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

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Paper

- 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:

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

- Can rewrite (1) as:

$$p(s_t) = d(s_t) + \frac{1}{R_t^f(s_t)} \sum_{s_{t+1}} \widetilde{\pi}(s_{t+1}|s_t) p(s_{t+1})$$

- where

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

- the twisted measure $\widetilde{\pi}(s_{t+1}|s_t)$ in (2) is the **risk-neutral** prob.distrib.
- $\widetilde{\pi}(s_{t+1}|s_t)$: more weight on 'bad' s_{t+1} than physical prob. $\pi(.)$

Risk neutral prob. and stochastic volatility

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

$$\widetilde{E}_t p(s_{t+1}) < E_t p(s_{t+1}) \tag{3}$$

  - 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_t^f when $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$, $\Delta \ln c_{t+1} \sim N(\overline{\mu}, \sigma_t)$

$$\ln R_t^f = -\ln \beta + \gamma\mu - 0.5\gamma^2\sigma_t^2 \tag{4}$$

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

$$\ln R_t = -\ln \beta + \gamma\mu_t - 0.5\gamma^2\overline{\sigma}^2$$

  - 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

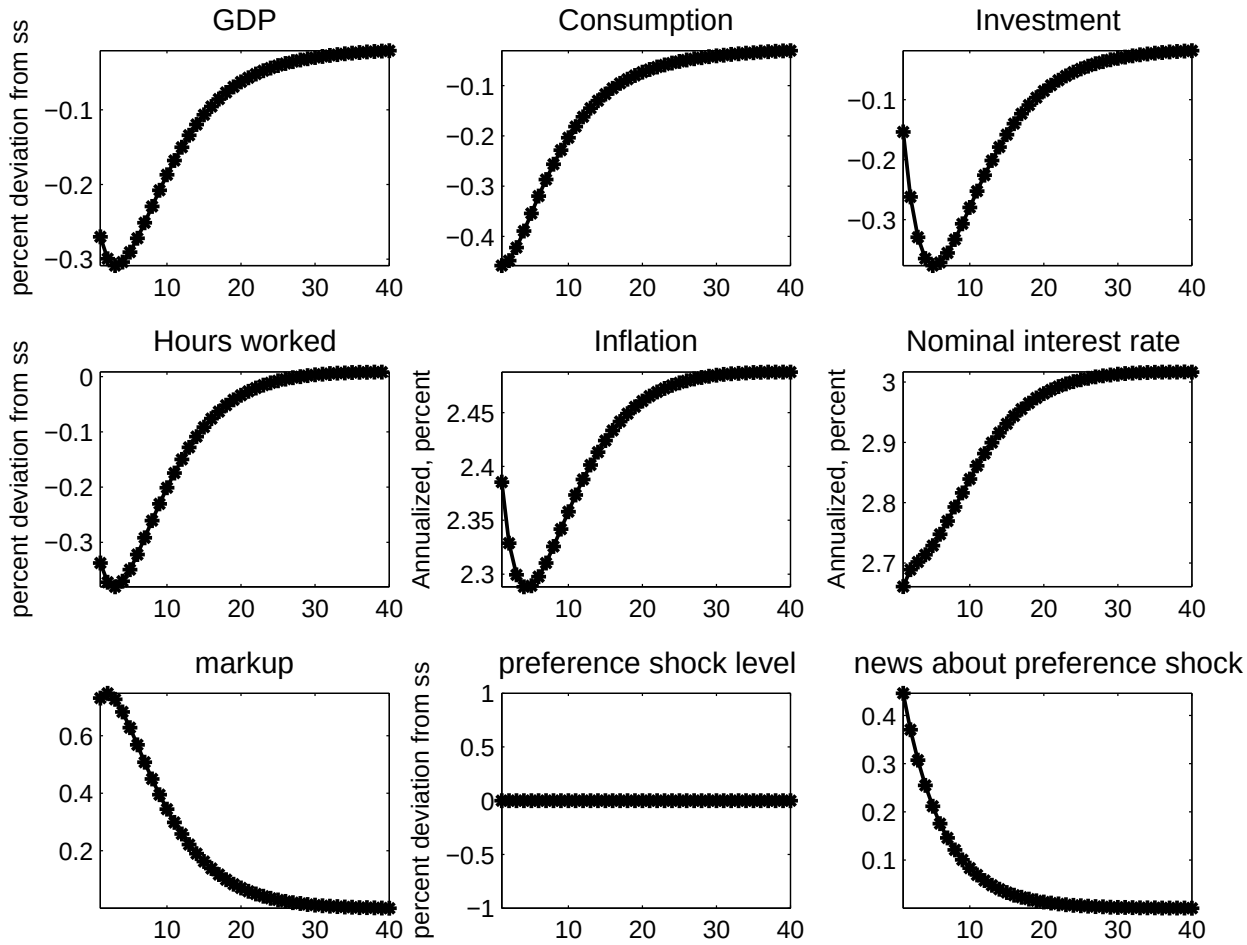
$$\log z_{t+1} = \rho_z \log z_t + \sigma_{z,t}\varepsilon_t^z \tag{5}$$
$$\log a_{t+1} = \rho_a \log a_t + \sigma_{a,t}\varepsilon_t^a \tag{6}$$

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

$$\widetilde{\pi}(s_{t+1}|s_t) : \log z_{t+1} = \rho_z \log z_t + \sigma_z \varepsilon_t^z - \mu_t^z$$
$$\widetilde{\pi}(s_{t+1}|s_t) : \log a_{t+1} = \rho_a \log a_t + \sigma_{a,t}\varepsilon_t^a + \mu_t^a$$

  - s.t. persistence of μ_t^z, μ_t^a is the same as for the $\sigma_{z,t}, \sigma_{a,t}$.
  - $\pi(s_{t+1}|s_t)$ implied by the homoskedastic version of (5) and (6)

- **linearization**: dec.rules under $\widetilde{\pi}$, realized shocks under π.



- 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):
     - CIMR, 2008, 2010: monetary policy + 'news' $\rightarrow$ large inefficient boom-busts in real activity and asset prices
     - 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

Magnitude of stochastic volatility: VIX

- VIX: recovers **expected** realized volatility btw t and T : $E_t^Q Var_{t,T}$
  - under some risk neutral measure $Q(.)$
  - potentially different than average realized volatility $\overline{Var}_{t,T}$
- Empirical finance lit. (ex. Carr and Wu, RFS, 2009) finds

$$E_t^Q Var_{t,T} > \overline{Var}_{t,T}$$

  - a '**variance premium**': on average $E_t^Q Var_{t,T} \approx 1.6 * \overline{Var}_{t,T}$
- Here Rational Expectations model: on average $E_t^Q Var_{t,T} = \overline{Var}_{t,T}$
  - need $\overline{Var}_{t,T}$ - can scale down $E_t^Q Var_{t,T}$ 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
  $\rightarrow$ eventually, estimation...