Global risk and the dollar

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The views stated herein are those of the authors and are not necessarily those of the ECB.
Global risk and the US$: strong co-movement in times of crisis

Global Financial Crisis

![Global Financial Crisis graph]

COVID-19 crisis

![COVID-19 crisis graph]
Research question

When global risk aversion spikes the US$ appreciates

- Prominent examples: Global Financial Crisis, COVID-19 pandemic
- But co-movement also significant in normal times
- Extensive theory (US’s exorbitant privilege/duty, flight-to-US$-safety)
- But little known about role of US$ for transmission of global risk shocks
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Effect of US$ appreciation on RoW ambiguous in theory

▶ **Dampening** through expenditure switching away from US towards RoW goods
▶ **Amplification** through tightening in global financial conditions
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Does the trade channel or the financial channel dominate?
Our paper

Research question

- Does US$ appreciation dampen or amplify effects of global risk shocks on RoW?
Our paper

Research question

▶ Does US$ appreciation dampen or amplify effects of global risk shocks on RoW?

Approach

▶ Estimate Bayesian proxy SVAR on US and RoW data for 1990m1 to 2019m6
  Arias et al. (2021)

▶ Identify global risk shock using gold price changes on narratively selected days
  Bloom (2009); Piffer & Podstawski (2018)

▶ Counterfactual analysis using minimum relative entropy methods
  Robertson et al. (2005); Cogley et al. (2005); Giacomini & Ragusa (2014)

▶ Policy experiment using structural shock counterfactual (SSC)
  Antolin-Diaz et al. (2021); Kilian & Lewis (2011); Bachmann & Sims (2012)

Findings

▶ Global risk shock induces US$ appreciation, a rise in risk aversion and a global recession

▶ As predicted by theory US net exports and global cross-border bank credit contract

▶ In counterfactual absence of US$ appreciation global recession is alleviated

▶ Hence financial channel dominates trade channel
Our paper

Research question
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Bayesian proxy SVAR of Arias et al. (2021)

Structural shocks in the VAR $A(L)y_t = \epsilon_t$ are

\[ \epsilon_t = \begin{bmatrix} \epsilon^*_t \\ \epsilon^o_t \end{bmatrix} \] (1)
Bayesian proxy SVAR of Arias et al. (2021)

Structural shocks in the VAR $A(L)y_t = \epsilon_t$ are

$$\epsilon_t = \begin{bmatrix} \epsilon_{t}^* & \epsilon_{t}^{o'} \end{bmatrix}'$$

Identifying assumptions with proxy variables $m_t$

$$E[m_t\epsilon_{t}^{*'}] = V, \quad E[m_t\epsilon_{t}^{o'}] = 0$$
Bayesian proxy SVAR of Arias et al. (2021)

Structural shocks in the VAR $\mathbf{A}(L)\mathbf{y}_t = \mathbf{e}_t$ are

$$\mathbf{e}_t = \begin{bmatrix} \mathbf{e}^{*'}_t & \mathbf{e}^{o'}_t \end{bmatrix}'$$

(1)

Identifying assumptions with proxy variables $m_t$

$$E[m_t\mathbf{e}^{*'}_t] = \mathbf{V}, \quad E[m_t\mathbf{e}^{o'}_t] = \mathbf{0}$$

(2)

Subject to Equation (2) estimate ‘augmented VAR’

$$\tilde{\mathbf{A}}(L) \begin{bmatrix} \mathbf{y}_t \\ m_t \end{bmatrix} = \begin{bmatrix} \mathbf{e}_t \\ \nu_t \end{bmatrix}$$

(3)
Bayesian proxy SVAR of Arias et al. (2021)

Structural shocks in the VAR $A(L)y_t = \epsilon_t$ are

$$\epsilon_t = [\epsilon_t^s' \quad \epsilon_t^o']'$$  \hspace{1cm} (1)

Identifying assumptions with proxy variables $m_t$

$$E[m_t\epsilon_t^s] = V, \quad E[m_t\epsilon_t^o] = 0$$  \hspace{1cm} (2)

Subject to Equation (2) estimate ‘augmented VAR’

$$\tilde{A}(L) \begin{bmatrix} y_t \\ m_t \end{bmatrix} = \begin{bmatrix} \epsilon_t \\ \nu_t \end{bmatrix}$$  \hspace{1cm} (3)

Pros: (i) joint estimation/identification improves efficiency, (ii) allows coherent inference, (iii) accommodates weak instruments, (iv) can be extended to identification of multiple structural shocks with multiple proxies and sign/zero restrictions
VAR specification and estimation

**Specification**

- Augment by: RoW industrial production, VXO, RoW policy rates, and US$ NEER
- For counterfactuals: US exports and imports, global cross-border bank credit
- Risk shock proxy $m_{1,t}$: HF gold price changes on narratively selected days
  - Bloom (2009); Piffer & Podstawski (2018)
- US MP shock proxy $m_{2,t}$: HF interest rates changes around FOMC meetings
  - Gertler & Karadi (2015); Jarociński & Karadi (2020)

**Estimation**

- Sample: 1990m2 to 2019m6
- Flat priors on VAR parameters
- Relevance threshold: 10% of proxy variable variance accounted for by global risk shock
  - Caldara & Herbst (2019); Arias et al. (2021)
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Effect of global risk shock

- **VXO**
- **US-IP**
- **US-NEER**
- **RoW-IP**
Baseline results

Global risk shock induces

▶ Increase in VXO and US$ appreciation

▶ Synchronised contraction in US and RoW real activity
Baseline results

Global risk shock induces

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Sensitivity/extensions

▶ Global demand shock vs global risk shock ▶ IRFs

▶ Large VAR ▶ IRFs

  Giannone et al. (2015)

▶ Allow gold price surprises to be correlated with all structural shocks ▶ IRFs

▶ Effects on price and quantity of risk ▶ IRFs

  Bekaert & Hoerova (2014)

▶ Other currencies’ responses ▶ IRFs
Refresher on trade and financial channel

**Trade channel**
Obstfeld & Rogoff (1996); Gopinath et al. (2020)

- US$ appreciation makes RoW goods cheaper relative to US goods
- Expenditure switching away from US towards RoW goods
- US imports from RoW rise, US exports to RoW fall
- US net exports fall, RoW net exports rise
- **Dampens** effects of global risk shocks on RoW

**Financial channel**
Bruno & Shin (2015); Aoki et al. (2018); Akinci & Queralto (2019); Bruno & Shin (2019); Mimir & Sunel (2019)

- RoW agents borrow in foreign currency
- US$ appreciation reduces RoW borrowers' net worth and makes them more risky
- International banks operating under VaR constraints reduce cross-border lending
- US$ appreciation associated with tightening in RoW financial conditions
- **Amplifies** effects of global risk shocks on RoW
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Effects of global risk shock on trade and cross-border credit

Note: “Cross-border bank credit” excludes credit to the US. The data are taken from the BIS Locational Banking Statistics Table A7, and the variable is calculated as “External liabilities to all sectors of all reporting banks” less “External liabilities to all sectors of banks owned by US nationals”.
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What if the US$ did not appreciate?

How to assess the overall effect of US$ appreciation?

- Compare baseline IRFs to ‘no-US$ appreciation’ counterfactual
- Apply ‘minimum relative entropy’ (MRE) approach in context of IRFs

Robertson et al. (2005); Cogley et al. (2005); Giacomini & Ragusa (2014)
What if the US$ did not appreciate?

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Intuition for MRE

▶ Seek counterfactual VAR in which global risk shock does not appreciate US$
▶ Disciplined by counterfactual VAR being ‘minimally different’ from actual VAR
▶ Corresponds to minimal ‘tilt’ of posterior of impulse responses
▶ Agnostic regarding structural forces that prevent US$ appreciation
Effect of global risk shock \(\text{w} \setminus \text{o \ US\$ appreciation}\)

**Introduction**
- Bayesian proxy SVAR model
- Baseline IRFs to a global risk shock
- What if the US\$ did not appreciate?
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**Conclusion**

**References**
Effect of global risk shock \textit{w\o} US$ appreciation

\begin{itemize}
\item \textbf{Introduction}
\item Bayesian proxy SVAR model
\item Baseline IRFs to a global risk shock
\item What if the US$ did not appreciate?
\item What if US MP stabilized the US$?
\item Conclusion
\item References
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\textbf{US Real Exports}

\textbf{US Real Imports}

\textbf{Cross-border bank credit}
Effect of global risk shock w/o US$ appreciation

In the ‘no-US$ appreciation’ counterfactual

- US net exports fall by less, amplifying contractionary effects on RoW
- Cross-border bank credit falls by less, dampening contractionary effects on RoW
- RoW real activity contraction estimated to be dampened overall
Effect of global risk shock \textit{w/o} US$ appreciation

In the ‘no-US$ appreciation’ counterfactual

\begin{itemize}
  \item US net exports fall by less, \textit{amplifying contractionary} effects on RoW
  \item Cross-border bank credit falls by less, \textit{dampening contractionary} effects on RoW
  \item RoW real activity contraction estimated to be \textit{dampened} overall
\end{itemize}

Key implication

\begin{itemize}
  \item US$ appreciation overall \textit{amplifies} contractionary effects of global risk shocks
  \item \textit{Financial channel} dominates \textit{trade channel}
\end{itemize}
Effect of global risk shock \(\text{w} \text{o US$ appreciation}\)

In the ‘no-US$ appreciation’ counterfactual
▶ US net exports fall by less, **amplifying contractionary** effects on RoW
▶ Cross-border bank credit falls by less, **dampening contractionary** effects on RoW
▶ RoW real activity contraction estimated to be **dampened** overall

**Key implication**
▶ US$ appreciation overall **amplifies** contractionary effects of global risk shocks
▶ **Financial channel** dominates **trade channel**

**Additional analyses in the paper**
- FX valuation effects?
- US$ FX is special
- US$ credit is special
- Robustness to SSA approach
- Role for US monetary policy?
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Use simultaneously identified US monetary policy shock
Gertler & Karadi (2015); Caldara & Herbst (2019); Jarociński & Karadi (2020); Miranda-Agrippino & Ricco (forthcoming)

Adopt structural shock counterfactual/structural scenario analysis approach
Bachmann & Sims (2012); Kilian & Lewis (2011); Wong (2015); Epstein et al. (2019)

In contrast to the MRE, SSC leaves the posterior of IRFs unchanged but changes the distribution of shocks to construct counterfactual scenario.

Along the impulse horizon, every period a US MP shock materialises such that US$ is stabilised
Effect of US monetary policy shock
What if US monetary policy stabilised US$?

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What if US monetary policy stabilised US$?

In a counterfactual in which US monetary policy steps in to stabilise US$

- US monetary policy loosened significantly more compared to past regularities
- Risk measures stabilised
- Global recession mitigated considerably
- But US consumer prices rise
- Fed’s reluctance may be due to trade-off between output and price stabilisation
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Global risk shocks have large effects on the global economy

- Induce US$ appreciation, a rise in risk aversion and a global recession
- US net exports and global cross-border bank credit contract

Does US$ appreciation dampen or amplify the effects of global risk shocks?

- Financial channel dominates trade channel
- Contraction in RoW real activity about 1/3 smaller without US$ appreciation
- US monetary policy could stabilise US$ and mitigate substantially global contraction

The US$ exchange rate and US$ cross-border bank credit play a unique role


Global risk shock vs global demand shock

Baseline: Global risk shock

Global demand shock
Baseline vs large VAR with optimal hyperpriors (Giannone et al., 2015)

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Allow gold price surprises to be correlated with all structural shocks
IRFs of the quantity and price of risk

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Effect of global risk shock: Other currencies

CHF NEER

JPY NEER

EUR NEER

GBP NEER

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Minimum-relative-entropy (MRE) approach

Borrow idea from forecasting literature

▶ Incorporate restrictions from theory to improve forecasts
▶ IRF as forecast $\tilde{y}_{T+h}$ conditional on $\epsilon_{T+1}^u = 1$, all other shocks zero, in short: $\tilde{e}_{T+1,T+h}$

Start from posterior beliefs about effect of risk shock in actual world

$$f(\tilde{y}_{T+h} | Y_T, \tilde{e}_{T+1,T+h})$$

(4)

Then determine posterior belief $f^*$ about effect of risk shock in a counterfactual world

$$\text{Min}_{\psi} \ D(f^* || f) \quad \text{s.t.} \quad \int f^*(\tilde{y}^$)\tilde{y}^$ d\tilde{y}^$ = E(\tilde{y}^$) = 0$$

(5)

$\mathcal{D}(\cdot)$ is Kullback-Leibler divergence between counterfactual and actual posteriors $f^*$ and $f$
Minimum-relative-entropy (MRE) approach

It turns out counterfactual posterior $f^*$ results from updating baseline posterior $f$

$$f^*(\tilde{y}_{T+h}|Y_T, \tilde{e}_{T+1, T+h}, E(\tilde{y}_T^\$)=0) \propto f(\tilde{y}_{T+h}|Y_T, \tilde{e}_{T+1, T+h}) \times \tau(g(y_{T+h}^\$(\psi)))$$ (6)

Solution to

$$\min_\psi D(f^*||f) \quad s.t. \quad \int f^*(\tilde{y}^\$)\tilde{y}^\$d\tilde{y}^\$ = E(\tilde{y}^\$) = 0$$

provides tilt $\tau(\cdot)$ in counterfactual posterior
Is the US$ special? (Absence of) Yen appreciation inconsequential

Other currencies’ responses
Mechanical exchange rate valuation effects in non-US$ credit component?

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US$ special: (Absence of) Yen appreciation inconsequential

Cross-border bank credit in JPY and CHF quantitatively small

...and also financed by insured deposits

Ivashina et al. (2015)
Is US$ cross-border bank credit special?

Bruno & Shin (2015) highlight the effect of variation in borrowers’ riskiness on VaR constraints of globally active banks and their overall cross-border lending.

Ivashina et al. (2015) present a model in which globally active banks cut US$ lending by more than EUR lending in response to a credit quality shock.

Key model features motivated by the data:

▶ US$ lending based on unsecured funding in the US, EUR lending based on secured deposit funding in the EA $\Rightarrow$ **US$ funding more risk-sensitive**

▶ Limited capital in FX swap markets gives rise to CIP deviations $\Rightarrow$ **Cannot perfectly substitute US$ by EUR funding**

Avdjiev et al. (2019) document a ‘triangular’ relationship between (i) a stronger US$, (ii) larger CIP deviations, and (iii) contractions in cross-border US$ bank credit.
Is US$ cross-border bank credit special?

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Effect of global risk shock without dollar appreciation (SSA)
Effect of US monetary policy shock

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