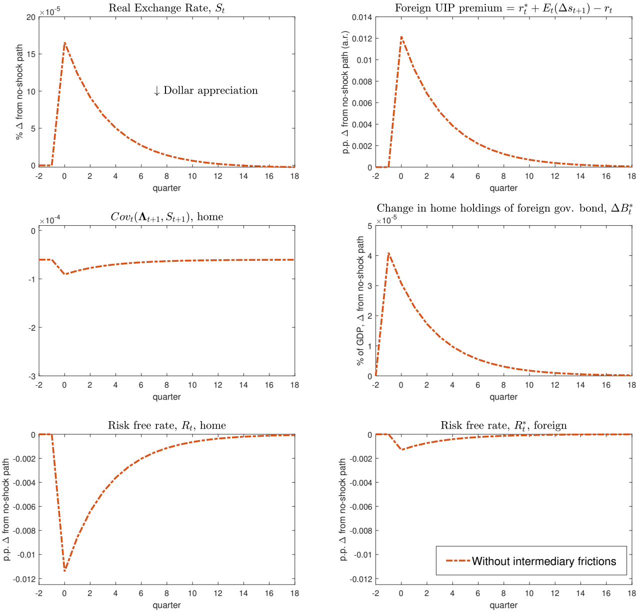
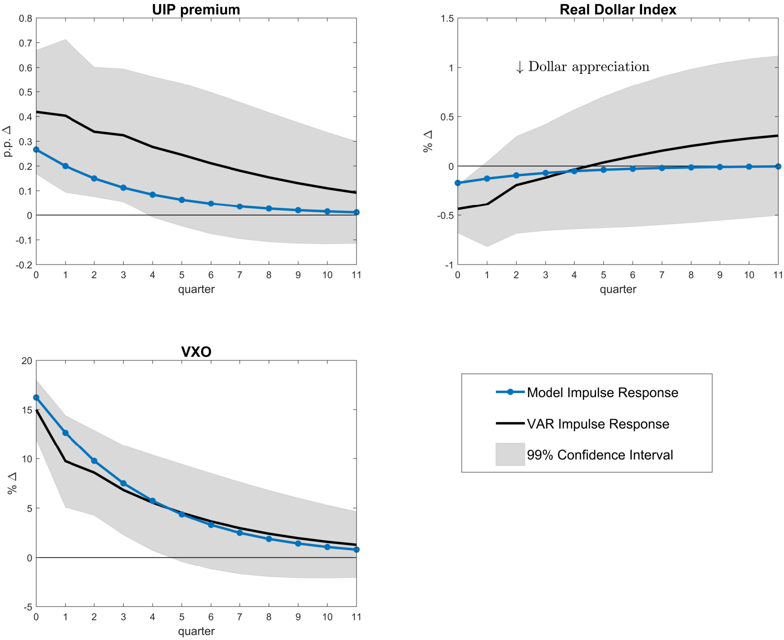
  - Value of net worth Ψ highly elastic to Z
- $\rightarrow$ When σ_{zt} rises, $Cov_t(\Omega_{t+1}, \mathcal{S}_{t+1})$ falls sharply

Effects of increase in U.S. uncertainty without intermediary friction



Effects of higher uncertainty on ER & UIP premium, VAR v. model

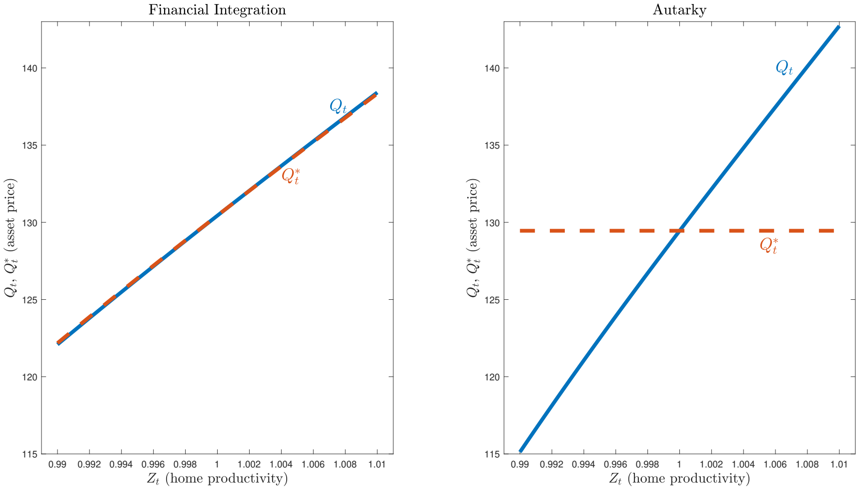


Conclusion

- Open economy w/ constrained intermediaries and time-varying uncertainty
- In a financially-integrated world, higher U.S. uncertainty leads to
  - Global deleveraging pressure
  - Lower global asset prices and higher risk premia
  - Dollar appreciation and wider UIP premia on foreign currencies
- Next steps
  - Use model to shed light on AFE v. EME behavior

APPENDIX

Figure: Model policy functions



back

Table: Model-implied conditional covariances (with constant uncertainty)

Variable	Financial Integration	Autarky
$Cov_t(Z_{t+1}, Z^*_{t+1})$	0	0
$Cov_t(Q_{t+1}, Q^*_{t+1})$	14.26	0
$Cov_t(\Omega_{t+1}, Q_{t+1} + Z_{t+1})$	-0.72	-1.44
$Cov_t(\Omega_{t+1}, Q^*_{t+1} + Z^*_{t+1})$	-0.72	0
$Cov_t(\Omega^*_{t+1}, Q^*_{t+1} + Z^*_{t+1})$	-0.72	-1.44

Figure: Effects of U.S. uncertainty shock in autarky without intermediary frictions

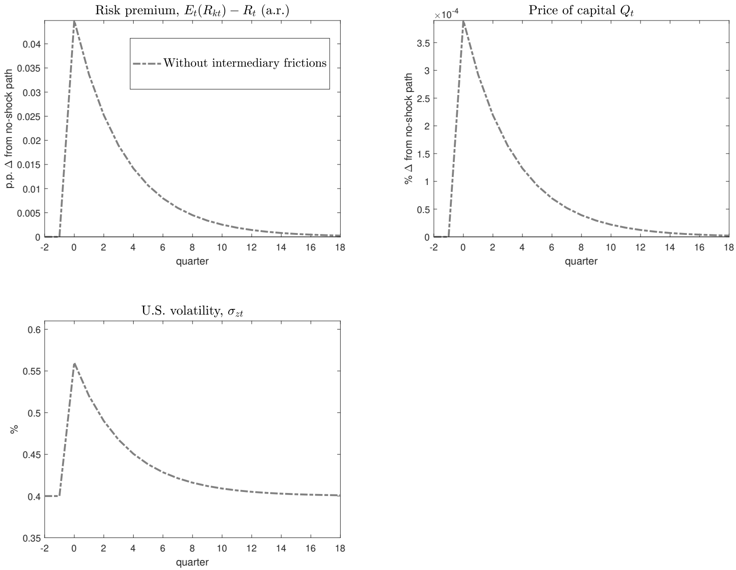


Figure: Effects of U.S. uncertainty shock with financial integration and no intermediary frictions

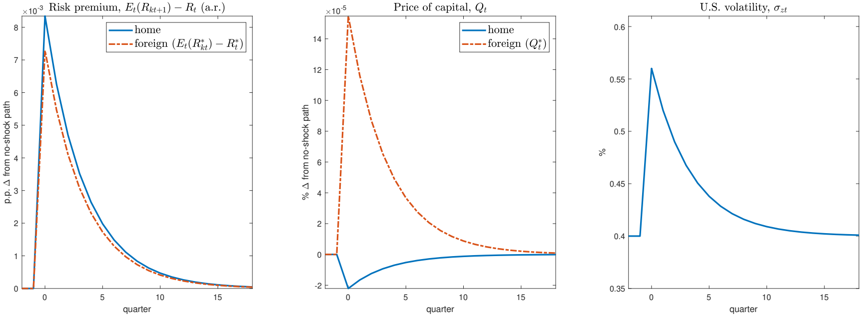


Figure: VAR-predicted effects of uncertainty shock on credit spreads

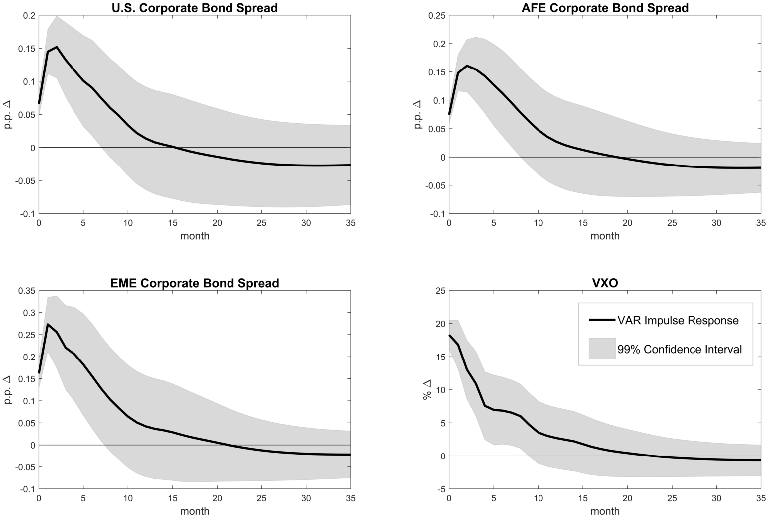


Figure: VAR-predicted effects of uncertainty shock on dollar exchange rates