Exam Number: 57230

The UK Demand for Money 1963-1989

Econometrics for Economists (2030003)
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Introduction

Econometric analysis can be used to help explain the importance of certain factors on a dependent variable. In this project the dependent variable is the "demand for money in the UK between 1963-1989". Although it is very difficult, if not impossible to find perfect econometric models, this project will attempt to explain the relationship between the demand for money and other various explanatory factors.

The Economic Theory

Money is one of many forms of wealth. A simply economic explanation, using two of the more important forms of wealth, is that people have a choice between holding money and holding bonds. Money is used for everyday transactions and includes currency (coins and notes) and checkable deposits. Bonds will pay an interest rate but cannot be used for transactions, i.e. you cannot buy a cup of coffee with a bond. The interacting relationship between money and its substitutes (bonds being an example) can help explain the demand for money.

The measure of money in this project is the liquid money, M1. The demand for M1 will basically depend on the opportunity cost of not holding M1 money, i.e. saving it instead of spending it. The interest rate is, by definition, the opportunity cost of holding money, i.e. by keeping £20 in my pocket I am losing out on £20*the interest rate, which would be more, if only by a small margin. It is becoming clear, even only after scraping the surface of this project, that the interest rate is likely to be an important factor affecting the demand for money.

Economic theory suggests that certain factors can influence the demand for money, theses will be included in econometric analysis but may not be included in the final model for various reasons that I shall come to later.

An obvious factor that affects the demand for money is consumer expenditure. If people want to buy more goods they need more money. During periods of high consumer spending, of which the main one is usually the Christmas period, people will cash in alternative forms of wealth, such as stocks and bonds, in exchange for money. This money is then used to pay for services and goods such as Christmas presents. Consumer expenditure is related to the level of disposable income available to households Whether consumers' expenditure (ca), or Real personal disposable income of households (ia) is used in the model will be addressed when looking into the econometric model in the next section.

The cost of goods, i.e. rising levels of inflation, will also affect the demand for money. If goods become more expensive then people will need more money in order to buy what they need. Although this is the case in the form of "nominal" demand for money, the "real" demand for money is liable to remain the same, as the level of money holdings tends to rise at the same rate as the price level.

Peoples demand for money will also depend on what has happened in the last year or two, perhaps longer in some cases.

"Due to force of habit, people do not change their consumption habits immediately following a price decrease or an income increase, perhaps because the process of change involves some immediate disutility."[2]

This theory can be applied to the project and there is now demand for at least one lagged variable, whether it is a lag of the dependent variable or one of the explanatory variables will be addressed later in this analysis, after having started with a basic model.

The Econometric Model

Using economic theory it is decided that the dependent variable will be *ma-mp,* which is a measurement of M1 money (which was addressed earlier), minus the "implicit price deflator for total final expenditure". This is a measure of the "real" money, while if only M1 was used for the dependent variable, the "nominal" level of money would have been measured.
The interest rate, which has already been labelled a likely important factor in this analysis, will be measured using the *RNET* variable. The *RLA* variable was not used because it only measures the interest rate on deposits held for at least three months. It is interesting to note that the *RLA* and *RNET* values are identical up until the third quarter of 1984.
The hardest decision is whether to use the *ca* (consumers' expenditure) or *ia* (real personal disposable income) variable in the model. After careful deliberation it is decided that the *ia* variable will be used, as it will address what "proportion" of income is dedicated to money, which seems a more interesting analysis that simply the level of expenditure. If there is time, however, the *ca* variable will be looked at later.

So finally analysis can start, with the basic model given below:

$$ma\text{-}pa_t = \text{B1} + \text{B2}\ RNET_t + \text{B3}\ ia_t + u_t$$

As mentioned above the use of lagged variables will be important in our regression analysis. The most obvious variable to lag is going to be *ma-mp,* suggesting that the level of money demanded this year, will be affected by the amount of money demanded last year. The *ia* variable may also be lagged to see if disposable income last year, affects this year's demand for money. (Note: when regressing theses lagged variables one will have to be aware of the possibility of correlation and multicollinearity.) This note neatly brings this project straight on to the next important topic.

Data Issues and the Hypotheses to be Tested

The data used is seasonally adjusted so there is no need to add dummy variable to represent different part of the year.
Dummy variables could be used to distinguish between other external variables such as the type of government in power at the time but this would be an unnecessary complication. Because this is a "log-linear" model, the coefficients will be a measure

of elasticity. The regression will cover the time period, i.e. from 1963_1 to 1989_2 (Note: 1983_3/4 will not be included due to incomplete data)

Hypotheses

The variables will each be tested for individual significance and the overall strength of the model will also be measured. After the initial regression the model will be tested for problems such as autocorrelation, multicollinearity and misspecification bias. The model shall also be tested in the long run.

As mentioned before, if there is sufficient time the *ca* variable will be looked at.

Estimation

The regression results from our original basic model are reproduced in appendix, (a). The signs of the two explanatory variables are as expected, i.e. the level of disposable income has a positive relationship with the demand for money while the interest rate has a negative one. The t-values obtained from the coefficients of *RNET* and *IA* reject the null hypothesis that they are individually insignificant at both the 5% and 1% level of significance. The model has a fairly strong R^2 of 0.68154 as well which is promising.

Unfortunately the Durbin-Watson d statistic that we obtain, once run through the Durbin-Watson test is suggestive of positive autocorrelation. The Durbin-Watson test for autocorrelation does, however, have it limitations, some of which include the fact that there are zones of "indecision" and more importantly is not appropriate to use when a lagged dependent variable is included which will occur later when the basic model starts to evolve. The Breusch-Godfrey test will therefore be used to test for autocorrelation. The Breusch-Godfrey test also says that autocorrelation is present in the model at both the 5% and 1% level especially at the first order serial correlation. The Whites General Test also reveals heteroscedasticity. These results mean than the variables in the model are not BLUE.

In an attempt to counteract the adverse effects above the model will have to be changed. The variables in the basic model will remain but lagged values of the variables will be included, meaning that the new model will now be:

$$ma\text{-}pa_t = B1 + B2\ RNET_t + B3\ ia_t + B4\ ma\text{-}pt_{t-1} + B5\ RNET_{t-1} + B6\ ia_{t-1} + B7\ ma\text{-}pa_{t-2} + B8\ RNET_t\text{-}2 + B9\ ia_{t-2} + B10\ ma\text{-}pa_{t-3} + B11\ RNET_{t-3} + B12\ ia_{t-3} + u_t$$

The results of this regression can be found in the appendix under part (c). The new Chi squared figures indicate that we can accept the null hypothesis that there is no heteroscedasticity present at the 5% and 1% levels. We can also accept the null hypothesis that there is no longer autocorrelation at the same levels of significances as above. The R^2 value has shot up to 0.994653 and by using the F-test is significant. Although we seem to have dealt with the worst of the autocorrelation and heteroscedasticy, the t-ratios now seem to be insignificant. A high R^2 value and few significant t-ratios is a classic indicator of multicollinearity. Multicollinearity is undesirable as it leads to large standard errors of the estimators.

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Remedial measures to combat multicollinearity.

The simplest model to attempt to control multicollinearity is to drop variables, we can do this confidently seeing as we have so many. The new model (now greatly cut down) is:

$$ma\text{-}pa_t = B1 + B2\ RNET_t + B3\ ia_t + B4\ ma\text{-}pt_{t-1}$$

The regression results for this model can be found in appendix (d). The results for this model look proimising. We have a high R^2 value, the t-values (apart from the intercept) seem to all be significant, suggesting we have lost the problem of multicollinearity. We can accept the null hypothesis that there is no autocorreation present at the 1% level and it is tantilisingly close to being accepted at the 5% level. We can also accept the null hypothesis that there is no heteroscedasticity at both the 1% and 5% levels of significance. At last, we seem to have found a valid final model.

Appendix:

APPENDIX (a)

EQ(1) Modelling ma-pa by OLS (using dataset3.in7)

The estimation sample is: 1963 (1) to 1 989 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	6.67414	0.6125	10.9	0.000	0.5355
RNET	-3.83729	0.2829	-13.6	0.000	0.6412
ia	0.421047	0.05679	7.41	0.000	0.3480

sigma	0.108626	RSS	1.21535824
R^2	0.68154	F(2,103) =	110.2 [0.000]**
log-likelihood	86.4177	DW	0.223
no. of observations	106	no. of parameters	3
mean(ma-pa)	10.8979	var(ma-pa)	0.0360034

APPENDIX (b)

Error autocorrelation coefficients in auxiliary regression:

Lag	Coefficient	Std.Error
1	1.0444	0.1013
2	-0.048955	0.1458
3	-0.16074	0.1448
4	0.1128	0.1466
5	-0.076463	0.1065

RSS = 0.247076 sigma = 0.00252118

Testing for error autocorrelation from lags 1 to 5

Chi^2(5) = 84.451 [0.0000]** and F-form F(5,98) = 76.812 [0.0000]**

Testing for heteroscedasticity using squares

Chi^2(4) = 28.035 [0.0000]** and F-form F(4,98) = 8.8098 [0.0000]**

APPENDIX (c)

EQ(3) Modelling ma-pa by OLS (using dataset3.in7)

The estimation sample is: 1963 (4) to 1989 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
ma-pa_1	0.660335	0.1082	6.10	0.000	0.2905
ma-pa_2	0.144261	0.1289	1.12	0.266	0.0136
ma-pa_3	0.0782691	0.09929	0.788	0.433	0.0068
Constant	0.139320	0.1524	0.914	0.363	0.0091
RNET	-0.766103	0.1182	-6.48	0.000	0.3157
ia	0.101770	0.08265	1.23	0.221	0.0164
RNET_1	-0.101028	0.1963	-0.515	0.608	0.0029
ia_1	0.107584	0.09780	1.10	0.274	0.0131
RNET_2	-0.126755	0.1975	-0.642	0.523	0.0045
ia_2	-0.0637855	0.09550	-0.668	0.506	0.0049
RNET_3	0.0297317	0.1319	0.225	0.822	0.0006
ia_3	-0.0322372	0.07834	-0.411	0.682	0.0019

sigma	0.0149724	RSS	0.0203998214
R^2	0.994653	F(11,91) =	1539 [0.000]**
log-likelihood	292.988	DW	2.01
no. of observations	103	no. of parameters	12
mean(ma-pa)	10.8974	var(ma-pa)	0.0370415

Error autocorrelation coefficients in auxiliary regression:

Lag	Coefficient	Std.Error
1	0.34614	0.9412
2	0.48134	0.6174
3	-0.23942	0.2097
4	0.16274	0.1137
5	0.21758	0.1099

RSS = 0.0188337 sigma = 0.000218997

Testing for error autocorrelation from lags 1 to 5

Chi^2(5) = 7.9075 [0.1614] and F-form F(5,86) = 1.4303 [0.2216]

Testing for heteroscedasticity using squares
Chi^2(22)= 20.089 [0.5774] and F-form F(22,68) = 0.74893 [0.7728]

APPENDIX (d)

EQ(3) Modelling ma-pa by OLS (using dataset3.in7)
The estimation sample is: 1963 (4) to 1989 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
ma-pa_1	0.909460	0.01242	73.2	0.000	0.9819
Constant	0.120873	0.1260	0.960	0.340	0.0092
RNET	-0.743990	0.05791	-12.8	0.000	0.6251
ia	0.0864331	0.009326	9.27	0.000	0.4645

sigma	0.0149187	RSS	0.0220341891
R^2	0.994225	F(3,99) =	5681 [0.000]**
log-likelihood	289.019	DW	2.46
no. of observations	103	no. of parameters	4
mean(ma-pa)	10.8974	var(ma-pa)	0.0370415

Error autocorrelation coefficients in auxiliary regression:

Lag	Coefficient	Std.Error
1	-0.25767	0.1024
2	-0.053333	0.1055
3	-0.079404	0.1061
4	0.11792	0.1063
5	0.20319	0.1029

RSS = 0.0196544 sigma = 0.000209089

Testing for error autocorrelation from lags 1 to 5

Chi^2(5) = 11.125 [0.0490]* and F-form F(5,94) = 2.2764 [0.0531]

Testing for heteroscedasticity using squares

Chi^2(6) = 7.3739 [0.2876] and F-form F(6,92) = 1.1824 [0.3226]