Monetary and Macroprudential Policy with Endogenous Risk

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December 2018

Disclaimer

- The results are preliminary and incomplete
- The views expressed in the presentation might not reflect the views of the IMF or the Federal Reserve

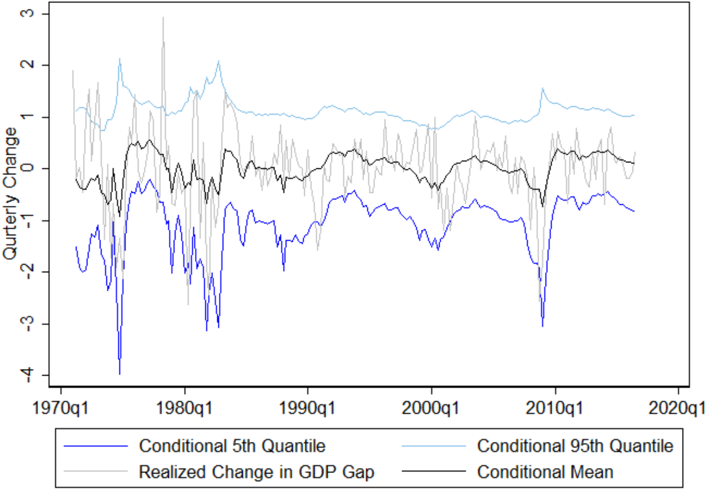
Forecast Distributions

- Policy makers surely want to know the density of state variables (Timmermann (2000))
- But the literature has not yet proposed parsimonious structural models of macroeconomic conditional densities

NKV

- We present a New Keynesian model with financial vulnerability that matches macroeconomic forecast densities closely
- NKV model: "New Keynesian Vulnerability"
- Movements in risk are linked to state variables

Stylized Fact 1: Financial Variables Predict Tail of Output Gap Distribution



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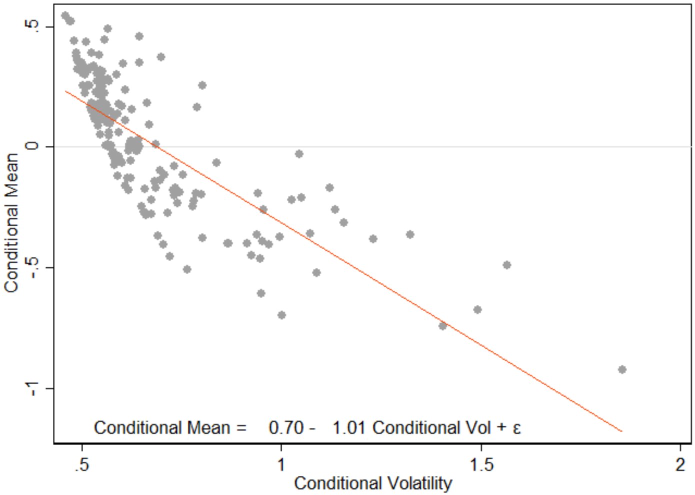
Output Gap Mean and Variance Correlate Negatively



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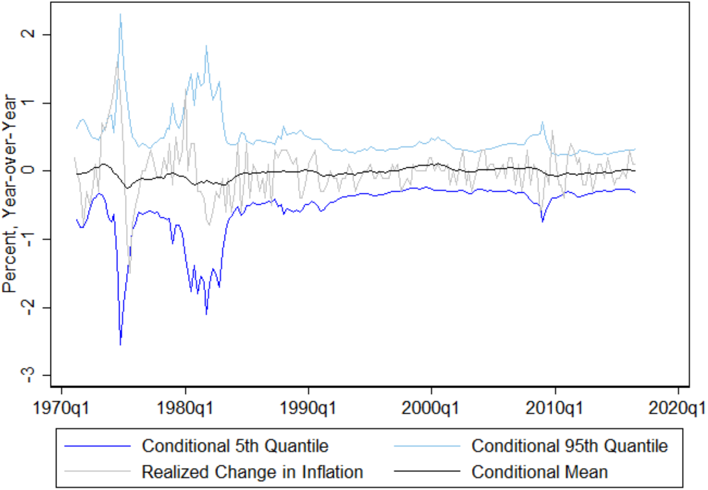
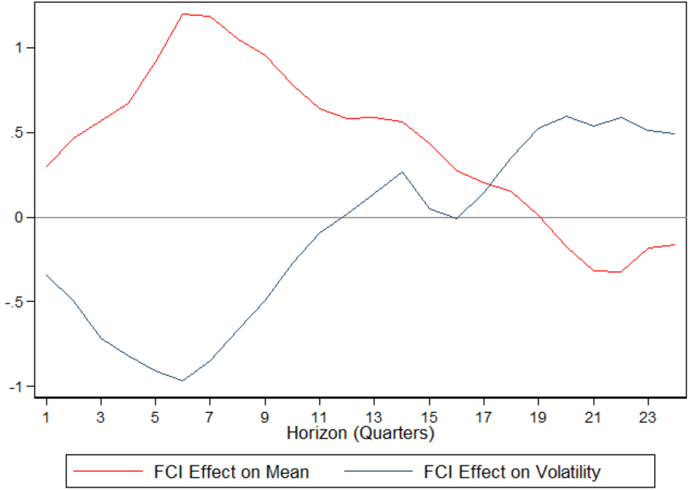
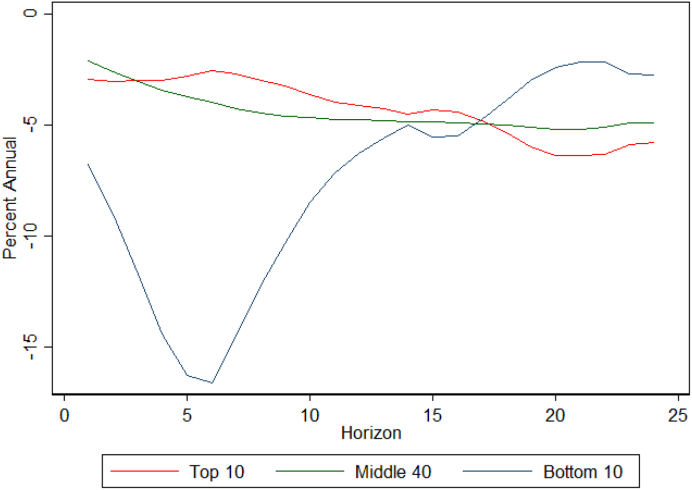
Financial Variables Do Not Predict Inflation



Stylized Fact 4: The Volatility Paradox



Stylized Fact 5:
Term Structures of Growth-at-Risk Cross



Goal: Match the 5 Stylized Facts

1. Financial Variables Predict Tail of Output Gap
2. Output Gap Mean and Variance Correlate Negatively
3. Financial Variables Do Not Predict Inflation
4. The Volatility Paradox
5. Term Structures of Growth-at-Risk Cross

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- NKV: Parsimonious DSGE model

Outline

The IS Curve

Assume a consumption log pricing kernel with a wedge ω_t

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$$m_{t+1} = -(i_t - E_t[\pi_{t+1}]) - \sigma\eta_t\varepsilon^y_{t+1}$$

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We will assume that the wedge is proportional to the price of risk

$$c_{t+1} - c_t = \frac{1}{\sigma}\left(i_t - E_t[\pi_{t+1}]\right) + \gamma\eta_t + \eta_t\varepsilon^y_{t+1}$$

Hence consumption features "*accelerator*" and "*endogenous risk*"

The Endogenous Price of Risk η

Then the output gap is

$$y_{t+1} - y_t = \frac{1}{\sigma}\left(i_t - E_t[\pi_{t+1}] - r^*\right) + \gamma(\eta_t - \eta^*) + \eta_t \varepsilon^y_{t+1}$$

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η_t is endogenous risk

$$\eta_t = \sqrt{E_t[y^2_{t+1}] - (E_t[y_{t+1}])^2}$$

The Endogenous Price of Risk η

- Assume that the price of risk η is determined by financial intermediaries
- Competitive banks solve the following optimization problem

$$\max_{x_t} x_t \left[E_t[y_{t+1}] - y_t + \frac{1}{\theta}\left(Vol_t[y_{t+1}] - Vol^*[y] + \varepsilon_t^\eta - \xi \varepsilon_{t-1}^\eta \right) \right]$$

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- The first order condition is

$$\eta_t = \eta^* - \theta(E_t[y_{t+1}] - y_t) + \varepsilon_t^\eta - \xi \varepsilon_{t-1}^\eta .$$

- Competition ensures that this first order condition always holds
- Captures the economics of leverage cycles

The NKV Model

The full model also features a standard Phillips curve and Taylor rule

$$
\begin{aligned}
&\text{(IS)} && y_{t+1} - y_t = \frac{1}{\sigma}\left(i_t - E_t[\pi_{t+1}] - r^*\right) + \gamma(\eta_t - \eta^*) + \eta_t \varepsilon^y_{t+1} \\
&\text{(Vulnerability)} && \eta_t = \eta^* - \theta(E_t[y_{t+1}] - y_t) + \varepsilon^\eta_t - \xi \varepsilon^\eta_{t-1} \\
&\text{(Phillips)} && \pi_t = \beta E_t[\pi_{t+1}] + \kappa y_t \\
&\text{(Taylor Rule)} && i_t = r^* + \phi_y y_t + \phi_\pi \pi_t
\end{aligned}
$$

- Feedback from y to η and η to y
- Extension of standard NK model (Woodford (2003), Galí (2015))

Bayesian Estimation and Model Behavior

- Standard NK parameter priors
- Complemented by ML parameter estimates
- For the estimated parameter values our model is saddle-path stable around the zero inflation steady state

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- Next: The NKV model matches the 5 stylized facts

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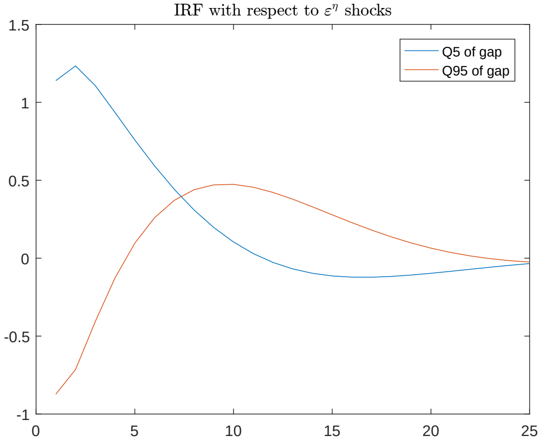


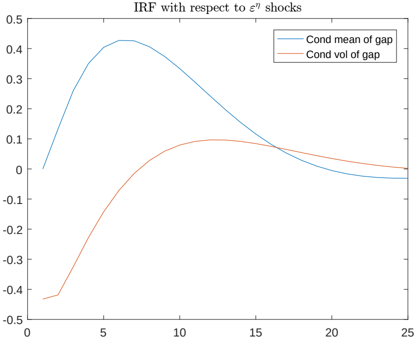
Figure: Conditional density of y_t becomes narrower, then wider after 6 quarters

Stylized Fact 2:
Output Gap Mean and Variance Correlate Negatively

$$E_t\left[y_{t+1}\right] = a + bVol_t\left[y_{t+1}\right] + \varepsilon_t$$

	Data	Model*
$\hat{a}$	0.70	0.95
	(0.06)	
$\hat{b}$	−1.01	−1.03
	(0.04)	

*Mean over simulations with same number of obs.



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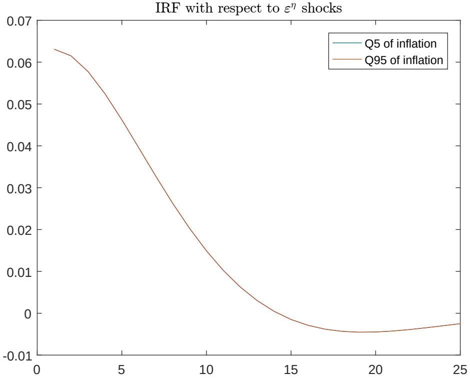
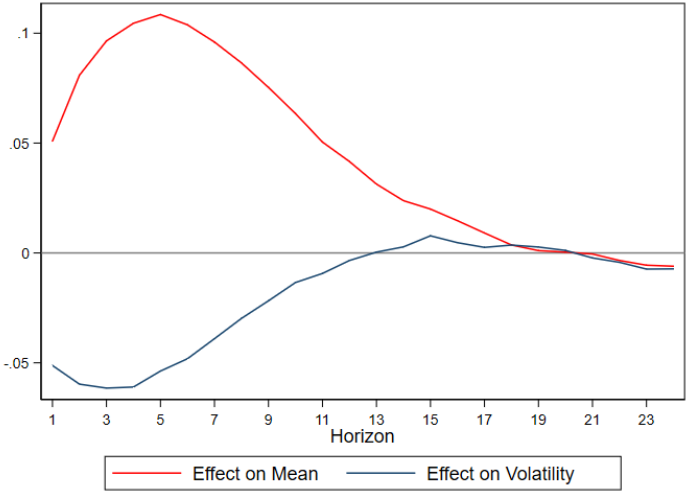


The size of IRF is 6 basis points and Q5 lies on top of Q95

Stylized Fact 4:
The Volatility Paradox



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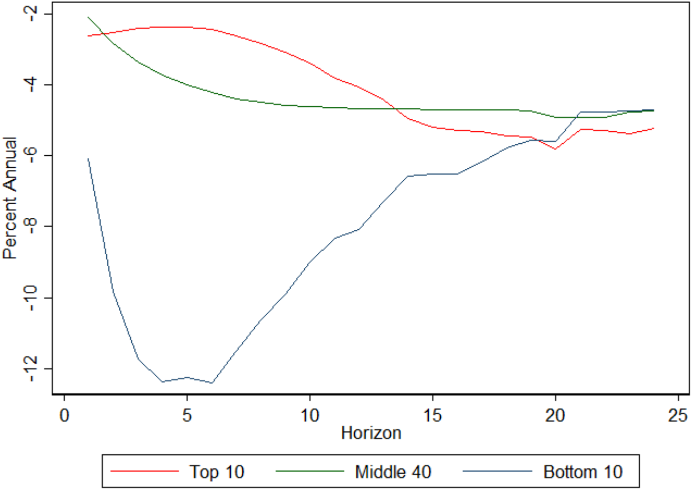

NKV Empirical Bottom Line

- NKV model features overshooting behavior (Dornbusch (1976))
  - Crossing of the term structures/volatility paradox

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NKV Empirical Bottom Line

- NKV model features overshooting behavior (Dornbusch (1976))
  - Crossing of the term structures/volatility paradox
- NKV captures the 5 stylized facts about the conditional densities
- What are policy implications?

Outline

Monetary Policy

- Use the NKV model for monetary policy purposes
- Alternative policy paths should account for endogenous risk
- Thus more fully capture the tradeoffs facing policymakers

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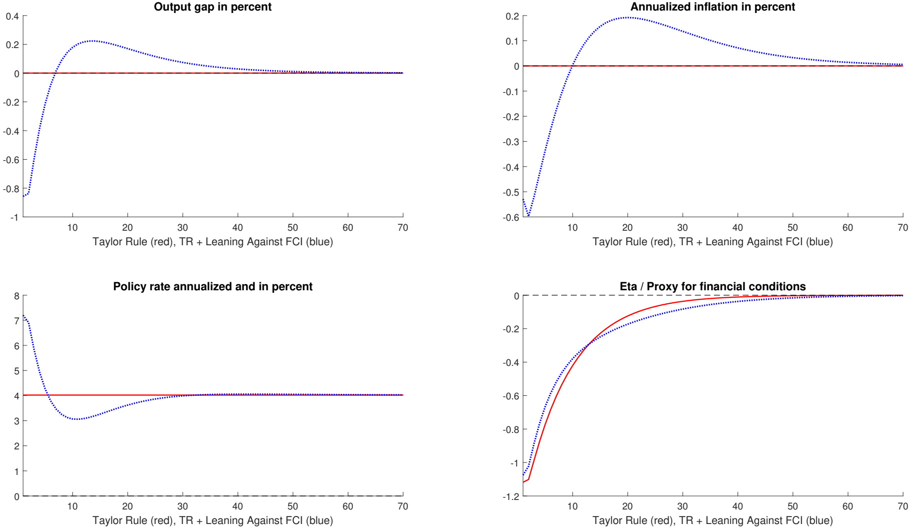
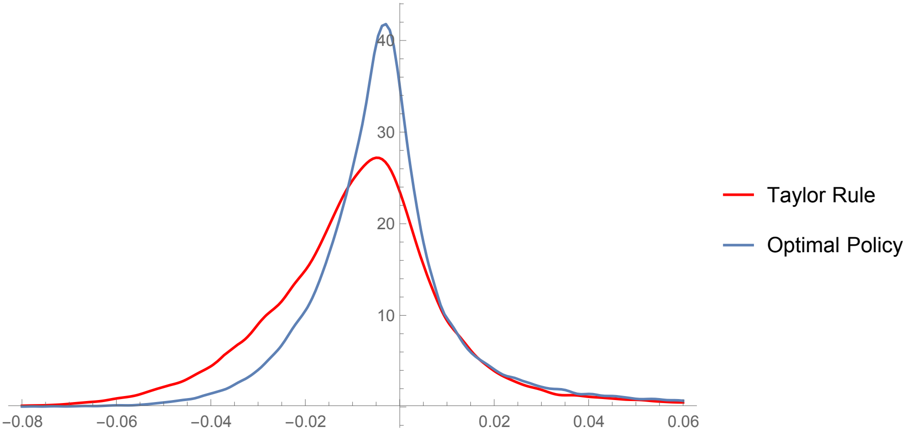
- Use the NKV model for monetary policy purposes
- Alternative policy paths should account for endogenous risk
- Thus more fully capture the tradeoffs facing policymakers
- Alternative policy rules
  1. Standard Taylor (1993) rule
  2. Adrian and Duarte (2018) rule conditioning on η

Alternative Paths with Endogenous Risk



Steady State Output Gap Distribution



Macroprudential Policy: 3 Steps

1. Contemporaneously Effective Macroprudential Policy
2. Lagged Effective Macroprudential Policy
3. Less Effective Macroprudential Policy

Macroprudential Policy 1: Contemporaneously Effective Macroprudential Policy

$$
\begin{aligned}
y_{t+1} - y_t &= \frac{1}{\sigma}\left(i_t - E_t[\pi_{t+1}] - r^*\right) + \gamma(\eta_t - \eta^*) + \eta_t \varepsilon^y_{t+1} \\
\eta_t &= -\mu_t + \eta^* - \theta(E_t[y_{t+1}] - y_t) + \varepsilon^\eta_t - \xi\varepsilon^\eta_{t-1} \\
\pi_t &= \beta E_t[\pi_{t+1}] + \kappa y_t \\
i_t &= r^* + \phi_y y_t + \phi_\pi \pi_t
\end{aligned}
$$

Macroprudential Policy 1: Contemporaneously Effective Macroprudential Policy

Proposition 1: *"Divine Coincidence"*

Assume that policies are set according to

$$\mu_t = \eta^* + \varepsilon_t^\eta - \xi \varepsilon_{t-1}^\eta$$
$$i_t = r^*$$

Then

$$y_t = \pi_t = \eta_t = 0$$

Macroprudential Policy 2:
Lagged Effective Macroprudential Policy

$$
\begin{aligned}
y_{t+1} - y_t &= \frac{1}{\sigma}\left(i_t - E_t[\pi_{t+1}] - r^*\right) + \gamma(\eta_t - \eta^*) + \eta_t \varepsilon^y_{t+1} \\
\eta_t &= -\mu_{t-1} + \eta^* - \theta(E_t[y_{t+1}] - y_t) + \varepsilon^\eta_t - \xi \varepsilon^\eta_{t-1} \\
\pi_t &= \beta E_t[\pi_{t+1}] + \kappa y_t \\
i_t &= r^* + \phi_y y_t + \phi_\pi \pi_t
\end{aligned}
$$

Macroprudential Policy 2: Lagged Effective Macroprudential Policy

Proposition 2: *"Divine Coincidence in Expectation"*

Assume that policies are set according to

$$\mu_t = \eta^* - \xi \varepsilon_t^\eta$$
$$i_t = r^* - \sigma y_t - \sigma \gamma \mu_t$$

Then

$$E_t[y_{t+1}] = 0$$
$$E_t[\pi_{t+1}] = 0$$
$$E_t[\eta_{t+1}] = 0$$

Macroprudential Policy 3:
Relatively Ineffective Macroprudential Policy

- In reality, we do not observe the divine coincidence
- This is due to additional constraints on effectiveness:
  1. Tools do not address all sources of risk
  2. Implementation lags
  3. Governance has often shortcomings

Macroprudential Policy 3: Relatively Ineffective Macroprudential Policy

$$
\begin{aligned}
y_{t+1} - y_t &= \frac{1}{\sigma}\left(i_t - E_t[\pi_{t+1}] - r^*\right) + \gamma(\eta_t - \eta^*) + \eta_t \varepsilon^y_{t+1} \\
\eta_t &= -\mu_{t-4} + \eta^* - \theta(E_t[y_{t+1}] - y_t) + \varepsilon^\eta_t - \xi\varepsilon^\eta_{t-1} \\
\pi_t &= \beta E_t[\pi_{t+1}] + \kappa y_t \\
i_t &= r^* + \phi_y y_t + \phi_\pi \pi_t
\end{aligned}
$$

Result: Macroprudential policy is ineffective

Monetary and Macroprudential Policy

- When the divine coincidence does not hold, monetary and macroprudential policy are linked
  - Monetary policy tracks financial conditions and vulnerabilities
  - Cyclical macroprudential policy conditions on monetary policy

7. Conclusion

- NKV model features endogenous risk
  - Tractable and parsimonious
  - Matches the conditional output gap distribution
  - Provides a basis for endogenous risk considerations in policy
- Allows joint determination of monetary and macroprudential policies

Literature

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