
Discussion by James D. Hamilton
• What happens to capital flows to emerging markets when U.S. interest rates go up?

• Want to distinguish whether U.S. rates went up because of:
  – Stronger U.S. output growth
  – U.S. monetary contraction
• Identify monetary policy effect using both zero restrictions and sign restrictions as in Baumeister and Benati (IJCB, 2013)

• Sign restrictions:
  – U.S. monetary contraction raises 3-year fed funds futures and lowers U.S. inflation and output growth

• Zero restriction:
  – U.S. monetary contraction has no immediate effect on current fed funds rate
\( y_t = (\text{fed funds rate, 36-month futures, } \) \\
U.S. inflation, U.S. ind prod growth, \\
VIX, first PC of emerging mkt cap flows) \\
Step 1: Estimate reduced-form VAR(1) \\
\[ y_t = \hat{\mathbf{c}} + \hat{\Phi} y_{t-1} + \hat{\mathbf{e}}_t \quad t = 1, 2, \ldots, T \] \\
\[ \hat{\Omega} = T^{-1} \sum_{t=1}^{T} \hat{\mathbf{e}}_t \hat{\mathbf{e}}_t' \]
Step 2: Draw $\Omega^{(m)}$ and $\Phi^{(m)}$ from asymptotic distribution of $\hat{\Omega}$ and $\hat{\Phi}$
Step 3: Generate $Q^{(m)}$ from Haar distribution of orthonormal matrices ($Q^{(m)}Q^{(m)'} = I_n$) and propose to interpret $\varepsilon_t^{(m)} = P^{(m)}Q^{(m)}v_t^{(m)}$

for $P^{(m)}P^{(m)'} = \Omega^{(m)}$

$$E(v_t^{(m)}v_t^{(m)'}) = I_n$$

$$\Rightarrow E(\varepsilon_t^{(m)}\varepsilon_t^{(m)'}) = P^{(m)}Q^{(m)}Q^{(m)'}P^{(m)'} = \Omega^{(m)}$$

$$\Rightarrow v_t^{(m)} \text{ is a proposed structural shock perfectly consistent with observed } y_t$$
Step 4: Check if \( \mathbf{P}^{(m)} \mathbf{Q}^{(m)} \) is consistent with sign and zero restrictions.
If yes, keep \( \mathbf{v}_t^{(m)} \) as plausible structural shock.
If no, discard \( \mathbf{v}_t^{(m)} \) and try again.
Retained set \( \mathbf{v}_t^{(m_1)}, \mathbf{v}_t^{(m_2)}, \ldots, \mathbf{v}_t^{(m_D)} \) represent \( D \) plausible structural shocks and 
\[
[\Phi^{(m_i)}]^s \mathbf{P}^{(m_i)} \mathbf{Q}^{(m_i)}
\] a set of \( D \) plausible structural IRFs at horizon \( s \).
Step 2: draw $\Omega^{(m)}$ from $f(\hat{\Omega})$:
randomness comes from sampling uncertainty ($\Omega$ might differ from estimate $\hat{\Omega}$)

Step 3: draw $Q^{(m)}$ from Haar distribution:
randomness comes entirely from researcher’s random number generator
Let’s shut down first effect (fix $\Omega^{(m)} = \hat{\Omega}$ and $\Phi^{(m)} = \hat{\Phi}$ for all $m$), as if we had an infinite sample size $T \rightarrow \infty$ and had no sampling uncertainty. Plot median value of structural IRF from retained draws that satisfy sign restrictions when $\Omega^{(m)} = \hat{\Omega}$ and $\Phi^{(m)} = \hat{\Phi}$ for all $m$. 
Median structural IRFs when there is no sampling uncertainty
Distribution of retained draws for effect on cap flows after 1 period (no sampling uncertainty)

median = -0.41
The Haar distribution amounts to implicit prior belief that some answers are more plausible than others.
• Option 1: If we have no prior information beyond the sign restrictions, we should report the identified set (the boundaries of the set of all retained draws)
Identified set of structural IRFs (no sampling uncertainty)
• Option 2: Acknowledge source of prior information that some answers are more likely than others
  – Unlikely to take the form of Haar distribution
  – Economic examples of how to do this: Baumeister and Hamilton (JME, 2018; AER, 2019)
• Option 3: Bring in additional information (e.g., changes on days of FOMC announcements) as instrument
  – Proxy SVAR (Mertens and Ravn, AER 2013; Stock and Watson, BPEA 2012, Econ J 2018)
  – Additional variable in VAR with zero restrictions (Eul Noh, UCSD 2019)
  – Instrumental variable in VAR with sign restrictions (Lam Nguyen, UCSD 2019)