Money Demand in the UK

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Graphs

1

In Figures 1 through 4 all appear to mostly match their counterparts in Chapter 16. There are some minor differences but I think that may have been more about messing up the scaling somewhat, but the general figures seem to match pretty well.

2

With just a constant term, there is one significant test, which is Dp at a lag of 0. With a trend model, none are significant. We cannot reject the hypothesis that all of these series have a unit root, essentially. (at least with trend accounted for).

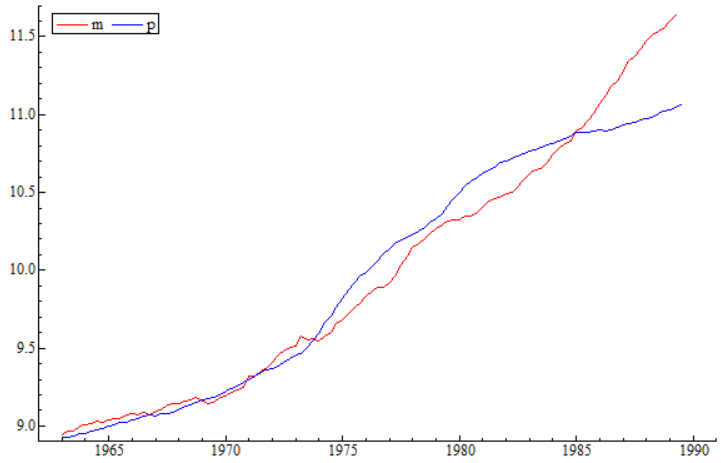

Figure 1: m and p

VAR

3

Somewhat? but not really strong evidence for it. There doesn't seem to be autocorrelation, but it doesn't seem that the residuals are normal either, and portmanteau test fails. So mixed bag overall.

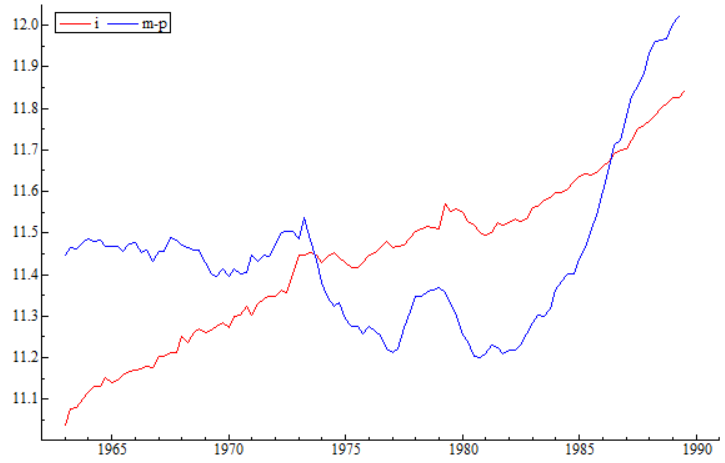

Figure 2: i and m-p

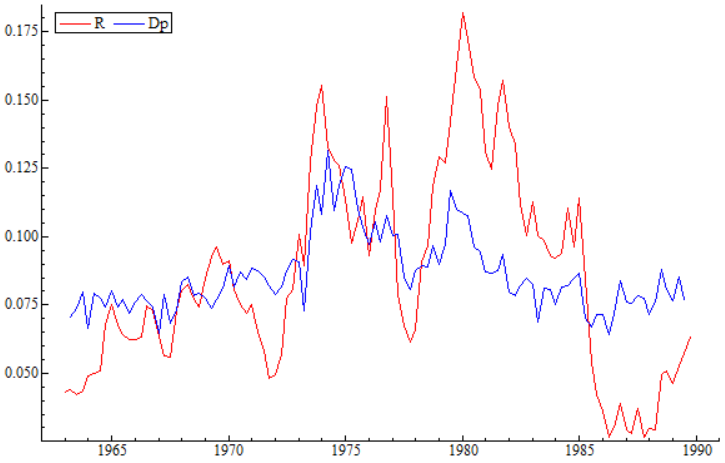

Figure 3: R and Dp

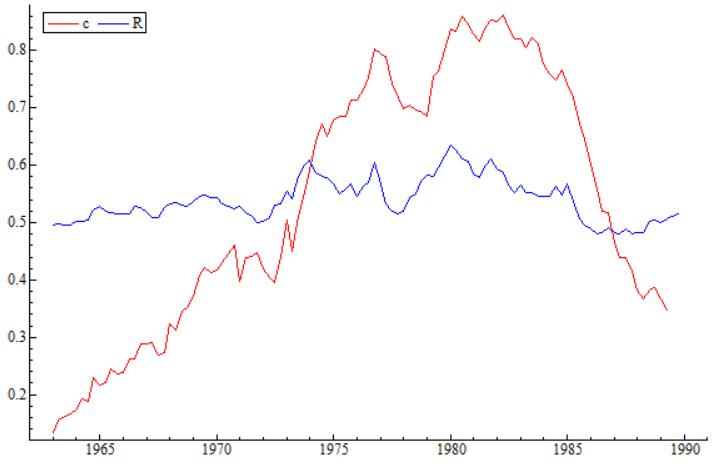

Figure 4: C and R

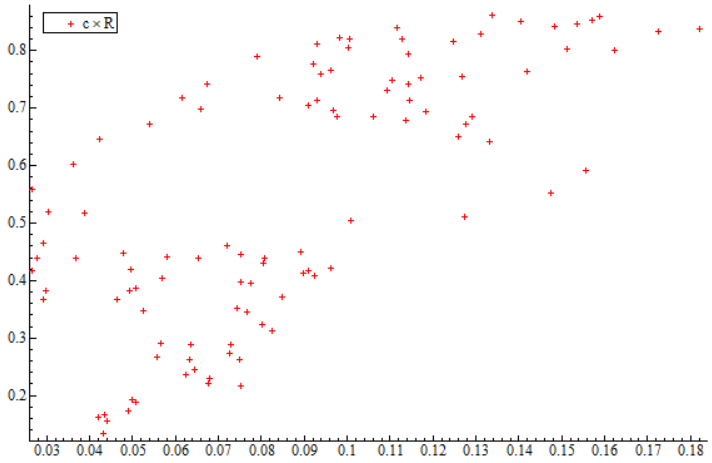

Figure 5: C and R Scatter Plot

```
  Vector Portmanteau(11):  Chi^2(112)=   156.62 [0.0035]**
  Vector AR 1-5 test:      F(80,231) =   1.2462 [0.1060]
  Vector Normality test:   Chi^2(8)  =   19.616 [0.0119]*
  Vector ZHetero test:     F(144,245)=   1.2629 [0.0552]
  ZHetero-X test: not enough observations
  Vector RESET23 test:     F(32,259) =   1.5309 [0.0390]*
```

4

Generally no, it seems that most of them are not significant

5

Yes, the correlations are similar.

```
 correlation of URF residuals (standard deviations on diagonal)
                      i           m-p           Dp            R
   i          0.010368    -0.053735    -0.017704      0.11500
   m-p       -0.053735     0.016468     -0.48963     -0.47696
   Dp        -0.017704     -0.48963    0.0068128      0.29166
   R           0.11500     -0.47696      0.29166     0.012991
```

6

Yes, my results are close to his.

7

With individual equation statistics, it seems that for the most part it is coherent. With ones for the whole vector, it is mixed bag but not super coherent, similar story to question 3.

```
Single-equation diagnostics using reduced-form residuals:
m-p          : Portmanteau(11):  Chi^2(9)  =   8.0436 [0.5298]
m-p          : AR 1-5 test:      F(5,84)   =   1.6401 [0.1583]
m-p          : ARCH 1-4 test:    F(4,93)   =  0.81082 [0.5214]
m-p          : Normality test:   Chi^2(2)  =   4.9029 [0.0862]
m-p          : Hetero test:      F(20,80)  =   1.7776 [0.0377]*
m-p          : Hetero-X test:    F(56,44)  =   2.1612 [0.0045]**
i            : Portmanteau(11):  Chi^2(9)  =   10.866 [0.2850]
i            : AR 1-5 test:      F(5,84)   =   1.0543 [0.3916]
i            : ARCH 1-4 test:    F(4,93)   =  0.71176 [0.5859]
i            : Normality test:   Chi^2(2)  =   1.1722 [0.5565]
i            : Hetero test:      F(20,80)  =   1.2717 [0.2228]
i            : Hetero-X test:    F(56,44)  =  0.99097 [0.5172]
Dp           : Portmanteau(11):  Chi^2(9)  =   6.4613 [0.6930]
Dp           : AR 1-5 test:      F(5,84)   =   1.8701 [0.1082]
Dp           : ARCH 1-4 test:    F(4,93)   =   3.9399 [0.0053]**
Dp           : Normality test:   Chi^2(2)  =   12.310 [0.0021]**
Dp           : Hetero test:      F(20,80)  =   1.5415 [0.0903]
Dp           : Hetero-X test:    F(56,44)  =   2.4287 [0.0014]**
```

```
R           : Portmanteau(11):  Chi^2(9)  =   7.3352 [0.6023]
R           : AR 1-5 test:      F(5,84)   =   1.2264 [0.3040]
R           : ARCH 1-4 test:    F(4,93)   =   6.7019 [0.0001]**
R           : Normality test:   Chi^2(2)  =   4.7606 [0.0925]
R           : Hetero test:      F(20,80)  =   1.8212 [0.0319]*
R           : Hetero-X test:    F(56,44)  =   1.6399 [0.0454]*

Vector Portmanteau(11):  Chi^2(144)=   181.54 [0.0186]*
Vector AR 1-5 test:      F(80,262) =   1.2654 [0.0870]
Vector Normality test:   Chi^2(8)  =   18.629 [0.0170]*
Vector ZHetero test:     F(80,306) =   1.6164 [0.0021]**
Vector ZHetero-X test:   F(224,166)=   1.5024 [0.0029]**
Vector RESET23 test:     F(32,289) =   1.5026 [0.0448]*
```

8

The data is almost consistent at the 5% level, being 0.0507. So extremely close to consistent at the very least. Consistent if rounding down, I guess.

Cointegration analysis

9

The exact order of all the variables is a bit messed up, but they are relatively similar, yes.

```
beta (scaled on diagonal; cointegrating vectors in columns)
     i            1.0000      -14.704      0.51251      -1.5546
     m-p        -0.97495       1.0000     -0.22198      0.29368
     Dp          -7.2092       49.210       1.0000       1.0711
     R           -7.4187      -12.298     -0.56969       1.0000
     Trend    0.00032407     0.087165   -0.0018500    0.0095602

     alpha
     i          0.022943    0.0070794    -0.054474     0.015919
     m-p        0.090313  9.4229e-005     0.068397     0.042629
     Dp        0.0014385   -0.0048729    -0.035024    -0.015688
     R         0.0018416    0.0041603    -0.021857    -0.078084
```

10

There is at least 1 cointegrating vector, as we can reject the null of 0, but not of 1.

11

The value of the log likelihood is 1289.42

12

No, at least not at a 5% level. We would need a 22% level of confidence to reject null hypothesis

13

Yes. The alpha matrix shown below leads us to conclude that.

```
 alpha
     i       1.8402e-006      0.00000
     m-p         0.00000 -5.1969e-005
     Dp          0.00000 -9.2301e-007
     R           0.00000 -7.1196e-007
```

14

Yes, it is.

15

Elasticities of demand with respect to inflation and the interest rate are the same, No trend in demand for money. (m-p in second cointegrating vector is zero). The coefficient on the trend term is -.0063, the coefficient on Dp is -3.4, and the coefficient on R is 1.8.

Yes. Coefficient on income in the money demand equation is equal to zero with those constraints. The Friedman hypothesis is that $\beta_1 = 1$. In the less restricted system, there is still evidence pointing towards the quantity theory, with m-p and i being opposite in sign.

16

Values of parameters are m -p = -1.63i + 7.812Dp + 6.569R for the less restricted model, and m -p = -1i + 6.95Dp + 6.95R for the more restricted testing model.

```
&8=1; &14=1;
beta
m-p          1.0000   -0.0045433
i           -1.6336       1.0000
Dp           7.8126      -1.3327
R            6.5691       1.6303
Trend     0.0037246   -0.0065427

alpha
m-p        -0.10075      0.00000
i           0.00000     -0.13561
Dp          0.00000    0.0053716
R           0.00000    -0.031692

&9= -1; &10=&11; &12=0; &13=0; &17=-.0063;&15=-3.4;&16=1.8;

beta
m-p          1.0000      0.00000
```

```
i           -1.0000       1.0000
Dp           6.9526      -3.4000
R            6.9526       1.8000
Trend       0.00000   -0.0063000

alpha
m-p        -0.10176      0.00000
i           0.00000     -0.10961
Dp          0.00000     0.034841
R           0.00000    -0.054146
```

PVAR

17

Yes, the means used are the same.

For $\Delta(m-p)_t$, it matches up very well. For all other variables it is pretty close as well, with ΔR being very close as well to 16.7. Overall most are roughly the same.

Estimating the econometric model

18

Results for $\Delta(m-p)_t$ match up well, with slight differences. Results for Δi_t match up very well. $\Delta^2 p_t$ is mostly similar with small differences. ΔR_t is very similar. Overall roughly the same as Henry

19

Are the results generally data coherent (especially with respect to serial correlation)?

```
 Single-equation diagnostics using reduced-form residuals:
     Dm-p        : AR 1-5 test:      F(5,90)   =   2.3259 [0.0491]*
     Dm-p        : ARCH 1-4 test:    F(4,95)   =   1.4288 [0.2304]
     Dm-p        : Normality test:   Chi^2(2)  =  0.44247 [0.8015]
     Dm-p        : Hetero test:      F(13,89)  =   1.7787 [0.0588]
     Dm-p        : Hetero-X test:    F(28,74)  =   1.4750 [0.0946]
     Di          : AR 1-5 test:      F(5,94)   =  0.48707 [0.7851]
     Di          : ARCH 1-4 test:    F(4,95)   =   1.3879 [0.2440]
     Di          : Normality test:   Chi^2(2)  =  0.92369 [0.6301]
     Di          : Hetero test:      F(5,97)   =   1.5402 [0.1845]
     Di          : Hetero-X test:    F(6,96)   =   1.4403 [0.2073]
     DDp         : AR 1-5 test:      F(5,94)   =  0.53630 [0.7483]
     DDp         : ARCH 1-4 test:    F(4,95)   =   1.3295 [0.2647]
     DDp         : Normality test:   Chi^2(2)  =   3.7566 [0.1528]
     DDp         : Hetero test:      F(7,95)   =   2.3792 [0.0276]*
     DDp         : Hetero-X test:    F(10,92)  =   2.1202 [0.0303]*
     DR          : AR 1-5 test:      F(5,95)   =   1.2879 [0.2756]
     DR          : ARCH 1-4 test:    F(4,95)   =   4.2030 [0.0035]**
```

```
DR          : Normality test:   Chi^2(2)  =   3.0560 [0.2170]
DR          : Hetero test:      F(5,97)   =   2.8332 [0.0197]*
DR          : Hetero-X test:    F(6,96)   =   2.4617 [0.0294]*

Vector SEM-AR 1-5 test:  F(80,302) =   1.2112 [0.1293]
Vector Normality test:   Chi^2(8)  =   8.8618 [0.3541]
Vector ZHetero test:     F(56,332) =   1.4830 [0.0195]*
Vector ZHetero-X test:   F(116,280)=   1.1210 [0.2243]
```

Mostly. There are some issues with the ZHetero test that might suggest heteroskedasticity, but that isn't present in the ZHetero-X test, so might not mean much. The rest of the statistics don't show many issues. Individual equations, however, do sometimes show issues. Such as Dm-p AR tests that might lead to serial correlation. In terms of the entire model it seems okay.

20

Does the model parsimoniously encompass the system? That is, is the model a valid reduction from the system?

Yes, or at the very least no point in the sample would it fail tests for encompassing the PVAR

Single Equation Modeling

21

Is the model data coherent? How do you know?

It seems to be coherent except for one thing: Normality, which it fails. No heteroskedasticity issues though, and narrowly escapes being significant for AR tests.

```
AR 1-5 test:      F(5,86)   =   2.1180 [0.0709]
ARCH 1-4 test:    F(4,95)   =  0.62384 [0.6466]
Normality test:   Chi^2(2)  =   21.381 [0.0000]**
Hetero test:      F(22,80)  =  0.99241 [0.4830]
Hetero-X test:    F(77,25)  =  0.91002 [0.6353]
RESET23 test:     F(2,89)   =  0.64993 [0.5245]
```

22

It seems so, the wald tests rejects the null of not having a long run relationship.

23

Implied long run solution below.

```
Solved static long-run equation for m-p
                Coefficient  Std.Error  t-value  t-prob
Constant          -0.515710      1.407   -0.366  0.7148
i                   1.07155     0.1283     8.35  0.0000
Dp                 -6.99831      1.925    -3.64  0.0004
```

```
R                    -7.33717     0.7154    -10.3  0.0000
Long-run sigma = 0.138804

ECM = m-p + 0.51571 - 1.07155*i + 6.99831*Dp + 7.33717*R;
WALD test: Chi^2(3) = 121.081 [0.0000] **
```

24

Is it similar to that found by the Johansen multiple equation method above?

Yes, they are generally pretty similar.

25

Yes, it is consistent with weak exogeneity

Equilibrium Correction Model

26

	Coefficient	Std. Error	t-value	t-prob	Part.R^2
Dm-p_1	-0.246657	0.09026	-2.73	0.0075	0.0729
Constant	0.0762829	0.007839	9.73	0.0000	0.4992
Di	0.00358347	0.09938	0.0361	0.9713	0.0000
Di_1	0.110815	0.1030	1.08	0.2846	0.0120
DDp	-0.823609	0.1646	-5.01	0.0000	0.2087
DR	-0.489271	0.1043	-4.69	0.0000	0.1882
DR_1	-0.0540433	0.1058	-0.511	0.6106	0.0027
ECM_1	-0.0992113				

Yes, the results are approximately the the as 16.14 in Hendry

27

Yes. No significant results in autocorrelation, normality, or heteroskedasticity.

```
AR 1-5 test:      F(5,90)   =   1.8561 [0.1100]
ARCH 1-4 test:    F(4,95)   =  0.50787 [0.7300]
Normality test:   Chi^2(2)  =   4.1942 [0.1228]
Hetero test:      F(14,88)  =  0.77306 [0.6949]
Hetero-X test:    F(35,67)  =   1.0173 [0.4645]
RESET23 test:     F(2,93)   = 0.010273 [0.9898]
```

28

Yes, It is a valid reduction

```
Progress to date
Model           T    p         log-likelihood          SC          HQ         AIC
EQ( 3)        103   12  OLS         306.35993     -5.4088     -5.5914     -5.7157
EQ( 4)        103    8  OLS         305.43968     -5.5709<    -5.6926<    -5.7755<

Tests of model reduction (please ensure models are nested for test validity)
EQ( 3) --> EQ( 4): F(4,91)   =  0.41017 [0.8009]
```

29

With an R^2 of 0.77 for this model, yes, it can explain the majority of the variance in the model.

30

In Figure 6, they match Henry's results. The fitted values appear to track with the actual values pretty well overall. Although the residual graph is slightly different than Henry's as it doesn't show lag order, so im not sure how to tell with that. I also got a lag order figure in Figure 7. There seems to be some third order autocorrelation. The Residuals seem pretty normal (important for data congruence. Non normally distributed residuals are unlikely if white noise).

31

Yes, it is structural. As seen in Figure 8, the parameters are constant and never get close to the SE bounds. Same for the chow test.

32

They are very similar, line up quite well.

33

Yes, it is consistent with theory.

35

Is it a valid reduction from the unrestricted reduced form (system)?

Yes, it seems so given the model reduction tests and other metrics.

36

Yes. See question 31

37

Overall, yes. It is a pretty simple model, but overall it seems to hold up quite well to testing and seems to be data congruent. Residuals are free of white noise as well.

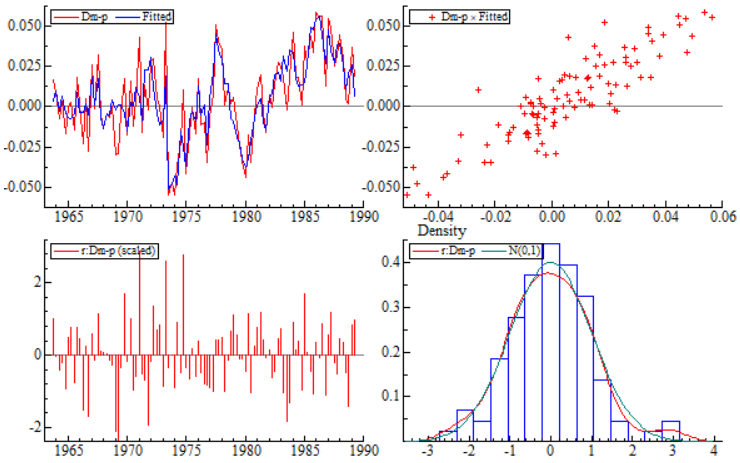

Figure 6: Graphical Analysis for Question 30

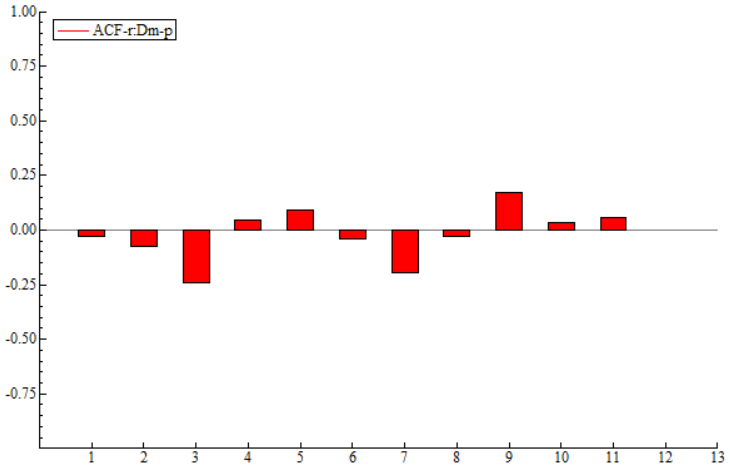

Figure 7: Graphical Analysis for Question 30, ACF

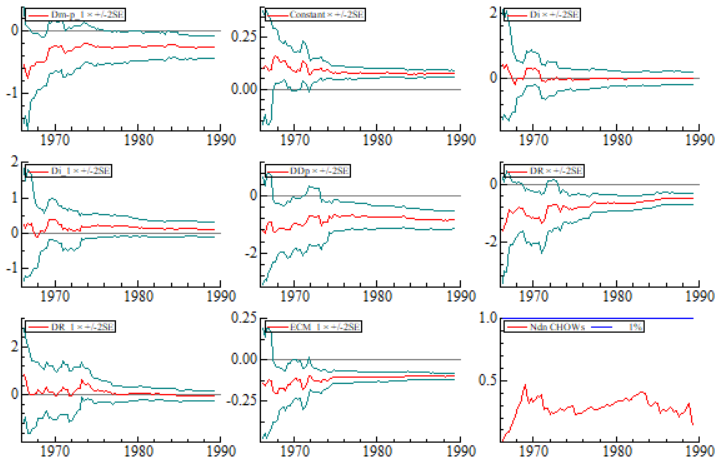

Figure 8: Graphical Analysis for Question 31, structural