The Impact of Institutional Changes on the Australian Short-Run Money Demand Function

By Ian G. Sharpe and Paul A. Volker, Sydney

I. Introduction

In an earlier issue of Kredit und Kapital *Jüttner* and *Tuckwell* (1974) present estimates of the Australian short-run real money demand function for the period 1952 (1) to 1972 (3). They conclude that the demand for real balances is a stable function of expectations with respect to real income, interest rates, and inflation, over this period. Unfortunately the authors did not report the results of their stability analysis, merely asserting that "the application of the usual Chow test suggested the absence of any significant structural change in the relationship between these two periods [1952 (1) to 1963 (3) and 1963 (4) to 1972 (3)]".[1] No indication is given as to the level of significance at which the Chow test is applied nor is there any explanation as to why two unequal sub-periods are selected for the test. Unless one has an *a priori* belief that structural change may have occurred at 1963 (4), and a reading of Australian monetary history[2] suggests no obvious reason for selection of this date, then it would seem more appropriate to split the sample into two equal sub-periods and apply the Chow test accordingly.

Until recently *Jüttner* and *Tuckwell's* findings might well have appeared to conform to received doctrine. There has been, however, a steadily increasing body of evidence[3] to suggest that the demand function for money is less stable than previously envisaged, and this instability is often associated with changes in the framework of monetary control. Given that significant changes have occurred in the institutional framework of the Australian monetary sector since the early 1950's one might expect the Australian money demand function to exhibit some instability also. Should instability in fact be present

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[1] D. J. *Jüttner* and R. B. *Tuckwell* (1974, p. 63).

[2] See H. W. *Arndt* and D. W. *Stammer* (1972).

[3] See for example, G. *Hacche* (1974, pp. 288 - 290), S. *Goldfield* (1973, p. 591) and G. C. *Rausser* and G. S. *Laumas* (1976).

and attributable to changes in or characteristics of the framework then in order to achieve unbiased $\hat{\beta}$'s the functional form will have to become more complex as it incorporates variables which capture the effect of the monetary framework. A situation such as this points out the potential inconsistency between the dual *Friedman* criteria of simplicity of the functional form and stable $\hat{\beta}$'s.

In the following section we discuss the institutional framework through which Australian monetary policy has functioned over the last 2 1/2 decades. It is argued that the framework in the 1950's differed significantly from that of the 1960's, raising doubts as to the existence of a stable money demand function over the two periods. In Section III of the paper we discuss briefly some of the weaknesses of the Chow test of stability and present some tests recently developed by *Brown, Durbin* and *Evans* (1975). When these tests are applied in Section IV of the paper to *Jüttner* and *Tuckwell's* money demand formulations all formulations are found to be unstable at the 95 per cent confidence level.

In Section V we examine the possibility that the instability is due to these formulations being in real rather than in real per capita form or to the constraint that real money balances are homogeneous of degree zero in prices. The evidence strongly suggests that the observed instability is not attributable to the specification of inappropriate price level elasticities nor the failure to specify the demand function in per capita terms. Then in Section VI we examine the impact of various direct controls on the Australian money demand function. The evidence in this section is consistent with the hypothesis that direct controls and institutional changes have contributed to the observed instability of the money demand function and that attempts to estimate money demand functions from 1952 to the present should explicitly consider the effect of direct controls and other institutional factors.

Finally in Section VII the sample period is extended to incorporate the more recent period to 1975 (1) with the result that a further period of monetary instability is detected from 1972 (3) to 1975 (1). The evidence examined is consistent with the hypothesis that the observed instability is due to the use of the "administered" government bond yields as the opportunity cost of holding money in the money demand functions. It is suggested that in recent years, with the development of the short term money market, the "administered" bond yield may no longer reflect the true opportunity cost of holding money and may

produce poor fits when money demand functions are estimated using such data.

II. Australian Institutional Framework

The following discussion of the institutional context within which post World War II Australian monetary policy has functioned is necessarily brief. For a comprehensive description, the interested reader is referred to *Arndt* and *Stammer* (1972) or *Giblin* (1951).

The post WWII banking regulatory environment in Australia had its origins in the emergency measures of the National Security (Banking) Regulations 1939 - 41. This provided for the establishment of a "special account" procedure (a form of minimum cash reserve requirement), provided the Central Bank with powers to license banks, control bank interest rates, issue directives on bank advance policy, and control bank investments.

Unlike most other industries in which wartime controls were discontinued upon conclusion of the War, the general provisions of the 1941 banking regulations were continued with minor modifications. Consequently from 1945 the banking sector comprised by far the most heavily regulated component of the private sector. This exclusive reliance on direct banking controls provided the opportunity for the development of alternative financial intermediaries which enjoyed phenomenal growth in the 1950s.

In the immediate post war decade the experience of the Central Bank with its newly acquired powers was not a happy one. Not being independent of the Federal Government it was forced in 1951 and 1955 to support an artificially low level of interest rates with the result that control of the money supply was effectively lost at these times. Movements in long-run government bond rates occurred infrequently at intervals of three to four years. Bank interest rates were similarly pegged at very low levels resulting in significant shifts of deposits to the non-controlled finance areas.

A further problem encountered by the Central Bank in this period was the existence of very different liquidity conventions between the major Trading Banks. A call of funds into special accounts could completely exhaust several banks' excess reserves but have no impact on the lending policies of others. An early attempt to overcome this

problem involved making lender of last resort facilities available at what was intended to be a penal borrowing rate. As it turned out, the discount rate was set too low with the result that the Central Bank once again lost control of the money supply as the Trading Banks availed themselves of the cheap source of funds.

Early in 1953 the Central Bank altered its approach to special account policy. Prior to this time it had used special account calls and releases to control Trading Bank liquidity directly. In the new policy, special account changes were intended to be an indicator to the Trading Banks of the policy direction the Central Bank wanted them to pursue. "The Trading Banks were asked to agree to conduct their advance policies so as to maintain an average LGS ratio (liquid assets plus Government securities to deposits) over the year of 25 per cent. The idea was that the Central Bank would use special accounts so as to reduce the Trading Banks' LGS ratio somewhat below 25 per cent if it wished them to restrict advances, or to raise the LGS ratio somewhat above 25 per cent if it wished them to expand advances."[4] For a combination of reasons, the new policy failed and was eventually abandoned in late 1955. The Trading Banks in effect ignored the signal conveyed by special account changes with the result that the Central Bank once again lost control of the money supply.

Control over the money supply was effectively regained in 1956 when the Central Bank permitted interest rates to rise from their previously artificially low levels and when an effective LGS convention was finally established.

The preceding discussion suggests that there have been occasions when the combination of a shifting supply curve of money and an inflexible and artificially low rate of interest may have conspired to produce a disequilibrium market situation in which a credit rationing effect operated.

It was not until after the Reserve Bank was established in 1959 as the first fully fledged Central Bank in Australia without any subsidiary Trading and Saving Bank functions that a significantly different approach to the banking sector began to filter through. There has been since that time a positive attempt to make the sector more competitive with other financial institutions. It is still true that direct controls

[4] H. W. *Arndt* and D. W. *Stammer* (1972, pp. 172 - 3).

impose a burden on the banks but this burden is relatively much lighter than during the 40s and 50s. Interest rate ceilings still exist but they are more flexible and not always effective. The proportion of bank assets held in the form of special accounts has fallen considerably, and banks have been allowed to offer a wider variety of liabilities. This more market oriented policy is reflected in the following statement by the Governor of the Reserve Bank in 1971:

> In recent years the Bank has tried to move towards reducing its reliance on direct controls over banks, and towards action which operates over a wider field. While direct controls can be a useful help to policy in the short run, they cannot be used continuously in the long run without support from appropriate market-oriented policies: as time goes on, the market tends to find ways around a direct control[5].

The implication of such a switch in policy on the demand for money is clear. Relative to the 1950s, the increased attractiveness of bank deposits in the 1960s should have increased the demand for money. As *Jüttner* and *Tuckwell's* estimated equations do not explicitly consider such a factor one might expect to find some instability in their relationships over the two decades.

The movement towards a market oriented policy has from time to time been interrupted as the Reserve Bank, in many cases bowing to political pressure, has resorted to direct controls. For example, the Reserve Bank issued lending directives to the Banks in the periods 1964 (4) - 1966 (3), 1967 (2) - 1967 (3), 1969 (3) - 1970 (3), and 1973 (3) - 1974 (2) instructing them in each case to reduce their new lending. Presumably the objective of the directive was to restrict the rate at which high powered money was converted into money.[6] *Artis* and *Lewis* (1976) have provided British evidence consistent with the hypothesis that such directives act as a constraint upon money holders' ability to bring their money holdings to the desired level. To the extent that the directives are effective in Australia one would expect to observe some instability in *Jüttner* and *Tuckwell's* money demand formulations from this source, also.

III. Test of Stability

Until recently statistical tests of stability have generally relied upon the existence of *a priori* information as to the likely timing of struc-

[5] J. G. *Phillips* (1971, p. 27).
[6] See I. G. *Sharpe* (1976, p. 5).

tural change in estimated relationships or alternatively they have arbitrarily split the sample period and then applied the Chow test (analysis of variance) or dummy variables to analyse structural change. But in the great majority of cases such *a priori* information is not available and an *ad hoc* splitting of the sample period risks the possibility of not detecting the structural change.

Fortunately less restrictive tests of stability are now available. *Brown, Durbin* and *Evans* (1975) have suggested a combination of the following tests and techniques as a means of identifying the existence and timing of structural change: (i) the homogeneity statistic; (ii) the cusum test; (iii) the cusum of squares test; (iv) progressive βetas; and (v) Quandt's log likelihood ratio.[7]

The homogeneity statistic is a generalisation of the Chow test, using analysis of variance for '*p*' equal sized non-overlapping periods. Like the Chow test it suffers from the criticism that the selection of subperiods for examination is rigid and may conceal the existence of an unstable relationship. The cusum test involves the computation of the sum of the recursive one period prediction errors. A statistical test is available to ascertain whether this statistic differs significantly from its expected value of zero thereby indicating an unstable relationship. Generally such coefficient instability will become evident when one period prediction errors are consistently positive or negative over a significant portion of the sample. No *a priori* knowledge of the probable timing of structural change is necessary for this test.

Brown, Durbin and *Evans* assert that the cusum of squares test "provides a useful complement to the cusum test, particularly when the departure from constancy of the βetas is haphazard rather than systematic".[8] It also is useful in detecting whether the variance of a relationship is constant over time. While a non-constant variance does not bias the ordinary least squares regression coefficients, it does produce inefficient estimates.[9] The cusum of sqares test also involves the sum of the recursive one period prediction errors though in this case the errors are squared so that the sign is lost. Essentially the test ascertains whether the recursive prediction errors are evenly distributed through-

[7] The Variable Parameter Regression technique for analysing stability provides an alternative to the above tests. For a discussion of the two sets of tests see *Garbade* (1977).

[8] See R. L. *Brown*, J. *Durbin* and J. M. *Evans* (1975, p. 154).

[9] See J. *Johnston* (1963, pp. 207 - 11).

out the sample period. A change in variance is evident in a concentration of large errors (either positive or negative) within a portion of the sample.

The tests of significance of the cusum and cusum of squares statistics assume that the errors in the regression equation are normal independent variables with zero means. This imposes some restrictions on the use of the tests. They are clearly not appropriate when there are auto-regressive error schemes. The zero mean assumption implies that the tests would be biased in equations which omit the constant term because in such cases the regression residuals will not necessarily sum to zero. The tests are also inappropriate in estimating auto-regressive models.

Analysis of progressive βetas merely involves the recursive calculation of regression coefficients, lengthening the sample period by one observation in each step. There is no statistical test of significance of coefficient change in this case but the information provided may be of use in identifying the timing of structural change. Finally, *Quandt's* log-likelihood technique is useful for detecting an abrupt change in a regression relationship at an unknown time. However, since there is as yet no statistical test of significance associated with *Quandt's* technique, its role in this study has been to assist in the identification of the timing of structural change. In the following section these tests and techniques are applied to analyse the stability of *Jüttner* and *Tuckwell's* money demand formulations.

IV. Stability of the Australian Short-Run Money Demand Function

Despite extensive attempts to do so, *Jüttner* and *Tuckwell's* results could not be replicated exactly. It is felt that the difference between the two sets of results probably arises from two sources: (i) our use of revised gross national product statistics; and (ii) our use of end of quarter data for the money supply and interest rate series. *Jüttner* indicated in correspondence that he thought they had used average of monthly figures for the money supply and interest rate series. However a problem arises in the monthly money supply series because a consistent series is available only from June 1956.[10] A consistent end of quarter series is, however, available from June 1952. Hence our choice of end of quarter data.

[10] See R. C. *White* (1973, pp. 621 - 4).

In addition to these minor data changes, one change in the specification has been made. Whereas *Jüttner* and *Tuckwell* include the quarterly price change in linear form in an otherwise logarithmic formulation our variable is the ratio of the current to the prior period price level (or one plus the quarterly inflation rate) which is then included in logarithmic form. A minor change has also been made in the estimation technique. We have taken first differences of logs of each of the variables and included a constant in the transformed equation. The addition of the constant in a first difference formulation is equivalent to adding a time trend to the original money demand function. As *Jüttner* and *Tuckwell* apply a Hildreth-Lu rho value of .99 to transform their data in the Almon estimates, applying first differences should make little difference to the results, with the possible exception of that deriving from the first observation.

The model estimated took the following form:[11]

$$\ln\left(\frac{M3}{P}\right)_t = a_0 + \sum_{i=0}^{6} a_{1i} \ln\left(\frac{Y}{P}\right)_{t-i} + \sum_{i=0}^{6} a_{2i} \ln R_{t-i} + \sum_{i=0}^{4} a_{3i} ln\left(\frac{P_{t-i}}{P_{t-i-1}}\right) \quad [1]$$

where $M3$ is a broad definition of the money stock including currency, current (demand) and fixed (time) deposits at the Trading Banks, and savings deposits at Savings Banks; Y is gross national product at current prices; R is a government bond yield of either 2-year or 10-year maturity (denoted $R2$ and $R10$ respectively); and P is the consumer price index. A surprising aspect of the results, which for space reasons are not reported, was that the Durbin-Watson statistics indicated the existence of serial correlation in the residuals despite first differences being used. A further problem is the existence of spurious correlation (with the price deflator in the dependent variable) when the current price level appears as an explanatory variable. Consequently the model was re-estimated substituting $\ln\left(\frac{P_{t-1}}{P_{t-2}}\right)$ for $\ln\left(\frac{P_t}{P_{t-1}}\right)$. With this modification we could no longer reject the hypothesis of no serial correlation at the 95 per cent confidence level.

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[11] Two alternative partial adjustment models, with and without inflation respectively, were also estimated. For space reasons these results are not presented here. The above model was regarded as more interesting than the partial adjustment models because it allows non-uniform speeds of adjustment for different variables. The fact that auto-regressive models are not suitable for testing with the *Brown, Durbin, Evans* tests also influenced our decision to present the *Almon* results. A complete set of results for the lagged

Stability analyses were then conducted on this modified form of the model. The homogeneity statistics were generally significant at the 95 per cent confidence level suggesting considerable instability in the estimated equations over time (for the short-run interest formulation F statistics of 1.92, 1.11 and 1.44 were found when the sample period was divided into two, three and four subperiods respectively while for the long-run interest formulation the F statistics were 3.55, 2.13 and 2.99). This conclusion is further supported by the results of the cusum and cusum of squares tests, plots of the short-run run interest formulations being depicted in Figures 1 and 2.[12] Thus contrary to *Jüttner* and

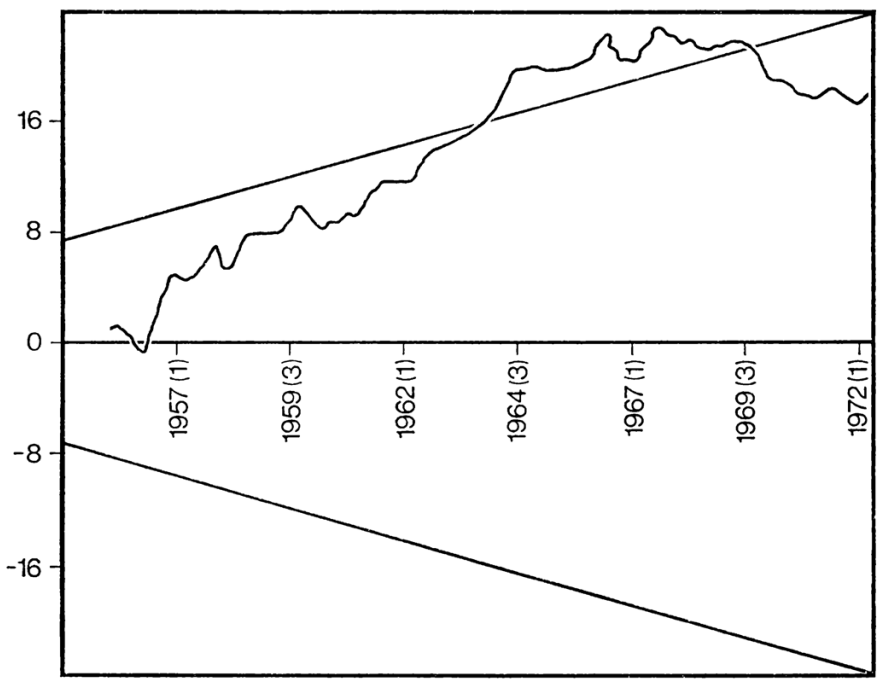

Figure 1: Cusum Forward Plot.

dependent models is available in Working Paper No. 13, Department of Economics, The University of Sydney.

[12] *Brown, Durbin* and *Evans* suggest that additional information may be obtained by running the data backwards as well as forwards. While the meaning of this procedure is not clear when the model includes lagged values it does allow any errors in the initial „*K*" observations to be revealed. See *Brown, Durbin* and *Evans* (1975, p. 155).

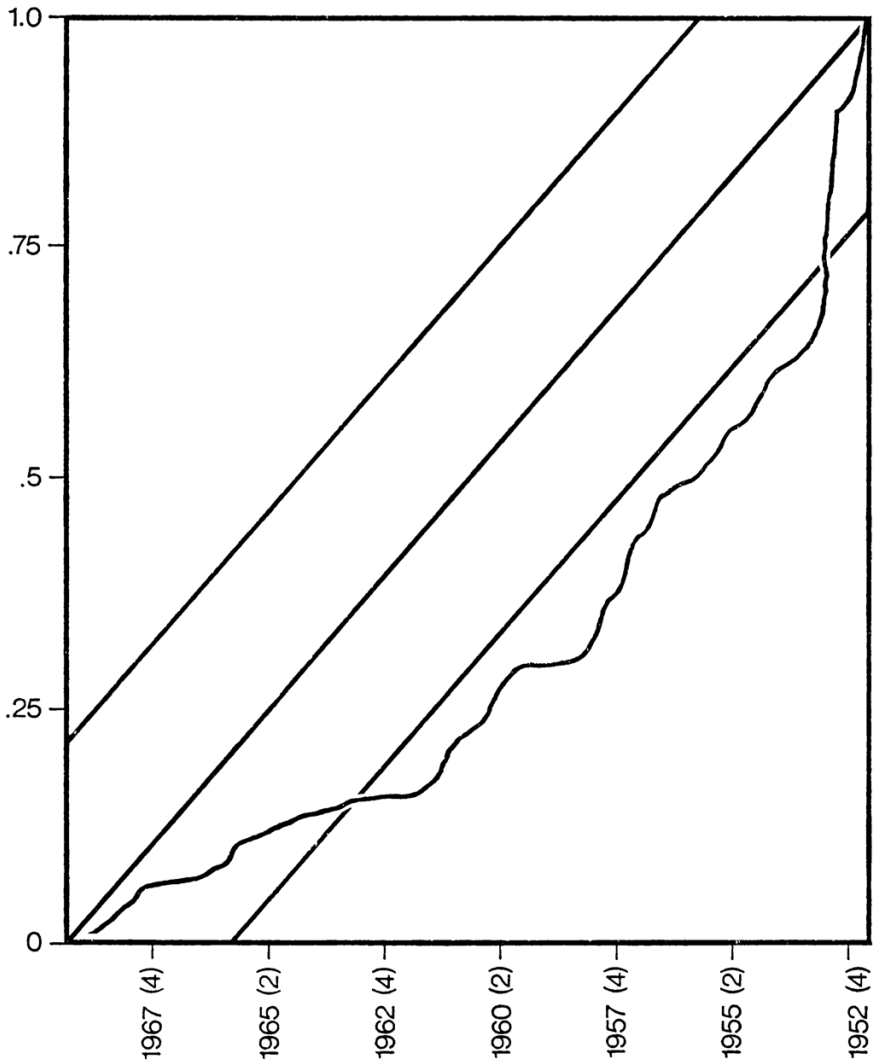

Figure 2: Cusum of Squares Reverse Plot.

Tuckwell's assertion, we may reject the null hypothesis of stable money demand functions for each of the estimated formulations at the 95 per cent confidence level.

Much of recent monetarist literature assumes the money demand function is stable although, as *Jüttner* and *Tuckwell* indicate, in most cases the precise nature of the stability required is not clear. For adequate monetary control at least two stability conditions appear relevant: (i) that the estimated parameters of the money demand function be stable over time; and (ii) that the residual variance be stable over time. If the behaviour of money demanders is unstable or subject to sudden and unpredictable changes in either of these senses, this would have obvious and serious consequences for monetary analysis.

However, statistical instability may arise from numerous sources most of which are not nearly as serious as the type of instability discussed in the previous paragraph. It may, for example, arise if the money demand function is incorrectly specified. This possibility is examined in the following section of the paper. Another alternative is that the observed statistical instability may reflect institutional changes which have not been adequately accounted for in the estimated equations. Several institutional factors ignored by *Jüttner* and *Tuckwell* were outlined in the previous section of the paper. Their impact on the demand for money is examined below in Section VI.

V. Possible Misspecifications of the Money Demand Function

A feature of the formulations used so far is the implicit constraint that real money balances have a zero price elasticity of demand with respect to the price level. If such an assumption is incorrect then "the demand for real balances will also depend upon the level of prices, and the omission of this variable should show itself in instability and poorness of fit in any test which uses data measured in real terms".[13] To test for this misspecification the model was estimated allowing for the price level to vary. Elasticities of .804 and .913 with standard errors of .222 and .230 were found. When an Almon lag was applied to the price level the elasticities were. .870 and .926 with standard errors of .231 and .240. In neither case, therefore, was there any indication that the price elasticity was significantly different from one.

Another potential source of prediction error and instability was the use of real balances rather than real balances per capita as the dependent variable. Regression results almost identical to the previous model

[13] D. E. W. *Laidler* (1969, p. 516).

were obtained, however, when the model was estimated in per capita form. The homogeneity statistics calculated were 2.19, 1.11 and 1.47 for the short-run interest model and 3.56, 2.16 and 3.04 for the long-run interest model.

A third possible misspecification arises from the exclusion of an own interest rate. When the yield on twelve month fixed deposits was incorporated into the model however, it was found to be insignificant. The reason for this is apparent when one remembers that the model is estimated in first differences and the cusum plot of Figure 1 indicated a continuous set of positive residuals after the early 1960s. Prior to the early 1970s an own interest rate would have shown significant changes in only isolated quarters.

We are left therefore with the indication that the instability is not attributable to the specification of inappropriate price level elasticities, to the failure to specify the demand function in per capita terms, or to the exclusion of an own interest rate.

VI. The Impact of Direct Controls and Institutional Changes

In this section we examine an alternative hypothesis that the instability in the money demand estimates arises because of the neglect of institutional factors which, we have argued in Section II, could profoundly influence money demand. Three institutional factors were specifically considered: (i) the movement towards a somewhat more market oriented monetary policy and competitive banking system in the early 1960s; (ii) the loss of effective control over the money supply from 1952 to 1956; (iii) the imposition of direct lending controls on Banks. Examination of the cusum plot of Figure 1 indicates the possibility of a structural change occurring in the early 1960s. This is supported by the log likelihood ratio (not shown) which places the switching point at the end of 1961. The cusum of squares plot of Figure 2 indicates a source of instability in the period 1952 - 55. Thus each of the stability tests is consistent with an institutional explanation for the observed instability.

The problem, however, lies in finding suitable proxies which permit quantification of institutional factors. The first difference regressions generate sets of residuals which are continuously negative until 1960 and then positive for an extended period. This implies in the levels formulation a trend away from and then towards holding real money

balances and is a similar result to that found by *Hacche* (1974) in his estimation of the U. K. money demand function for the period after the introduction of Competition and Credit Control.

Given that the near-bank sector progressively became more viable and attractive to asset holders during the 1950s in Australia it is eminently reasonable that there should have been a trend away from money, rather than a once and for all movement. In a similar manner the relaxation of controls on banks has been progressive since 1960 and we would expect relative holdings of bank liabilities to progressively increase also.

If we hypothesise that the trend away from or towards money is related to the degree of competitiveness of bank liabilities then a suitable proxy variable for the degree of competitiveness is provided by the differential between the yield on bank liabilities and the bond rate (R - RFD). This differential was relatively large until 1960 and then decreased as the Reserve Bank allowed banks to become more competitive. It is entered as a trend variable in the regression in Table 1 and is found to possess the correct sign and to be highly significant.

We argued earlier that the short-run supply effects of the 1950s and the lending restrictions of different periods may have been a cause of monetary disequilibrium. This disequilibrium, it is suggested, was primarily a result of the inflexibility of the rate of interest which prevented new equilibria being attained in the same quarter as the supply curve shifted. In order to proxy the effect of a supply constraint in the case of lending restrictions we use a variable denoted *LENDD*, taking a positive value when the directives are in force and zero otherwise.[14] The effect of the short run supply effects of the money market in the 1950s is proxied by a variable similar to that used by *Artis* and *Lewis* (1976) and equal to the rate of growth of the liquidity augmented money base, denoted $\dot{AB}$.[15] This variable is included only

[14] LENDD = 1 in 1952 (1) - 1952 (3); 1955 (3) - 1957 (1); 1960 (1) - 1961 (2); 1964 (4) - 1966 (2); 1967 (2) - 1967 (3); 1968 (4) - 1969 (1); = ½ in 1969 (3) - 1970 (1); = 1 in 1970 (2) - 1971 (4) and 1973 (3) - 1974 (3); and = 0 otherwise. See Reserve Bank of Australia, Annual Reports and Statistical Bulletins.

[15] From 1952 (1) to 1956 (4) $\dot{AB}$ = Percentage rate of growth in the seasonally adjusted liquidity augmented monetary base defined as notes on issue held by public, special deposit account and other deposits of Trading Banks at Commonwealth Bank, coin and bullion and Australian notes of All Trading Banks, and total Commonwealth Government Securities of All Trading Banks; = 0 otherwise. See *White* (1973).

from 1952 - 56, the period during which the institutional framework was such that supply factors are likely to be significant.[16] Both of the disequilibrium variables are found to be of the correct sign and significant at the 95 per cent level of confidence. The equations incorporating these three variables are REG 1 and 2 in Table. 1.

Applying the cusum and cusum of squares tests to these equations, we were unable to reject the null hypothesis of stability over time at the 95 per cent confidence level. Thus the evidence examined is consistent with the hypothesis that the observed instability in the earlier estimates is attributable to institutional factors not considered in *Jüttner* and *Tuckwell's* formulations.

VII. Extension of Sample Period

The period from 1972 to the present is widely acknowledged to be a period of monetary instability. This raises the interesting question of whether the modified formulations REG 1 and 2 of Table 1 remain statistically stable when the sample period is extended to include the period to 1975 (1). The regression results utilizing the extended period were unsatisfactory, the *Durbin-Watson* statistic indicating the presence of serially correlated residuals so that the stability tests are not applicable. Furthermore, the residuals from 1972 (3) to 1975 (1) were extremely large suggesting further inadequacies in this formulation.

Part of the explanation for the poor performance of the estimated money demand functions in the 1970s could lie in several institutional developments. Firstly the late 1960s and early 1970s witnessed a significant development of merchant banking and the short-term money market in Australia. With such a development it is possible that the administered yield on government securities no longer reflects the true opportunity cost of holding money. To test such a hypothesis we include the interest rate on 90-day trade bills denoted *DRTB* to represent the market yield on short-term money. Secondly, the Banks have become somewhat more competitive in their quest for funds in the capital markets. This has been facilitated by Reserve Bank policy as reflected

[16] Both of these variables derive much of their impact from a credit rationing effect. Such an effect is likely to be particularly strong in any situation in which interest rates are slow to adjust, as for example, when they were pegged at very low levels in the 1950s. For a discussion of a credit rationing effect see *Chick* (1973).

in the relaxation, and in some cases, removal, of interest ceilings on deposits and the granting of permission for Banks to issue marketable claims such as certificates of deposit. As a proxy for the increased willingness and ability of Banks to actively seek funds we use the yield on Trading Bank fixed deposits of approximately 12 months term, denoted *DRFD*.

Results utilizing the yields on trade bills and fixed deposits are shown as REG 3 and 4 in Table 1. It must be borne in mind that the *DRTB* and *DRFD* variables are of a dummy variable form taking a zero value prior to 1971 (4) and the relevant yield thereafter. Relative to the results excluding these dummies, REG 3 and 4 represent a considerable improvement as the serial correlation problem appears to have been eliminated. Furthermore, both regressions easily pass the cusum test while regression 3 just passes and 4 just fails the cusum of squares test at the 95 per cent confidence level. Much of the problem appears to arise from a large error in 1972 (3), a period of large capital inflow and speculation against the Australian dollar.[17]

One characteristic of the results is that it required a large number of parameter estimates to produce a stable result and in the recent period from 1973 (4) to 1975 (1) a total of four additional dummy variables were added. Many of the parameter estimates are of course attributable to seasonal factors and to the existence of lags in the money demand formulation. Nevertheless if we expect a stable demand function and we consider *David Laidler's* approach to defining "a more stable demand for money function" as "one that requires knowledge of fewer variables and their parameters in order to predict the demand for money with a given degree of accuracy..."[18] our results must be considered disappointing. Obviously one could limit the study to subperiods in which the institutional context was relatively constant and thereby restrict the number of required parameter estimates. Results of this nature would no doubt rank higher utilizing *Laidler's* relative stability definition than the results in Table 1.

The results of this paper suggest that *Meltzer's* approach to stability is more realistic in the Australian context. *Meltzer* argues that:

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[17] *Adams* and *Porter* (1977) argue that precautionary money holdings may have increased in advance of the variable deposit scheme which was implemented in the final quarter of 1972.

[18] D. E. W. *Laidler* (1969, p. 516).

[19] A. H. *Meltzer* (1963, p. 222).

Table 1: **O. L. S. Regression Results**

REG	DEP VAR	LAG i	Regression Coefficient of[a]							
			$\Delta \ln\left(\frac{Y}{P}\right)_{-i}$	$\Delta \ln R_{-i}$	$\Delta \ln\left(\frac{P_{-i}}{P_{i-1}}\right)$	$(R\text{-}RFD)$[b]	$LENDD$	$\Delta \dot{AB}_{-1}$	$\Delta \ln DRFD_{-i}$	$\Delta \ln DRTB_{-i}$
1.	$\Delta \ln\left(\frac{M3}{P}\right)$	$i=0$	.248 (6.50)	− .029 (2.07)	...	−.005 (3.18)[b]	− .006 (2.28)	.240 (5.98)		
		$i=1$	.130 (4.08)	− .025 (2.78)	− .584 (4.28)					
		$i=2$	.095 (2.97)	− .016 (1.65)	− .743 (4.17)					
		$i=3$	.110 (4.41)	− .005 (.64)	− .600 (3.56)					
		$i=4$	.142 (5.67)	.003 (.34)	− .303 (2.20)					
		$i=5$	.157 (4.92)	.006 (.69)						
		$i=6$	.121 (4.30)							
	Sample 1952 (2) - 1972 (3), $R^2 = .922$, $D\text{-}W = 1.87$									
2.	$\Delta \ln\left(\frac{M3}{P}\right)$	$i=0$	.231 (5.99)	− .067 (2.62)	...	−.004 (3.57)[b]	− .005 (1.70)	.198 (4.98)		
		$i=1$	.106 (3.21)	− .046 (2.82)	− .669 (4.75)					
		$i=2$	.069 (2.01)	− .032 (1.72)	− .748 (4.22)					
		$i=3$	.086 (3.10)	− .024 (1.37)	− .618 (3.78)					
		$i=4$	.121 (4.68)	− .018 (.89)	− .347 (2.61)					
		$i=5$	.141 (4.47)	− .011 (.59)						
		$i=6$	.112 (4.04)							
	Sample 1952 (2) - 1972 (3), $R^2 = .922$, $D\text{-}W = 1.78$									
3.	$\Delta \ln\left(\frac{M3}{P}\right)$	$i=0$	.269 (6.41)	− .022 (1.36)	...	−.005 (2.73)[b]	− .006 (1.95)	.240 (5.16)	.201 (5.13)	− .021 (1.53)
		$i=1$	.145 (3.97)	− .025 (2.27)	− .557 (3.59)				.040 (1.47)	− .128 (5.65)
		$i=2$	.102 (2.73)	− .022 (1.90)	− .717 (3.53)				.075 (2.71)	
		$i=3$	.109 (3.78)	− .016 (1.62)	− .581 (2.99)					
		$i=4$	.134 (4.61)	− .008 (.84)	− .293 (1.84)					
		$i=5$	.146 (3.85)	− .002 (.25)						
		$i=6$	.112 (3.32)							
	Sample 1952 (2) - 1975 (1), $R^2 = .911$, $D\text{-}W = 1.86$									
4.	$\Delta \ln\left(\frac{M3}{P}\right)$	$i=0$	.260 (6.13)	− .033 (1.20)	...	−.044 (2.85)[b]	− .005 (1.39)	.219 (4.75)	.202 (4.77)	− .023 (1.70)
		$i=1$	.102 (2.60)	− .036 (1.82)	− .644 (4.06)				.066 (2.35)	− .127 (5.34)
		$i=2$	.049 (1.19)	− .044 (1.92)	− .754 (3.68)				.099 (3.28)	
		$i=3$	.062 (1.95)	− .051 (2.58)	− .600 (3.18)					
		$i=4$	.103 (3.48)	− .049 (2.79)	− .307 (2.00)					
		$i=5$	.132 (3.53)	− .034 (2.23)						
		$i=6$	.111 (3.31)							
	Sample 1952 (2) - 1975 (1), $R^2 = .909$, $D\text{-}W = 1.85$									

a) Constant and seasonal dummy variables have been omitted. — b) In REG 1 and 3 variable is (R 2-RFD) and in REG 2 and 4 (R 10-RFD). t statistics in parentheses.

"The problem is one of defining money so that a stable demand function can be shown to have existed under differing institutional arrangements, changes in social and political environment, and changes in economic conditions, or to explain the effects of such changes on the function."[19]

The implication from *Jüttner* and *Tuckwell's* study is that their formulations of the Australian short-run money demand function are stable under differing institutional arrangements. Results from the present study suggest otherwise. The evidence is consistent with the hypothesis that direct controls and institutional changes have contributed to the observed instability of the Australian short-run money demand function. Consequently attempts to estimate money demand functions from 1952 to the present should explicitly consider the effect of direct controls and other institutional factors as *Meltzer* suggests and as this paper has attempted.

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Zusammenfassung

Wirkung von institutionellen Änderungen auf die australische kurzfristige Geldnachfragefunktion

In einer früheren Ausgabe von Kredit und Kapital* legen *Jüttner* und *Tuckwell* Schätzungen der australischen kurzfristigen realen Geldnachfragefunktion für den Zeitraum vom 1. Quartal 1952 bis zum 3. Quartal 1972 vor. Sie kommen zu dem Ergebnis, daß die Nachfrage nach realer Kasse eine stetige Funktion der Erwartungen der realen Einkommen, Zinssätze und der Inflation für diesen Zeitraum ist.

In Teil II des Beitrags beschreiben wir den institutionellen Rahmen, innerhalb dessen die australische Geldpolitik in den letzten 2 1/2 Jahrzehnten abgelaufen ist. Dabei wird unterstellt, daß der Rahmen in den 50er Jahren sich signifikant von dem der 60er Jahre unterscheidet. Diese Tatsache weckt Zweifel an einer stabilen Geldnachfragefunktion über diese beiden Zeiträume.

In Teil III des Beitrags zeigen wir kurz einige Schwächen des Chow-Stabilitätstests auf und legen einige kürzlich von *Brown, Durbin* und *Evans* (1975) entwickelte Tests vor. Bei Anwendung dieser Tests auf *Jüttners* und *Tuckwells* Geldnachfrageformel in Abschnitt 4 dieses Beitrages stellt sich heraus, daß bei einem Konfidenzniveau von 95 Prozent alle Formeln unstetig sind.

In Abschnitt 5 weisen wir die Möglichkeit zurück, daß die Instabilität darauf zurückzuführen ist, daß die Formeln reale statt reale pro Kopf-Größen beinhalten oder daß sie auf der Beschränkung beruht, daß die realen Geldgleichungen hinsichtlich der Preise homogen vom Grade Null sind. Weiterhin untersuchen wir in Abschnitt 6 die Wirkung von verschiedenen direkten Kontrollen auf die australische Geldnachfragfunktion. Der in diesem Abschnitt erbrachte Beweis stimmt mit der Hypothese überein, daß direkte Kontrollen sowie institutionelle Änderungen zu dieser beobachteten Instabilität der Geldnachfragefunktion beigetragen haben und daß Versuche, die Geldnachfragefunktionen seit 1952 bis heute zu schätzen, ausdrücklich die Wirkung direkter Kontrollen und anderer institutioneller Faktoren berücksichtigen sollten.

* Kredit und Kapital, 7. Jg. (1974), Heft 1, S. 48.

Summary

The Impact of Institutional Changes on the Australian Short-Run Money Demand Function

In an earlier issue of Kredit und Kapital *Jüttner* and *Tuckwell* present estimates of the Australian short run real money demand function for the period 1952 (1) to 1972 (3). They conclude that the demand for real balances is a stable function of expectations with respect to real income, interest rates, and inflation, over this period.

In Section II of the paper we describe the institutional framework through which Australian monetary policy has functioned over the last 2½ decades. It is argued that the framework in the 1950's differed significantly from that of the 1960's, raising doubts as to the existence of a stable money demand function over the two periods. In Section III of the paper we discuss briefly some of the weaknesses of the Chow test of stability and present some tests recently developed by *Brown, Durbin* and *Evans* (1975). When these tests are applied in Section IV of the paper to *Jüttner* and *Tuckwell's* money demand formulations all formulations are found to be unstable at the 95 per cent confidence level.

In Section V we reject the possibility that the instability is due to these formulations being in real rather than in real per capita form or to the constraint that real money balances are homogeneous of degree zero in prices. Then in Section VI we examine the impact of various direct controls on the Australian money demand function. The evidence in this section is consistent with the hypothesis that direct controls and institutional changes have contributed to the observed instability of the money demand function and that attempts to estimate money demand functions from 1952 to the present should explicitly consider the effect of direct controls and other institutional factors.

Résumé

L'impact de changements institutionels sur la fonction de demande monétaire à court terme australienne

Dans une édition antérieure de „Kredit und Kapital", *Jüttner* et *Tuckwell* présentent pour la période du 1er trimestre 1952 au 3e trimestre 1972 des estimations de la fonction de demande monétaire réelle à court terme australienne. Ils concluent que la demande d'encaisse réelle est une fonction permanente des anticipations des revenus réels, des taux d'intérêt et de l'inflation.

La Section II du présent article décrit le cadre institutionnel dans lequel s'inscrit la politique monétaire australienne des 2 1/2 dernières décennies. Il est à ce propos présumé que le cadre des années cinquante se distinguait de manière significative de celui des années soixante. Ce fait permet de douter de la stabilité de la fonction de demande monétaire couvrant ces deux périodes.

La Section III pointe le doigt sur certaines lacunes du test de stabilité de Chow et expose quelques tests récemment développés par *Brown, Durbin* et *Evans* (1975). L'application de ce test à la Section IV à la formule de demande monétaire de *Jüttner* et *Truckwell* démontre qu'à un niveau de confiance de 95 pourcent, toutes les formules sont discontinues.

La Section V n'admet pas la possibilité selon laquelle l'instabilité proviendrait du fait que les formules comprendraient des grandeurs réelles plutôt que des grandeurs réelles par tête ou qu'elles reposeraient sur la limitation selon laquelle les équations monétaires réelles sont à l'égard des prix homogènes de degré zéro. L'on examine ensuite à la Section VI l'effet de divers contrôles directs sur la fonction de demande monétaire australienne. La preuve apportée à cet endroit correspond à l'hypothèse qui veut que les contrôles directs et les changements institutionels ont contribué à l'instabilité constatée de la fonction de demande monétaire et qui requiert des essais d'estimation des fonctions de demande monétaire de 1952 à nos jours qu'ils prennent expressément en compte l'impact de ces contrôles directs et d'autres facteurs institutionnels.