ECONOMIC RESEARCH
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WORKING PAPER SERIES

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Authors	Michael T. Belongia, and K. Alec Chrystal
Working Paper Number	1989-007A
Creation Date	January 1989
Citable Link	https://doi.org/10.20955/wp.1989.007
Suggested Citation	Belongia, M.T., Chrystal, K.A., 1989; An Admissible Monetary Aggregate for The United Kingdom, Federal Reserve Bank of St. Louis Working Paper 1989-007. URL https://doi.org/10.20955/wp.1989.007

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AN ADMISSIBLE MONETARY AGGREGATE FOR
THE UNITED KINGDOM

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89-007

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AN ADMISSIBLE MONETARY AGGREGATE FOR THE U.K.

Michael T. Belongia and K. Alec Chrystal

It is well known that the official monetary aggregates published by the world's central banks and monitored or targeted for the conduct of monetary policy suffer from at least two deficiencies in their construction. The first is that the collections of assets used to define the array of alternative aggregates have not been shown to be weakly separable commodity groups, a condition required by aggregation theory. If, by chance, the asset groupings of official aggregates were admissible collections, a second criticism still would be relevant: the system of equal weights used to sum the balances in component assets is valid only if the assets are perfect substitutes. Much empirical evidence, however, has shown that this is not the real world case.[1/] As Barnett (1982, p. 700) has argued, these two deficiencies imply that "the official aggregates cannot approximate behaviorally stable aggregates .... and permit all forms of spurious and unstable relationships during the [process of selecting which aggregate works best empirically]."

In this article we build from first principles to offer an alternative monetary aggregate for the U.K. We first conduct tests for the weak separability of plausible asset groupings to identify admissible groups. A Divisia weighting strategy then is applied to the admissible groups to create admissible monetary variables that can be viewed as candidates to serve as an intermediate target variable for the conduct of monetary policy. Finally, the alternative aggregates are evaluated against three conventional linear tests: the stability of their velocity functions, their in-sample relationship with aggregate spending and their relationship with base money, i.e., their controllability. Comparisons against sterling M4 also are evaluated.

I. THEORETICAL CRITICISMS OF EXISTING AGGREGATES

Official monetary aggregates are simple sum indexes of balances in some subset of financial assets. This approach to construction of monetary aggregates fails on two grounds.

A. Index Construction

A simple sum weighting scheme, which gives equal weight to each component, is valid only if the components are perfect substitutes. Sterling M3, for example, includes assets from coins and notes in circulation up through and including both interest-bearing and non-interest-bearing retail current accounts, savings deposits and wholesale interest bearing deposits. The former, of course, are pure media of exchange and pay zero explicit rate of return whereas the latter are primarily a store of value that, in recent years, has earned an own-rate of return in excess of 10 percent. In addition to the large accumulated empirical evidence that indicates a low degree of substitutability between "money" and "near-monies," the quite different characteristics of the individual assets suggests they are not likely to be perfect substitutes.

The consequences of the simple sum weighting scheme, at least for broad aggregates, are several. First, because the monetary variable of interest for policy purposes is one that represents the economy's flow of monetary services, the simple sum aggregates mute the signal of the "true" monetary variable by adding, with equal weight, assets that offer little or no monetary services; the degree to which this effect is likely to be felt increases as the aggregate becomes broader. Second, a simple sum aggregate, because it does not internalize pure substitution effects caused by changes in interest rates, can change even if there has been no change in monetary service flows.[2/] Together, these properties imply that the official, simple sum aggregates misrepresent both the level of the money stock and changes in it.

B. Composition of the Aggregates

The (properly weighted) asset collection to be employed as a monetary aggregate should behave as an elementary good. If we consider the set of all monetary assets $M = \{m_i;\ i=1 \ldots N\}$, an admissible grouping will be one that is both separable and consistent. The former implies that some subset, C, of the set M is a weakly separable block or, alternatively, that the marginal rate of substitution between any two assets in C is independent of the quantity of any asset or good not in C. The latter condition is that, similarly, the elasticity of substitution between any two assets in C is independent of the quantity of any asset or good not in C. Whereas the first condition defines a weakly separable block, the second condition also requires this block to be linearly homogeneous; linear homogeneity assures that the growth rate of the aggregate will be equal to the weighted-average growth rate of its components.

In contrast to the unavoidable problems introduced by simple sum weighting, it is possible that an official aggregate is based on an asset grouping that, if tested, would be shown to be admissible. In practice, however, testing the separability of asset collections has not been done for U.K. data and has been investigated on only a few occasions for U.S. data.[3/] Thus, although the fundamental asset collections used to define M1 through M4 may be supportable, this actuality would be fortuitous indeed.

II. PREVIOUS RESEARCH ON ALTERNATIVE AGGREGATES

Most investigations of alternatives to the official aggregates have applied the Divisia weighting scheme, suggested by Barnett (1980, 1982), to the asset collections that represent the official aggregates. These efforts include Batchelor (1987) and Holtham, et al. (1988) for the U.K., Cockerline and Murray (1981) for Canada, Ishida (1984) for Japan and Barnett and Spindt (1979, 1980, 1982) and Barnett, Spindt and Offenbacher (1984) for the U.S. In general, these results find the aggregates constructed with Divisia weights perform better than those constructed with simple sum weights.

On the second issue, regarding the search for an admissible group, the volume of work is substantially smaller and applies largely to U.S. data. The necessary tests for the weak separability of particular asset collections have been reported by Belongia and Chalfant (1989), Swofford and Whitney (1987) and Serletis (1986). Other studies have reported estimated elasticities of substitution between assets and argued on their basis in favor of or against particular asset collections; see, for example, Ewis and Fisher (1984, 1986) and the references they cite. These estimates, while offering evidence on the degree of substitutability between assets, do not provide evidence on the separability of a particular group [Barnett (1982), pp. 695-96]. Therefore, only the evidence in a few recent studies deals directly with the necessary condition for an admissible group.

Finally, again for U.S. data, *ad hoc* adjustments to official aggregates have been made and the performance of these "revised" measures has been analyzed in the context of spending equations. Because U.S. M1 is the aggregate thought most likely to be affected by post-1980 financial innovations--specifically, the payment of interest on checkable deposits--and has been the aggregate to deviate from past behavior most widely since 1982, these studies have subtracted all [Hafer (1984); Darby, et al. (1986)] or part [Wenninger (1984)] of interest-bearing checkable deposits from total M1.

Although their results indicate the adjusted M1 performs better than official M1, none of the evidence is applicable to the question of which assets belong in an aggregate monetary variable.

III. TESTING THE WEAK SEPARABILITY OF ALTERNATIVE U.K. ASSET COLLECTIONS

A. Theoretical Principles

The conditions necessary for an admissible asset collection--a linearly homogeneous, weakly separable commodity block--implies the traditional approach of inserting money as an argument in the utility function of the representative individual.[4/] Assuming that the consumer follows a multi-step budgeting process and that the utility function is weakly separable in financial assets, it then is possible to investigate which financial assets, in the second-stage budgeting decision, are weakly separable from other (near money) financial assets. The question now is how to test the weak separability of the alternative asset collections.

To this end, Belongia and Chalfant, for U.S. data, have applied the techniques of nonparametric demand analysis suggested by Varian (1982). This strategy was chosen, rather than a parametric test, as reported by e.g. Serletis (1986) or Hancock (1986), because Swofford and Whitney (1987) and many others before them (e.g. Ewis and Fisher) have indicated the parametric tests are sensitive to functional form. The nonparametric approach, which makes no assumptions about functional forms, allows one to test whether, for a set of observed prices and quantities:

(i) a stable utility function exists that rationalizes the data and

(ii) the data are compatible with a utility function that is weakly separable in some subset of goods.

These properties can be designated, respectively, consistency and separability.

Varian demonstrated, based on earlier work by Affriat (1967), that consistency requires the data to exhibit no violations of the Generalized Axiom of Revealed Preference (GARP), as defined by Samuelson (WARP; 1938) and Houthakker (SARP; 1950). SARP GARP is equivalent to the existence of a well-behaved utility function which, when maximized subject to a budget constraint by a rational consumer, could have generated the observed data. If a subset of the goods satisfies GARP while an aggregate of these goods along with the other goods still satisfies the consistency property, we have the result we are looking for in an admissible group of assets: a utility function exists which both rationalizes the observed data <u>and</u> is consistent with weak separability in these goods.

B. Data and Results for the Nonparametric Separability Tests

Data on prices and quantities for individual asset categories are required for the weak separability tests. Data for five assets were examined: currency, non-interest-bearing sterling sight deposits, private sector interest-bearing retail deposits, wholesale deposits and interest-bearing building society deposits. The simple sum of these is the aggregate M4. Quantities are simply the nominal balances in these asset categories. Relevant prices for financial assets are somewhat more complicated since they involve more than simply the opportunity cost of foregone interest. We follow the practice of measuring price as each asset's user cost as derived by Barnett (1978).[5/] We examined monthly data over the interval June 1982 through March 1988.

After investigating all reasonable groupings of the five asset categories, the nonparametric tests for weak separability indicated two groupings as candidates for a weakly separable group: currency alone and non-interest-bearing sight deposits, interest-bearing retail deposits and interest-bearing building society sight deposits; we call the latter aggregate D1 (in its divisia form). By default, the group of all five assets also should be considered because priors have led to the assumption that it is weakly separable from other financial assets as well as other goods and services. Thus, the first stage of the analysis suggests three asset groupings as admissible groups. We ignore currency for further study, however, and devote the remaining sections to an examination of the properties of D1.

While these groupings have been isolated, it is interesting to note others that failed to satisfy the conditions of GARP. Currency plus non-interest-bearing sight deposits, for example, which corresponds with the M1-A grouping identified for the U.S., is not weakly separable; in fact, currency could not be grouped with any other asset. Similarly, wholesale deposits, which pay nearly a competitive market interest rate, could not be grouped with the other deposits. This pattern of rejecting or not rejecting certain groupings, however, should be interpreted a bit cautiously because the nonparametric test apparently is biased toward rejection of weak separability.[6/] Nonetheless, this direction of the bias implies that one can be confident of identifying a separable group when a group does not reject GARP.

Two additional notes on these groupings may be in order. First, it is notable that our main group does not include currency, the one asset many economists believe unambiguously is money. While that denotation may be true, there is some debate whether currency should be included in the aggregate monetary variable used for policy purposes. Cagan (1982), for example, argues that currency is issued to the public on demand to conduct retail trade and tends to vary systematically with current and past movements in GNP; thus, if one is looking for a monetary measure that leads changes in aggregate spending and is an exogenous policy variable under the control of the monetary authority, currency would fail these tests. Therefore, even if currency and sight deposits were close substitutes, one might reasonably weigh the merits of the marginal information in a monetary aggregate that includes currency against the costs of estimating a relationship that included feedback from GNP to currency. Also note that Barnett (1982), who calls for testing weak separability only for groups that include currency suggests this condition only to limit the number of groups one might test and recognizes that this restriction does not come from either aggregation theory or monetary theory. Based on these arguments, we accept the second weakly separable group--that does not include currency--as a candidate for an aggregate monetary variable.

The second note is that the critical distinction between our favored aggregate and M4 is the exclusion of wholesale interest bearing deposits. Irrespective of the separability tests, it is easy to explain why their exclusion makes sense. Chart 1 shows the growth rate of wholesale interest bearing deposits. This is a highly volatile series and is extremely sensitive to regulatory changes (such as Competition and Credit Control and the Corset). It also is far more sensitive to interest rates than the other components and clearly is less related to transactions volume than to capital market conditions.

Interestingly, the necessity of excluding wholesale deposits imports a large advantage to Divisia indexes (see next section) over simple sum aggregates. This is because wholesale deposits are paid market interest rates and as a result are virtually excluded from Divisia aggregates. Hence <u>any</u> Divisia aggregate will have a very similar property. For example, we compare our three-component aggregate, D1, with Divisia M4. As chart 2 shows, the levels are different as we exclude cash, but the growth rates are very similar. Yet the growth rates of these Divisia measures are quite different from the simple sum aggregates M3 and M4, as shown in chart 3. These charts tend to confirm the assertion that both the composition of an aggregate and the weighting formula have important effects on its behavior.

IV. THE ADMISSIBLE AGGREGATES

To construct an aggregate monetary variable from the asset group identified in the previous section, one needs to use a weighting scheme for an index that is consistent with aggregation theory. Although the equal-weight simple sum scheme is clearly wrong, there are many alternatives from which to choose. For reasons detailed in Barnett (1982), we construct monetary aggregates using the Divisia weighting scheme, which is based on both prices and quantities of the goods being aggregated.[7/]

A. Descriptive Comparisons

Chart 4 plots the velocity of simple sum M3 and M4 and Divisia M4. Our D1 aggregate is much narrower and cannot be shown on a comparable scale, while M4 and M3 both intersect Divisia M4 in the time period. All three velocity measures have a downward trend; the Divisia aggregate, however, is the most stable of the three. It is particularly obvious that Divisia M4 is superior simple sum to M3 -- the latter being the aggregate which successive governments targeted between 1976 and 1987. Based on this simple comparison, a forward-looking monetary authority interested in a money growth path consistent with a nominal GDP objective and conditional on stable (or, at least predictable) velocity growth would prefer the Divisia aggregate.

B. The Alternative Aggregates in a Spending Equation

A traditional linear test of a variable's usefulness as a monetary indicator variable is its performance in an aggregate spending equation. Although the specifics vary, this equation typically is written as:

$$(1) \quad \dot{Y}_t = a + \sum_{i=0}^{p} b_i \dot{M}_{t-i} + \sum_{j=0}^{q} c_j \dot{F}_{t-j} + \sum_{k=0}^{r} g_k D_{t-k} + e_t$$

where Y is nominal GDP, M is the monetary indicator variable, F is some measure of fiscal actions and dots over variables indicate rates of change; a, b_i, c_j and g_k are coefficients to be estimated with lag lengths p, q and r to be determined in pretest estimation. For our purposes, M is represented by the alternative monetary aggregates described above; F and D are represented by nominal government consumption and an index of OECD industrial production. Lag lengths were determined by a final prediction error (FPE) criterion.[8/] The model was estimated with quarterly data over the I/1970-IV/1987 period.[9/]

We were not especially concerned with the relative performance of money and fiscal variables. Hence, we used non-nested testing techniques to see which of the money variables were preferable, holding the fiscal and exogenous demand variables the same in each case. Comparisons were made using the J-test and the Akaike Information Criterion (a battery of related tests yielded comparable results). The results were clear cut. Both divisia aggregates (D1 and Divisia M4) dominated sterling M3 and M4 and strongly so. The choice between D1 and Divisia M4 was more ambiguous as chart 2 would suggest. When the exogenous demand variable (OECD industrial production) was excluded from (1) Divisia M4 was preferred to D1. However, the inclusion of that variable reversed the dominance. In both cases the result was marginal and some of the non-nested tests were inconclusive in both cases.

A variation on these tests was conducted by adding lagged values of nominal GDP to the right-hand-side of (1). For long lags of all variables no discrimination was possible but for two lags of all variables the preference for D1 over the other aggregates (including divisia M4) remains in tact. This may be thought of as a test of Granger causality in the presence of other exogenous influences. At this lag length, both divisia aggregates Granger cause GNP but neither M3 or M4 does so.

C. Controllability

A final traditional criterion for selecting a monetary variable is its controllability by the monetary authority. In principle, many variables may pass the first two tests by explaining past and future movements in GDP and having a stable demand function in a few variables. In fact, there is evidence for the U.S. that at least a handful of aggregate variables, suggested by intuition, are in this category.[10/] But, at the same time, these same variables are not candidates as target variables for monetary policy because they are not under the direct control of central bank actions. Note that even narrow monetary aggregates have been criticized by opponents of monetary targeting on the grounds that the money stock is not controllable.

Although quite sophisticated investigations of controllability have been made, we use a simple test.[11/] The conditions are two. In a regression of the form,

$$(3)\ \dot{M}_t = a + \sum_{i=0}^{p} b_i\, \dot{MB}_{t-i} + e_t$$

where MB is the monetary base (MO):

(i) all lags beyond $i=0$ must have coefficients not significantly different from zero, and

(ii) there must be no evidence of mis-specification as suggested by a Durbin-Watson statistic substantially different from 2.0. In particular, the concern is that the chosen monetary variable is not influenced significantly by other variables beyond the direct control of central bank actions.

A third condition, which is convenient but not required, is that the constant term in (3) should be zero. If so, this would imply that the money multiplier is reasonably constant over time and the potential problem of forecasting multiplier movements would be avoided.

Equation (3) was estimated for each aggregate with quarterly data over the II/1969-IV/1987 interval. The results reported in table 1 suggest that none of the aggregates passes this set of tests. Each equation exhibits significant autocorrelation, suggestive of an omitted variable influencing the growth of the aggregate in question. Moreover, each equation's intercept is significantly different from zero, indicating that the multipliers are changing over time and need to be predicted by the central bank if an aggregate's growth path is to be targeted. Finally, each slope coefficient is significantly less than one and, for M3 and M4 is not significantly different from zero. Combined with the mis-specification suggested by the very low DW statistics, the overall impression from table 1 is that the U.K. institutions do not generate any simple relation between base and aggregates in this period. Clearly, there are some variables that affect the growth rates of the monetary aggregates and would require explicit treatment if aggregate targeting were to be implemented effectively via base control. Thus, while the new aggregate D1 appears to dominate the existing official aggregates and alternative Divisia measures, its usefulness in applied policy decisions still may be problematic. Nonetheless, it may be useful in that it is clearly more representative of 'monetary conditions' than are the traditional broad aggregates.

D. Demand for Money

A final test for the suitability of a monetary aggregate is whether it has a plausible underlying "demand" function. We are not especially interested in finding the best short run specification of a money demand function, but we are concerned to establish that a sensible long run relationship exists and that the identified relationship is indeed a candidate for being an equilibrium. Recent developments in time series modelling associated with the concept of cointegration turn out to be very helpful in this regard (Engle and Granger, 1987).

The benefit of the new methodology is that it allows us to estimate the core of the long run relationship directly - ignoring the serial correlation of the errors. We must then show simply that errors are stationary, in the sense that they would indeed return to zero (around the long run relationship). The long run relationship is referred to as the "cointegrating regression."

We do not offer an exhaustive statistical analysis of this problem as this would take a whole paper in itself. However, we do show that a plausible cointegrating regression exists, though it may be unique and there may exist a preferable one. It turns out that a cointegrating regression with simple form has a very traditional form for Divisia M4. It is:

$$\underset{}{D4} = \underset{(10.3)}{-6.5} + \underset{(24.2)}{1.04\,P} + \underset{(14.5)}{1.6\,Y}$$

where D4 is the divisia M4 aggregate, P is the GDP price deflator and Y is real GDP (all in logs). The data are quarterly for the period III/1969 to IV/1987. The coefficient of unity on the price level is exactly the prediction of the traditional quantity theory and confirms that this divisia aggregate is an effective candidate for being the true indicator of "money."

The augmented Dickey-Fuller unit root test has a value of 2.73 which, although not quite high enough to reject the hypothesis of a unit root, is very close to the critical value. This we regard as highly supportive over a data period in which there have been many structural changes and financial innovations and we have fitted a simple constant velocity model. There can be little doubt that, once stochastic trends are allowed for, a significant result will be available. Indeed, for the traditional simple sum aggregates, even monetarists have given up the hunt for stable relationships and a "monetarist" government has abandoned targeting. This result suggests that D4 will be a good long run guide to inflationary trends.

The comparable cointegrating regression for D1 has a P coefficient of 0.8 and a Y coefficient of 2.8. It is also less close to rejecting the unit root test for the same time period. Hence, on this basis at least, the broad D4 aggregate appears to be preferable to D1. This should not be too surprising since D1 omits high powered money.

Finally, it is worth reporting the short-run error correction form of the Divisia M4 aggregate. This turns out to be similar to the form reported by Taylor (1987) for sterling M3. It is:

$$\underset{}{\Delta(m-p)_t} = \underset{(4.7)}{0.12} - \underset{(2.6)}{0.25}\Delta(m-p)_{t-2} + \underset{(2.76)}{0.04}(m-p-y)_{t-4}$$

$$\underset{(6.99)}{-0.004}\, RLA_t$$

$R^2 = 0.38$ $\qquad$ $LM(8) = 5.25$

Although this is a simpler form than the M3 equation reported in Taylor, it has one additional novelty which is worth noting. This is that the steady state implied by this equation is:

$m = p + y + 0.1\ RLA$

The curiosity, clearly, is that the coefficient on the Local Authority Deposit Rate is positive. While this may appear to be an error, it actually makes sense in the context of Divisia aggregates. RLA is the return on the safe asset. Hence, for given returns on liquid assets, a higher RLA increases the measured Divisia aggregate relative to nominal GDP. In other words, it increases the implied transactions services of the existing liquid asset stock.

V. CONCLUSIONS

There is little doubt that the official monetary aggregates fail important tests of both economic and aggregation theory. Although the various efforts to derive Divisia aggregates on the basis of the standard asset groupings is a step in the right direction, it still relies on the assumption that these asset collections are admissible groupings. This assumption may be valid but has not been tested for U.K. data.

We have followed a sequence of steps to derive an economically and statistically defensible measure of the flow of monetary services in the U.K. economy. Our main departure from previous related work is to conduct the tests for weakly separable asset groupings that are necessary for an admissible aggregate. Having identified admissible groupings and constructed aggregate measures using Divisia weights, we investigate which of the alternatives performs best in the practical applications of interest to the conduct of monetary policy. The notable result is that a Divisia aggregate consisting of non-interest-bearing sight deposits and interest-bearing retail sight deposits and building society deposits would be preferred to the aggregates currently monitored and targeted. We have also discovered, however, that Divisia M4 has the most appealing long run characteristics. It is the aggregate most likely to conform to the traditional "homogeneity postulate" of monetary theory.

In a period when it is widely agreed that financial innovation has distorted behavioral or statistical relationships, it has become increasingly difficult to interpret monetary data. The advantage of Divisia aggregates is that they automatically adjust for the effects of financial innovation, at least in so far as this affects interest rates and, thereby, the "moneyness" of various financial assets. Finally, it seems clear to us that this paper has one very practical implication. Any monetary aggregate for the U.K. which includes wholesale deposits is going to be distorted as a monetary indicator relative to virtually any aggregate which does not.

FOOTNOTES

1/ See, for example, Ewis and Fisher (1984, 1986).

2/ For more detail on the shortcomings of the simple sum weighting scheme see, for example, Fisher (1932) or Barnett (1980).

3/ See, in addition to Belongia and Chalfant (1989), Fayyad (1986), Hancock (1986) and Serletis (1987).

4/ Although this approach is controversial to some, it has a long history in the literature. See Sidrauski (1967) or Feenstra (1987) for surveys and elaboration of relevant points.

5/ The exact formulation is:

$$P_{it} = \frac{P^*_t \; (R_t - r_{it})(1-M)}{1+R_t \; (1-M)}$$

where P* is the geometric mean of the CPI and the GNP deflator, R_t is the maximum expected holding period yield, r_{it} is the observed or imputed nominal own rate of return on asset i and M is the marginal tax rate.

This formula can be simplified, however, to: $\frac{R_t - r_{it}}{1 + R_t}$. To represent these terms, we used the following measures. The own rate of interest (r_{it}) on currency is assumed to be zero. The implicit own rate on demand deposits is estimated by Klein's (1974) formula. The long gilt rate +2% was chosen as our benchmark (R_t) because it was greater than all own-rates of interest (r_{it}) on other assets; this is a necessary condition to make user costs positive. Barnett and Spindt have found their experiments with Divisia indices to be robust with respect to choice of R_t. The overnight rate was used as the return on wholesale deposits, the seven day retail deposit rate applies to interest-bearing retail deposits and the gross share yield applies to building society deposits.

6/ The bias arises because a sufficient, rather than necessary, characterization of separability is used. See Barnett and Choi (1986) and the documentation to Varian's nonparametric demand analysis program.

7/ Divisia weights take the form: $W_{i,t} = .5\ (S_{i,t} - S_{i,t-1})$ where $W_{i,t}$ is the weight for asset i in period t and S_{ij} is the budget share of asset i in period j. The growth rate of the aggregate of n assets is merely the weighted-average growth rate of the component assets: $\dot{M}_t = \sum_{i=1}^{n} W_{i,t}\ \dot{Q}_{it}$, where $\dot{Q}_{it}$ is the growth rate of asset group i in period t.

8/ See Batten and Thornton (1984) for more details and an application to this type of spending equation.

9/ We thank Peter Spencer for making his data set available to us.

10/ See Batten and Belongia (1987) for a systematic investigation of alternative intermediate target variables for monetary policy.

11/ See Barnett and Chen (1988), for example.

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Chart 1. Growth Rates of Wholesale Deposits and D1

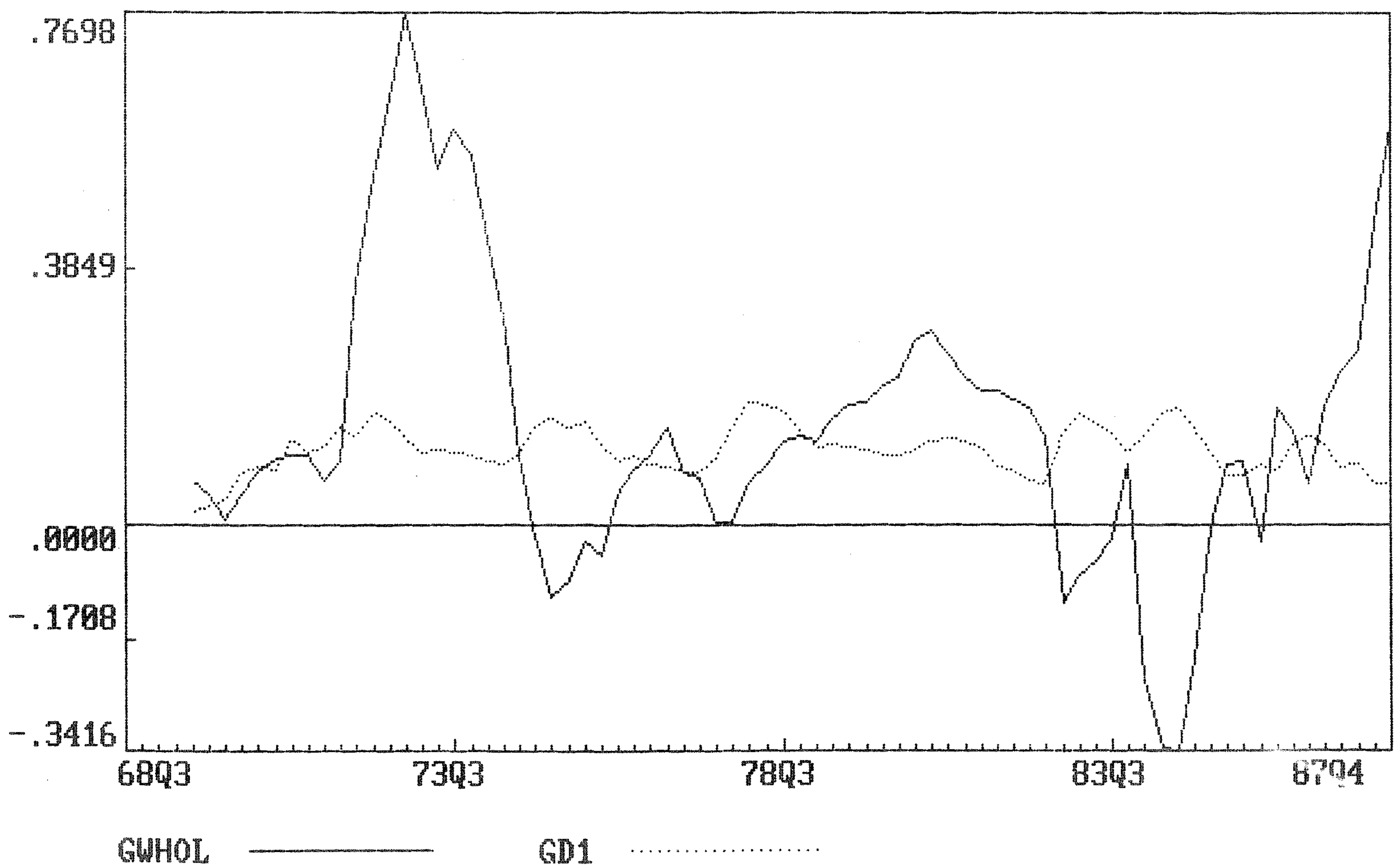

Chart 2. Growth Rate of Divisia M4 and D1

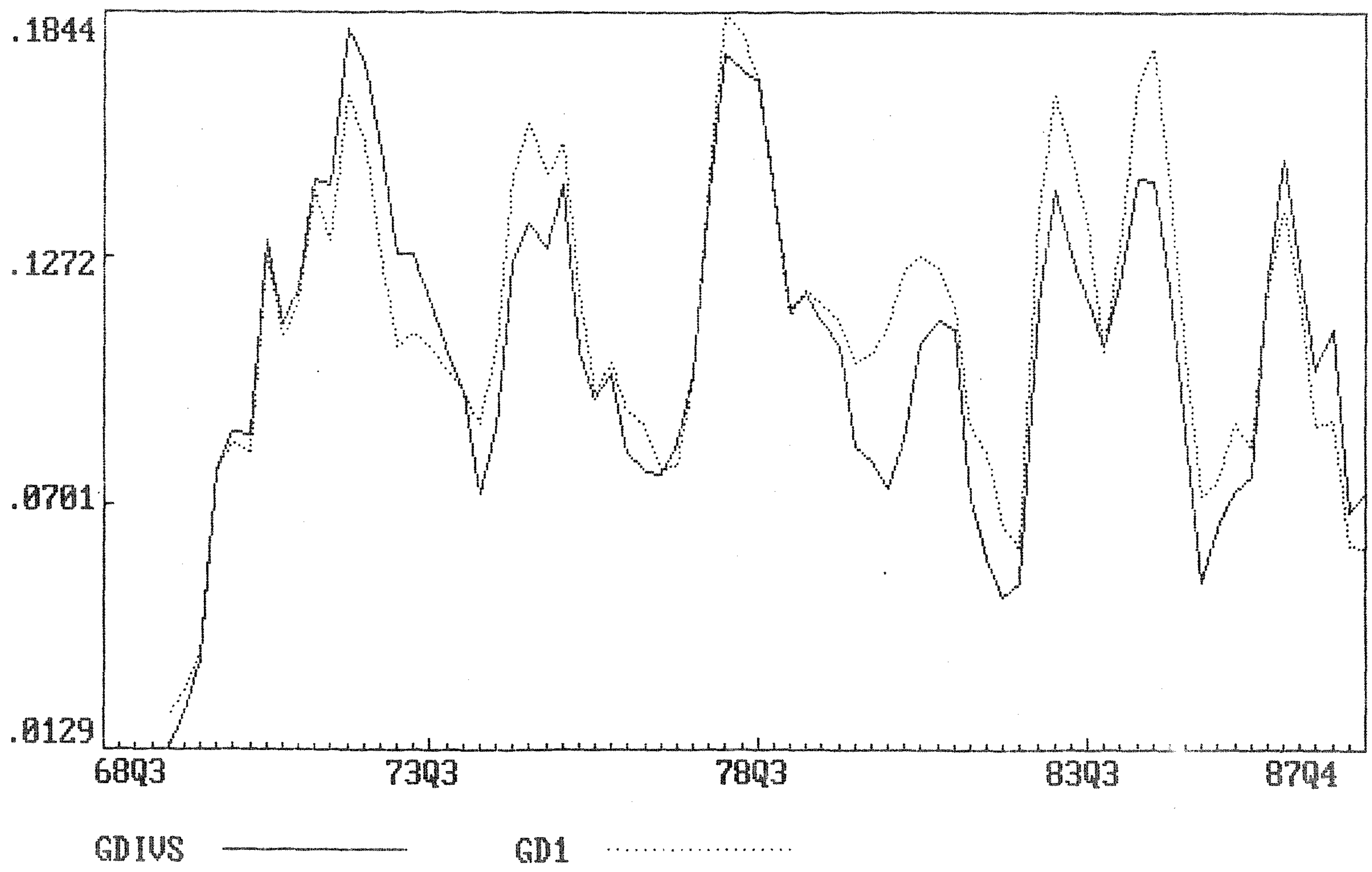

Chart 3. Growth Rates of D1, sterling M3 and M4

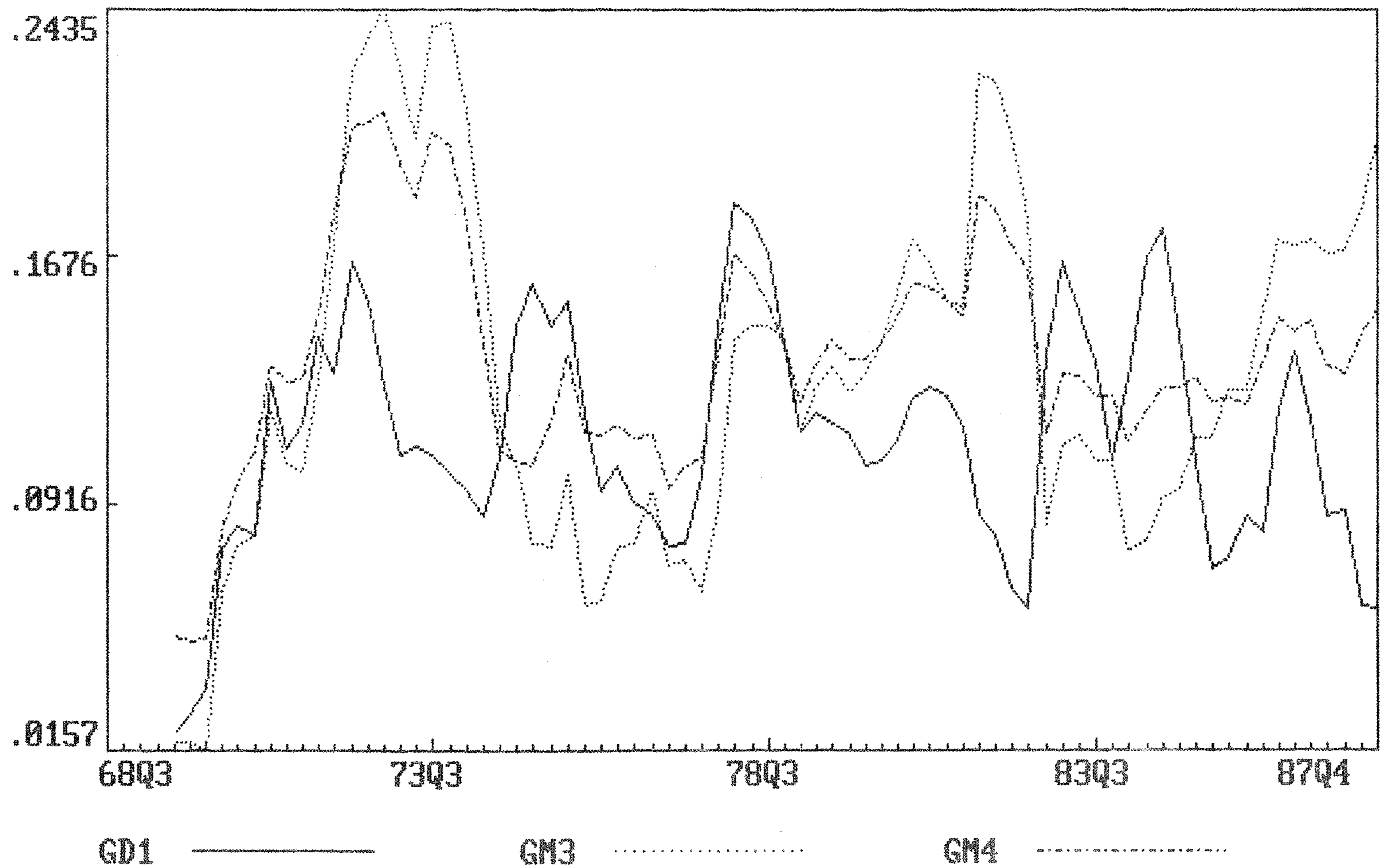

Chart 4. Velocity of Divisia M4, M3 and M4

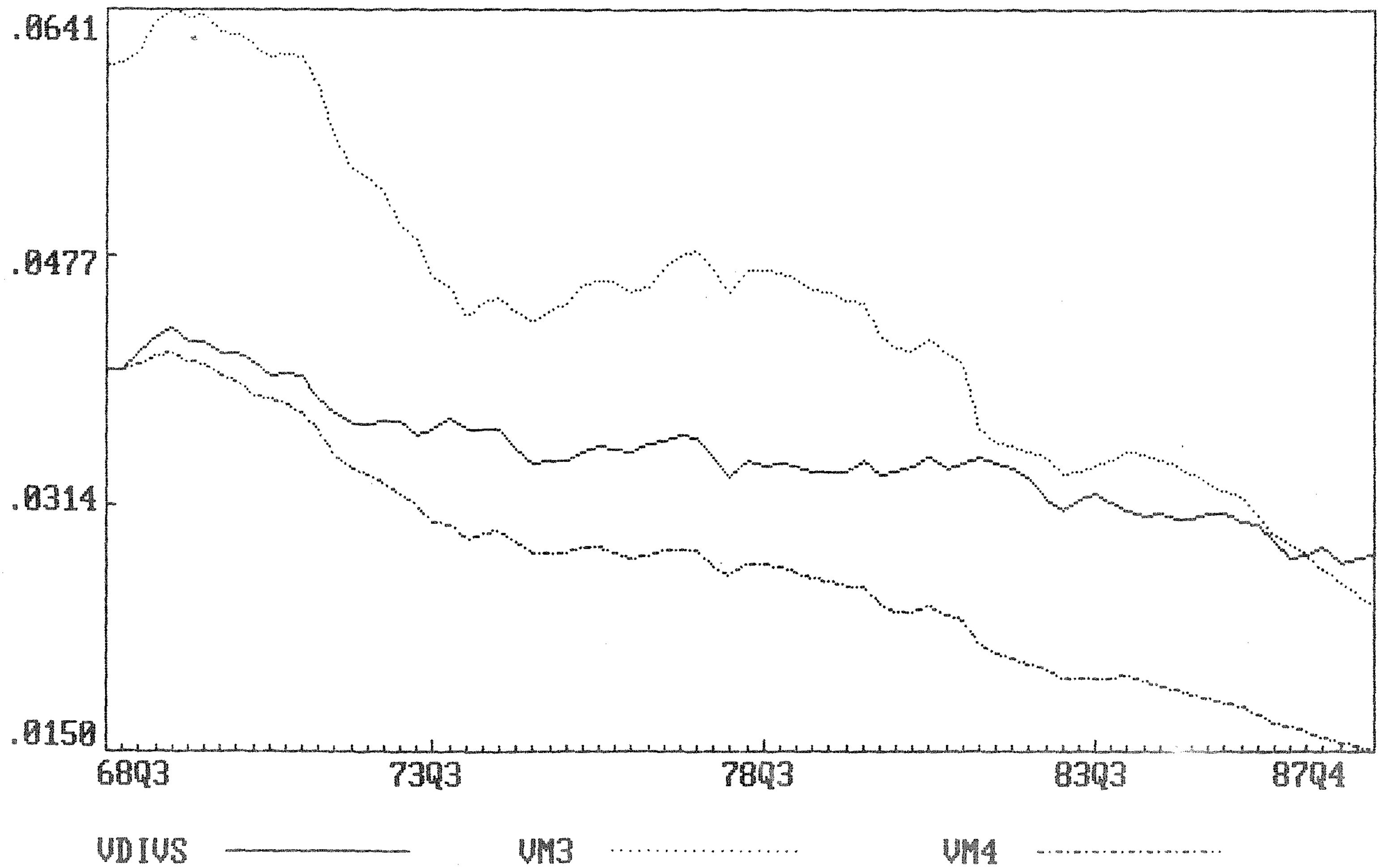

Table 1
Controllability of Alternative Aggregates

Aggregate	a	b	$\bar{R}^2$	DW
D1	0.090 (10.79)	0.319 (7.40)	0.17	0.58
Divisia M4	0.076 (9.60)	0.390 (6.91)	0.23	0.58
£M3	0.161 (11.04)	-0.261 (7.82)	0.03	0.23
£M4	0.144 (17.49)	-0.03 (11.32)	-0.02	0.29

For b, the t-statistic applies to the null hypothesis: b=1.

APPENDIX: Data Sources

The separability tests used monthly data from June 1982 to March 1988. They gave us both a suitable breakdown of interest and non-interest bearing deposits and also a period of minimal structural changes. Data were either directly provided by the Bank of England, taken from Bank of England Quarterly Bulletin or from Datastream.

The quarterly series used for longer term comparisons (1968 III to 1987 IV) are somewhat different. For construction of the Divisia aggregates we used the Local Authority 3-month rate on the quarterly data but the 10-year gilt yield monthly. The biggest difference is that we treat non-interest bearing current accounts as having a zero yield in the longer period, whereas for the monthly data we treat it as yielding a service flow as calculated by the Klein method. This assumption is important as without it we could not distinguish between cash and non-interest bearing current accounts. The bulk of the quarterly data was provided by Peter Spencer, to whom we are grateful. Additional series came from the Federal Reserve Bank of St. Louis, B.I.S. and OECD data tapes.