ECON 815

Identifying Monetary Policy Shocks

Winter 2015

Approach

1) Identify monetary policy shocks for actual economies.

2) Characterize the 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
- 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 step procedure:

1) Estimate the feedback rule.

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

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 $E[u_t, u_t'] = \mathbf{\Sigma}$

We impose a *structure* on the data via a contemporaneus impact matrix B

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

where

- $\mathbf{A}_1 = \mathbf{B}^{-1}\mathbf{B}_1$
- $u_t = \mathbf{B}^{-1}\epsilon_t$
- $E[\epsilon_t \epsilon_t'] = \mathbf{B\Sigma B}' = \mathbf{I}$

We assume that the shocks ϵ_t are orthogonal and their variance is normalized to 1. This gives us $n(n+1)/2$ restrictions.

Partial Identification

We will use a recursiveness assumption to only 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.

X_{2t} contains all variables that enter into Ω_t only with a lag.

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

Now I impose the restriction

$$\mathbf{B} = \begin{pmatrix} a_{11} & 0 & 0 \\ a_{21} & 1/\sigma & 0 \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$$

What is the interpretation? Consider $y_t = \mathbf{B}_1 y_{t-1} + \mathbf{B} u_t$.

- X_{1t} is independent of MP and all other shocks
- S_t reacts to shocks to X_{1t} and MP shocks
- X_{2t} reacts to every shock

Key Idea:

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

Monetary Policy Shocks in Canada

Specification according to CEE:

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

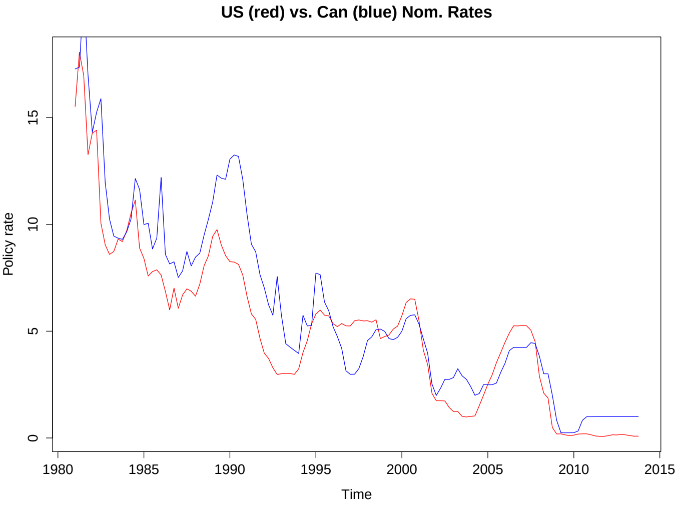
Problem 1: US policy will influence CAN policy.

I will include fed funds rate as proxy for US policy in X_{1t}.

Problem 2: Introduction of IT is a structural break.

I will run the estimation also separate for 1994 - 2013.

US and CAN Monetary Policy



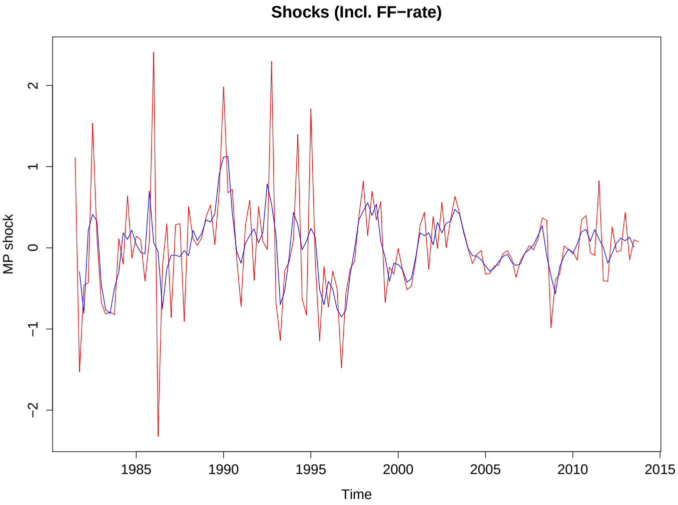
Model Fit: 1981-2013

```
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
---
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
```

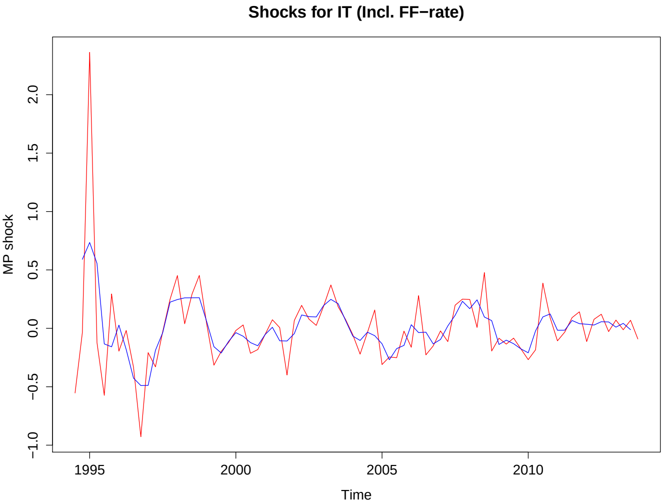
Model Fit: 1994-2013

```
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 .
---
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
```

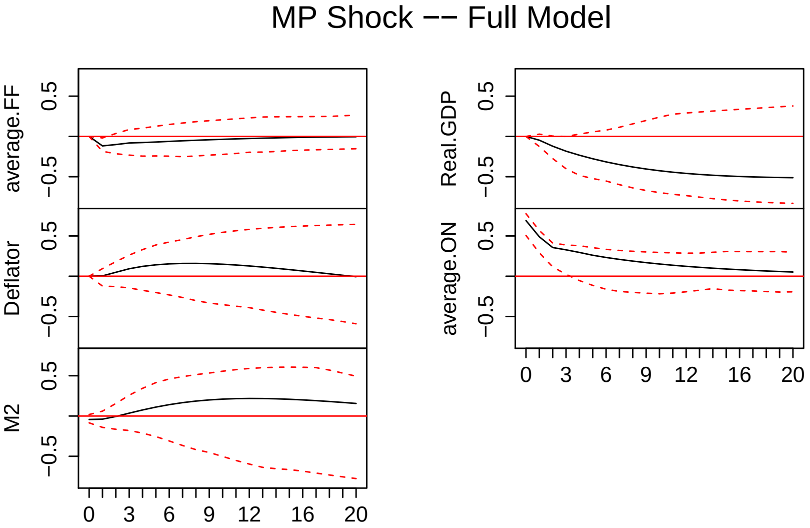
MP Shocks: 1981-2013



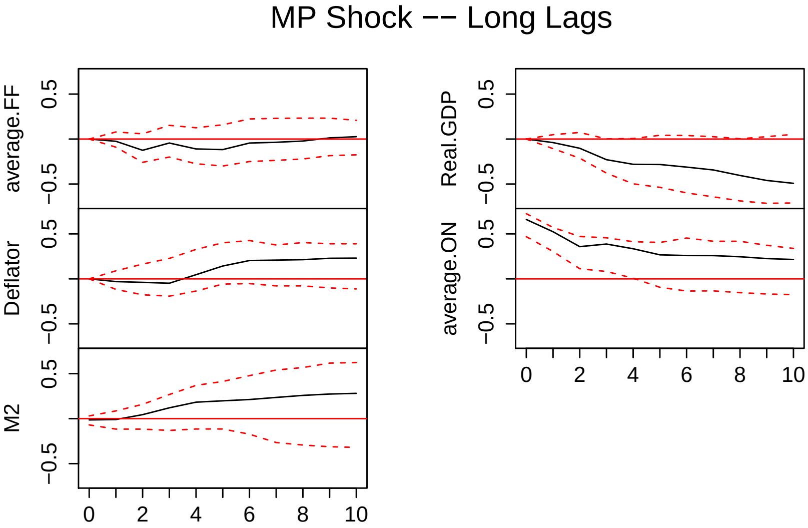
MP Shocks: 1994-2013



Impulse Response Function I



Impulse Response Function II



Impulse Response Function III