Measuring the impact of monetary policy on stock markets by means of an identified multivariate GARCH model

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June 29, 2022

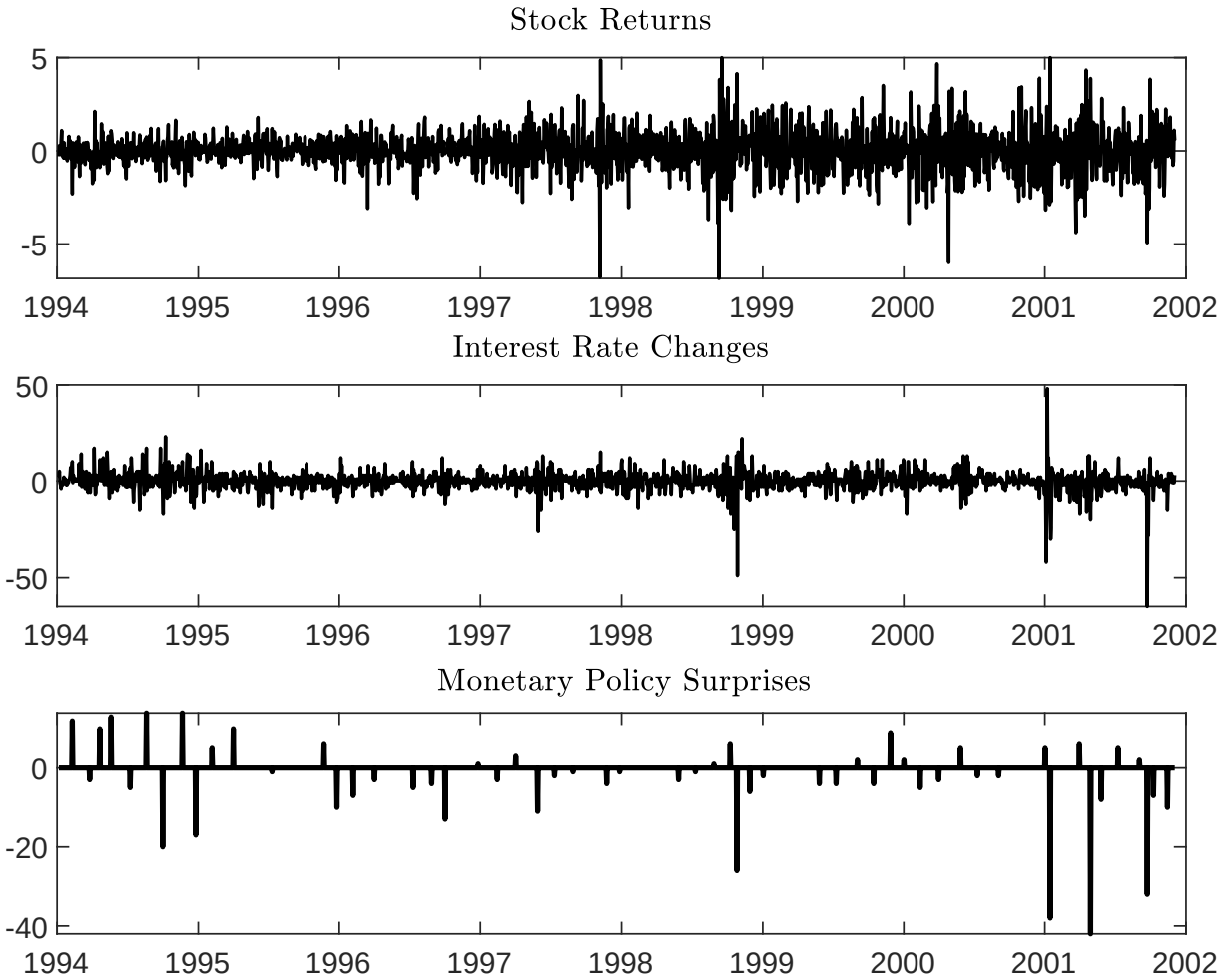
Motivation

- Endogenous relationship between monetary policy and stock market.
  - Negative relation: An increase in interest rates would reduce asset prices.
  - Positive relation: Drops in stock prices, through their effects on real economic activity, may induce an expansionary monetary policy (interest rate drops).
- Methods to identify the monetary policy impact on the stock market.
  - Event study approach (Bernanke and Kuttner, 2005)
  - Heteroskedasticity in the policy shocks (Rigobon and Sack, 2004)
  - External variable approach (Proxi SVARs) by Paul (2020)
- Recent literature progressed from estimating a constant policy effect to time-varying policy effects (Gali and Gambetti, 2015; Paul, 2020).

In this paper

- We focus at the time-varying monetary policy impact on the US stock market at the daily frequency.
- We propose a new approach using monetary policy surprises for identification.
- We consider a multivariate GARCH (MGARCH) framework, where heteroskedasticity of interest rates and stock market returns are taken into account.

Data



Returns on S&P 500; Changes in 3-month T-bill rates; Unexpected changes in fed funds target rate based on current-month fed fund future contracts (Kuttner, 2001)

An identified MGARCH framework

Let $y_t = (r_t, \Delta i_t)'$ denote a a bivariate vector comprising stock returns and interest rate changes. A reduced form MGARCH with BEKK(1,1,1) specification is

$$\begin{aligned} y_t &= \mu_t + e_t, \\ \text{Cov}[e_t|\mathcal{F}_{t-1}] &= H_t, \\ H_t &= CC' + A' e_{t-1} e_{t-1}' A + B' H_{t-1} B. \end{aligned}$$

The relation between the reduced form shocks and the corresponding structural shocks can be seen as

$$e_t = H_t(\theta)^{1/2} \tilde{\xi}_t, \ \tilde{\xi}_t \overset{iid}{\sim} (0, I_N).$$

Identification

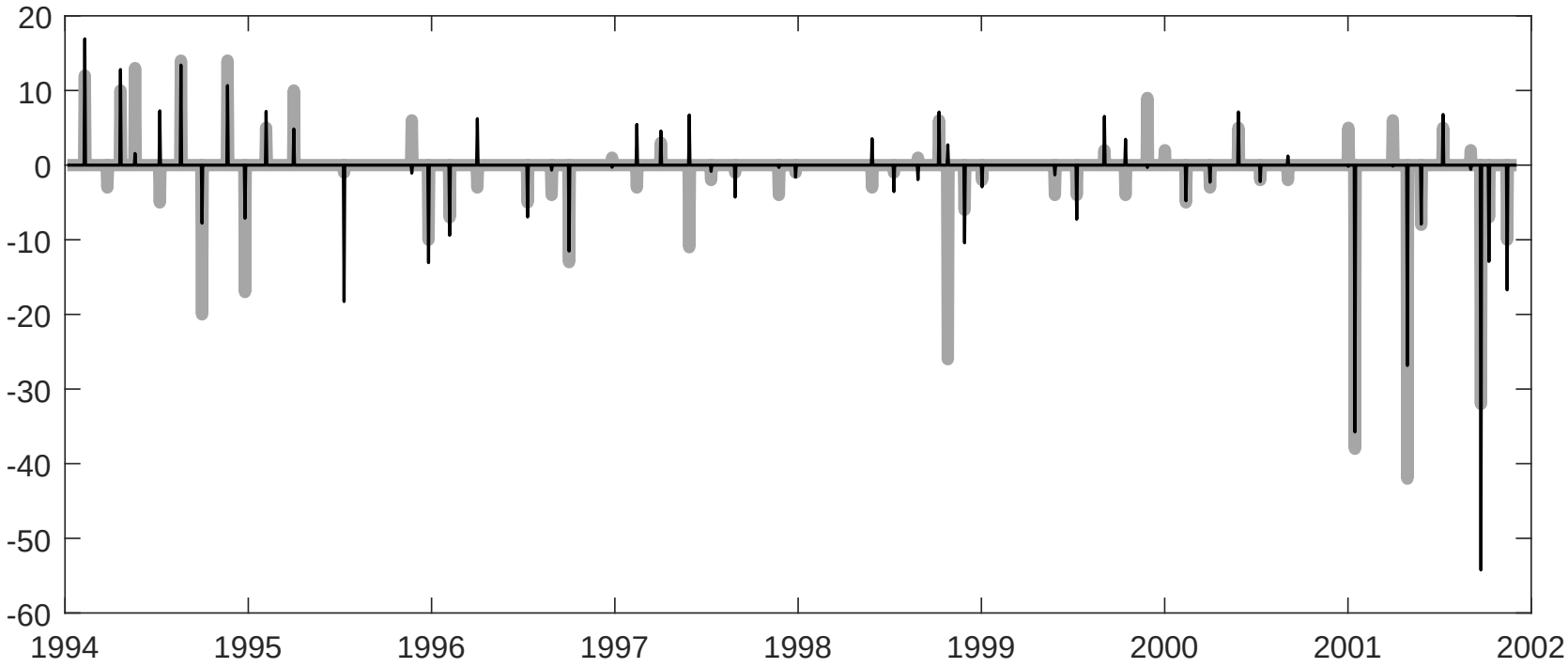
The covariance can be decomposed as

$$H_t(\theta) = H_t(\theta)^{1/2} H_t(\theta)^{1/2'} = H_t(\theta)^{1/2} R_\delta R_\delta' H_t(\theta)^{1/2'} = W_t(\theta, \delta) W_t(\theta, \delta)',$$

where R_δ is a rotation matrix (satisfying $R_\delta \neq I_N$ and $R_\delta R_\delta' = I_N$). We choose such δ that minimises the absolute difference between the structural innovation for the interest rate (ξ_{2t}^*) and the monetary policy surprises (s_t),

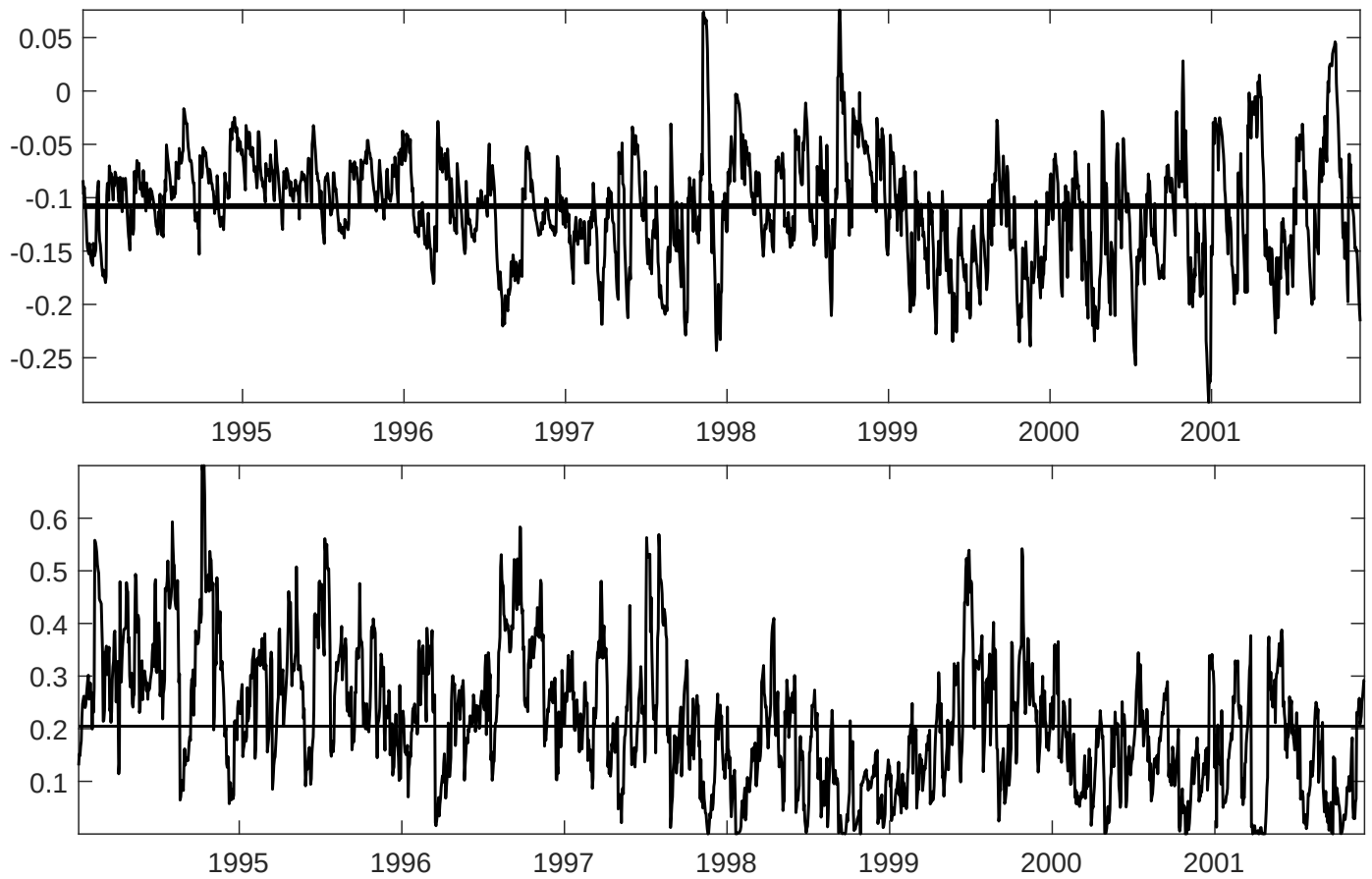
$$\delta^* = \min_\delta \sum_{t \in \Omega_s} |\xi_{2t}^* - s_t|, \quad \text{with } \xi_t^* = (W_t^{-1} \odot I_N)^{-1} W_t^{-1} e_t, \; W_t = W_t(\theta, \delta).$$

Result



The figure shows the model implied structural policy shocks ξ_{2t}^{*} (in black) jointly with monetary policy surprises (in grey) on policy action dates.

Time-varying policy effects with respective variance share



An unexpected 25 basis point cut of interest rates would induce a 2.76 percentage point increase in the equity index on average.

Policy effects in bear markets and high credit risk periods

	Panel A: policy effect		Panel B: (policy effect)^2	
constant	−2.71	−2.60	8.87	7.99
	(0.03)	(0.04)	(0.19)	(0.23)
Bear	−0.24		2.34	
	(0.07)		(0.43)	
Credit Risk		−0.33		2.67
		(0.06)		(0.33)

- In a high stress market environment, financial constraints are more binding, and thus monetary policy can have a stronger effect on stock markets.
- Our results show that both the average policy effect and the variability of the policy effect increases in bear markets and high credit risk periods (when BAA credit spread is above its sample mean).

Conclusions

- This paper proposes a new approach (multivariate GARCH) to estimate the impact of monetary policy on the stock market.
- We use the informational content embedded in the monetary policy surprises around events days to identify the market's response to the monetary policy in a large sample with daily data.
- Our results show that a cut of 25 basis points in the interest rate would induce a 2.76 percent increase in the equity index on average.
- In bear markets and during periods of relatively large credit risk, the monetary policy effects on the stock market are stronger and the variation of the policy effect is larger.