ECONOMIC RESEARCH
FEDERAL RESERVE BANK OF ST. LOUIS

WORKING PAPER SERIES

The Appropriate Interest Rate and Scale Variable in Money Demand: Results from Non-Nested Tests

Authors	Daniel L. Thornton
Working Paper Number	1983-006B
Citable Link	https://doi.org/10.20955/wp.1983.006
Suggested Citation	Thornton, D.L.; The Appropriate Interest Rate and Scale Variable in Money Demand: Results from Non-Nested Tests, Federal Reserve Bank of St. Louis Working Paper 1983-006. URL https://doi.org/10.20955/wp.1983.006

Published In	Applied Economics
Publisher Link	https://doi.org/10.1080/758534703

Federal Reserve Bank of St. Louis, Research Division, P.O. Box 442, St. Louis, MO 63166

The views expressed in this paper are those of the author(s) and do not necessarily reflect the views of the Federal Reserve System, the Board of Governors, or the regional Federal Reserve Banks. Federal Reserve Bank of St. Louis Working Papers are preliminary materials circulated to stimulate discussion and critical comment.

THE APPROPRIATE INTEREST RATE AND SCALE VARIABLE IN MONEY DEMAND: RESULTS FROM NON-NESTED TESTS

Daniel L. Thornton*
Federal Reserve Bank of St. Louis

83-006 REVISED

Preliminary, not for quotation.

*Senior Economist, Federal Reserve Bank of St. Louis. I would like to thank Alec Chrystal, Rik Hafer, Scott Hein, William Gavin and Mack Ott for their helpful comments on an earlier draft of this paper. The views expressed here are the author's and do not necessarily reflect those of the Federal Reserve Bank of St. Louis or the Federal Reserve System. I would also like to thank John Schulte for his research assistance.

6037R
0107R
11/18/83

THE APPROPRIATE INTEREST RATE AND SCALE VARIABLE IN MONEY DEMAND: RESULTS FROM NON-NESTED TESTS

1. Introduction

The demand for money play an essential role in nearly all theories of income determination and a crucial role in the monetarist framework. Most of the early empirical work on money demand centered on whether the evidence supported current income or permanent income or wealth as the relevant scale variable in money demand and, to a lesser extent, on whether a short or long-term interest rate is the relevant opportunity cost variable. Classic works by Chow (1966), Friedman (1959), Laidler (1966a, 1966b) and Meltzer (1963) gave overwhelming support to permanent income or wealth, and this finding has been confirmed time and again by numerous other investigations. With respect to the relevant opportunity cost variable, the results have been mixed. Friedman found evidence which would put money on a par with long-lived financial and real assets, while Laidler found short-term rates performed somewhat better than long-term rates.

In general these results tended to support the notion that the decision to hold money involve a longer term time horizon than the simple transactions models based on current income would suggest. Thus, the asset view, which emphasized money's role as a store of wealth over its role as a medium of exchange, became dominant. Indeed, it was commonplace to define money to include nonmedium of exchange assets.

Recently, increased emphasis has been placed on money's transaction characteristic. This is witnessed by the policy deliberations of the Federal Open Market Committee during the past several years, and by Spindt's (1983) development of a new monetary aggregate based solely on transactions media.[1/] This recent trend stems, in part, from financial innovation and deregulation which have resulted in financial assets with transactions features that pay market determined interest rates. However, it has been no doubt butressed by studies by Lieberman (1977, 1980), that find current income is a better scale variable than permanent income. He interprets his results as supporting the transactions over the asset motive for holding money.

Lieberman's latest study is particularly important because it reversed the conclusions of Chow's classic work. While Thornton (1982) has shown that many of Lieberman's results were due to his use of the Cochrane-Orcutt autocorrelation adjustment, the present study specifically addresses the question of the appropriate interest rate and scale variable in a general framework, using non-nested tests of model specifications developed by Davidson and MacKinnon (1981) and Pesaran (1974). Results consistent with Chow's original work are found.

2. The Specifications of Alternative Models

The following three non-nested specifications of money demand are considered:

$$(1)\ M_t^d = \alpha_0 + \alpha_1 Y_t + \alpha_2 CPR_t + \epsilon_t$$
$$(2)\ M_t^d = \beta_0 + \beta_1 YP_t + \beta_2 Bond_t + u_t$$
$$(3)\ M_t^d = \delta_0 + \delta_1 W_t + \delta_2 Bond_t + v_t$$

The last two equations make the demand for real money balances (M^d) a function of real permanent income (YP) or wealth (W) and a long-term interest rate, the 20-year corporate bond rate (Bond). The first equation makes the demand for money a function of current real income (Y) and a short-term interest rate, the commercial paper rate (CPR). All data, except the CPR, were used originally by Chow (1966).[2/]

The Test Procedures

The Davidson and MacKinnon procedure is a computationally efficient alternative to Cox's (1961) N-test, recently specialized to regression analysis by Pesaran (1974) and Pesaran and Deaton (1978).[3/] It begins by selecting one of the above specifications as the null hypothesis and one (or more) of the remaining as the alternative. A convex linear combination of the null hypothesis and maximum likelihood estimates of the alternative hypothesis is then formed. For example, if equation (1) were the null and (2) the alternative, then the combined equation would be

$$M_t = (1-\lambda)\ (\alpha_0 + \alpha_1 Y_t + \alpha_2\ CPR_t + \epsilon_t) + \lambda\ (\hat{\beta}_0 + \hat{\beta}_1 YP_t + \hat{\beta}_2\ Bond_t),$$

where $\hat{\beta}_0$, $\hat{\beta}_1$ and $\hat{\beta}_2$ are maximum likelihood estimates of the parameters of equation (2). The Davidson and MacKinnon J-test consists of an asymptotic t-test of the parameter

λ.[4/] If the estimate of λ is significantly different from zero, the null hypothesis is rejected; if not, the null hypothesis cannot be rejected in favor of the alternative.

The N-test is based on the difference of the log likelihood functions under the null and alternative hypotheses and, thus, on a likelihood ratio criterion. It is based on the asymptotic distribution of

$$T_0 = \frac{n}{2} \log \left[\frac{\hat{\sigma}_1^2}{\hat{\sigma}_0^2 + \frac{1}{n} (\varepsilon'_{01}\varepsilon_{01})} \right],$$

where $\hat{\sigma}_0^2$ and $\hat{\sigma}_1^2$ are the estimated standard errors from the null and alternative hypotheses, respectively, and ε'_{01} is a 1xn vector of OLS residuals from regressing the estimates of the dependent variable under the null hypothesis on regressors from the alternative hypothesis. The estimated asymptotic variance of T_o is

$$V_0 = \frac{\hat{\sigma}_0^2}{[\hat{\sigma}_0^2 + \frac{1}{n} (\varepsilon'_{01}\varepsilon_{01})]^2} (\varepsilon'_{010}\varepsilon_{010}),$$

where ε_{010} is the vector of OLS residuals from regressing ε_{01} on the regressors from the null hypothesis. Pesaran has shown that $T_0/(V_0)^{1/2}$ is asymptotically distributed N(0,1) under the null hypothesis.

Both the N-test and the J-test are null hypothesis specific: the null and alternative hypotheses must be reversed and the test repeated for the results to be conclusive. If both the null and alternative hypotheses are rejected (or accepted) when each is the maintained null hypothesis, the test is inconclusive--it cannot discriminate between the competing structures.[5/]

3. The Empirical Results

The tests were performed on both the long-run and short-run money demand specifications. Following Chow, the equation for the short-run demand for money on the assumption that individuals their actual money holdings to their desired level via the standard partial adjustment mechanism.[6/] The short-run specification differs from the long-run specification in that the dependent variable lagged appears on the r.h.s. of the equation. Chow's annual data for the period 1897-1958 was used. All dollar denominated variables were deflated by the price level and all equations were estimated in double log form. The equations were estimated over the full sample period and over the subperiod 1934-1958. The latter period was included to test Lieberman's claim that there was a shift in the relative roles of permanent and current income after 1933.

The test results for the long-run specification are given in Table 1. The dominance of specification (2) over the entire sample period is well documented. Model specification (1) is rejected relative to (2) when (1) is the null hypothesis, while (2) cannot be rejected relative to (1) when (2) is the null. Moreover, equation (3) is rejected relative to (2). This gives strong support to permanent income and the long-term rate in money demand over the entire period. Furthermore, when the short-term interest rate is included along with permanent income and the bond rate, its coefficient is not significant, as shown in Table 2. The tests cannot discriminate, however, between specifications (3) and (1). This result is also consistent with the results of the composite specification in Table 2.

When the tests are performed over the period 1934-1958, these general conclusions remain. Equation (2) continues to dominate equation (1), although not as dramatically. Furthermore, CPR continues to be insignificant when included along with YP and Bond, as seen in Table 2. Thus, the empirical evidence from Chow's data continues to support permanent income and the long-term interest rate as the relevant long-run money demand variables over both periods.

The results from the short-run specifications, shown in Table 3, are quite different from the long-run results. Neither the J nor N-test can discriminate between models (1) and (2) or between (1) and (3) over the entire period, although (2) continues to perform well relative to (3). When both scale variables are included along with both interest rate variables, as shown in Table 4, permanent income becomes insignificant, while both interest rates remain significant. Thus, there is some evidence of dominance of current over permanent income in the short-run money specification.

This dominance is more definitive when the short-run specification is estimated over the 1934-58 period. In this case, both the J and N-tests select model (1) over (2) or (3). Again, these results are consistent with the regression results of Table 4. Permanent income is insignificant over the entire period, and the bond rate is significant; both Bond and YP are insignificant during the short period. Thus, it is understandable that the tests failed to discriminate between (1) and (2) over the entire period, but discriminate in favor of (1) during the 1934-58 period.[7/]

4. Autocorrelation Adjustment

Of course, the above results could be affected by the presence of serial correlation in the residuals. Pesaran (1982b) has noted that even if the disturbances of the competing models are first-order autocorrelated, the disturbances of the combined model of the J-test will differ from that of the component models. He suggests this problem can be handled by a simple autocorrelation transformation of both models.[8/] This requires, however, that the competing structures be transformed with the identical transformation. If the estimates of the autocorrelation parameter, ρ, differ among specifications, the question of the appropriate transformation remains open.

For the Chow data, only the long-run specifications exhibited serial correlation. Furthermore, the maximum likelihood estimates of the autocorrelation parameter differed (in some cases markedly) by model specification and by estimation period.[9/] In order to determine how sensitive the

J-test is to the value of ρ, the test was repeated, following Pesaran's suggestion, for each estimate of ρ. The results of these tests for $\rho=.88$ over the 1897-1958 period and for $\rho=.57$ for the 1934-1958 period are presented in Table 5. The results for other values of ρ were qualitatively the same as those reported here.[10/] The only significant exception was the result for model (1) against (3). In this case, the results of Table 5 indicate that the J-test cannot discriminate; however, when the test is performed for $\rho=.90$ or $\rho=.67$ (the relevant values for these separate models) the test discriminates in favor of model (1). This represents the only instance when the qualitative conclusions were sensitive to the value of ρ. Thus, but for this exception, the results of Table 5 merely confirm the OLS results of Table 1.

Furthermore, the results are consistent with estimates of the composite equations adjusted for autocorrelation, given in Table 6. Current income and the commercial paper rate are insignificant over the long period, except when wealth is the alternative scale variable. In this instance, current income is significant. The results are much the same for the shorter period, except that neither wealth nor the bond rate are significant when included with current income.

5. Interpreting the Results

These results seem contradictory: permanent income and the long-term interest rate perform better in the long-run specification, over both time periods, while current income and the short-term interest rate perform better in the short-run specification, especially over the shorter period. There is, however, a simple argument which can reconcile the results in favor of the asset motive, if both the long-run and short-run specifications are valid.[11/]

Assume that the long-run demand for money is determined by permanent income and long-term interest rates. In the short-run, changes in current income have both transitory and permanent components. If changes in transitory income are absorbed initially as money holdings, as in the buffer stock analysis of Darby (1972) and Carr and Darby (1981), it is reasonable that current income performs better than permanent income in the short-run model, while permanent income performs better in the long-run.[12/]

Furthermore, if movements in short-term interest rates give rise to expectations about changes in long-term rates via some expectations term structure mechanism, then finding a significant short-term rate in the short-run specification is also plausible. That is to say, if lagged money captures the effects on money demand up to the last period so that the other variables in this form of the equation measure their effect on money holdings at the margin, then finding that current income and the short-term rate are significant in the short-run while permanent income and the long-term rate are significant in the long-run may not be unusual. This conjecture, of course, rests on a broader interpretation of the adjustment coefficient than in the standard partial-adjustment mechanism.[14/]

Finally, estimates of the long-run specification give little support to Lieberman's contention that there was a shift in the demand for money after 1933, while estimates of the short-run specification, given in Table 4, support it.[15/] The long-term rate was insignificant and the estimated long-run elasticities of both Y and CPR were larger during the 1934-58 period. Thus, the shift from permanent income and the long-term rate to current income and the short-term rate, and the apparent shift in money demand in 1933, both hinge on the short-run money demand specification.[16/]

6. Conclusions

This paper investigates Lieberman's claim that Chow's money demand data supports the transactions over the asset motive for holding money. The results indicate that permanent income and the long-term interest rate perform best in the long-run specification, whereas current income and the commercial paper rate perform better in the short-run specification. Although these results appear to conflict, they are consistent with the buffer stock analysis of Carr and Darby and with a general expectations interpretation of the term structure of interest rates, and Chow's original conclusion emerge unrefuted.

FOOTNOTES

1/To see the extent to which this has occurred, read the "Record of Policy Actions of the Federal Open Market Committee," in various numbers of the Federal Reserve Bulletin (1981-1983).

2/I would like to thank Charles Lieberman for supplying me with the Chow data.

3/Pesaran (1982a) has shown that both the Cox N-test and the J-test are asymptotically equivalent, and both have more local power than the orthodox test if the number of nonoverlapping variables is greater than one.

4/If more than one alternative hypothesis is considered, a likelihood ratio test should be used.

5/In this regard, if the null hypothesis differs from the alternative by the inclusion of one variable, the orthodox test and the J-test are identical. If this is not true, the two tests may yield different conclusions.

6/Laidler (1982) has shown that this argument has little justification for an aggregate money demand schedule. If one accepts Laidler's criticism, one is left with the problem of justifying the presence of a significant coefficient on lagged money in the short-run specification. It could be justified on the basis of autocorrelation, since statistically significant estimates of the coefficient of autocorrelation are obtained only for the long-run specifications. The estimates of the short-run specifications, however, differ markedly from the long-run specification adjusted for autocorrelation. Thus, the data do not support this interpretation. Alternatively, an adaptive (or other) expectations model could account for the explanatory power of lagged money.

7/The classical F-test results for the long-run specification are: 1897-58, 1/2 F = .39, 2/1 F = 43.98*, 1/3 F = 7.82*, 3/1 F = 29.89*; 1934-58, 1/2 F = .77, 2/1 F = 19.54*, 1/3 F = .62, 3/1 F = 5.18*. The results for the short-run specification are: 1897-1958, 1/2 F = 10.00*, 2/1 F = 12.19*, 1/3 F = 8.31*, 3/1 F = 13.73*; 1934-1958, 1/2 F = 2.88, 2/1 F = .32, 1/3 F = 3.75*, 3/1 F = .11. The * indicates statistical significance at the .05 level. Of course, when the specifications differ from one another by only one variable, as for 2 against 3, the results of the F-test and the J-test are identical. Hence, they are not reported.

8/See Pesaran (1982b).

9/The maximum likelihood estimates of ρ for each model for each time period are: 1897-1958, (1)=.99, (2) and (3)

= .88; 1934-1958, (1) = .90, (2) = .57, (3) = .67. The estimates were made using a grid search to the nearest .01.

10/Complete results for the other values of ρ can be obtained from the author upon written request.

11/In this respect, it is interesting to note that the short-run equation appears not to be simply the long-run equation adjusted for autocorrelation, as is sometimes supposed. If this were the case, we would have expected the results in Tables 5 and 6 to be much the same as those in Tables 3 and 4.

12/It is interesting to note that Chow found current income performed better in the short-run equation and permanent income and wealth performed better in the long-run equation. He attributed this to the importance of savings. However, by his definition of savings, $Y_t - \theta YP_t$ with $0 < \theta \leq 1$, he effectively included both the effect of savings, $YP_t - \theta YP_t$, and transitory income, $Y_t - YP_t$.

13/This interpretation is consistent with a conjecture of Friedman (1959) and is not necessarily inconsist with a rational expectations framework. I would like to thank Mack Ott for initially stimulating my thinking along these lines.

14/See Laidler (1982) chapter 2 for several interesting alternative interpretations of the coefficient.

15/A standard F-test of the equality of the coefficients on YP and Bond for the specification in Table 2 rejects the null hypothesis at the .05 level (F=5.32). There is evidence of autocorrelation in the long-run specification; therefore, the test was repeated adjusting for autocorrelation. This time, the null hypothesis could not be rejected (F=2.41). It should be noted, however, that both of these tests may lack power since the estimates of the coefficient of autocorrelation were dissimilar over the two periods.

16/The results of these tests are interesting in one additional respect. Recently, there has been a great deal of interest in various non-nested tests and their use relative to the classical F-test [e.g., Pesaran (1982a, 1982b), McAleer, Fisher and Volcker (1982), Fisher and McAleer (1979, 1981) and McAleer (1981) and Godfrey (1981)]. In our tests, however, both the J and N-tests yielded the same qualitative conclusions (the only possible exception was for the short-run specification for the entire period, where wealth was pitted against permanent income). Furthermore, these results are consistent with those obtained from a classic F-test, with the exception of the short-run specification for the short period (see footnote 7). Thus, there were few differences in the qualitative results of these tests when applied to the Chow money demand data.

Table 1: J-test and N-test Statistics for Long-Run Money Demand Specifications

Null/Alternative	λ	t-ratio	N-test
		1897 - 1958	
1/2	.932	9.460*	-12.247*
2/1	.107	.881	-.581
1/3	.764	6.853*	-7.499*
3/1	.381	2.926*	-2.700*
2/3	.240	1.767	-1.815
3/2	.851	6.070*	-7.554*
		1934 - 1958	
1/2	1.079	6.110*	-8.214*
2/1	-.088	-.460	1.034
1/3	.772	3.325*	-4.595*
3/1	.279	1.129	-1.025
2/3	-.374	-1.128	1.384
3/2	1.466	4.488*	-5.382*

*Indicates significance at .05 level.

Table 2: Composite Long-Run Specifications

Period	Const.	YP	Y	W	Bond	CPR	SE/$\bar{R}^2$
1897-1958	-.558*	.984*	.095*		-.680*	-.016	.064
	(2.18)	(5.89)	(0.65)		(9.38)	(0.82)	.991
	-1.482*		.442*	.584*	-.601*	-.012	.072
	(3.24)		(3.57)	(4.19)	(7.73)	(0.50)	.989
	-.613*	1.092*			-.709*	-.010	.064
	(2.55)	(55.60)			(12.70)	(0.60)	.991
1934-1958	-1.544	1.429*	-.255		-.575*	-.014	.048
	(1.28)	(4.89)	(0.93)		(4.00)	(0.23)	.985
	-3.616		.311	.870	-.792*	-.088	.070
	(1.47)		(0.76)	(1.81)	(3.22)	(0.98)	.967
	-1.702	1.170*			-.538*	-.044	.048
	(1.43)	(12.63)			(3.91)	(0.83)	.985

*Indicate significance at the .05 level.
Absolute values of the t-ratios in parentheses.

Table 4: Composite Short-Run Specifications

Period	Const.	Y	YP	CPR	Bond	M_{-1}	SE/$\bar{R}^2$
1897-1958	.576* (3.55)	.273* (3.563)	.006 (0.05)	-.042* (4.05)	-.171* (2.84)	.667* (10.89)	.050 / .998
	.581* (4.76)	.276* (6.31)		-.042* (4.71)	-.168* (4.99)	.669* (15.56)	.050 / .998
1934-1958	-.596 (0.66)	.581* (2.01)	-.311 (0.63)	-.124* (2.34)	.032 (0.17)	.745* (3.91)	.017 / .992
	-.777 (0.93)	.408* (4.21)		-.105* (2.44)	-.058 (0.48)	.636* (8.01)	.017 / .992

*Indicates significance at the .05 level.
Absolute values of the t-ratios in parentheses.

Table 5: J-test Statistics for the Long-Run Money Demand Specifications Adjusted for Autocorrelation

Null/Alternative	λ	t-ratio
	1897 - 1958	
1/2	.941	7.538*
2/1	.102	.764
1/3	.709	6.511*
3/1	.355	3.121*
2/3	.287	1.738
3/2	.733	4.537*
	1934 - 1958	
1/2	.866	4.286*
2/1	.172	.793
1/3	.498	2.069*
3/1	.579	2.338*
2/3	-.432	-1.379
3/2	1.416	4.633*

*Indicates significance at the .05 level.

Table 6: Composite Long-Run Specifications, Adjusted for Autocorrelation

Period	Const.	YP	Y	W	Bond	CPR	ρ	SE/$\bar{R}^2$
1897-1958	-1.433*	1.089*	.035		-.334*	-.049	.88*	.041
	(2.14)	(7.51)	(0.29)		(3.05)	(1.72)	(13.61)	.999
	-2.803*		.307*	.785*	-.419*	-.023	.89*	.045
	(3.11)		(3.13)	(6.37)	(3.34)	(0.72)	(14.34)	.999
1934-1958	-1.744	.788*	.349		-.333*	-.071	.80*	.034
	(1.44)	(2.90)	(1.48)		(2.45)	(1.62)	(5.96)	.999
	-1.453		.841*	.203	-.290	-.089	.87*	.039
	(0.75)		(3.91)	(0.77)	(1.67)	(1.82)	(7.87)	.986

*Indicates significance at the .05 level.
Absolute values of the t-ratios in parentheses.

NOTE: THIS TABLE IS NOT INTENDED FOR PUBLICATION

Appendix table: J-test Statistics for Long-Run Money Money Demand, Adjusted for Autocorrelation

	1897 - 1958	
	ρ = .99	
Null/Alternative	λ	t-ratio
1/2	.949	6.130*
2/1	.128	.679
1/3	.736	5.132*
3/1	.513	3.200*
2/3	.282	1.401
3/2	.800	4.469*
	1934-1958	
	ρ = .90	
Null/Alternative	λ	t-ratio
1/2	.636	2.819*
2/1	.431	1.887
1/3	.419	1.752
3/1	.658	2.719*
2/3	-.372	-1.044
3/2	1.311	4.112*
	ρ = .67	
1/2	.798	3.789*
2/1	.251	1.129
1/3	.419	1.752
3/1	.658	2.720*
2/3	-.430	-1.338
3/2	1.407	4.537*

*Indicates significance at the .05 level.

REFERENCES

Carr, J. and M. R. Darby, "The Role of Money Supply Shocks in the Short-Run Demand for Money," Journal of Monetary Economics 8 (September 1981): 183-99.

Chow, G. C. "On the Long-Run and Short-Run Demand for Money," Journal of Political Economy 74 (April 1966): 111-31.

Cox, D. R. "Tests of Separate Families of Hypotheses," Proceedings of the Fourth Berkeley Symposium on Mathematical Statistics and Probability Volume 1. Berkeley: University of California Press 1961.

Darby, M. R., "The Allocation of Transitory Income Among Consumer's Assets," American Economic Review 62 (December 1972): 928-41

Davidson, R. and J. G. MacKinnon, "Several Tests for Model Specification in the Presence of Alternative Hypothesis," Econometrica 49 (May 1981): 781-93.

Fisher, G. R. and M. McAleer, "On the Interpretation of the Cox test in Econometrics," Economics Letters 4 (1979): 145-150

______________, "Alternative Procedures and Associated Tests of Significance for Non-Nested Hypotheses," Journal of Econometrics 16 (1981): 103-119.

Friedman, M. S. "The Quantity Theory of Money: A Restatement," in Studies in the Quantity Theory of Money (University of Chicago Press, 1956).

______________. "The Demand for Money: Some Theoretical and Empirical Results," Journal of Political Economy 67 (August 1959): 327-51.

Godfrey, L. G., "Testing Non-Nested Models After Estimation by Instrumental Variables or Least Squares," Econometrica, forthcoming.

Goldfeld

Laidler, D. Monetarist Perspectives. Oxford: Philip Allen, 1982.

__________. "The Interest Rate and the Demand for Money--Some Empirical Evidence," Journal of Political Economy 64 (December 1966a): 543-55.

__________. "Some Evidence on the Demand for Money," Journal of Political Economy 64 (February 1966b): 55-68.

Lieberman, C. "The Long-Run and Short-Run Demand for Money, Revisited." Journal of Money, Credit and Banking 12 (February 1980): 43-57.

__________. "The Transactions Demand for Money and Technological Change," Review of Economics and Statistics 59 (August 1977): 307-17.

McAleer, M., "A Small Sample Test for Non-Nested Regression Models," Economics Letters 7(1981): 335-338.

McAleer, M., G. Fisher and P. Volker, "Separate Misspecified Regressions and the U.S. Long-Run Money Demand Function," Review of Economics and Statistics 64 (November 1982): 572-583.

Meltzer, A. H. "The Demand for Money: The Evidence from the Time Series," Journal of Political Economy 61 (June 1963): 219-46.

Pesaran, M. H. "On the General Problem of Model Selection," Review of Economic Studies 41 (April 1974): 153-71.

____________. "Comparison of Local Power of Alternative Test of Non-Nested Regression Models," Econometrica 50 (September 1982a): 1287-1305.

____________. "On the Comprehensive Method of Testing Non-Nested Regression Models," Journal of Econometrics (1982b):

____________, and A. S. Deaton. "Testing Non-Nested Nonlinear Regression Models," Econometrica 46 (May 1978): 677-94.

Spindt, P. A. "Money Is What Money Does: A Revealed Production Approach to Monetary Aggregation." Board of Governors of the Federal Reserve System (1983).

Thornton, D. L. "The Long-Run and Short-Run Demand for Money: Additional Evidence," Journal of Macroeconomics 4 (Summer 1982a): 325-38.