Risk news shocks and the business cycle

Gabor Pinter [Bank of England]
Kostas Theodoridis [Bank of England]
Tony Yates [U of Bristol; Centre for Macroeconomics]

FRB Dallas conference on ‘The causes and macroeconomic consequences of uncertainty’, 3-4 October, 2013

What we do

- Consider shocks to ‘risk’, and corresponding ‘news’, the objects studied in CMR (2013).
- =changes in variance of cross-section of returns, revelation about future changes
- CMR deployed full information BML estimation of a DSGE model
- We look for the same shock, but using VAR methods

What we do (2)

- ...Using a modification of Barsky-Sims' method (which they used to identify news in future tfp)
- Document contribution of risk+risk news shock to the business cycle
- Fit a DSGE model with credit frictions [SW+BGG] to the IRFs from the VAR

What we find

- Risk+risk news contribute about 20% to fluctuations in output in post WW2 US data
- Contrast (?) with CMR (2013,AER): 60%
- Risk and risk news shocks drove spreads, C, I through the crisis, less so output.
- DSGE model can get near (shape of) IRFs to risk news shock IF we modify it to have rule of thumb consumers as in (eg) GLS (2004)
- Weak DSGE propagation means need larger shocks than in data

What are these risk/news shocks?

- For our paper, the label ‘risk shock’ ...
  - ...has a particular meaning in a DSGE model, eg CMR (2013)
  - ...is an element of a convolution of an estimated reduced form VAR vcov matrix!

What is the risk/risk news shock?

- In a DSGE (Eg SW+BGG, similar to CMR) model
- Entrepreneurs borrow from banks, build capital, get hit by idiosyncratic shock, leading to variance in the amount of effective capital sold on to producers of intermediate goods
- Risk shock is a shock to this variance
- Risk *news* is revelation today about *future* values of this variance

Examples of risk news shocks

- Eg news about climate change
- Increased variance of future temperature
- More extreme local weather possibilities.
- Increased uncertainty about future farming returns
- Before it was ‘who’s going to get the windy shower’
- Now it’s ‘who’s going to get hit by the torrential rain and tornado’

Transformational dialogue for risk news shock sceptics

- Do you believe there is cross-sectional risk?
- OK, yes.
- Do you believe that this cross-sectional risk is fixed for all time?
- OK, no.
- If not, do you believe that information about this cross-sectional risk will only ever be released the instant before the risk is realised, or could it ever arrive before that?
- OK, yes, information could arrive sooner.

Why is the risk news shock interesting?

- Anecdotal: changes in risk and perceptions of risk a central feature of the crisis according to market participants and policymakers
- Facts: prices of risky assets changed a lot during the crisis.

Previous work: news

- Beaudry-Portier (2006)
  - VAR identified using lr res.; tfp mostly news, news explains ½ variance in output; +'ve comovement between c,i,h, contrary to RBC
- Jaimovich and Rebello (2006)
  - Modify RBC by using GHH preferences to turn off wealth effect, reconciling effects of news shock
- Barsky-Sims (2009)
- SGU(2012)
  - RBC + real rigidities, with many news shocks
  - 80% of business cycle var due to tfp

Previous work: financial/risk shocks

- BGG(1999), KM(1997); financial frictions only weakly propagate conventional (eg technology) shocks
- Finance can't therefore explain business cycles
- Financial shocks are a response to this
- CMR's(2013) risk shock. Also CMR(2008), Nolan-Thoenissen(2009), Gertler-Karadi(2011), Fuentes-Albero(2012) and others

We are not considering a*ggregate* uncertainty shocks

- Bloom (2009), Bloom *et al* (2012)
- Baker, Bloom and Davis (?) [economic policy]
- Bekaert *et al* (2012)
- Fernandez-Villaverde *et al* (2011) [fiscal]
- Born and Pfeifer (2011) [fiscal]

Barsky-Sims (2009)

- Construct tfp series from Solow residuals
- News shock to tfp:
  - Orthogonal to tfp_t, contributes maximally to forecast errors up to and including tfp_t+h
- Our paper: take proxy for uncertainty based on options prices and standard deviation of stock returns
  - Risk news shock is orthogonal to risk_t
  - Contributes maximally to risk_t+h
  - Satisfies certain sign restrictions

Identifying the *risk* news shock

$$y_t = B(L)u_t$$

$$u_t = A\varepsilon_t \qquad\qquad AA' = \Sigma$$

$$y_{t+h} - E_{t-1}y_{t+h} = \sum_{\tau=0}^{h} B_\tau \widetilde{A} Q(\omega)\varepsilon_{t+h-\tau}$$

$$\Omega_{i,j}(h) = \frac{e_i'\left(\sum_{\tau=0}^{h} B_\tau \widetilde{A} Q(\omega) e_j e_j' Q(\omega)' \widetilde{A}' B_\tau\right) e_i}{e_i'\left(\sum_{\tau=0}^{h} B_\tau \Sigma B_\tau\right) e_i}$$

Identifying the *risk* news shock(2)

$$\ln\sigma_{\omega,t} = (1-\rho_\sigma)\sigma_\omega + \rho_\sigma \ln\sigma_{\omega,t-1} + \varepsilon_{\sigma_\omega,t} + \varepsilon^{news}_{\sigma_\omega,t-1}.$$

$$\Omega_{1,1}(h) + \Omega_{1,2}(h) = 1$$

$$\omega^* = \arg\max \sum_{h=0}^{H} \Omega_{1,2}(h)$$

Identifying the *risk* news shock (3)

$$\tilde{A}_{\omega} = \tilde{A}Q(\omega)$$

Constraints on the maximum share criterion:

$$\tilde{A}_{\omega}(1,j) = 0, j > 1$$

Contemporaneous orthogonality of the risk proxy to risk news and other shocks

$$sign(S\tilde{A}_{\omega 22}) = F$$

Imposes sign restrictions

‘F’: Sign and zero restrictions in the VAR

	t				t+1			
	news	tech	net w	mpol	news	tech	net w	mpol
risk	0	0	0	0	+			
spread								
GDP growth	-	+	+	-	-	+	+	-
C growth								
I growth								
hours								
r wage growth								
inflation	-	-	+	-	-	-	+	-
policy rate	-	-	+	+	-	-	+	+
net worth growth	-	+	+	-	-	+	+	-

Estimation of VAR

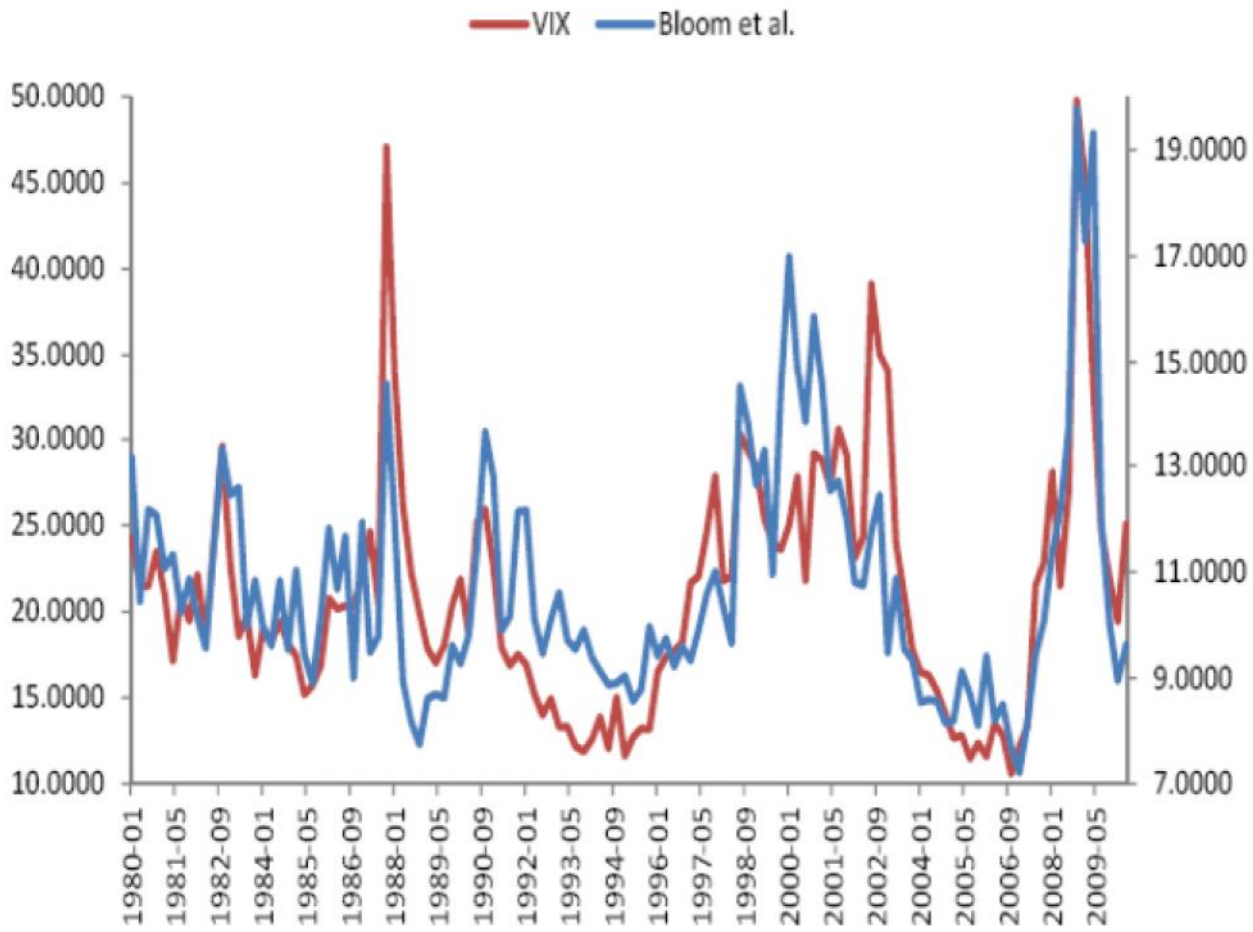
- Bayesian VAR [not just in respect of sign restrictions..]
- Minnesota Priors:
  - Centred on zero for off diagonals (Minnesota)
  - Tighter for more distant lags
  - Conjugate priors chosen to produce analytical solutions for the posterior
  - See, e.g. Doan *et al* (1984)/Kaddiyala and Karlsson (1997)

Data

- US data, 1980q1-2010q2
- Typical macro series: C, I, Y, w/p, h, pi, r
- Plus:
  - Uncertainty proxy: either VXO (Bloom,2009); or IQR of stock returns, CRSP data from Bloom *et al*
  - net worth(CMR): Dow Jones Wilshire 5000 index deflated by GDP deflator
  - Corporate bond spread: BAA-AAA

Risk proxies

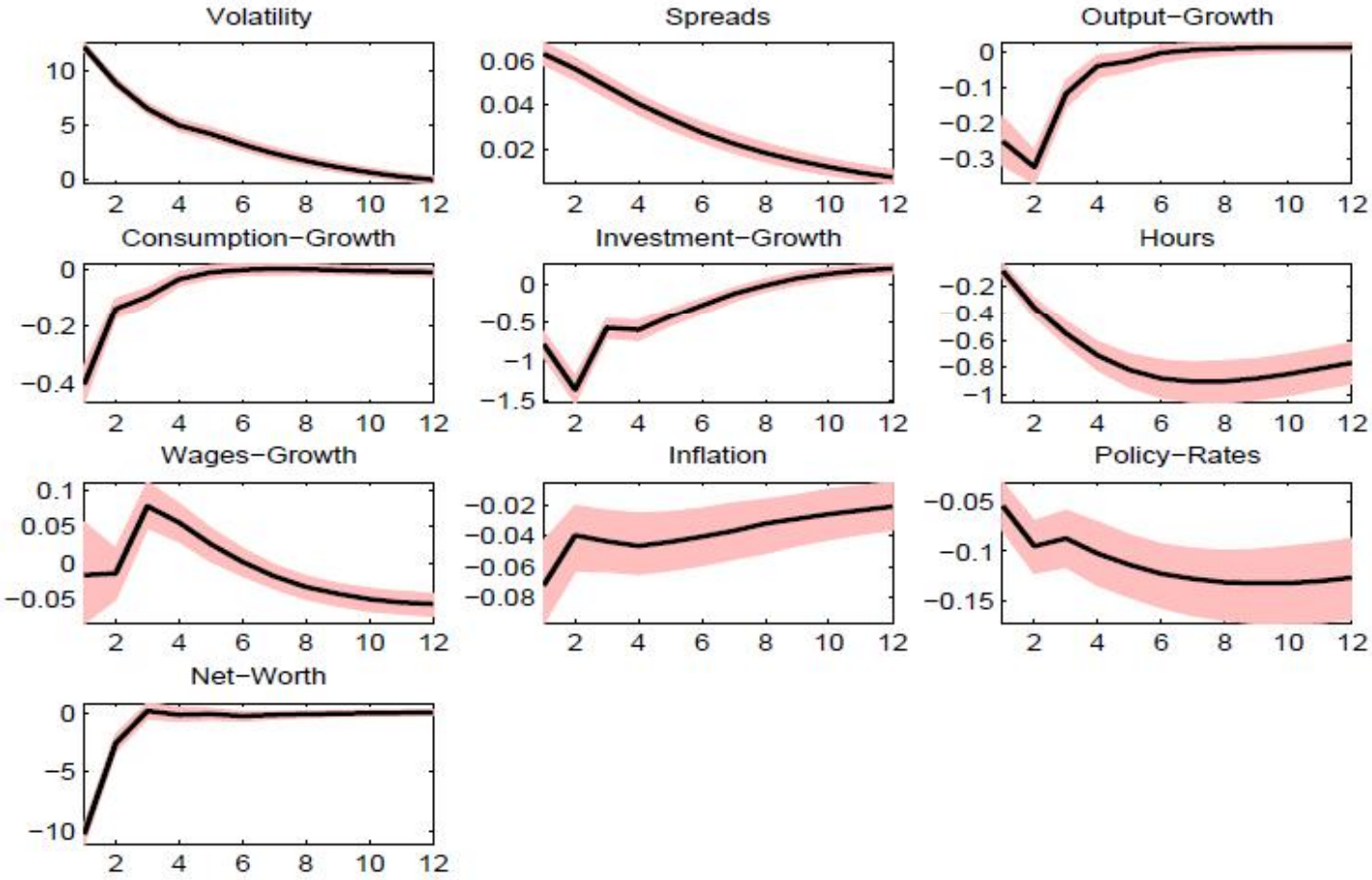
Figure 9: VIX versus Bloom, Floetotto, Jaimovich, Saporta-Eksten, and Terry (2012) Measure



Notes: The Bloom, Floetotto, Jaimovich, Saporta-Eksten, and Terry (2012) measure (right-hand side vertical axis) is the quarterly average of the interquartile range of firms' monthly stock returns for all public firms.

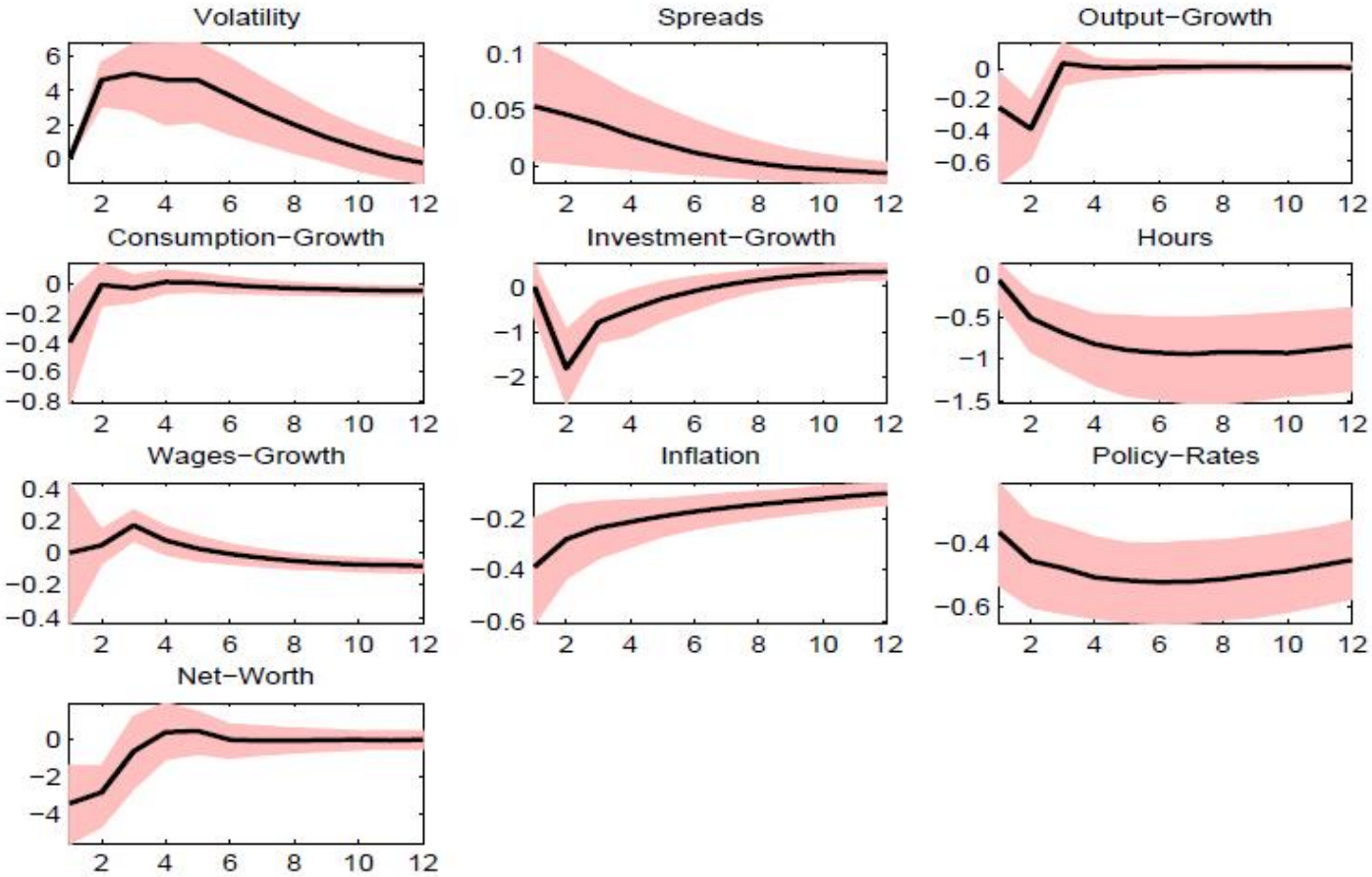
VIX: IRF to contemp. risk shock

Figure 1: Uncertainty Shock



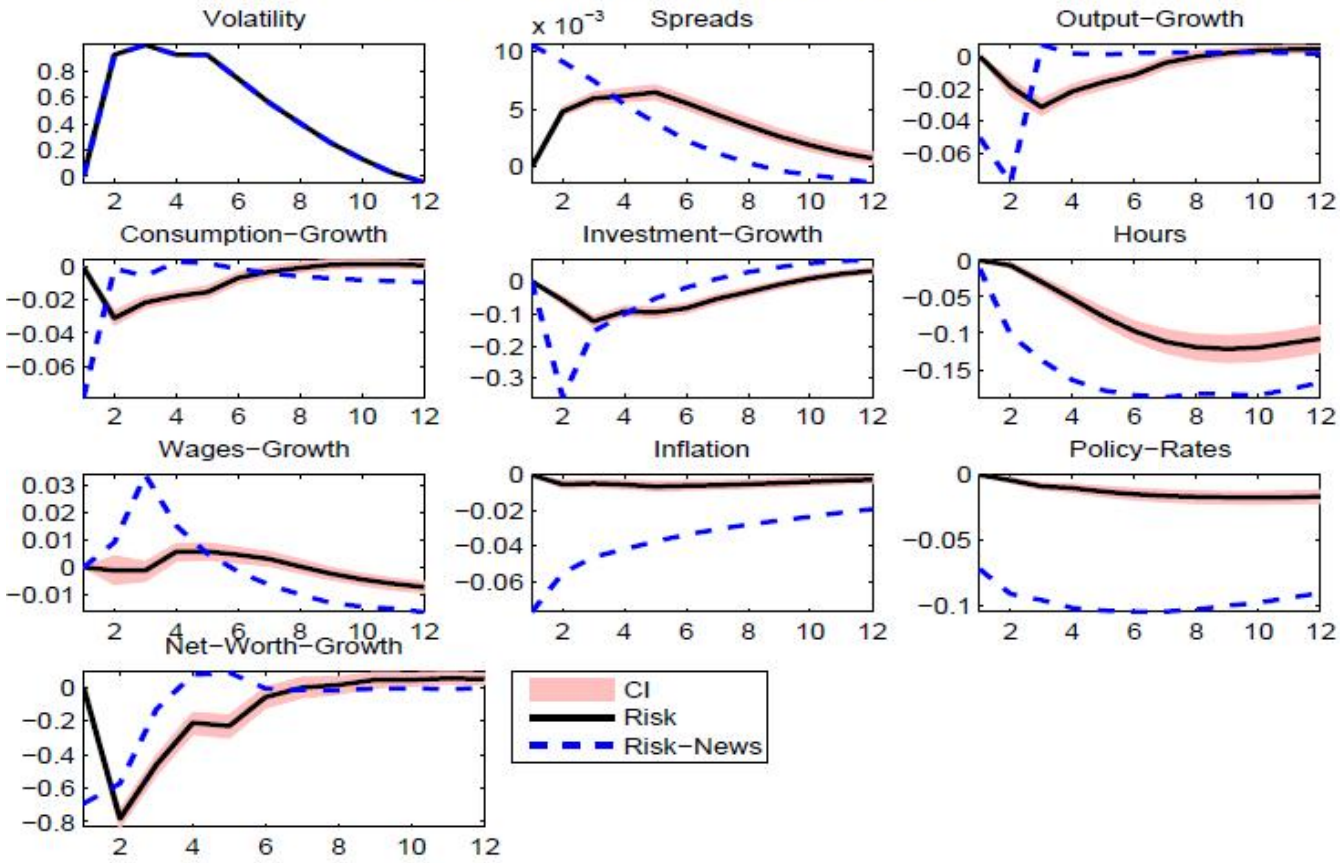
VIX: IRF to a risk news shock

Figure 2: Risk Shock



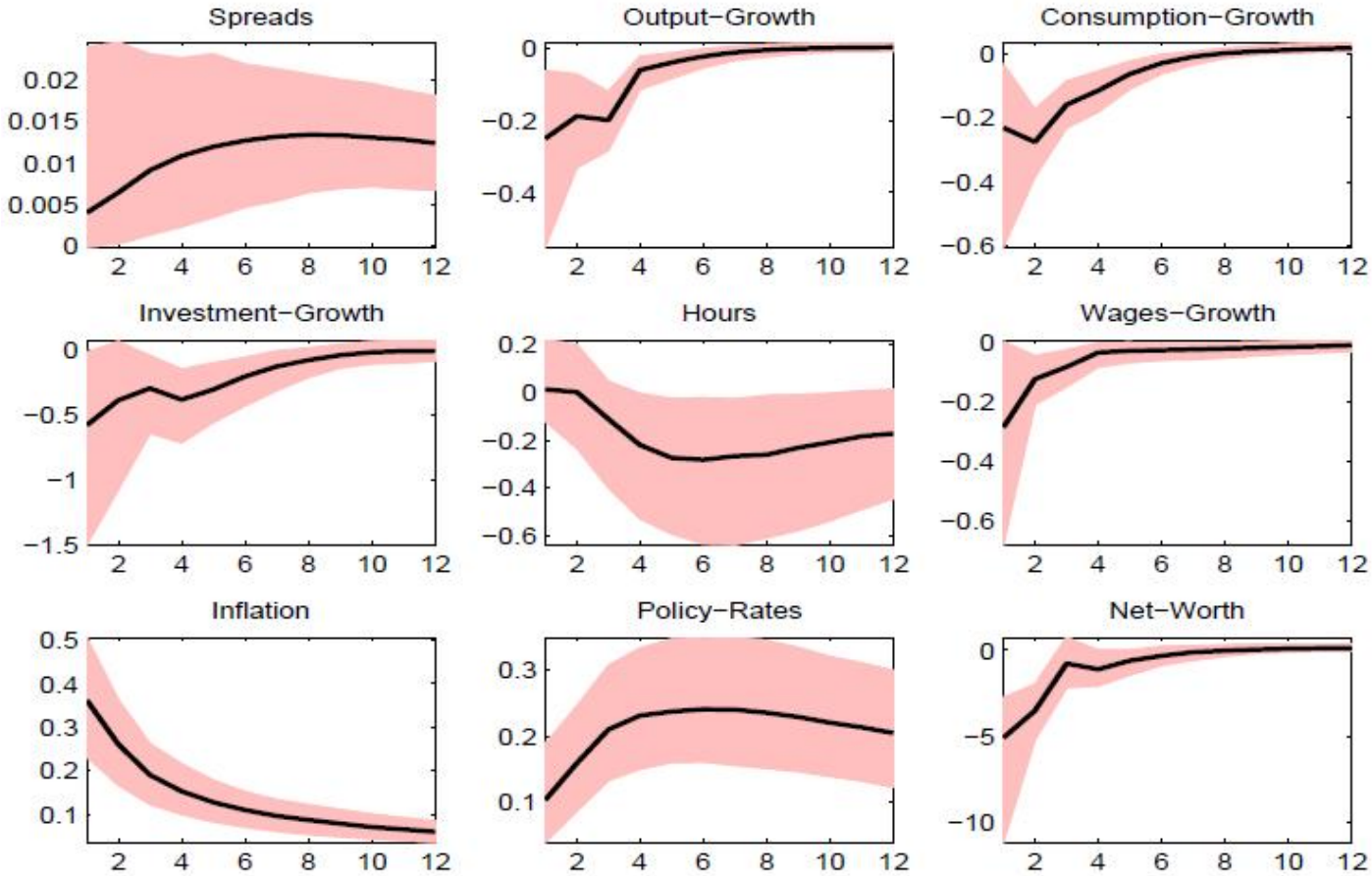
VIX, IRFs to risk shocks, contemp. vs news

Figure 8: Uncertainty versus Risk Shock



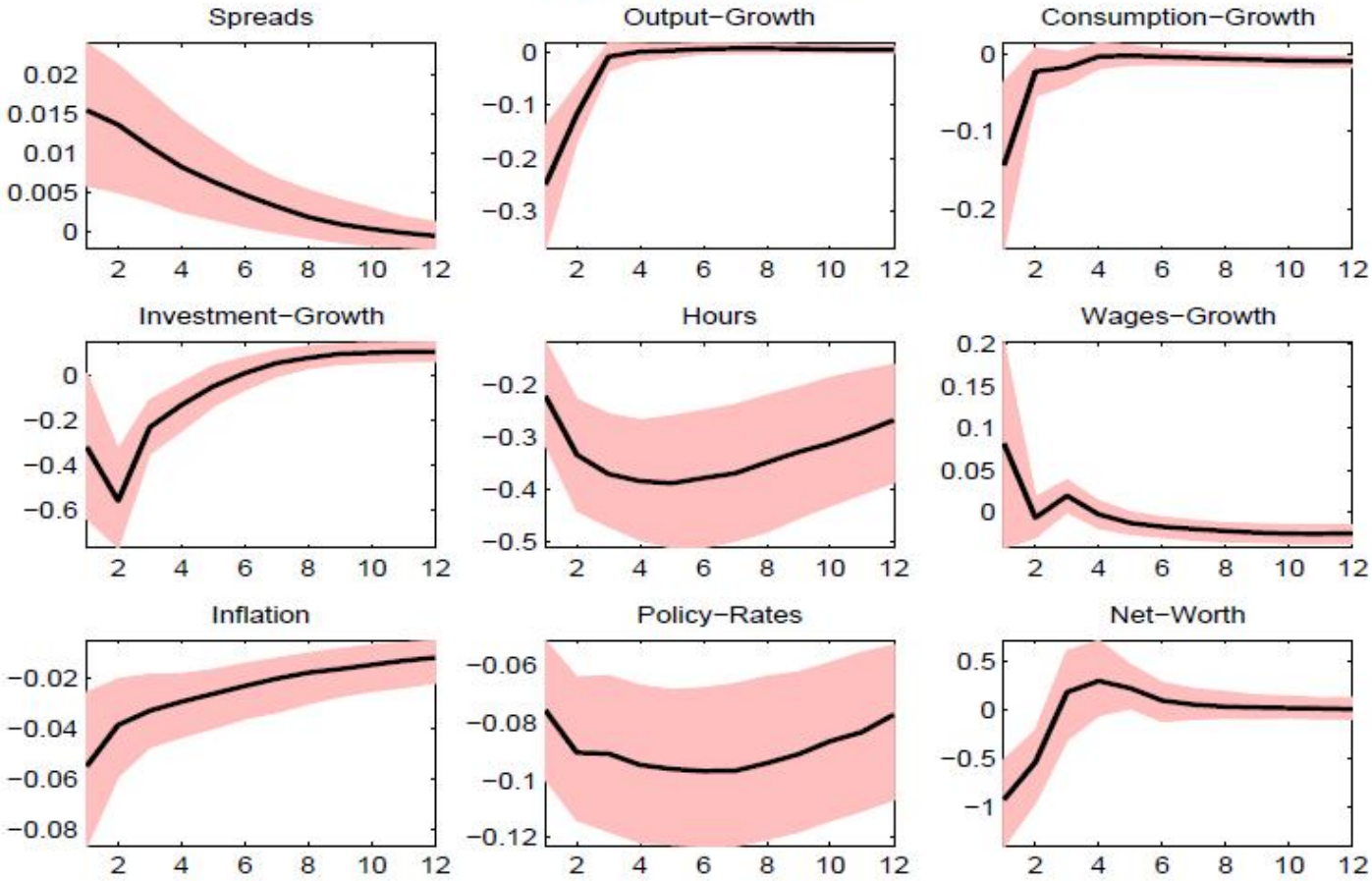
VIX: IRF to a technology shock

Figure 3: Supply Shock



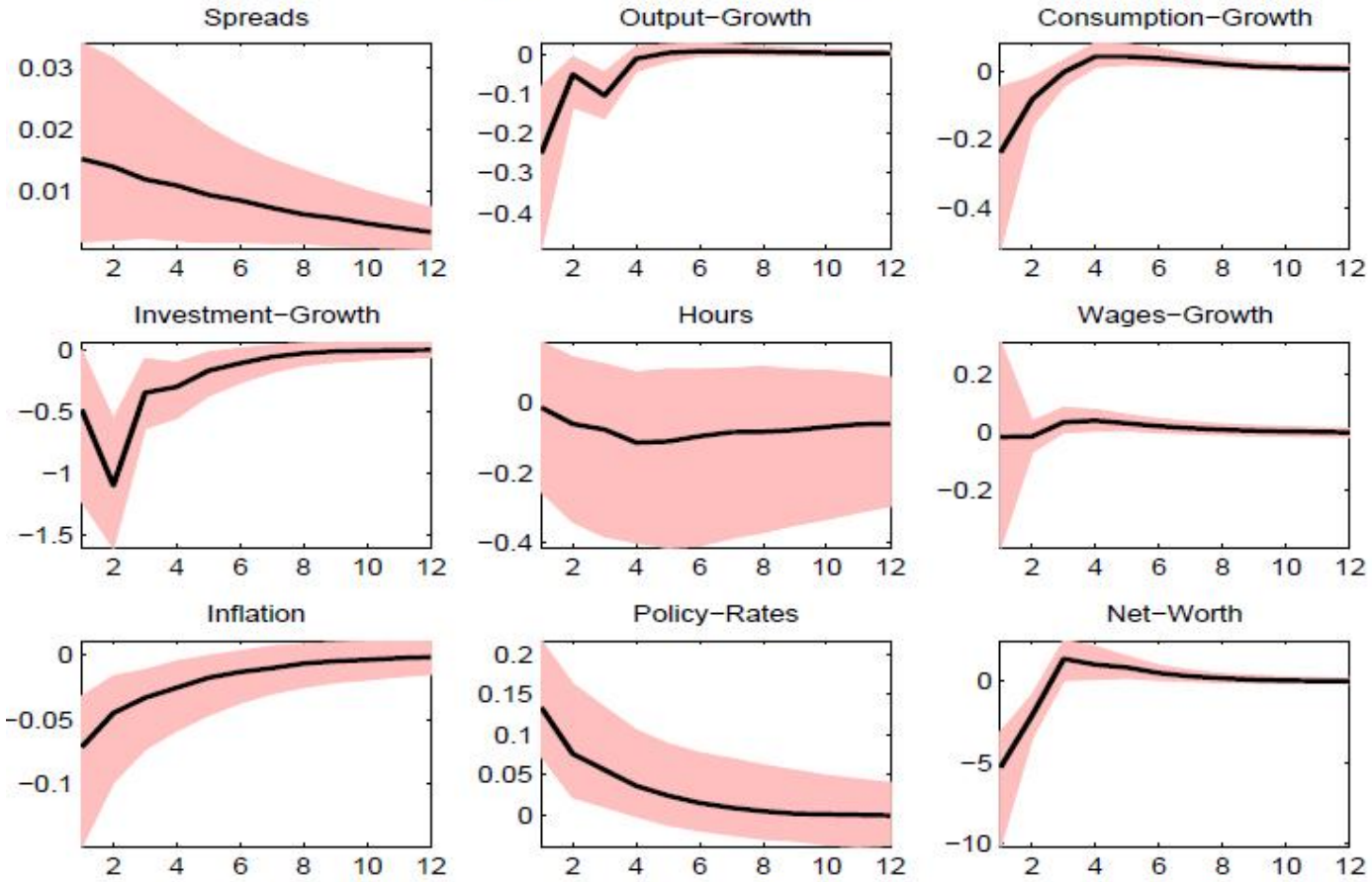
VIX: IRF to ‘demand’ shock

Figure 4: Demand Shock



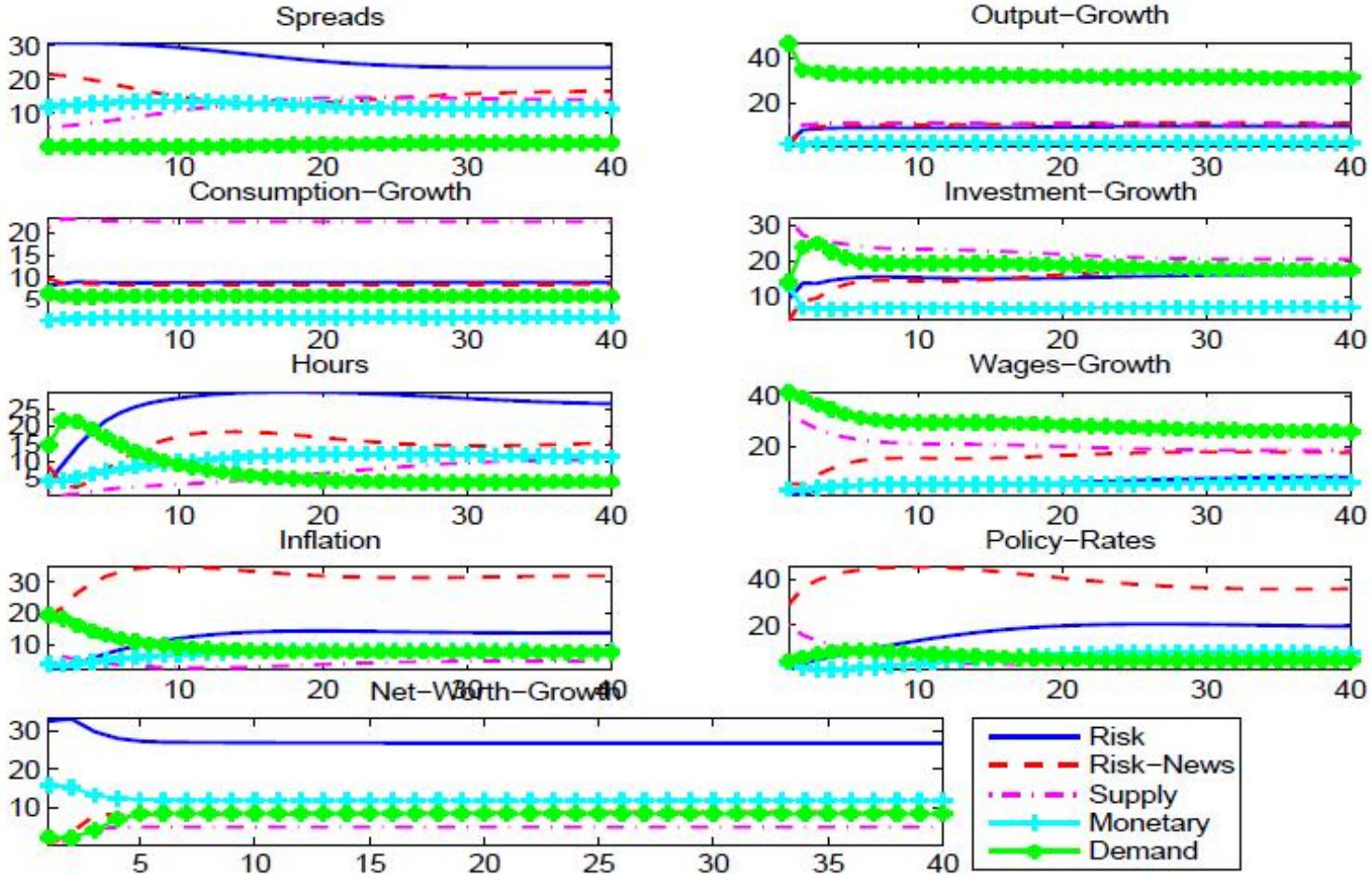
VIX: IRFs to a monetary policy shock

Figure 5: Monetary Policy Shock

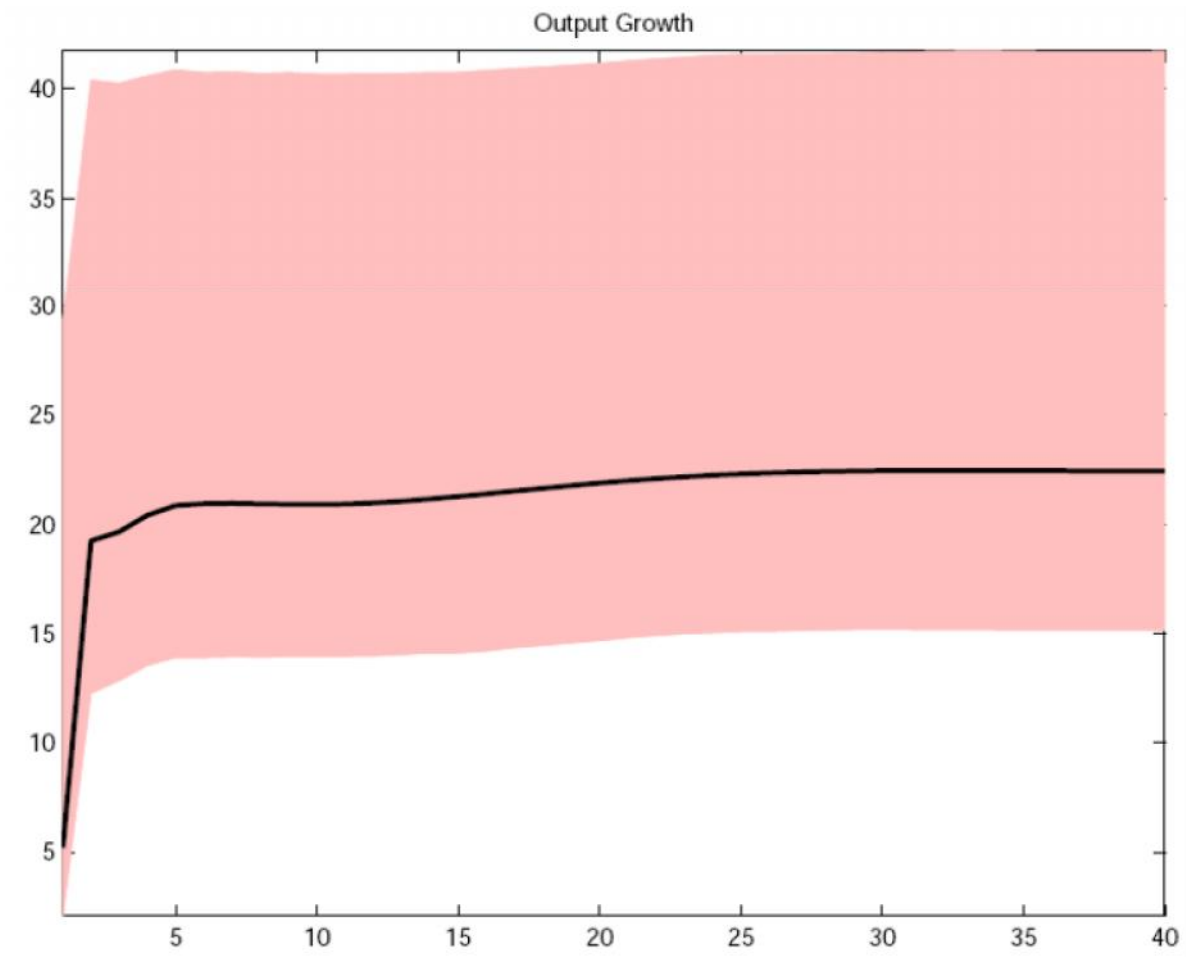


FEVD contributions (VIX)

Figure 7: Forecast Variance Decomposition: VIX



Confidence interval around the contribution of risk+risk news to output growth [16-84]



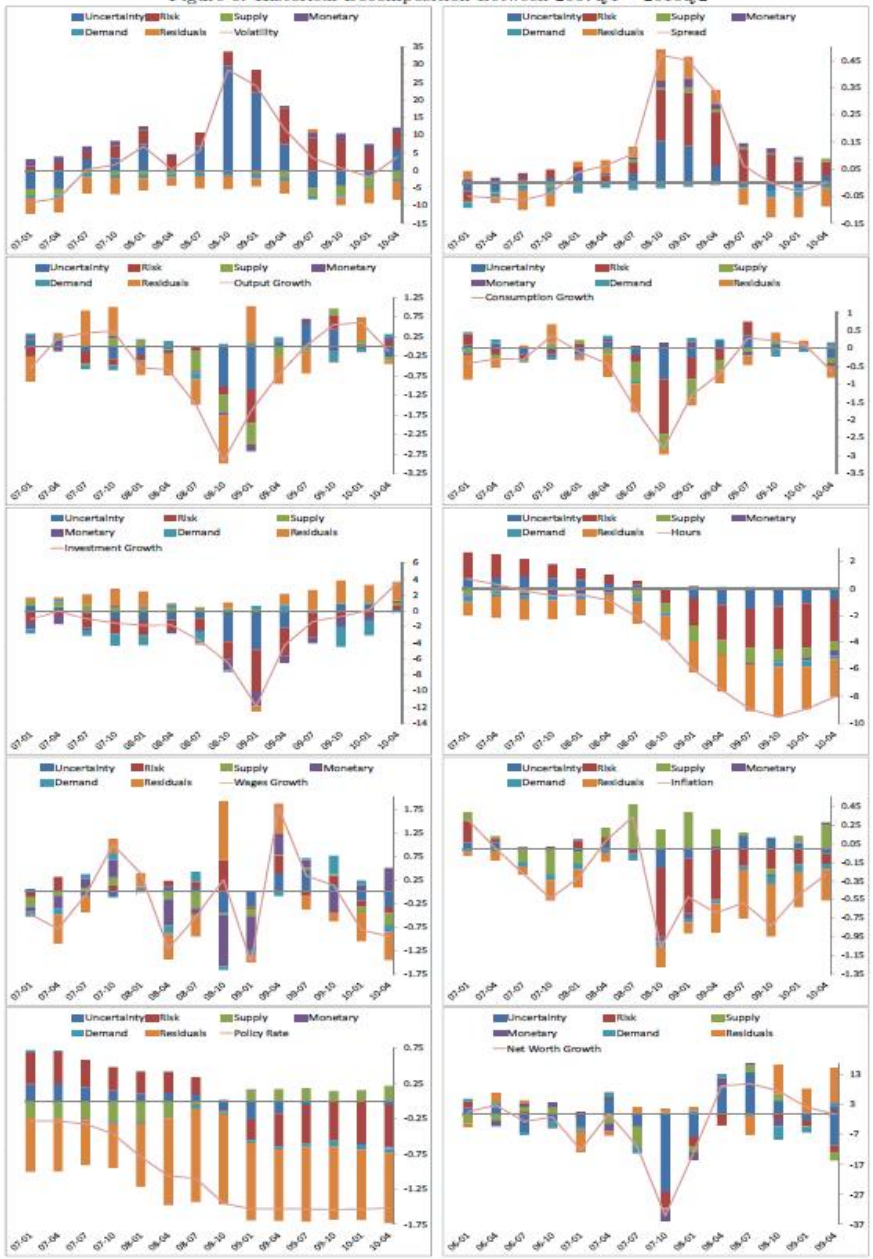
Risk shocks driving spreads up during the crisis, from late 2008

Sizeable impact on consumption and investment, but less so on output.

(VARs IRFs show effects of risk and risk news on C,Y to be roughly the same)

From late 2008 risk and risk news switch from forcing cb rate to tighten, to forcing it to loosen

Figure 6: Historical Decomposition Between 2007$Q1$ – 2010$Q2$



Crisis chart: key points

- Shocks that have small effect on spreads have sizeable effects on consumption, investment, inflation....
- Not large effects on output, suggesting that perhaps eg fiscal policy compensating

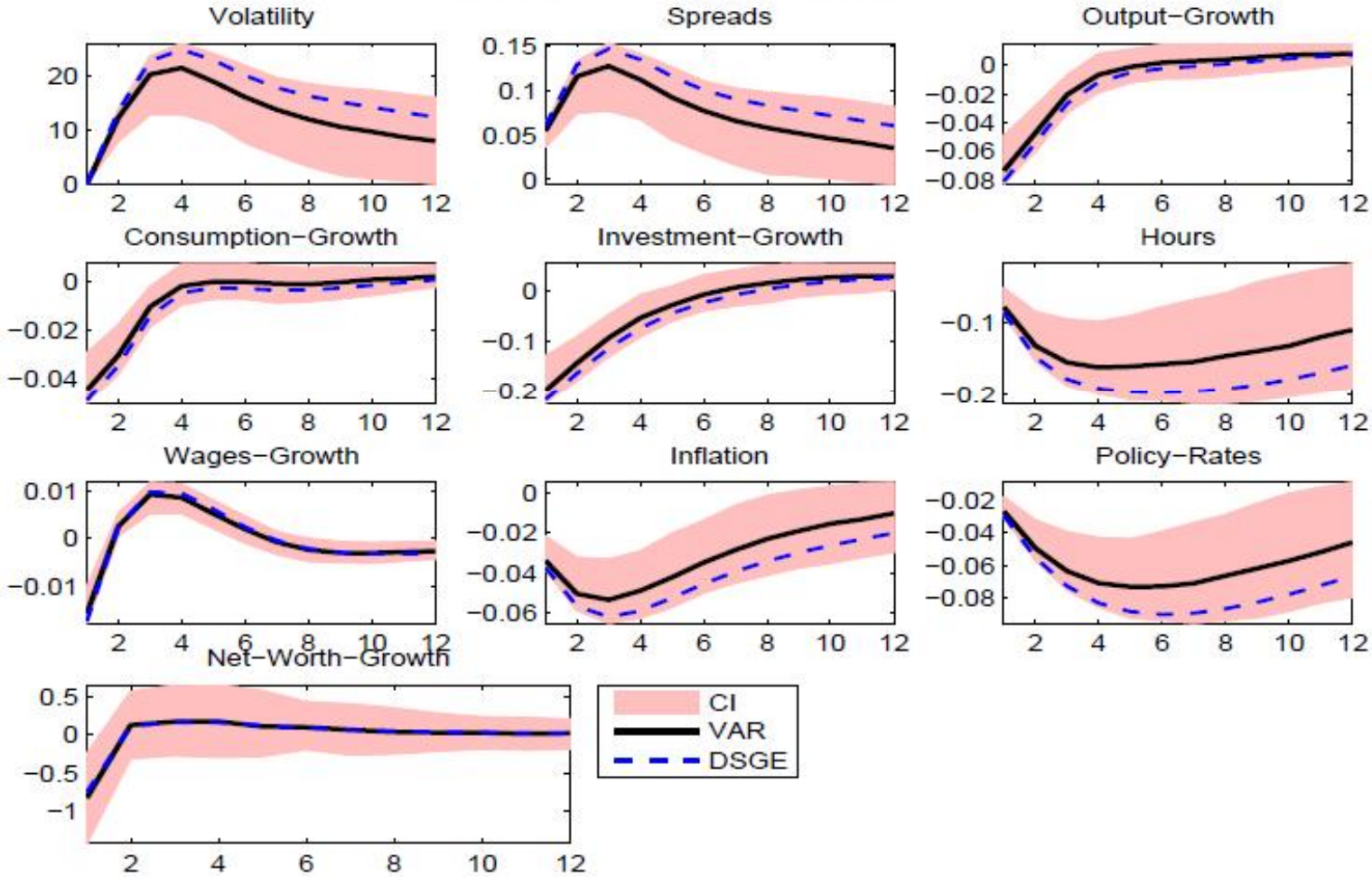
Robustness

- Monte Carlo
- Alternative risk proxy
- Alternative h’s

Monte Carlo evidence

- Barsky-Sims conducted Monte Carlo experiment in an RBC laboratory
- We follow suit using a DSGE (SW+BGG) model with a risk news shock
- Generate 1000 datasets of 200 obs
- Ask whether the VAR identification applied to the DSGE-generated data recovers the IRF computed directly from the DSGE model

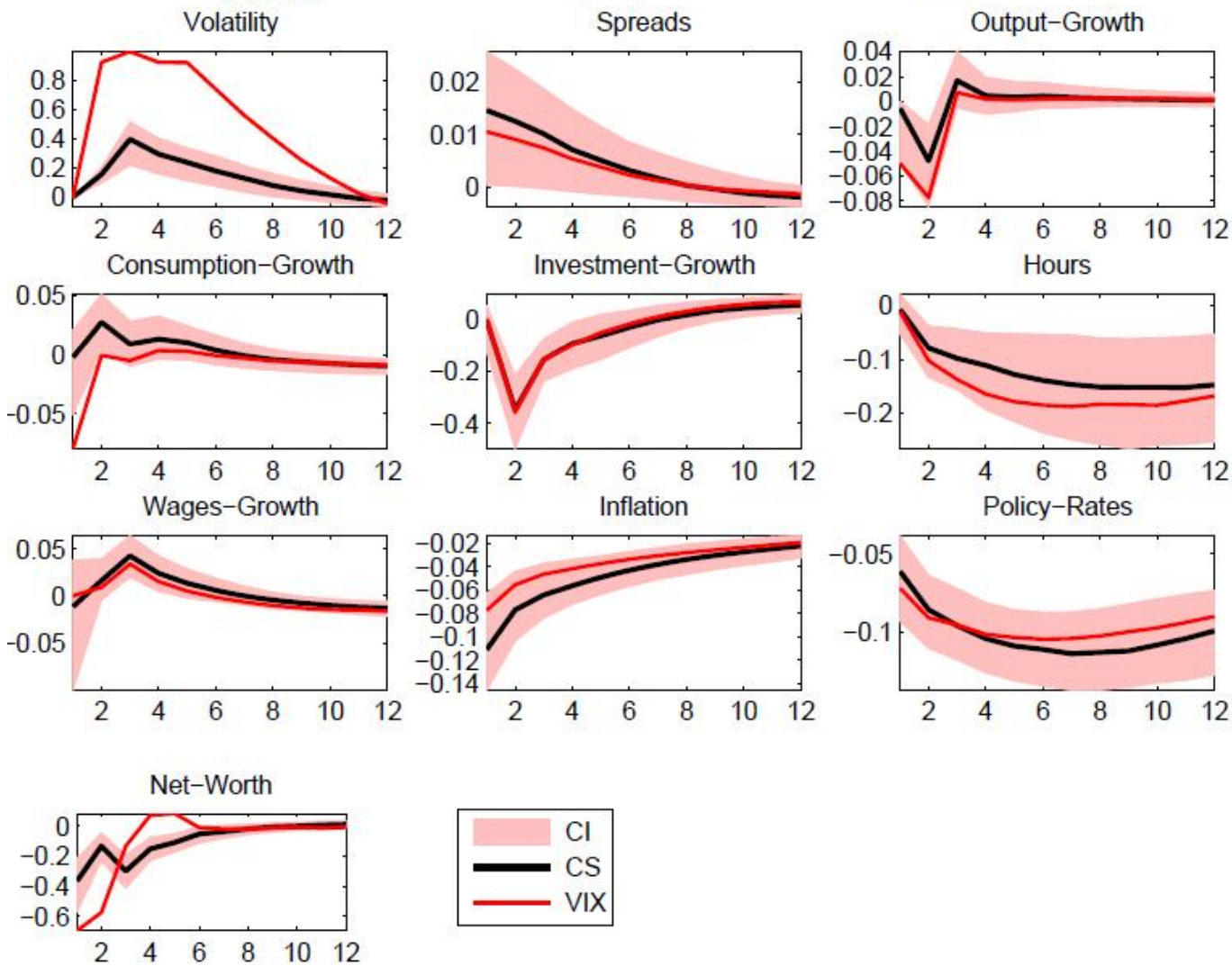
Figure 12: Monte Carlo Simulations



Alternative risk proxy

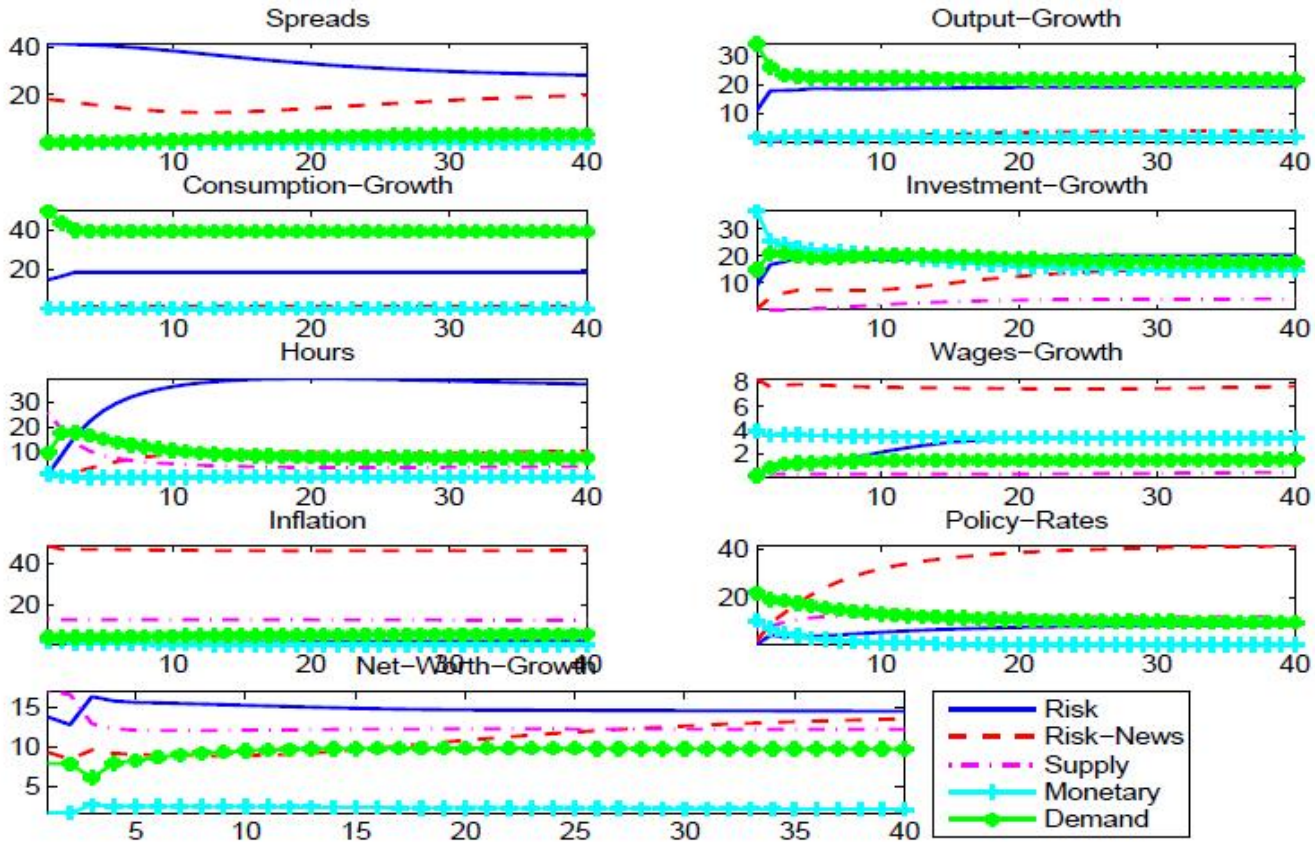
- Risk proxy may be flawed: measured with error or capturing instead simply volatility of an aggregate shock, not idiosyncratic shock.
- So do results survive use of other proxies?
- Use IQR of stock returns from Bloom et al ()

IRF to a risk news shock: VIX vs CSR



FEVD for cross section measure

Figure 9: Forecast Variance Decomposition: Cross-Section



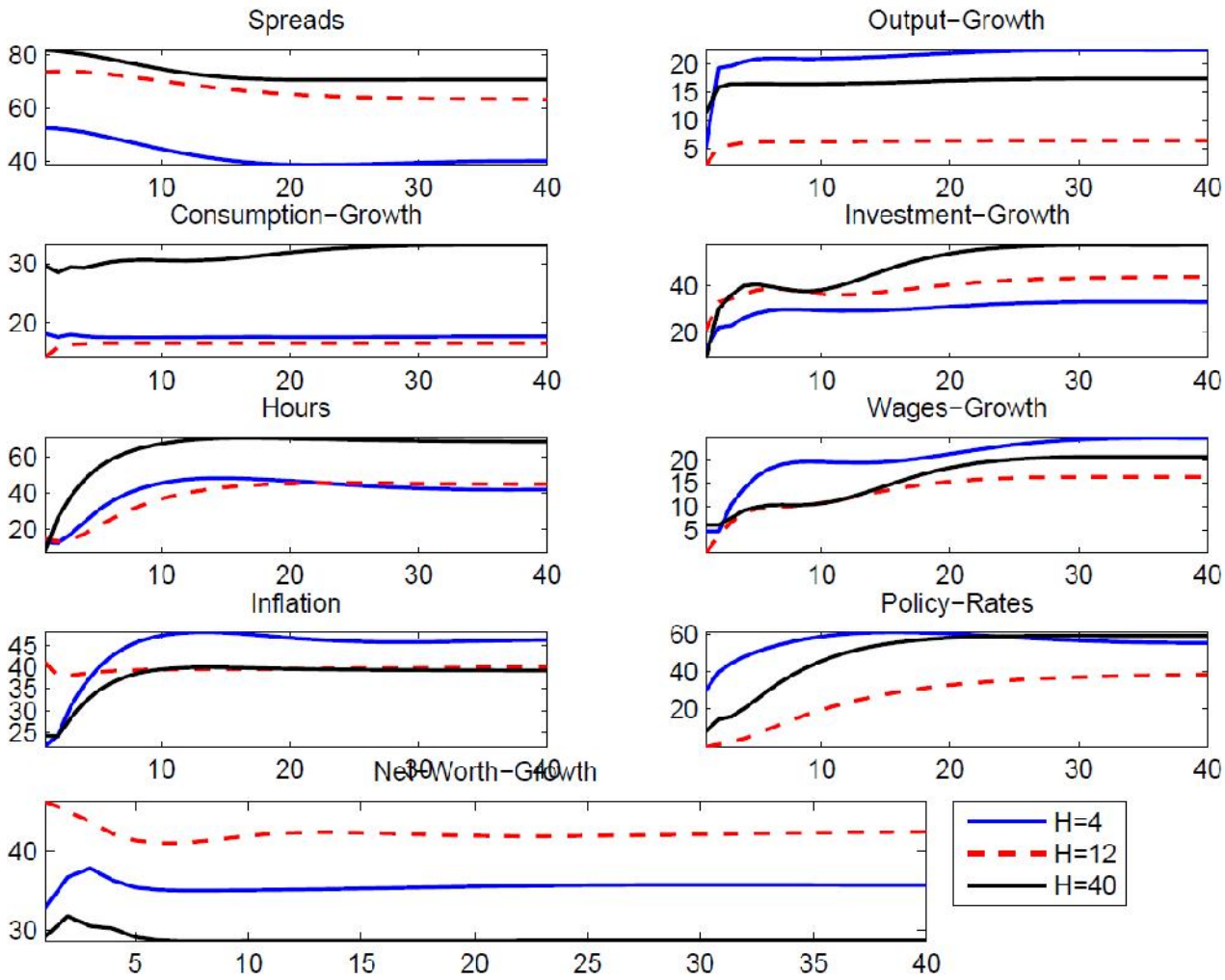
Risk news contribution shrinks; risk plus risk news roughly 20% again

Alternative h's

- Recall the horizon h, in:

$$\Omega_{i,j}(h) = \frac{e_i'\left(\sum_{\tau=0}^{h} B_\tau \tilde{A} Q(\omega) e_j e_j' Q(\omega)' \tilde{A}' B_\tau\right) e_i}{e_i'\left(\sum_{\tau=0}^{h} B_\tau \Sigma B_\tau\right) e_i}$$

FEVD for alternative h's [VXO] [contribution of risk+risk news]



Minimum distance estimates of a DSGE model

- What do we need to do to a standard DSGE model (that articulates a risk/risk news shock) to get it to fit the VAR-identified IRFs?

The DSGE model

- CEE/Smets-Wouters+BGG
- Patient consumers/impatient entrepreneurs
- Lending to entrepreneurs at spread related to net worth
- Entrepreneurs build capital and rent out to sticky price intermediate goods producers
- Imperfectly competitive intermediate producers, final goods aggregator
- Central bank, govt

Frictions

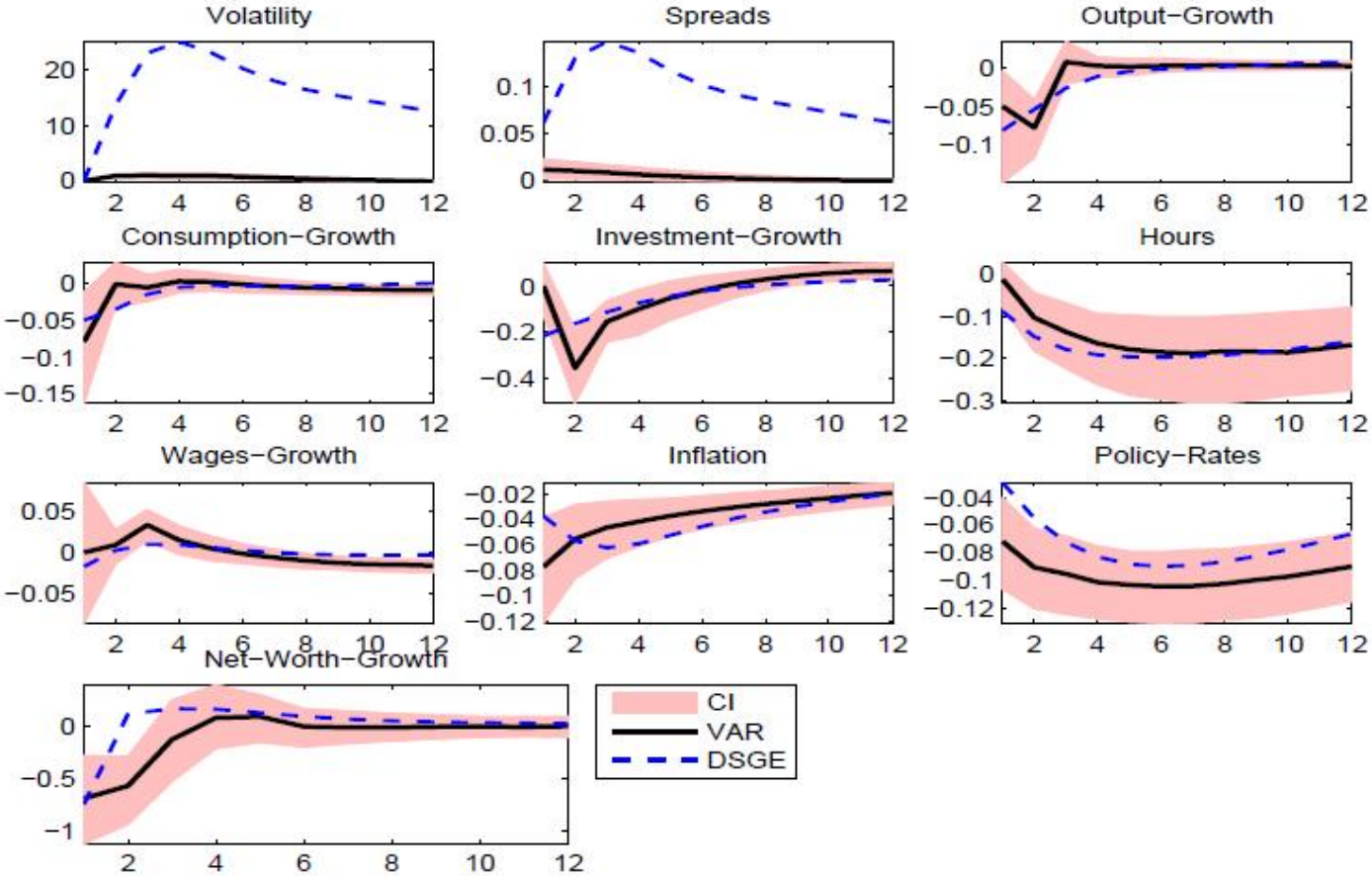
- Credit friction a la BGG
- Habits in consumption
- Investment adjustment costs
- Sticky prices, price indexation
- Sticky wages, wage indexation
- Variable capacity utilisation

Estimation of the DSGE model

- Match responses of DSGE model to a risk news shock to those from the VAR
- e.g. CEE (2005) match to IRFs to a monetary policy shock
- Partial information method:
  - Cost: inefficiency, bias, worsens identification?
  - Benefit: immunity to misspecification of the stochastic parts of the model about which we stay silent

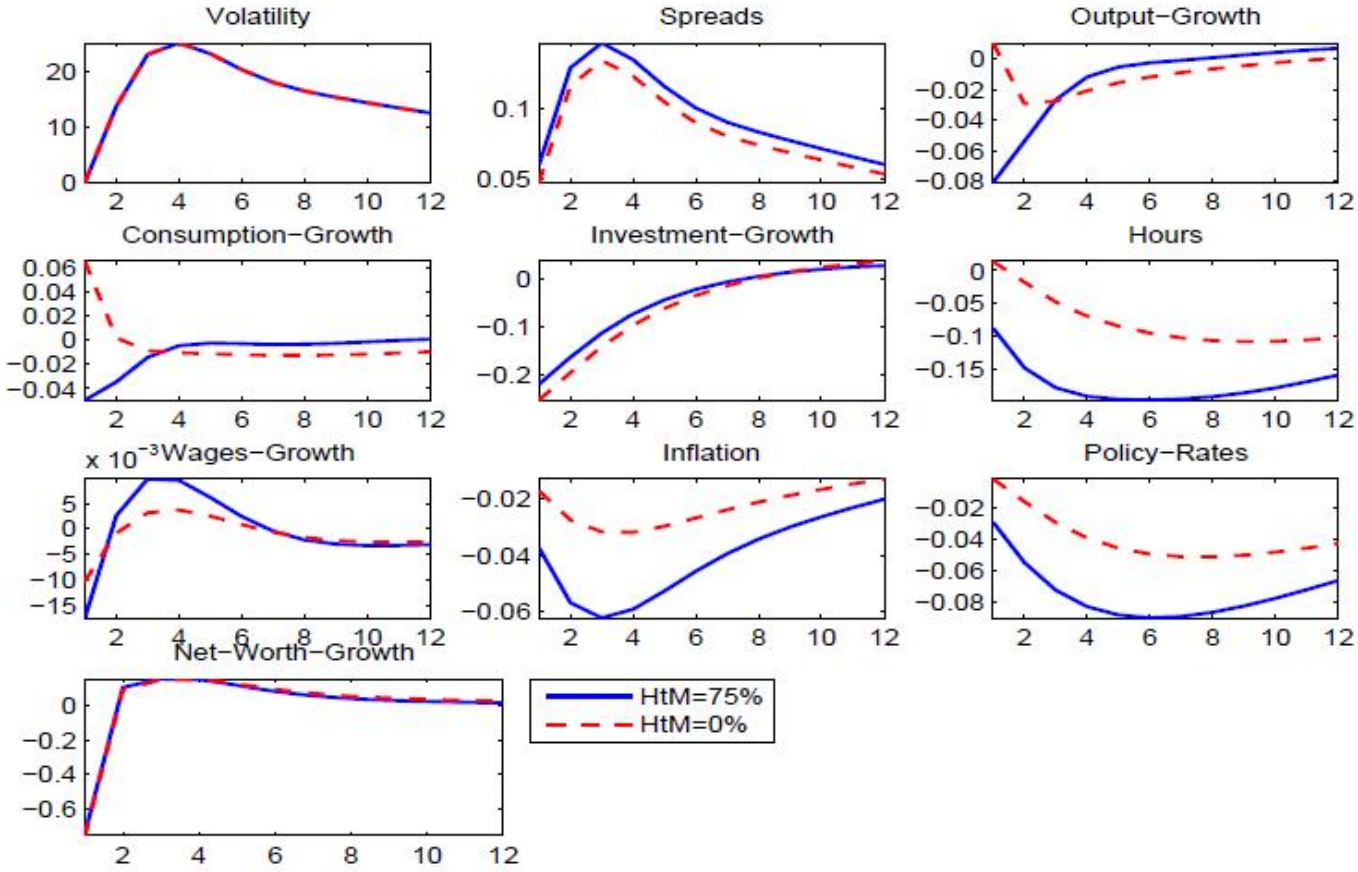
DSGE vs the VAR, IRFs to a risk news shock

Figure 11: DSGE Model Fit



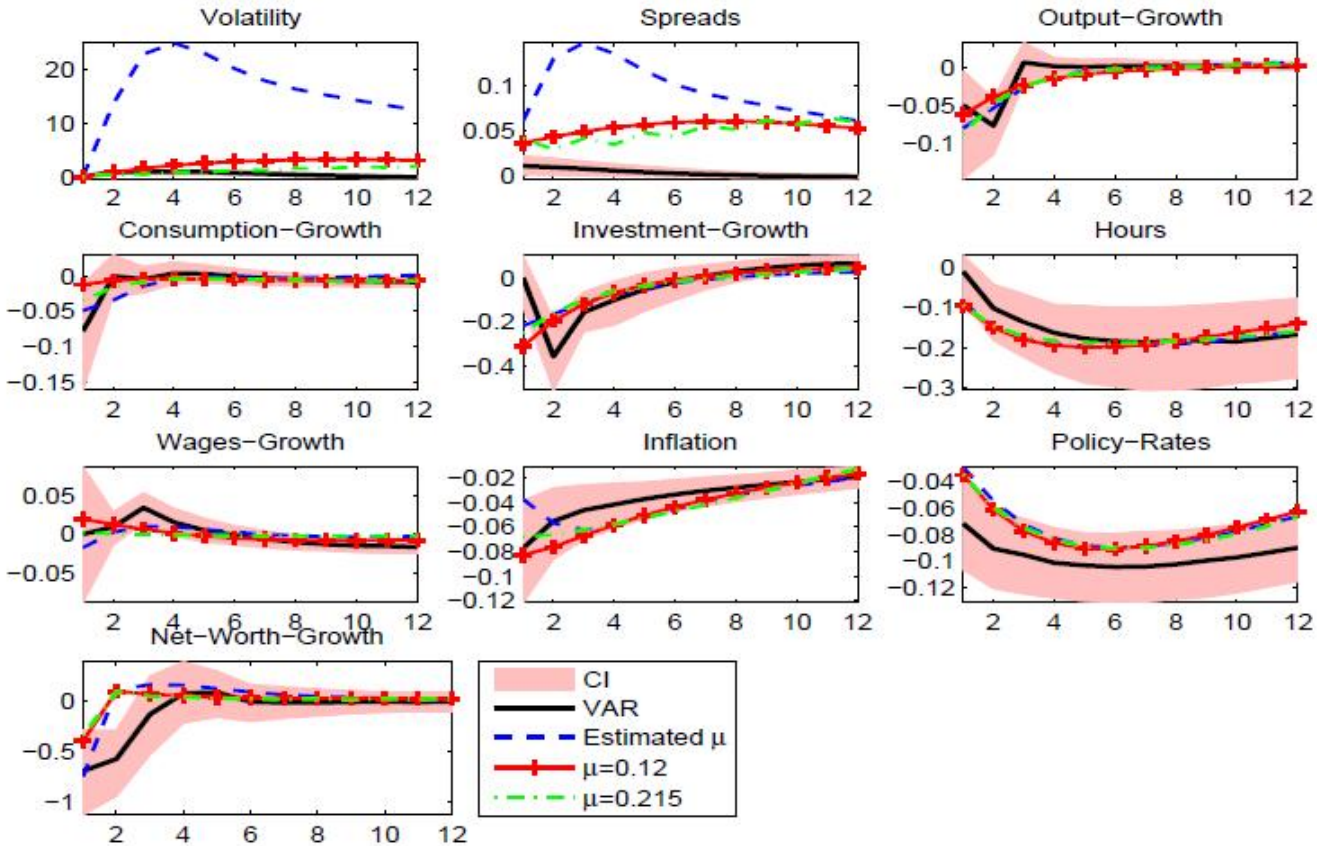
DSGE IRF to risk news shock with and without htm consumers

Figure 14: HtM versu No HtM Consumers: Risk News Shock



Effect of strength of ff on DSGE estimates

Figure 15: The relationship between the size of financial frictions and the magnitude of the shock



Recap

- VAR idenfitifcation using a Barsky-Sims method plus sign restrictions
- Our VAR identified risk and risk news shocks imply contribution of about 20% to volatility in output
- Scheme works in MC, robust to using alternative risk proxy
- DSGE model has to be greatly modified with inclusion of HTM consumers to get close to matching IRFs to risk news shock.