ECON 815

Monetary Policy Shocks

Winter 2020

Approach

1) Identify monetary policy shocks for actual economies.

2) Characterize the impulse response of the economy to such shocks.

3) Conduct the same experiment in a model economy.

If the responses look similar, we trust the model to be a good approximation of reality and use it to give advice for MP.

Problem:

MP reacts to shocks in the economy, but is itself subject to shocks.

Feedback Rules

Consider the model

$$S_t = f(\Omega_t) + \sigma\epsilon_t$$

- ▶ S_t is a policy instrument
- ▶ f is the feedback rule on the information set Ω_t
- ▶ ϵ_t is the MP shock with variance normalized to 1

What are the shocks?
- ▶ change in preferences
- ▶ strategic considerations
- ▶ measurement error, imperfect observability, mistakes?

Two steps:

1) Estimate the feedback rule.

2) Use residuals to estimate the response of the economy to the shock.

Recall VAR Analysis

We start with a reduced form VAR

$$y_t = \mathbf{A}_1 y_{t-1} + u_t$$

where u_t are arbitrary shocks with $E[u_t u_t'] = \mathbf{\Sigma}_u$

We impose a *structure* on the data via a contemporaneus impact matrix $\mathbf{B}_0$

$$\mathbf{B}_0 y_t = \mathbf{B}_1 y_{t-1} + w_t$$

where

- $u_t = \mathbf{B}_0^{-1} w_t$
- $\mathbf{A}_1 = \mathbf{B}_0^{-1} \mathbf{B}_1$
- $E[u_t u_t'] = \mathbf{B}_0^{-1} \mathbf{B}_0^{-1\prime}$

Hence, we assume that the shocks w_t are orthogonal and their variance is normalized to 1.

Partial Identification

We use a recursiveness assumption to partially identify the MP shock.

Order the variables as follows

$$y_t = \begin{pmatrix} X_{1t} \\ S_t \\ X_{2t} \end{pmatrix}$$

X_{1t} contains all contemporaneus variables in Ω_t or $S_t = f(X_{1t})$.

X_{2t} contains all variables that enter into Ω_t only with a lag or $X_{2t} = f(X_{1t}, S_t)$.

Since we are not interested in the contemporaneus relationship between other variables, we do not care about the ordering of variables in X_{1t} and X_{2t}.

Restrictions

We impose the restriction

$$\mathbf{B}_0^{-1} = \left(\begin{array}{ccc} b_{11} & 0 & 0 \\ b_{21} & b_{22} & 0 \\ b_{31} & b_{32} & b_{33} \end{array} \right)$$

What is the interpretation?

▶ X_{1t} is independent of MP and all other shocks

▶ S_t reacts to shocks to X_{1t} and MP shocks, but not to X_{2t}

▶ X_{2t} reacts to every shock

Key Idea:

Any $\mathbf{B}_0$ that satisfies these restrictions will produce the same (!) IRFs to a one standard deviation (σ) shock that is associated with the variable S_t.

Monetary Policy Shocks in Canada

Specification:

- S_t is the overnight rate
- X_{1t} has GDP and some index of price/inflation
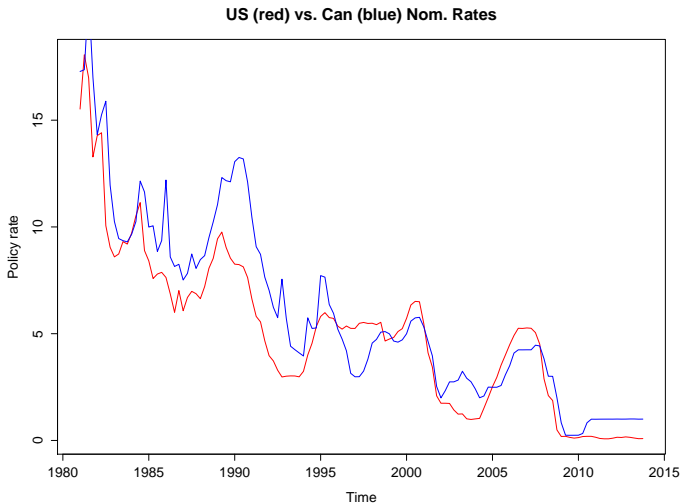- X_{2t} has M2

<u>Problem 1:</u> US policy will influence CAN policy.

I will include the Fed Funds Rate as a proxy for US policy in X_{1t}.

<u>Problem 2:</u> The introduction of IT is a structural break.

I will run the estimation separately across different time series.

US and CAN Monetary Policy

US (red) vs. Can (blue) Nom. Rates

Model Fit: 1981-2013

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Time series regression with "ts" data:
Start = 1981(3), End = 2013(4)

Call:
dynlm(formula = on_rate ~ ff_rate + gdp + p + L(gdp, 1:2) + L(p,
    1:2) + L(ff_rate, 1:2) + L(m2, 1:2) + L(on_rate, 1:2))

Residuals:
     Min      1Q  Median      3Q     Max
-2.32182 -0.32039 -0.03311  0.32726  2.40874

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)       2.19363    1.43013   1.534  0.12779
ff_rate           0.22491    0.10460   2.150  0.03361 *
gdp              -0.29336    0.12834  -2.286  0.02409 *
p                 0.02209    0.08644   0.256  0.79874
L(gdp, 1:2)1      0.63079    0.19364   3.258  0.00147 **
L(gdp, 1:2)2     -0.33932    0.12401  -2.736  0.00719 **
L(p, 1:2)1        0.04573    0.13684   0.334  0.73884
L(p, 1:2)2       -0.10113    0.09716  -1.041  0.30008
L(ff_rate, 1:2)1  0.62021    0.14552   4.262 4.15e-05 ***
L(ff_rate, 1:2)2 -0.69546    0.10316  -6.742 6.42e-10 ***
L(m2, 1:2)1       0.27982    0.13416   2.086  0.03919 *
L(m2, 1:2)2      -0.27072    0.13453  -2.012  0.04649 *
L(on_rate, 1:2)1  0.72943    0.07706   9.465 4.25e-16 ***
L(on_rate, 1:2)2  0.08814    0.07532   1.170  0.24430
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.6957 on 116 degrees of freedom
Multiple R-squared: 0.9747,  Adjusted R-squared: 0.9719
F-statistic: 343.7 on 13 and 116 DF,  p-value: < 2.2e-16
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Model Fit: 1994-2013

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Time series regression with "ts" data:
Start = 1994(3), End = 2013(4)

Call:
dynlm(formula = on_rate ~ ff_rate + gdp + p + L(gdp, 1:2) + L(p,
    1:2) + L(ff_rate, 1:2) + L(m2, 1:2) + L(on_rate, 1:2), start = c(1994,
    3), end = c(2013, 4))

Residuals:
     Min      1Q   Median      3Q     Max
-0.92801 -0.18014 -0.02548  0.09137  2.36280

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)        2.30086    1.48192   1.553  0.12545
ff_rate            0.43194    0.14844   2.910  0.00497 **
gdp               -0.05548    0.09883  -0.561  0.57651
p                 -0.03467    0.05517  -0.628  0.53195
L(gdp, 1:2)1       0.10705    0.14727   0.727  0.46994
L(gdp, 1:2)2      -0.02541    0.08999  -0.282  0.77857
L(p, 1:2)1         0.11550    0.08474   1.363  0.17769
L(p, 1:2)2        -0.14291    0.06871  -2.080  0.04155 *
L(ff_rate, 1:2)1  -0.19284    0.27097  -0.712  0.47926
L(ff_rate, 1:2)2  -0.06066    0.16337  -0.371  0.71163
L(m2, 1:2)1        0.04557    0.10949   0.416  0.67867
L(m2, 1:2)2       -0.03186    0.10921  -0.292  0.77143
L(on_rate, 1:2)1   0.98754    0.10980   8.994  5.8e-13 ***
L(on_rate, 1:2)2  -0.22729    0.11875  -1.914  0.06009 .
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3962 on 64 degrees of freedom
Multiple R-squared: 0.9615,   Adjusted R-squared: 0.9536
F-statistic: 122.8 on 13 and 64 DF,  p-value: < 2.2e-16
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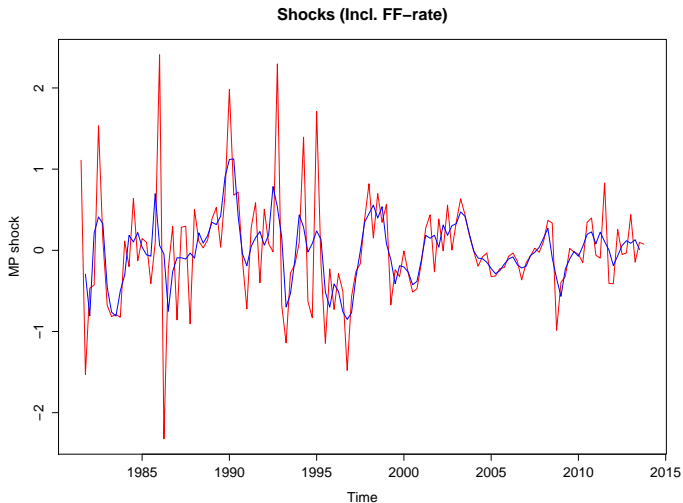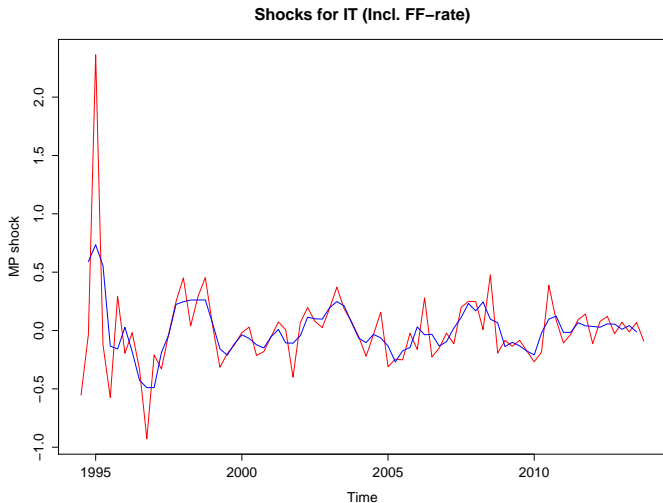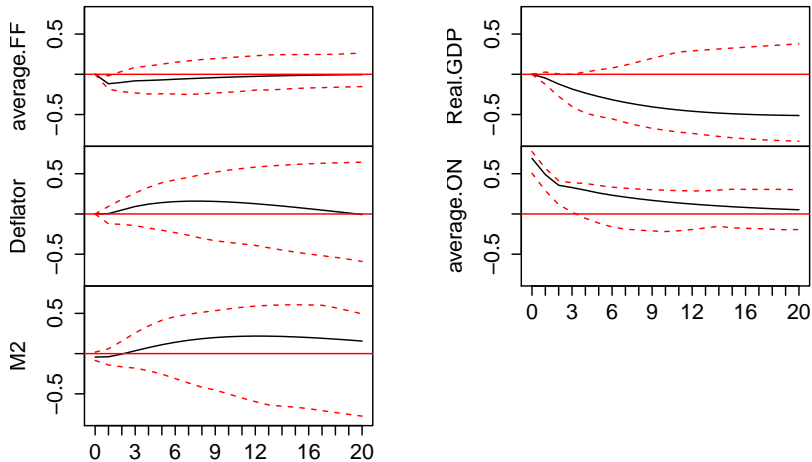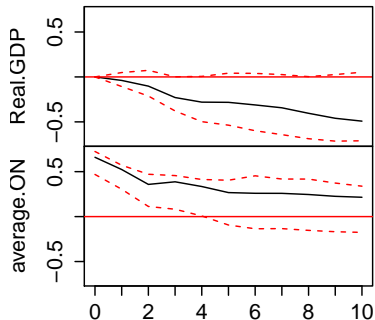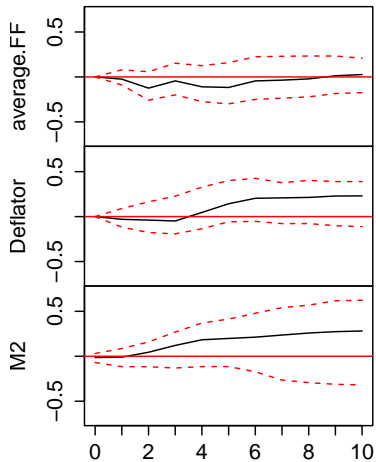
MP Shocks: 1981-2013

Shocks (Incl. FF–rate)

MP Shocks: 1994-2013

Shocks for IT (Incl. FF–rate)

Impulse Response Function I

MP Shock –– Full Model

Impulse Response Function II

MP Shock –– Long Lags

Impulse Response Function III

MP Shock –– IT Regime