A Macroeconomic Framework for Quantifying Systemic Risk Comments

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Overview

- Model of financial intermediary capital and production/investment decision.
- Serious attempt to quantify non-linear mechanism inherent in models of endogenous leverage (Brunnermeier and Sannikov, He and Krishnamurthy, Adrian and Boyarchenko)
- Quantify the importance of GE feedback effects for macro-prudential policies such as stress-testing

Model:

- AK Production.
- Capital quality shocks.
- Investment-Q relationship.
- Housing in fixed supply.

Intermediaries:

- Net worth (reputation):

$$\frac{d\varepsilon_t}{\varepsilon_t} = m d\tilde{R}_t - \eta dt + d\psi_t$$

- Portfolio shares chosen to solve

$$\max E_t\left[d\tilde{R}_t\right] - \frac{m}{2} Var_t\left[d\tilde{R}_t\right]$$

subject to capital constraint

$$(1-\lambda)\left[q_t K_t + p_t K_t\right] \leq \varepsilon_t$$

- CAPM – price of risk equal to marginal cost of bearing risk:

$$\frac{\pi_t^k}{\sigma_t^k} = \frac{\pi_t^h}{\sigma_t^h} = m\left(\alpha_t^k \sigma_t^k + \alpha_t^h \sigma_t^h\right)$$

Model Intuition:

- Without frictions asset prices and Sharpe ratios are constant:

$$\frac{\pi^k}{\sigma^k} = \frac{\pi^h}{\sigma^h} = \frac{m}{1-\lambda}\left(\frac{q}{q+p}\sigma^k + \frac{p}{q+p}\sigma^h\right)$$

  With frictions if $\varepsilon_t >> (1-\lambda)W_t$ we get a similar result.
- If $\varepsilon_t < (1-\lambda)W_t$ constraint binds, less equity financing and more leverage – expected returns must rise to compensate intermediaries for increased risk – asset prices fall and Sharpe ratios rise.
- GE feedback – drop in asset prices implies lower intermediary net worth and further increase in Sharpe ratios.

Real effects:

- Investment falls – q-theory.
- $Y = AK$ so consumption increases.
- Land in fixed supply so land prices much more volatile that q

Results:

- Calibration chosen to fit unconditional moments
- Model does well at explaining conditional moments – Sharpe ratios increase and investment falls when EBP is high.
    - Occasionally binding constraint implies non-linear dynamics owing to endogenous leverage – fear of a "sudden stop".
- Financial crisis – 15% exogenous decline in capital leads to 70% drop in intermediary net worth and land prices.

Policy implications:

- Hidden leverage is bad.
- Stress tests must take GE effect into account.
- Macroprudential policy – m, λ, r?

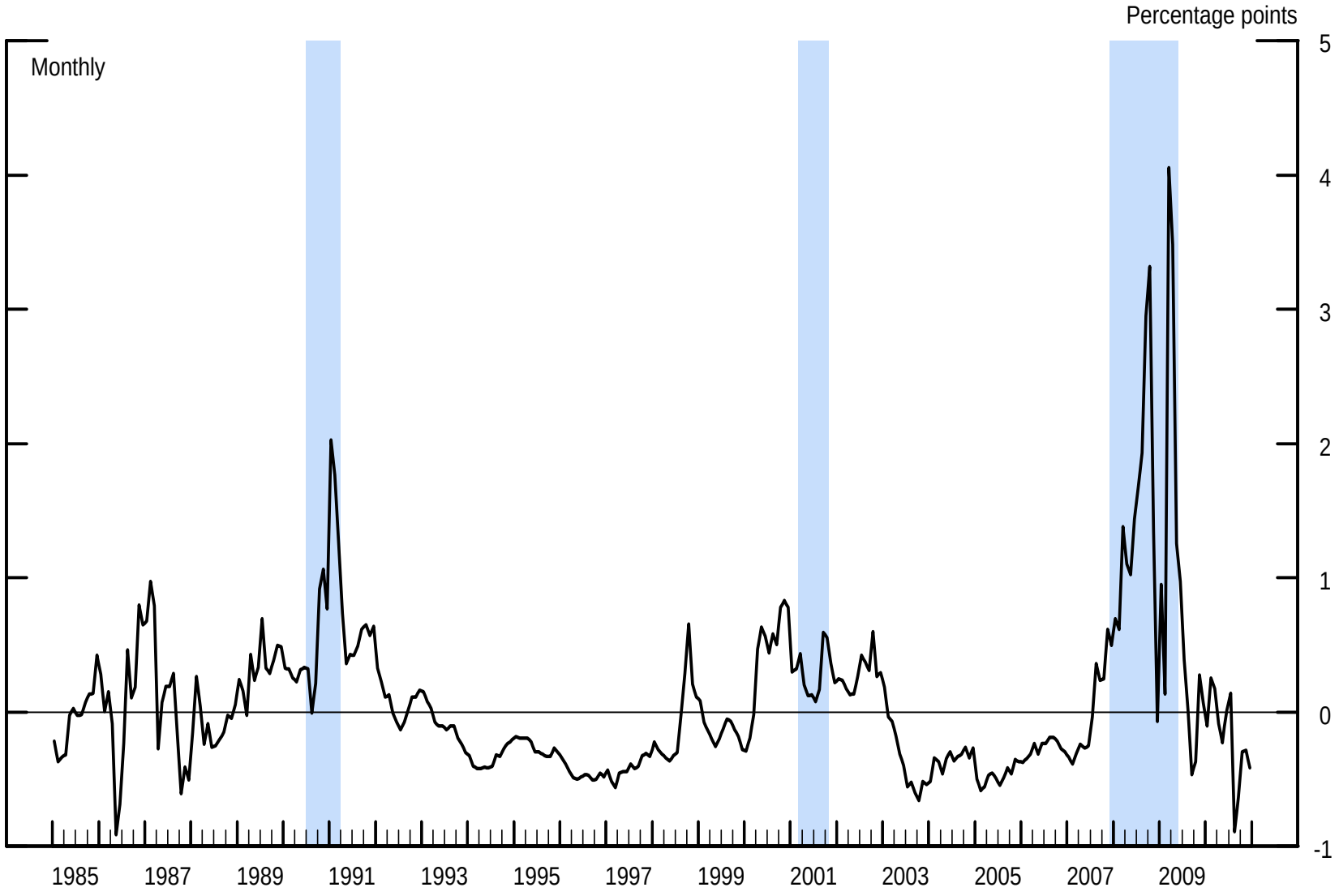
Gilchrist & Zakrajsek (2012)

- Financial accelerator model with risk shock.
  - Calibrate key parameters including strength of financial friction to fit impulse response of [Y,C,I,π] to GZ excess bond premium obtained from VAR estimated with pre-crisis data.
- Assess model's ability to account for financial crisis.
- Consider stabilization benefits of spread-augmented "robust rule" a la Orphanides-Williams:

$$i_t = \rho i_{t-1} + (1-\rho)[1.87\pi_t + 1.12\Delta y_t - 0.5 s_t]$$

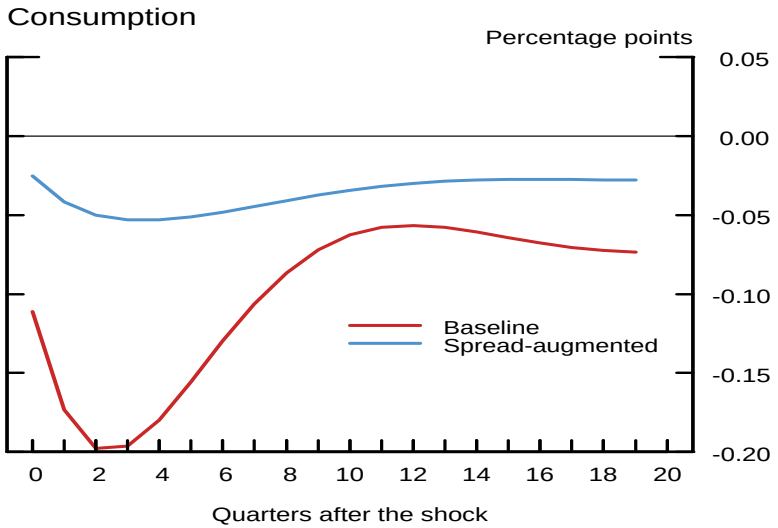
Financial Bond Premium (FBP)

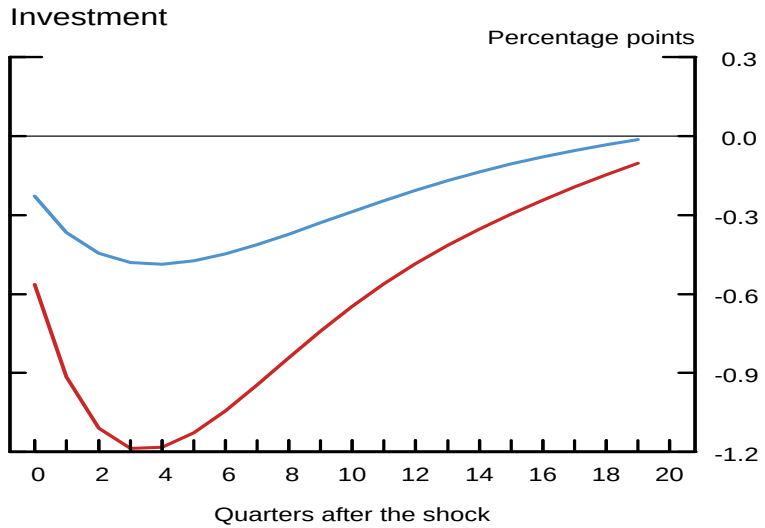
(Jan1985–Dec2010)

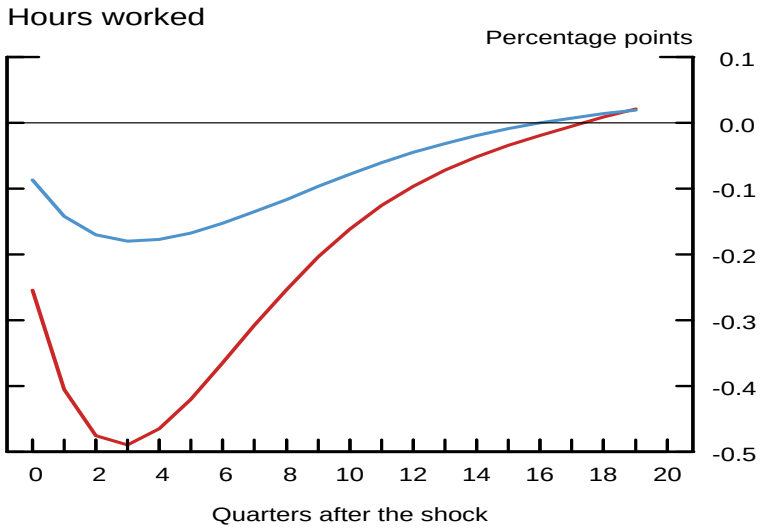


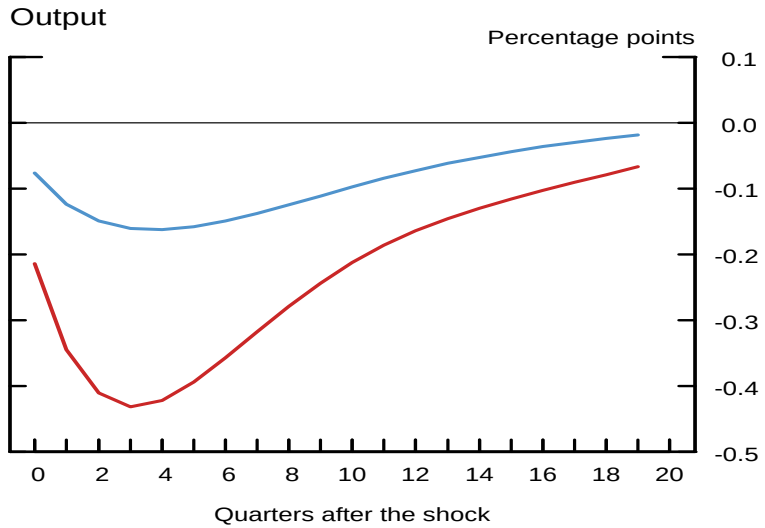
Model Response to a Financial Shock

Baseline vs. Spread-Augmented Monetary Policy Rule









NOTE: In deviations from the steady state.

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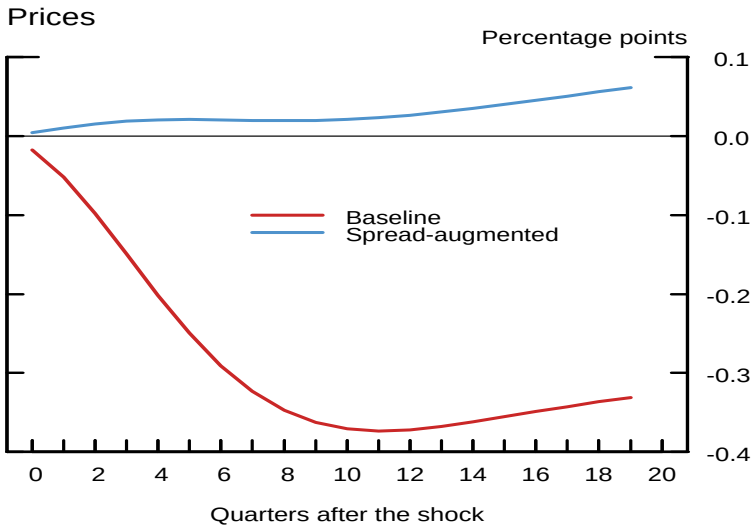

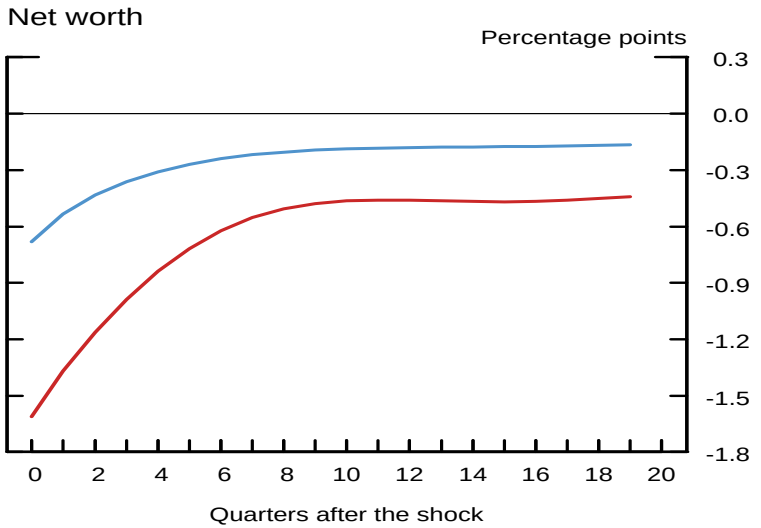

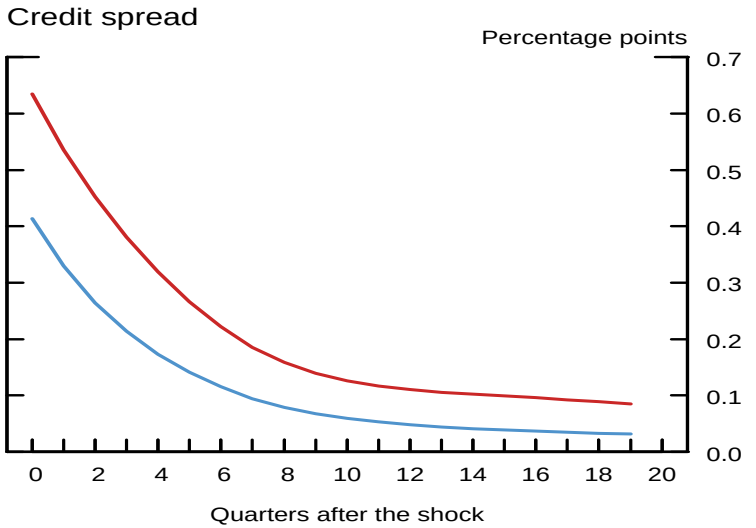

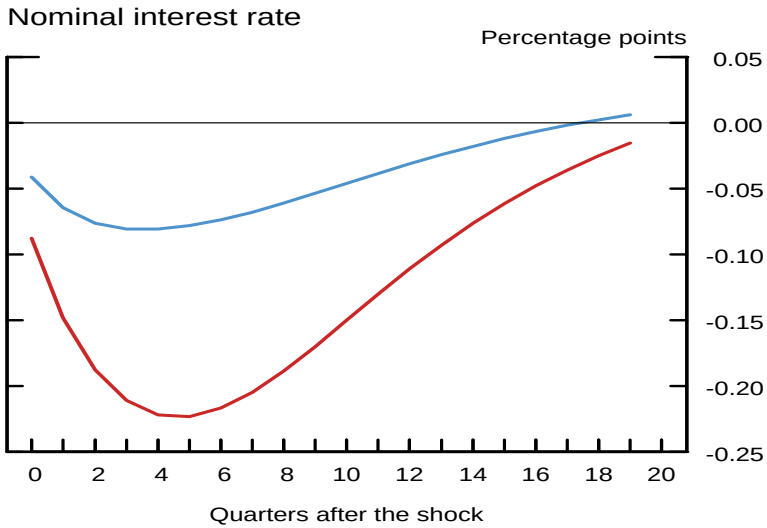

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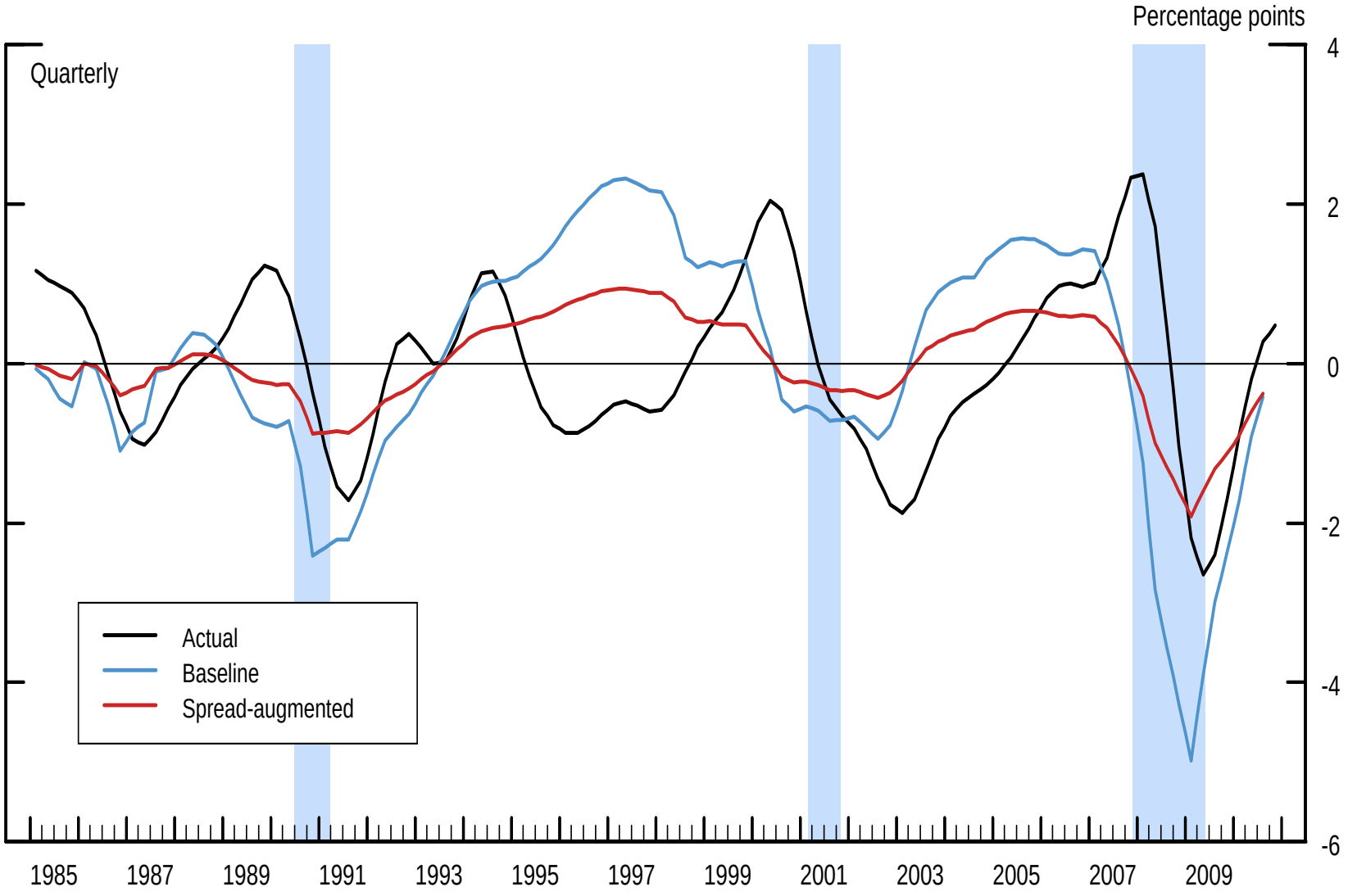
Model Simulations vs. Actual Data

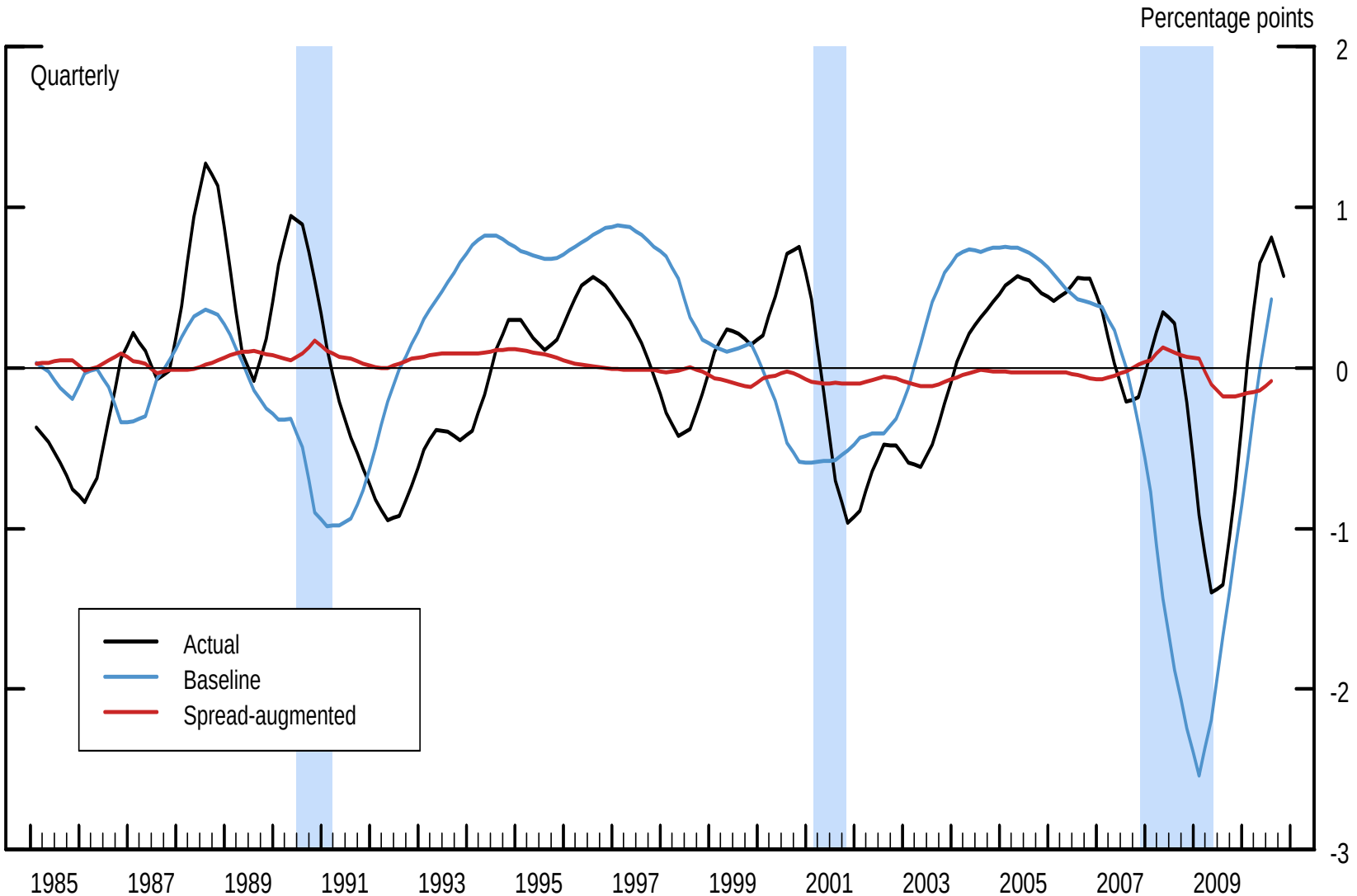
Real GDP



NOTE: All variables have been demeaned.

Model Simulations vs. Actual Data

Inflation



NOTE: All variables have been demeaned.

Policy alternatives

- Inflation targeting:

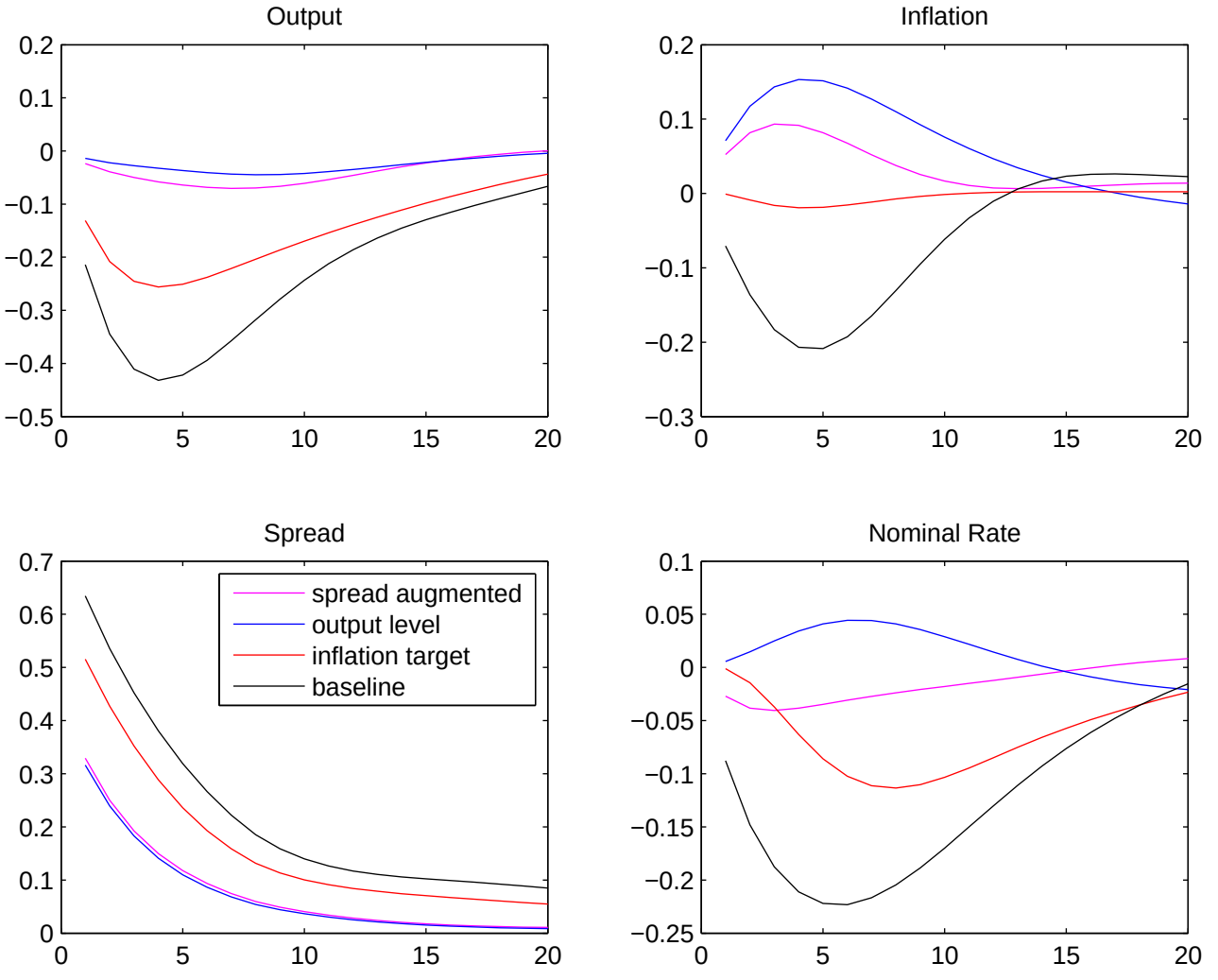
$$i_t = (1-\rho)10[1.87\pi_t] + \rho i_{t-1}$$

- Output level (gap) rule

$$i_t = (1-\rho)[1.87\pi_t + 1.12y_t] + \rho i_{t-1}$$

- Spread augmented (Taylor: coefficient =1):

$$i_t = (1-\rho)[1.87\pi_t + 1.12\Delta y_t - s(t)] + \rho i_{t-1}$$


Output
Inflation
Spread
Nominal Rate
spread augmented
output level
inflation target
baseline

Monetary policy implications

- Linear model:
  - Augmenting "robust" output growth rules with financial variable (spread, leverage) substantially improves outcomes.
  - Rules with strong response to output gap also do very well – but what is output gap after financial crisis?
- Non-linear model – volatility paradox comes into play:
  - Stabilization policy will lead to higher leverage and increased probability of a crisis.
  - Need separate macro-prudential policy to limit leverage.
- Commitment to an effective rule is very powerful in models where financial friction depends on asset prices – a promise to react mitigates the need to react.