Discussion of “Uncertainty Shocks in a Model of Effective Demand” by Susanto Basu and Brent Bundick

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Really like the paper.

Model: standard New Keynesian model with:

- flow investment adj. costs, Taylor rule, Epstein-Zin pref.
- shocks: level and **stochastic volatility** to
  - stationary technology shocks ($z_t$)
  - intertemporal preference shocks ($a_t$)

Main findings:

1. Risk shocks can generate comovement (qualitative).
2. Higher risk can generate significant recession (quantitative).
   - Even stronger at the ZLB.

My discussion:

1. Qualitative: Propagation mechanism (“risk shocks as news shocks“)
2. Quantitative: Magnitudes.
Detour: Risk neutral probability distributions

- Markov trans prob. $\pi(s_{t+1}|s_t)$; asset pays $d(s_t)$. Price:

$$p(s_t) = d(s_t) + \beta \sum_{s_{t+1}} \frac{u'[c_{t+1}(s_{t+1})]}{u'(c_t(s_t))} \pi(s_{t+1}|s_t) p(s_{t+1})$$  \hspace{1cm} (1)

- Can rewrite (1) as:

$$p(s_t) = d(s_t) + \frac{1}{R^f_t(s_t)} \sum_{s_{t+1}} \tilde{\pi}(s_{t+1}|s_t) p(s_{t+1})$$

- where

$$\tilde{\pi}(s_{t+1}|s_t) = \frac{u'[c_{t+1}(s_{t+1})] \pi(s_{t+1}|s_t)}{\sum_{s_{t+1}} u'[c_{t+1}(s_{t+1})] \pi(s_{t+1}|s_t)}$$  \hspace{1cm} (2)

- the twisted measure $\tilde{\pi}(s_{t+1}|s_t)$ in (2) is the risk-neutral prob.distrib.
- $\tilde{\pi}(s_{t+1}|s_t)$: more weight on ‘bad’ $s_{t+1}$ than physical prob. $\pi(.)$
Risk neutral prob. and stochastic volatility

- For ex. if \( \text{cov}[p(s_{t+1}), u'(c_{t+1}(s_{t+1}))] < 0 \), then

\[
\tilde{E}_t p(s_{t+1}) < E_t p(s_{t+1})
\]  

(pricing the asset as if it had a lower future mean
larger dispersion in \( s_{t+1} \), stronger mean correction in (3).

- Analytical ex.: find \( R^f_t \) when \( u(c) = \frac{c^{1-\gamma}}{1-\gamma} \), \( \Delta \ln c_{t+1} \sim N(\mu, \sigma_t) \)

\[
\ln R^f_t = -\ln \beta + \gamma \mu - 0.5 \gamma^2 \sigma_t^2
\]  

(find \( \mu_t = \bar{\mu} - 0.5 \gamma (\sigma_t^2 - \bar{\sigma}^2) \), s.t. \( R_t = (4) \) when \( \Delta \ln c_{t+1} \sim N(\mu_t, \bar{\sigma}) \)

\[
\ln R_t = -\ln \beta + \gamma \mu_t - 0.5 \gamma^2 \bar{\sigma}^2
\]  

(if \( \sigma_t \uparrow \): worry more about low \( c_{t+1} \) than higher \( c_{t+1} \)
\rightarrow as if ex-ante expect a lower mean that is not materialized ex-post)
Propagation mechanism of risk shocks in the NK model

- Interested in understanding the effects of risk shocks on decisions.
- Through \( u'(c_{t+1}) \), agents overweigh future low \( z_{t+1} \) and high \( a_{t+1} \)
- Instead of stoch vol

\[
\log z_{t+1} = \rho_z \log z_t + \sigma_z t \varepsilon^z_t \\
\log a_{t+1} = \rho_a \log a_t + \sigma_a t \varepsilon^a_t
\]  

(5)  

(6)  

- take a model with ‘bad’ news shocks that don’t materialize

\[
\tilde{\pi}(s_{t+1}|s_t) : \log z_{t+1} = \rho_z \log z_t + \sigma_z t \varepsilon^z_t - \mu^z_t \\
\tilde{\pi}(s_{t+1}|s_t) : \log a_{t+1} = \rho_a \log a_t + \sigma_a t \varepsilon^a_t + \mu^a_t
\]

- s.t. persistence of \( \mu^z_t, \mu^a_t \) is the same as for the \( \sigma_z, \sigma_a \).
- \( \pi(s_{t+1}|s_t) \) implied by the homoskedastic version of (5) and (6)

- linearization: dec.rules under \( \tilde{\pi} \), realized shocks under \( \pi \).
same parameterization, but here time-separable utility (RA=2).

- a ‘bad news’ that \(a_{t+1}\) is higher by 0.45\% matches almost perfectly the effect of a 80\% increase in volatility of \(a_{t+1}\).
  - 0.45\% : indirectly, from ‘matching’ IRFs
Propagation mechanism of risk shocks is like ‘news not materialized’:

1. **RBC model:** lack of comovement (Christiano, Ilut, Motto and Rostagno, 2008, Jaimovich and Rebelo, 2009)
   - fixes: habit or no wealth effect + inv. adj. costs

2. **Sticky prices or sticky wages (and technology shocks):**
   - Kobayashi and Nutahara, BEJM 2010: role of countercyclical markups with news about $z_{t+1}$

- Can find some level of news that ‘explains’ the qualitative effect
  - but need to solve the nonlinear model to get the quantitative effect

- **Comparison with Knightian uncertainty** (Ilut and Schneider, 2011):
  - higher uncertainty about $s_{t+1}$ still works like ‘news not materialized’
  - there: direct first-order effects on policy rules
  - only need to solve the linearized model
  - estimate a medium-scale DSGE model with uncertainty shocks with standard Kalman filter

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Magnitude of stochastic volatility: VIX

- **VIX**: recovers **expected** realized volatility btw $t$ and $T$ : $E^Q_t \text{Var}_{t,T}$
  - under some risk neutral measure $Q(.)$
  - potentially different than average realized volatility $\overline{\text{Var}}_{t,T}$


\[ E^Q_t \text{Var}_{t,T} > \overline{\text{Var}}_{t,T} \]

  - a ’**variance premium**’: on average $E^Q_t \text{Var}_{t,T} \approx 1.6 \times \overline{\text{Var}}_{t,T}$

- Here Rational Expectations model: on average $E^Q_t \text{Var}_{t,T} = \overline{\text{Var}}_{t,T}$
  - need $\overline{\text{Var}}_{t,T}$ - can scale down $E^Q_t \text{Var}_{t,T}$ by 1.6

- Measurement: time-averaging in computing quarterly VIX.
  - in the calibration average end-of-month VIX into quarterly.
  - what if construct average based on daily VIX ?

\[
\ln V_t = (1 - \rho_V) \ln V + \rho_V \ln V_{t-1} + \sigma_V \varepsilon_{V,t} \]

  - very similar numbers: $\rho_V = 0.84$, $\sigma_V = 0.18$
Stochastic volatility in macro aggregates

- Feed in large stochastic volatility shocks to match endogenous VIX.
  - actually, stoch. volatility in $a_{t+1}$, since we don’t see much in TFP.
  - JP (2008): small $\sigma_{a,t}$ shocks, FGR (2010): large $\sigma_{a,t}$ shocks.
  - existing estimated models ignore dynamic effects on decision rules

- Should be reflected in stochastic volatility of endogenous macro aggregates (output, consumption, investment etc.)

- In the data there seems to be some (hard to find in consumption).
  - larger movements seem to be regime-switching type ("great moderation” and its recent end...)

- But a quantitative question: how much model predicts vs. data?:
  - observed conditional time-variation in volatility
  - unconditional volatility
  - important for authors to check.

- If risk shocks have important effects on decision rules
  → eventually, estimation...