Monetary policy analysis using vector autoregression

Kyle B. Lackinger

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1 Data summary

I choose the Federal Funds Rate (FFR)[1], industrial production (IP)[2], and real personal consumption expenditure (PCE)[3], excluding food and energy, to analyse the effect of a policy rate shock on U.S. economic activity and inflation. Monthly data from 1959M2 through 2019M5 are used. To avoid econometric estimation issues due to non-stationarity of data, percent change relative to the previous periods are utilized for industrial production and real PCE.

2 VAR specifications

As mentioned above, care is taken in choosing data included in the analysis to avoid non-stationarity in the VAR model. Eigenvalue stability condition is tested and indicates the process is stable, which is a sufficient condition for ensuring stationarity. The Akaike information criterion (AIC) test is utilized to determine the number of model lags. Results indicate nine lags.[1] Cross-correlation and Granger causality tests are used to assess the order of variables. It appears that IP lags the FFR based on cross-correlation results. Granger causality tests appear to support both IP Granger causing inflation and FFR Granger causing IP. Comparison of impulse responses of both orders appear to be marginally different so I choose FFR, IP, inflation model order. I use a recursive VAR with restrictions placed on the error terms by orthogonalizing them, producing an orthogonal shock vector. This results in a single-variable initial shock which propagates through the system over time.[2]

3 Results

Impulse responses to the positive shock to the FFR can be seen in Figure 1. IP and core PCE responses are shown on the left and right panels, respectively. A clear drop in IP can be seen, reaching its nadir after five periods following the shock. There appears to be a slow recovery from that point on. Core PCE rate appears to oscillate slightly below its initial level while asymptotically returning to zero over the 20 periods.

[1] BIC indicates three lags are required but I opt for $p = 9$ lags.

[2] I leverage the Spring 2016 lecture "Section 10: Vector Autoregression (VAR)" provided by Patrick Herb of Brandeis University for information on Stata functions and accompanying statistical tests.

References

[1] Board of Governors of the Federal Reserve System (US). Effective federal funds rate [fedfunds].

[2] Board of Governors of the Federal Reserve System (US). Industrial production index [indpro].

[3] U.S. Bureau of Economic Analysis. Real personal consumption expenditures: Pce excluding food and energy [dpccram1m225nbea].

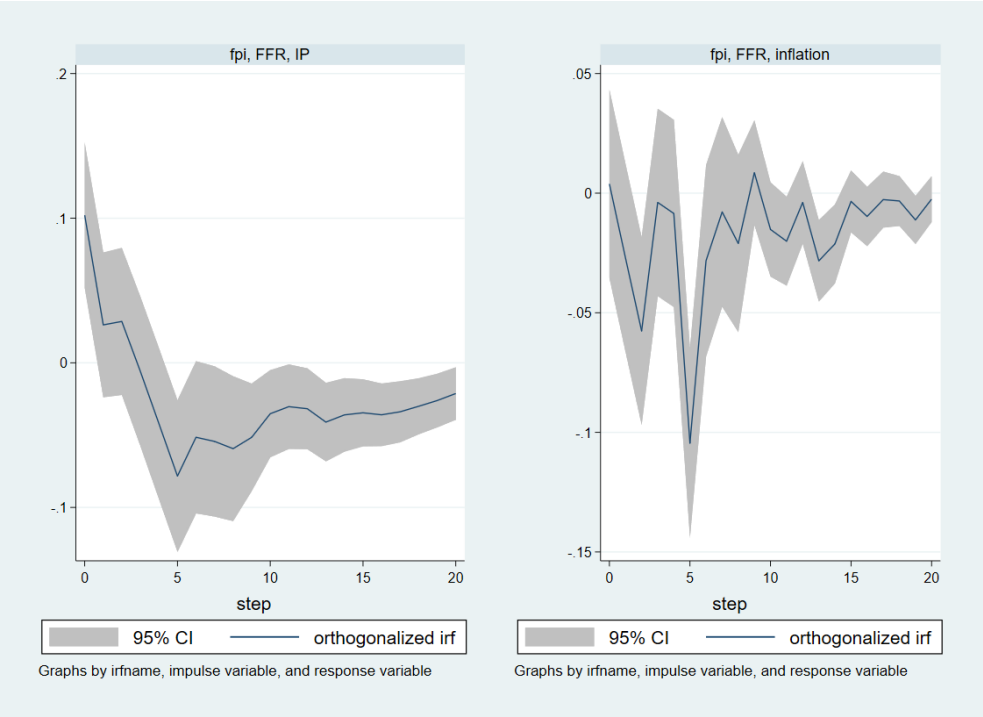

Figure 1: Impulse response functions for IP (left) and core PCE (right) due to a monetary shock to the FFR. Vertical axes differ for each panel. Notes: Model based on monthly data: 1959M2 - 2019M5.