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Final Project

Introduction

In this paper I am going to be looking at the equation of exchange. This is: the money supply (M2) multiplied by the constant velocity of money (V) is equal to the price level (CPI) times output (RGDP). I am going to look at how this model looks in the data, since I am curious how each variable might affect one another. Does a change in M2 cause a larger change in price level or output? Or do changes typically start in real output, and M2 is adjusted by the Fed in response? I also want to see how shocks to particular variables like CPI affect the other variables. I also want to look at these relationships through time to see if there are certain time periods when the effect of some variables was great.

Data

For my data, money supply will be represented by M2, price level will be represented by CPI, and output will be represented by Real GDP. Although RGDP is a quarterly measure while the others are monthly, I'm taking the monthly figures on a quarterly basis to get an even flow of data. All data is seasonally adjusted as well.

Empirical Methodology

I am first going to conduct VAR model tests to find causality among the variables. This will allow me to see which variables impact others during select time periods. Then I will conduct a stationarity test using command varstable. This will allow me to test my data for stationarity. Then I will conclude with impulse response function tests, which will tell me what impacts a shock in one variable will have on the others. Each of these tests will have specific time

parameters. The first will be 1960 – 1975. The second will be 1976 – 1995. The last will be 1996 – 2017. I will report these findings in the next section.

Results

The impacts of money supply on real output

1960-75: significant impact

1976-95: Impact not significant

1996-2017: Impact not significant

The impacts of money supply on price level

1960-75: significant impact

1976-95: Very significant impact

1996-2017: Impact not significant

The impacts of real output on money supply

1960-75: Impact not significant

1976-95: Impact not significant

1996-2017: Very significant impact

The impacts of real output on price level

1960-75: significant impact

1976-95: Impact not significant

1996-2017: Impact not significant

The impacts of price level on real output

1960-75: Very significant impact

1976-95: Very significant impact

1996-2017: Significant impact

The impacts of price level on money supply

1960-75: significant impact

1976-95: Impact significant

1996-2017: Impact significant

1960-75

Irf, m, m: How a one unit shock to money supply affects money supply.

M2 increased for 2 periods before leveling off.

Irf, p, m: How a one unit shock to money supply affects price level.

Price level decreased for 3 periods before leveling off. Increases from periods 9-12 before leveling off.

Irf, q, m: How a one unit shock to money supply affects output.

Output is relatively stable.

Irf, m, p: How a one unit shock to price level affects money supply

Money supply increases until period 11, where it levels off.

Irf, p, p: How a one unit shock to price level affects price level

Price level increases until period 8, where it levels out.

Irf, q, p: How a one unit shock to price level affects output

Output is relatively stable.

Irf, m, q: How a one unit shock to output affects money supply

Money supply falls from periods 6-12, then levels.

Irf, p, q: How a one unit shock to output affects price level

Price level falls from period 2 to 9, then levels out

Irf, q, q: How a one unit shock to output affects output

Output remains relatively stable. Decreases slightly at period 5.

1976-95

Irf, m, m: How a one unit shock to money supply affects money supply.

Money supply is consistently positive, only dropping down periods 4-6.

Irf, p, m: How a one unit shock to money supply affects price level.

Price level is relatively stable.

Irf, q, m: How a one unit shock to money supply affects output.

Output is stable.

Irf, m, p: How a one unit shock to price level affects money supply

Money supply is slightly positive until period 10, where it levels off.

Irf, p, p: How a one unit shock to price level affects price level

Price level is positive until period 10 where it levels off.

Irf, q, p: How a one unit shock to price level affects output

Output is relatively stable.

Irf, m, q: How a one unit shock to output affects money supply

Money supply is stable.

Irf, p, q: How a one unit shock to output affects price level

Price level is slightly negative until period 9.

Irf, q, q: How a one unit shock to output affects output

Output is positive periods 1-4, negative 6-9, then levels out.

1996-2017

Irf, m, m: How a one unit shock to money supply affects money supply.

Money supply positive until period 3, then it levels off.

Irf, p, m: How a one unit shock to money supply affects price level.

Price level relatively stable, though slightly positive at period 3.

Irf, q, m: How a one unit shock to money supply affects output.

Output is negative periods 1-3, positive 6-10, then levels out.

Irf, m, p: How a one unit shock to price level affects money supply

Money supply is stable.

Irf, p, p: How a one unit shock to price level affects price level

Price level is positive, then decreases to 0 at period 3.

Irf, q, p: How a one unit shock to price level affects output

Output is stable

Irf, m, q: How a one unit shock to output affects money supply

Money supply is relatively stable.

Irf, p, q: How a one unit shock to output affects price level

Price level is negative periods 4-8, then levels out.

Irf, q, q: How a one unit shock to output affects output

Output is positive periods 0-5, then levels out.

Conclusion

For the VAR model of 1960-75, I found that the money supply has a significant impact on RGDP, and price level. I also found that price level has a significant impact on money supply, and price level and RGDP have significant impacts on one another.
The VAR model for 1976-95 has some changes. Here, money supply no longer has a significant impact on real GDP and RGDP has less impact on price level.

The VAR model for 1996-2017 has some further changes. Money supply no longer has significant impact on price level, but RGDP has a very significant impact on money supply. The price level has significant impact over RGDP and the money supply for the last 60 years. The money supply has had a significant impact on price level and real output in the past, but since 1996, it hasn't. RGDP has had a significant impact on the money supply recently where it hasn't played much of a story before.

For the impulse response functions, there weren't any huge shifts over the time periods in how variables responded to shocks. Real GDP was consistently unaffected by shocks until 1996-2017. The money supply shock had a large effect on price level in 1960-75 but became less of a shock in 1976-95 and even more so 1996-2017. This exact same pattern happened with price level and RGDP on the money supply. The shocks had less and less effect. The swings in price level as a result of a shock in RGDP also decreased from 1960-2017.
There are dynamic changes in how certain variables have a significant impact on other variables in one set of years, then have an insignificant impact in another set of years. If these tests were conducted with very careful choosing of the time parameters, I'm sure even more polarizing results could be found.

STATA do file

```
clear all
set more off
global gopt1 graphregion(color(white)) legend(size(small)) legend(region(lwidth(none)))
global begin_yr 1960
global end_yr 1975

freduse MYAGM2USM052S CPIAUCSL GDPC1
gen month = month(daten)
gen year  = year(daten)
*keep if month == 1 | month == 4 | month == 7 | month == 10
keep if year >= $begin_yr & year <= $end_yr
```

```
gen yearm =  mofd(daten)
gen yearq =  qofd(daten)
format yearm %tm
format yearq %tq

collapse MYAGM2USM052S CPIAUCSL GDPC1 year, by(yearq)
tsset yearq
gen m = 100*ln(MYAGM2USM052S/L4.MYAGM2USM052S)
label var m "M2"
gen p = 100*ln(CPIAUCSL/L4.CPIAUCSL)
label var p "CPI"
gen q = 100*ln(GDPC1/L4.GDPC1)
label var q "RGDP"
drop if m == . | p == . | q == .

var  m p q  , lag(1/4)
vargranger

varstable, graph

var  m p q , lag(1/4)
irf create irf, set(macro) step(20) replace
irf graph irf, yline(0)




clear all
```

```
set more off
global gopt1 graphregion(color(white)) legend(size(small)) legend(region(lwidth(none)))
global begin_yr 1976
global end_yr 1995

freduse MYAGM2USM052S CPIAUCSL GDPC1
gen month = month(daten)
gen year  = year(daten)
*keep if month == 1 | month == 4 | month == 7 | month == 10
keep if year >= $begin_yr & year <= $end_yr
gen yearm =  mofd(daten)
gen yearq =  qofd(daten)
format yearm %tm
format yearq %tq

collapse MYAGM2USM052S CPIAUCSL GDPC1 year, by(yearq)
tsset yearq
gen m = 100*ln(MYAGM2USM052S/L4.MYAGM2USM052S)
label var m "M2"
gen p = 100*ln(CPIAUCSL/L4.CPIAUCSL)
label var p "CPI"
gen q = 100*ln(GDPC1/L4.GDPC1)
label var q "RGDP"
drop if m == . | p == . | q == .

var  m p q  , lag(1/4)
vargranger
```

```
varstable, graph

var  m p q , lag(1/4)
irf create irf, set(macro) step(20) replace
irf graph irf, yline(0)



clear all
set more off
global gopt1 graphregion(color(white)) legend(size(small)) legend(region(lwidth(none)))
global begin_yr 1996
global end_yr 2017

freduse MYAGM2USM052S CPIAUCSL GDPC1
gen month = month(daten)
gen year  = year(daten)
*keep if month == 1 | month == 4 | month == 7 | month == 10
keep if year >= $begin_yr & year <= $end_yr
gen yearm =  mofd(daten)
gen yearq =  qofd(daten)
format yearm %tm
format yearq %tq

collapse MYAGM2USM052S CPIAUCSL GDPC1 year, by(yearq)
tsset yearq
gen m = 100*ln(MYAGM2USM052S/L4.MYAGM2USM052S)
label var m "M2"
```

```
gen p = 100*ln(CPIAUCSL/L4.CPIAUCSL)
label var p "CPI"
gen q = 100*ln(GDPC1/L4.GDPC1)
label var q "RGDP"
drop if m == . | p == . | q == .

var  m p q  , lag(1/4)
vargranger

varstable, graph

var  m p q , lag(1/4)
irf create irf, set(macro) step(20) replace
irf graph irf, yline(0)
```