Estimation of Monetary Policy Shocks

Why Shocks?

- Assessing the effects of a change in monetary policy institutions or rules could be accomplished using purely statistical methods. But, we don't have data drawn from otherwise identical economies operating under monetary institutions or rules we are interested in evaluating.
- Purely statistical approaches to these sorts of questions aren't feasible and so is real world experimentation
- What do we do?
  - one isolates monetary policy shocks in actual economies and characterizes the nature of corresponding monetary experiments (identified VAR)
  - Characterize the response of the actual economy to these monetary experiments (impulse responses).

- General identification strategies:
  - Short-run identification: Cholesky, recursiveness assumption.
  - Event studies: a la Romer and Romer (1989)
  - Long-run identification: Blanchard and Quah (1989), King, Plosser, Stock and Watson (1991).
  - Other identification strategies: heteroskedasticity, set identifcation
- Recursive assumption is very popular but also controversial
- Structural models: advantages as wells as disadvantages
- Disadvantage: A broader set of economic relations must be identified

- Consensus about the qualitative effects of monetary policy shocks:
  - After a contractionary monetary policy shock, short term interest rates rise,aggregate output, employment, profits and various measures of monetary aggregates fall, the aggregate price level responds very slowly, and various measures of wages fall, albeit by very modest amounts.
  - In addition, there is agreement that monetary policy shocks account for only a modest percentage of the volatility of output, they account for even less of the movements in the aggregate price level (This doesn't imply that a systematic monetary policy account for a small proportion of variability of output and inflation).

Monetary Policy SHOCK

- What is a monetary policy shock?
- A significant fraction of the variations in output and prices is due to systematic changes in monetary policy. A systematic component of monetary policy is typically formalized with the concept of a feedback rule or reaction function.
- Chistiano, Eichenbaum and Evans (1999) argue that not all variations in central bank policy can be accounted for as a reaction to the state of the economy.
- The unaccounted variation is formalized with the notion of a monetary policy shocks.

- A monetary policy shock is disturbance term in the following equation:

$$S_t = f(\Omega_t) + \sigma_s \varepsilon_t^s$$

- where S_t is the instrument of monetary policy and f is a linear function that relates S_t to the information set Ω_t. The random variable $\sigma_s \varepsilon_t^s$ is the monetary policy shock. ε_t^s is normalized to have unit variance and σ_s is the standard deviation of monetary policy shock.
- Problem with the above approach:
  - If you believe the Fed there are no shocks, there are just omitted variables. Furthermore, an optimizing agent never introduces shocks in a control variable. Optimal policy must always be policy=f(economy)+0.

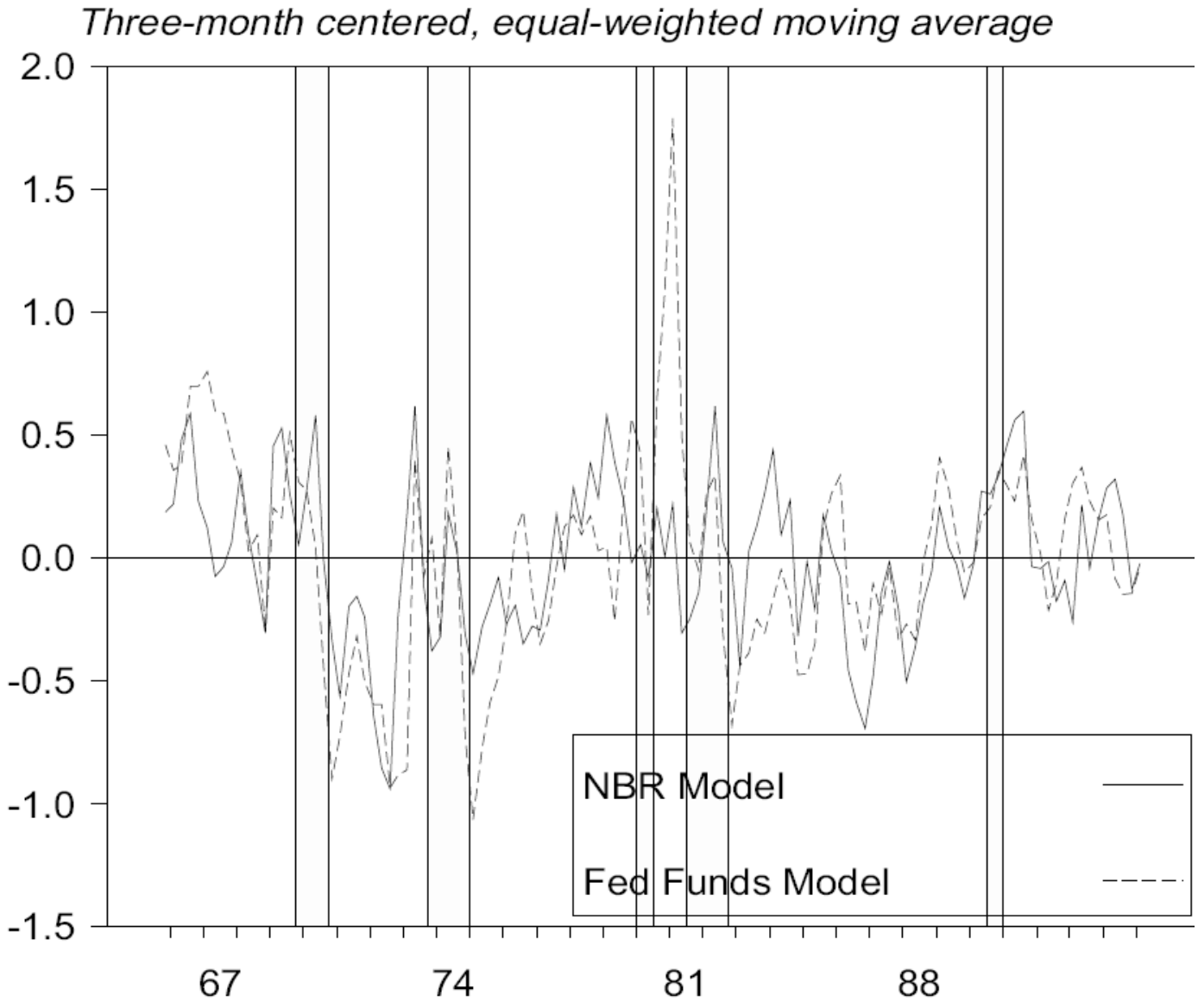
- Three popular approaches to identify monetary policy shock
  - VAR Approach
  - Narrative approach of Romer and Romer
  - High Frequency Federal Funds Futures Market

- How does CEE justify using regression errors as shocks anyway?
  - Shocks to preferences
  - Strategic considerations, social cost of disappointing private sector explanations
  - Measurement error in preliminary data

Identification Schemes

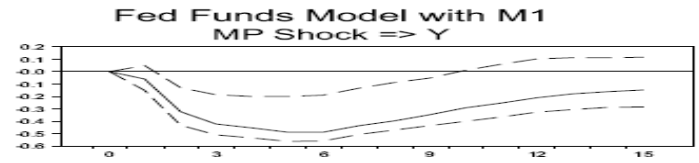
- Recursive structure
- Two measures of policy instrument in CEE paper: federal funds rate and non-borrowed reserves (NBR)
- Benchmark VAR:
  - [Y P PCOM FF TR NBR M]
  - [Y P PCOM NBR FF TR M]
- 4 lags in VAR
- Both models assume that monetary authority sees Y_t,P_t and $PCOM_t$ before choosing S_t

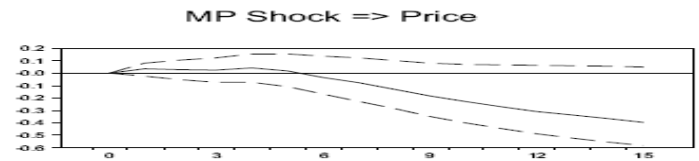
Benchmark Policy Shocks

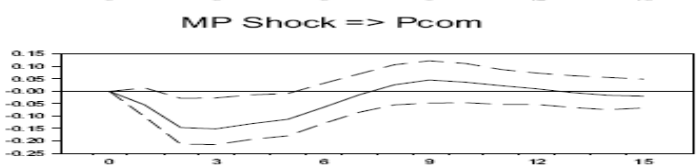


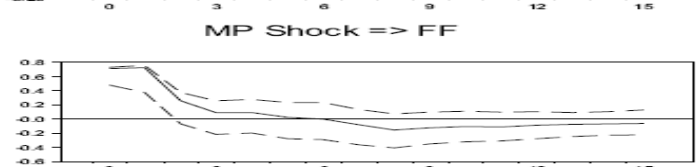
- Three quarter moving average of the shock
- The two shocks are positively correlated with a correlation coefficient of 0.51 (problem?)

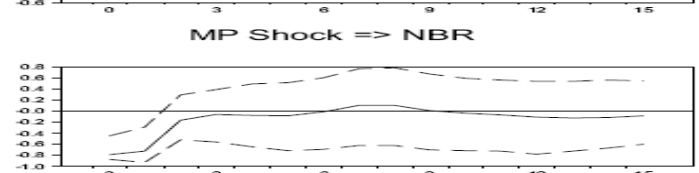
Impulse Response Analysis (What happens after a Benchmark Policy Shock?)

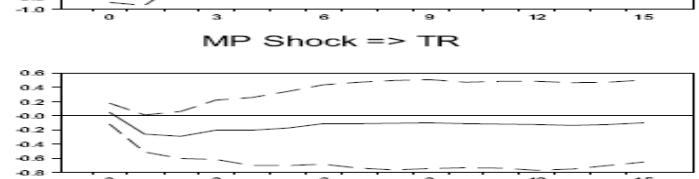


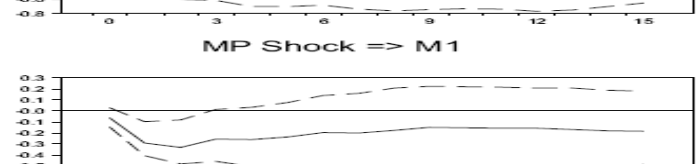


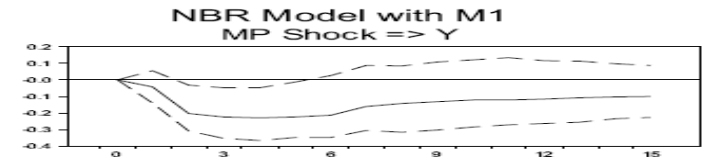


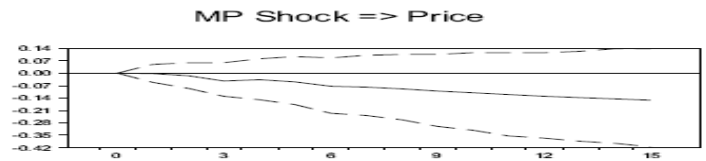


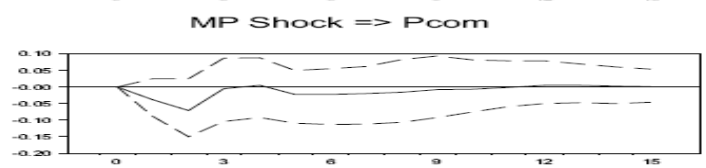


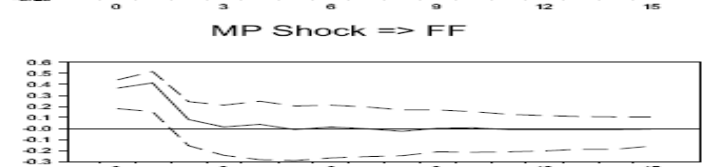


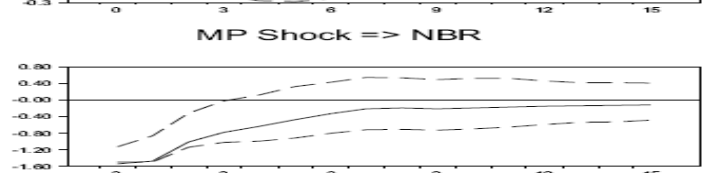


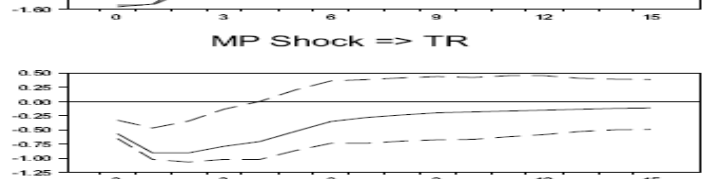


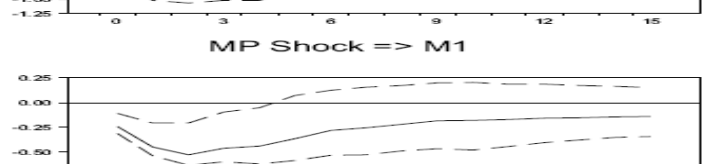


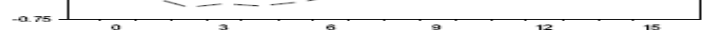










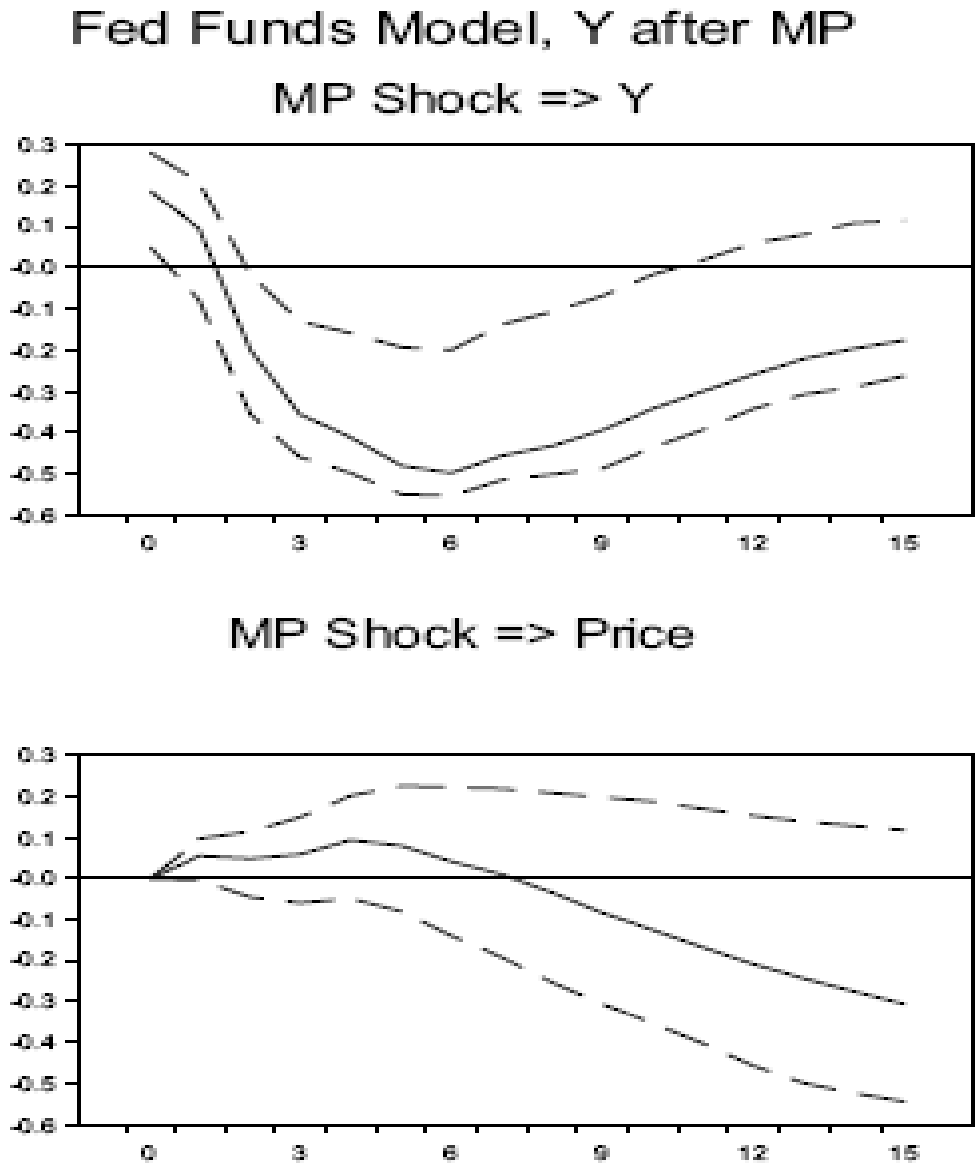


Impulse Response Analysis

- Are you surprised that monetary policy seems to have no impact effect on output, price level or commodity prices?
- Fall in total reserves is negligible initially. But eventually total reserves fall by roughly 0.3 percent, so according to this policy shock measure the Fed insulates total reserves in the short-run from the full impact of a contraction in non-borrowed reserves by increasing borrowed reserves.
- Hump-shaped response of GDP
- Results are robust to the use of monthly data: non-farm payroll employment as a proxy for output
- CEE$\Rightarrow$ in response to a contractionary monetary policy shock, the federal funds rate rises, monetary aggregates decline, the aggregate price level initially responds very little, aggregate output falls displaying a hump-shaped pattern and commodity prices fall.

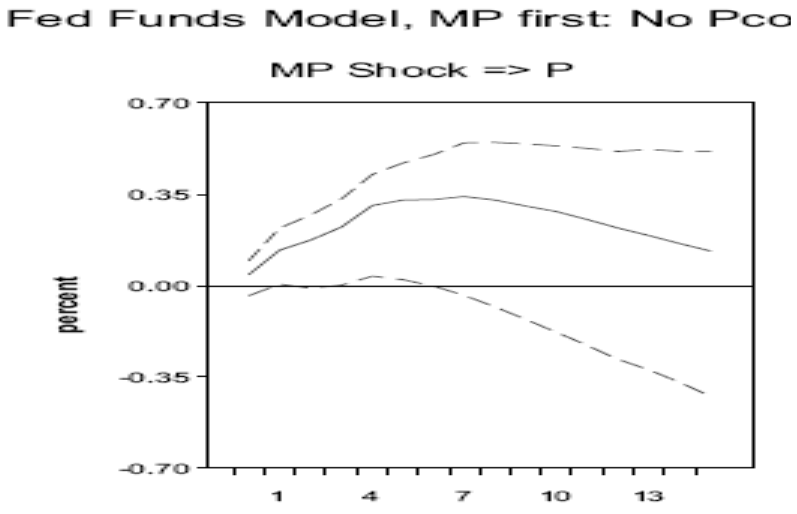
Robustness Check

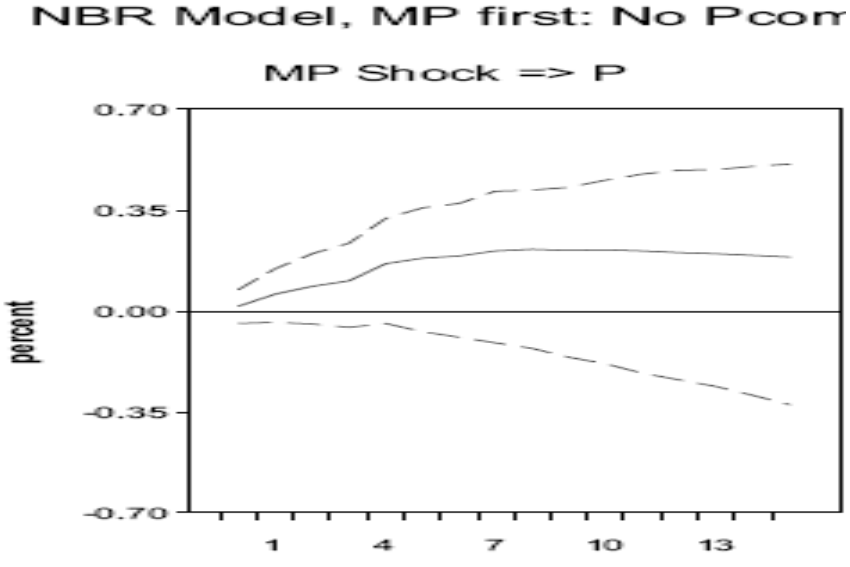
- What happens if you put output or prices after ff in the orthogonalization?



- Output rises instantaneously. This is dismissed on the ground that no theory produces this sign.
- No effect on prices. Price and shock are not correlated to start with so it doesn't matter which goes first.

What is the "Price Puzzle" and how is it resolved?





What is the "Price Puzzle" and how is it resolved?

- Without pcom in the system, mp shocks seem to raise prices. This is the "Price Puzzle"
- Explanation: Prices appeared to rise after certain measures of contractionary policy shock because those measures were based on Ω_t that did not include information about future inflation that was available to the Fed. Therefore, this is a case of omitted variable.
- The Fed sees inflation rising (it sees fast moving pcom). It raises ff, and then we see the price rise. Putting in PCOM solves this problem.
- This is a classic case of the "third variable" in VARs. But, how do we know it's over? In particular, Fed watches long term interest rates and long term interest rates add a lot to the FF equation

- What happens if you follow Friedman and use M aggregates as the shock?
  - For M1, standard errors are huge and many signs are large. M2 is little bit better

Sub-sample Analysis

- Standard errors are huge
- Seems that the results are driven by few data points

Narrative Measure of Monetary Policy Shock

- Use Greenbook forecast prepared by the Federal Reserve Board Staff to measure monetary policy shock
- One notable approach is the identification of monetary policy shocks by Romer and Romer (2004), who derive their measure of monetary policy shocks by regressing changes in the intended federal funds rate on Greenbook forecasts of output growth, inflation and the unemployment rate for every regular Federal Open Market Committee (FOMC) meeting in the period between 1969 and 1996.
- The residuals from this regression are the changes in the federal funds rate target not taken in response to information about future economic developments and thus constitute a measure of monetary policy shocks.

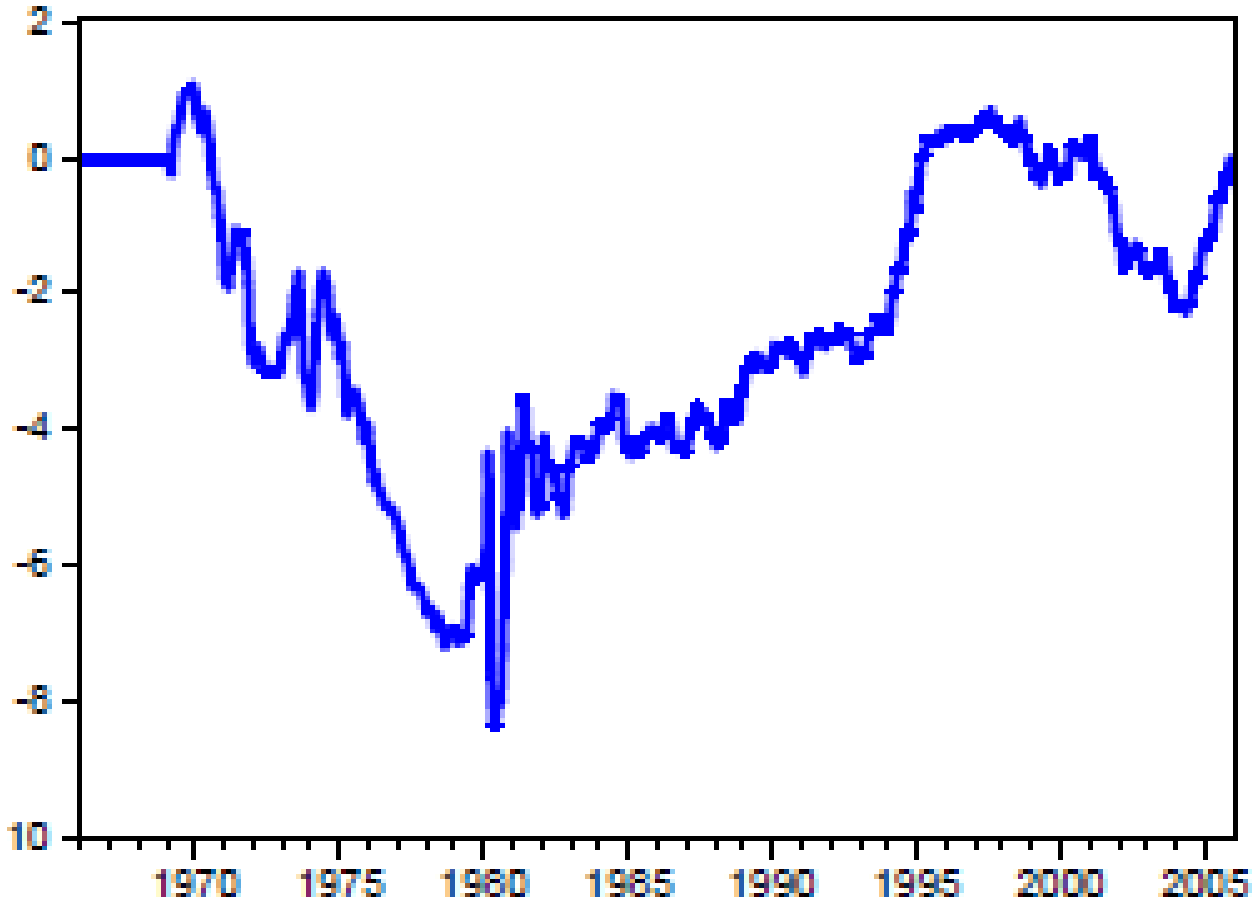
Estimation of MP Shock based on RR (2004)

- Monetary policy shocks are derived by regressing the changes in the federal funds rate target Δff_m around meeting m on the federal funds rate target before the meeting ffb_m, the current Greenbook forecasts of inflation $\widetilde{\pi}_{mi}$, output growth $\Delta\widetilde{y}_{mi}$ (past quarter, current quarter and two quarters ahead) and the unemployment rate $\widetilde{u}_{m0}$ (current quarter) as well as changes of these forecasts compared to the last meeting's predictions[1]:

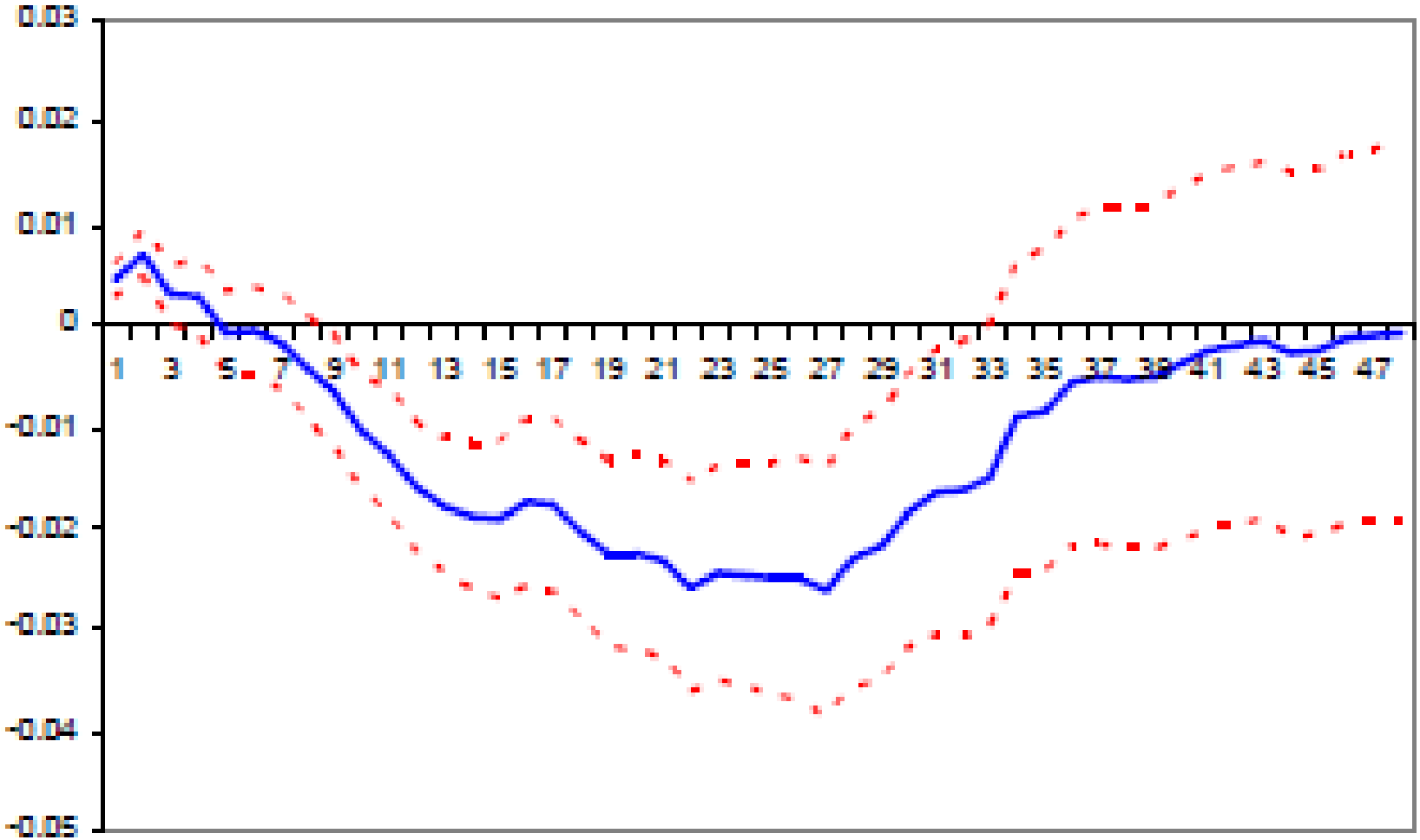
$$\begin{aligned}\Delta ff_m &= \alpha + \beta ffb_m + \sum_{i=-1}^{2} \gamma_i \Delta\widetilde{y}_{mi} + \sum_{i=-1}^{2} \lambda_i (\Delta\widetilde{y}_{mi} - \Delta\widetilde{y}_{m-1,i}) \\ &\quad + \sum_{i=-1}^{2} \varphi_i \widetilde{\pi}_{mi} + \sum_{i=-1}^{2} \theta_i (\widetilde{\pi}_{mi} - \widetilde{\pi}_{m-1,i}) + \rho\widetilde{u}_{m0} + \varepsilon_m \quad (1)\end{aligned}$$

- The residuals ε_m from the estimation of represent the component of monetary policy that does *not* represent the component of monetary policy that is made in response to macroeconomic conditions.
- They are therefore treated as the measure of monetary policy shocks.

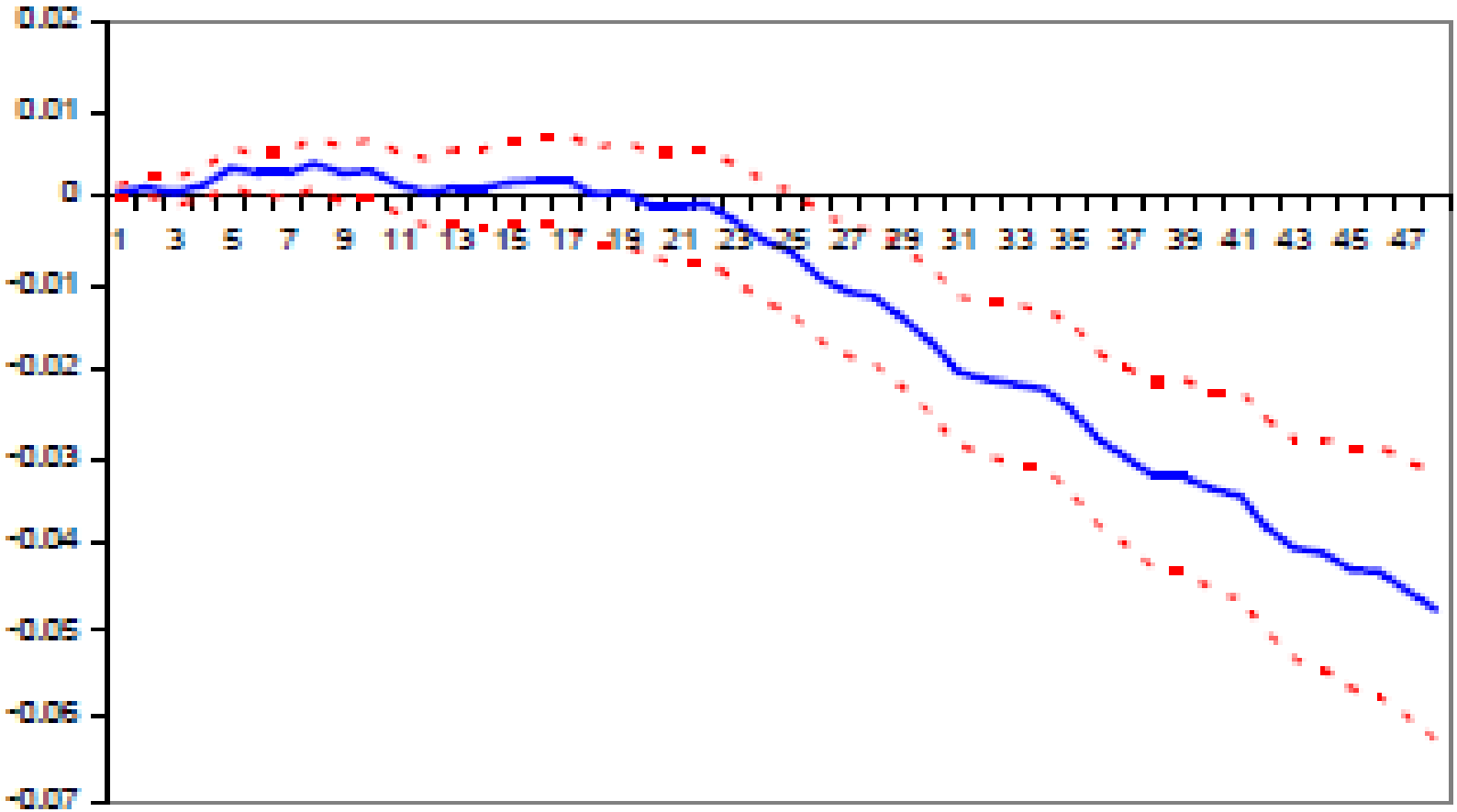
Cumulated monetary policy shocks, derived from single monetary policy function for 1969-2005



Output Response to Monetary Policy Shock (1969-2005)



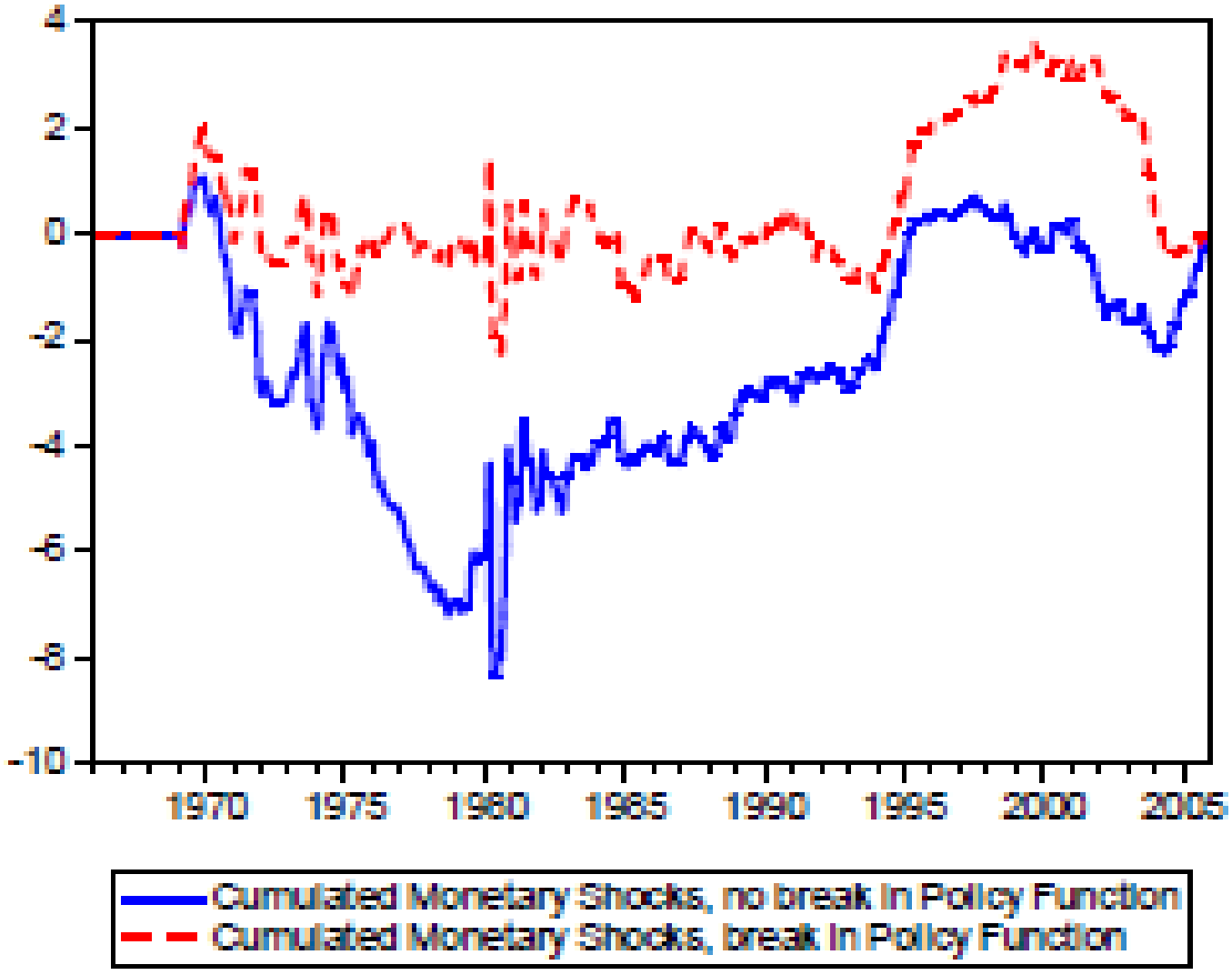
Price Response to Monetary Policy Shock (1969-2005)



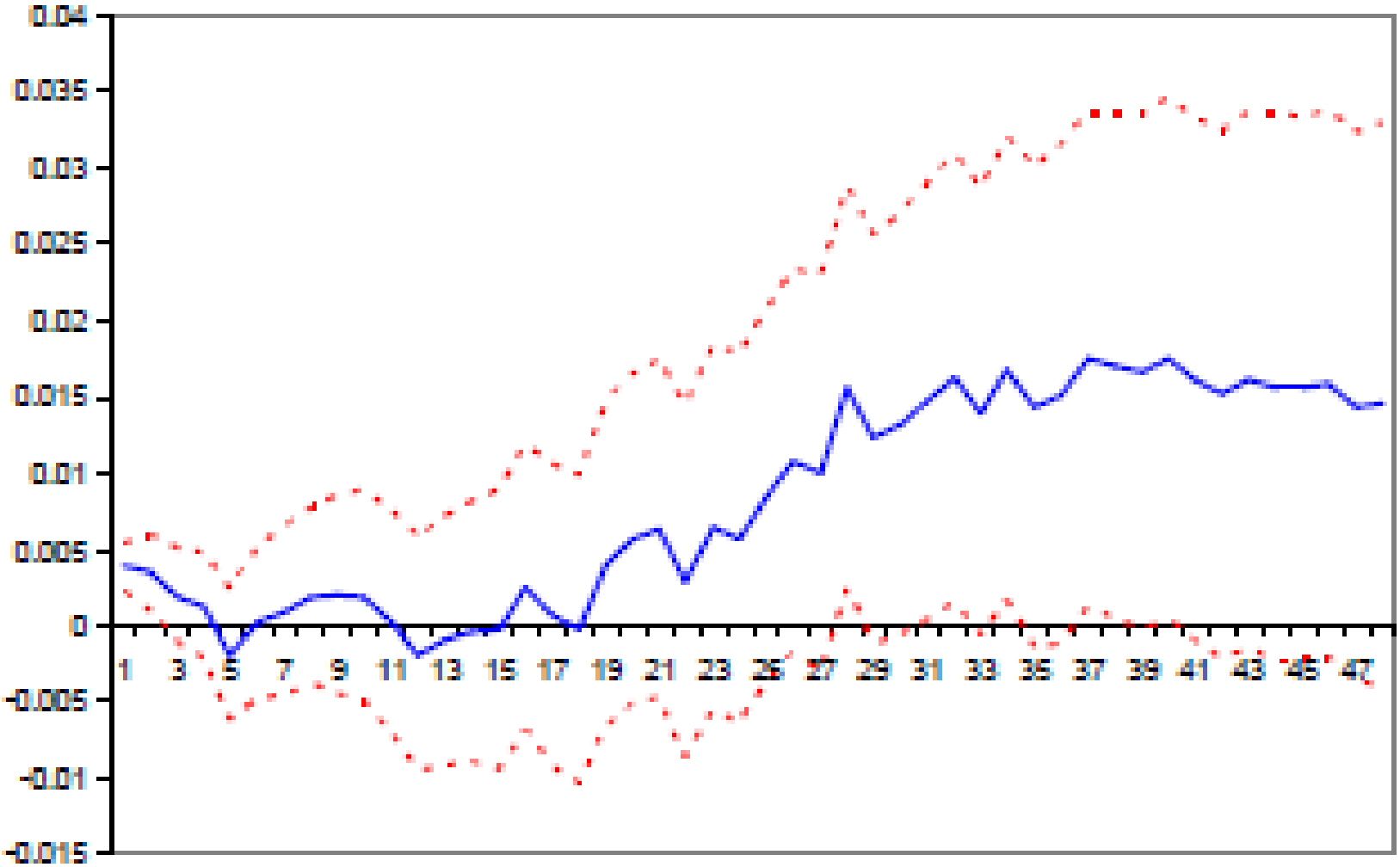
Narrative Measure of Monetary Policy Shock

- Problem: monetary policy makers' response to macroeconomic conditions has changed since Paul Volcker took over the chairmanship of the Federal Reserve in 1979, and
- Macroeconomic stability experienced in the U.S. after 1979 might have changed the response of output and prices to monetary policy shocks.
- Significant evidence for a break in the monetary policy reaction function
- Kishor and Newiak (forthcoming) derive monetary policy shocks for the pre-1979 and post-1979 periods by estimating different monetary policy reaction functions for both sample periods

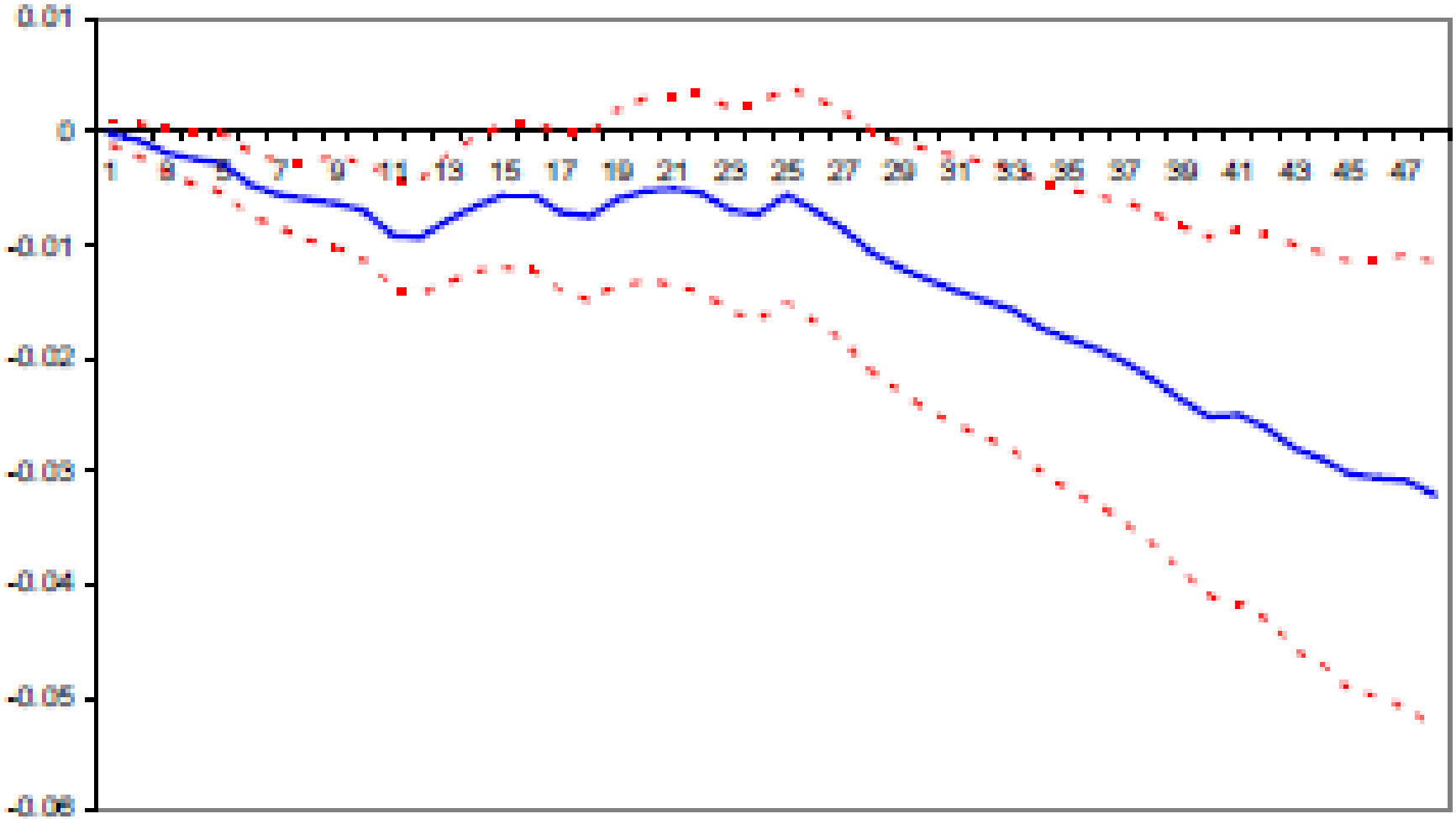
Cumulated monetary policy shocks, derived from different monetary policy functions (pre-1979 and post-1979)



Output Response to Monetary Policy Shock (1979-2005)



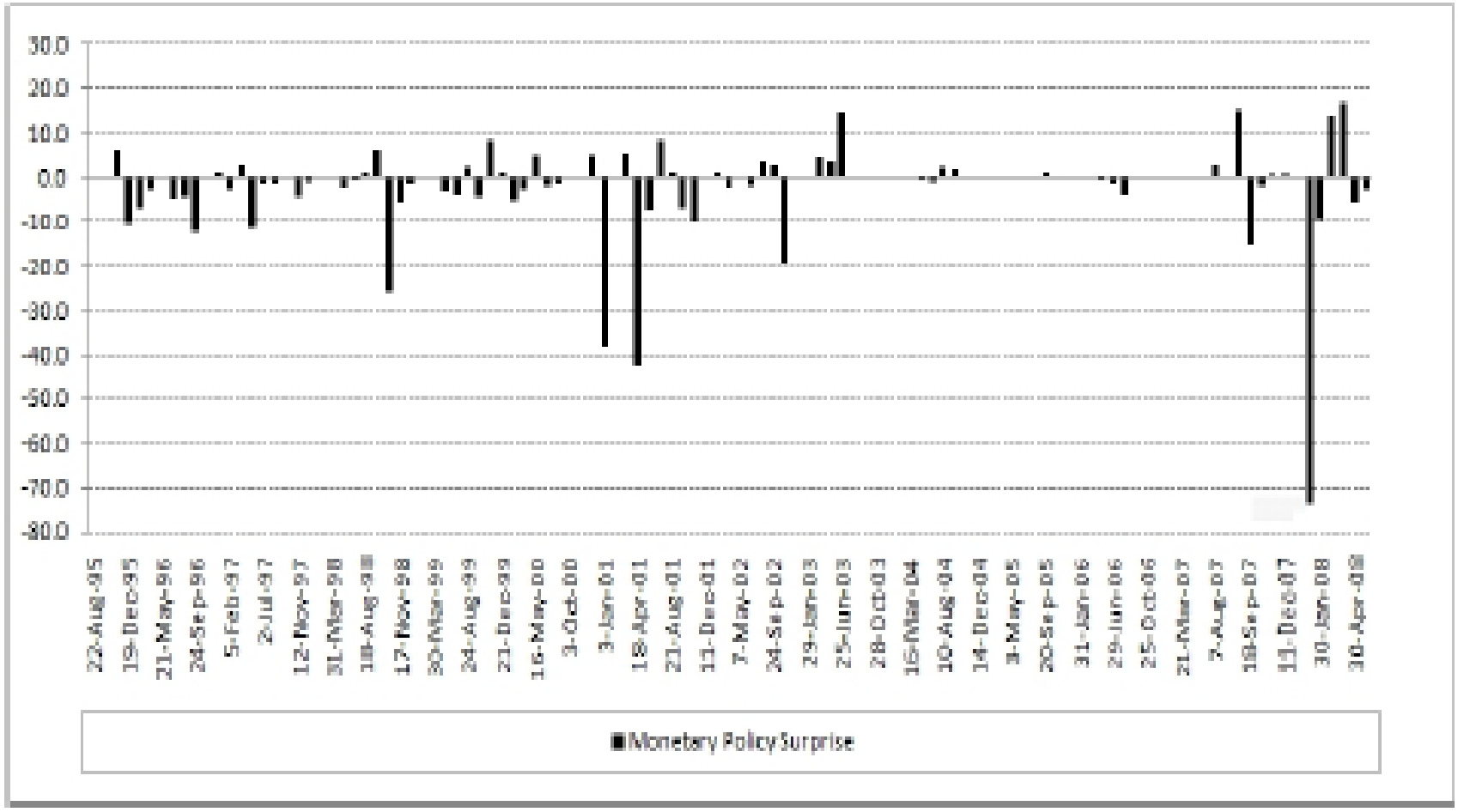
Price Response to Monetary Policy Shock (1979-2005)



Monetary Policy Shock Based on High-Frequency Data

- Use information from the Federal funds futures market.
- This has been used by Krueger and Kuttner (1996) among others, who find that the Fed funds futures rate is an unbiased predictor of the Fed funds rate and is an 'efficient' measure of Fed funds rate.
- Gürkaynak, Sack and Swanson (2002) also show the superiority of the Fed funds futures price among different market based measures of monetary policy expectations.
- Given the superiority of the Fed funds futures data to measure policy expectations, Bernanke and Kuttner (2005) find that a typical unanticipated 25 basis point rate cut has been associated with a 1.3 percent increase in the S&P 500 index

Figure 1: *Monetary Policy Surprise Computed from the Federal Funds Futures Interest Rate*



Impulse response for Fed Futures Shocks