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CLASS II - FOMC

TO: FOMC

DATE: January 22, 1986

FROM: S. H. Axilrod

SUBJECT: Weighted Monetary Indexes

Following up an aspect of the FOMC discussion on monetary aggregates at the previous meeting, attached for your information is a technical analysis by Messrs. Lindsey and Spindt of monetary indexes that differentially weight components, including a comparison of these measures with conventional aggregates.

STRICTLY CONFIDENTAL (FR)
CLASS II - FOMC

BOARD OF GOVERNORS
OF THE
FEDERAL RESERVE SYSTEM

Office Correspondence

Date January 22, 1986

To Federal Open Market Committee

Subject: Evaluation of Monetary Indexes

From Staff*

I. Summary

This paper is a progress report on ongoing research on indexes of monetary aggregates that represent weighted-average measures of money growth. Monetary indexes are designed to measure aggregate monetary quantities in an environment characterized by a variety of assets that may have both transaction and investment features. By incorporating information on how assets are used for transactions or on the value of the services they provide, monetary indexes allow for graded differences among assets in an aggregate. Monetary indexes, in principle, can adjust automatically for certain changes in payments practices or in the menu of financial assets.

One class of monetary indexes--the transaction money stock indexes--takes a narrow view of money as a medium of exchange. The MQ index is designed to measure money used to carry out transactions associated nominal GNP. The MT index is designed to measure money used to finance total transactions, which include--in addition to GNP--spending on financial assets, previously produced capital goods, intermediate goods, raw materials, and other productive factors. Thus, as shown on the right side of table 1, these transaction indexes contain as components currency and checkable instruments--including money market mutual funds and MMDAs that are excluded from M1 due to limitations on their checkability.

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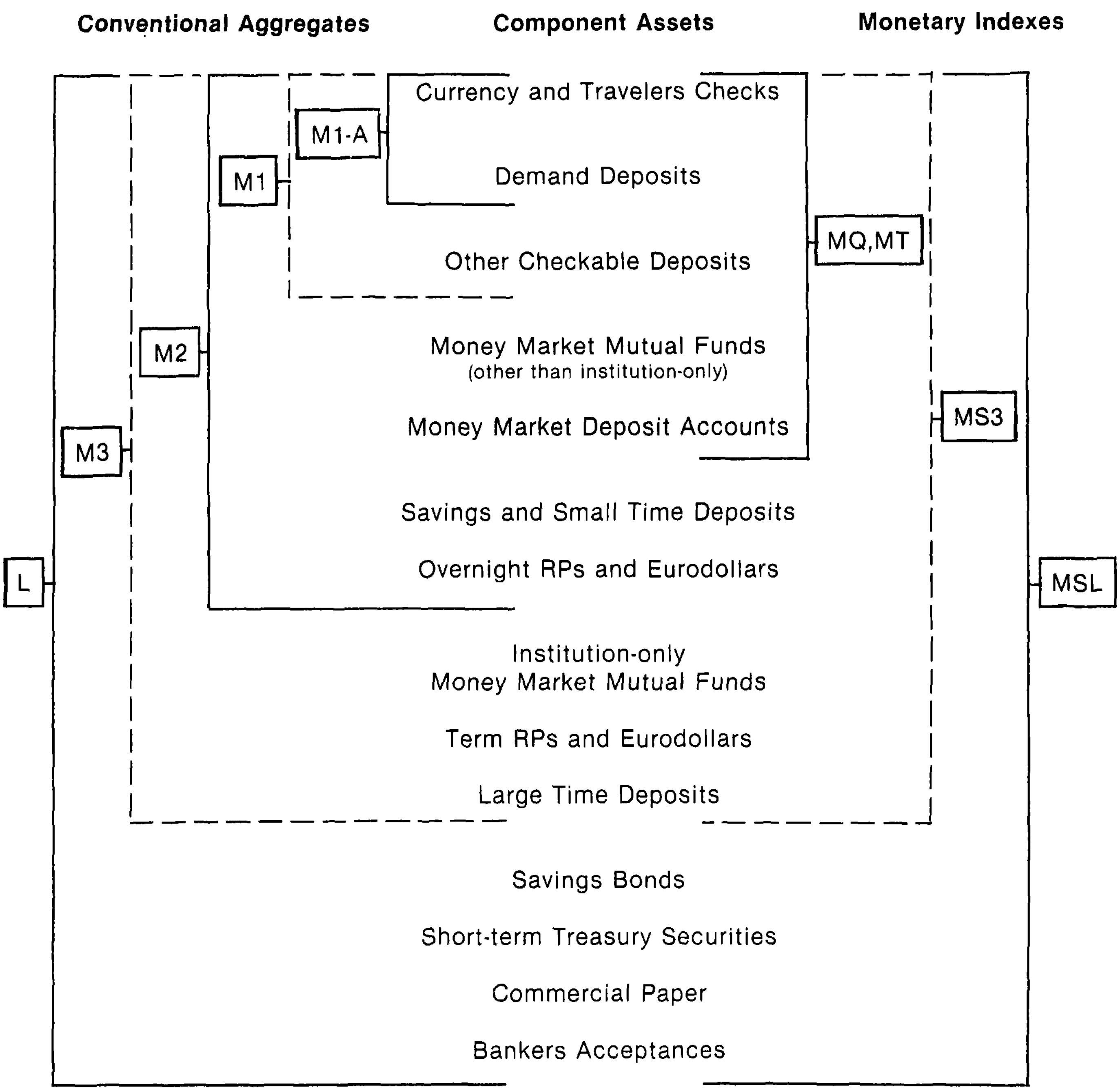
*/ David E. Lindsey, Associate Director, and Paul A. Spindt, Senior Economist, Division of Research and Statistics, were principally responsible for the preparation of this paper. Significant contributions were made by Arthur B. Kennickell, Peter E. Kretzmer, Michael P. Caffrey, Garland B. DeMarco, and Deborah A. Kennedy.

Table 1

Composition of Conventional and Indexed Monetary Aggregates



The other class of monetary indexes--the monetary services indexes--takes a broader view of money as providing a range of services beyond means of payment, such as liquidity, certainty of nominal value, and so on. Hence, these indexes encompass a broader class of monetary asset components--in the case of MS3, the components of conventional M3 and in the case of MSL, the components of conventional L.

Monetary indexes and the conventional aggregates are alike in that the growth rate of each can be thought of as a weighted average of the growth rates of its components. For the conventional aggregates these weights are simply quantity shares of components in the total aggregate. The MQ transaction money stock index uses as weights the shares of final-product transactions--GNP spending--financed by each component, while MT uses shares of total transactions. The weights for the broader monetary services indexes are shares of the total value of monetary services accounted for by each component. Because these weightings differ, monetary indexes differ from conventional aggregates and from each other.

The GNP transaction money stock index, MQ, in principle "internalizes" certain institutional and behavorial changes that could distort conventional aggregates as indicators of evolving monetary conditions--thus, in theory, obviating the need for "shift adjustment." The assumption behind MQ's construction--that balances in some components are used more or less actively than balances in other components--represents a step in the direction of realism compared with the assumption implicit in conventional aggregates that all balances in an aggregate are perfect substitutes for each other. Still, the practical assumption made in calculating MQ--that all balances in any given component are used in the same way (or have equal turnover rates in supporting GNP spending)--is obviously not fully realistic. This can distort measured MQ growth in response to special types of shifts that also tend to distort conventional aggregates. For example, the outflows of relatively inactive household demand deposits to newly introduced NOW accounts in early 1981 were weighted in MQ as though the shifted funds were like the active demand deposits that remained; conventional M1-A, by excluding NOWs altogether, was distorted by more than MQ. In addition, each of the conventional and MQ measures of narrow money are subject to generalized velocity shifts, in which GNP turnover rates of all transaction accounts tend to vary in the same direction, such as evidently occurred in a major way with M1 as well as MQ in 1985. Thus, evaluation of the macroeconomic implications of movements in MQ, just as for the conventional aggregates, requires judging the extent of "demand shifts" versus "underlying" growth. Also, while calculated MQ growth is not very sensitive to most elements of the procedure used for estimating GNP spending shares, uncertainty about the accuracy of a few elements does seem to pose a potentially significant measurement problem for MQ as now constructed.

The monetary services, MS, indexes embody the idea that monetary assets are valued for the services they provide. The MS indexes conceptually measure the aggregate flow of monetary services and thus are distinct from measures of the stock of transaction money. The monetary services provided per dollar of each component in principle are measured by the opportunity cost of holding that asset and in practice by the difference between an alternative "benchmark" interest rate and the asset's own rate. Appropriate measurement of the benchmark yield foregone and selected own rates, however, remains an important unresolved problem. The procedures used in current calculations seem inadequate because they sometimes produce anomalous results. For example, during the last three years, measures of the average opportunity cost of the MS components implausibly have tended to move in the opposite direction to the Treasury bill rate; in addition, whenever the yield curve is inverted, the current measurement procedure arbitrarily sets the value of the monetary services of one of its highly liquid short-term components to zero.

Our findings regarding empirical properties of the monetary indexes can be summmarized as follows:

The GNP transaction money stock index, MQ, has grown 3-1/2 percentage points more slowly than M1 since 1979, owing to its higher weight on relatively subdued demand deposit and currency growth, lower weight on rapid OCD growth, and very small weights on its non-M1 components.1/ Over the same period, MQ growth has been 3 percentage points faster than that of M1-A, which excludes OCDs entirely. Still, the growth of MQ velocity, as with V1-A and V1, has recorded sizable quarter-to-quarter and year-to-year variations during the 1980s.

Not all of this variation can be explained by the typical response to market interest rates that had been observed in the 1970s, according to estimated money demand functions. A large shortfall of actual MQ growth from predicted occurs in 1981 when, as noted, measured MQ evidently was more distorted than M1 but less than M1-A. Over the 1982-83 period, MQ's demand was quite predictable, unlike M1, which grew faster, and M1-A, which grew slower, than predicted. The sizable underprediction by the demand

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1/ Appendix tables A1 and A2 give growth rates for all the various financial aggregates and their velocities, respectively.

equation of MQ growth in 1985, while somewhat smaller than for M1, is larger than for M1-A. In terms of indicator properties of future GNP, the errors of equations using M1-A and M1 in the 1980s are respectively below and above the misforecasts using MQ, with all three yielding substantial overpredictions of GNP growth in 1982 and 1985, and to a lesser extent in 1983. In general, MQ's demand and indicator behavior has been intermediate between these two conventional measures of narrow money.

With regard to the monetary services indexes, growth rates of their levels and velocities have displayed wide swings so far in the 1980s that do not seem well explained by the typical money demand relations of earlier years. The GNP indicator properties of the broader indexes have been only a little better than the transaction measures during the past five years. The conventional broad measures of money have behaved better over this period in these regards than either the monetary services indexes or the transaction measures of money, whether conventional or indexed. The demand for conventional M2, and to a lesser degree M3, has been rather stable so far in the 1980s, at least as judged by equations estimated over the prior decade. The errors in predicting GNP growth with M3 growth have been lowest of all the aggregates in the 1980s, with M2 growth running second best. However, these conventional broader aggregates were significantly inferior to the transaction measures as indicators of GNP in the 1970s.

In sum, MQ growth in most recent years behaves much like an average of M1-A and M1 growth rates, even though MQ incorporates non-M1 components. All three transaction money measures have recorded episodes in which historical relationships with other macroeconomic measures have suffered marked instability. The estimated monetary services indexes also have deviated considerably from monetary relations as normally conceived, with indications that some of their abberant behavior has reflected conceptual flaws in procedures used to measure opportunity costs. The overall evidence examined in this paper suggests that monetary developments in the 1980s have been influenced significantly by shifting behavioral patterns in the way money holders have managed their portfolios. These shifts apparently are reflected in the behavior of both the conventional aggregates and the monetary indexes, although conventional M2 and M3 seem affected least. While measurement problems with the monetary indexes remain and conceptual issues have not been fully resolved, the possibility that these measures may be able to provide additional information about monetary conditions as a supplement to the conventional aggregates suggests that continued research and experimental development are warranted.

Topics covered in more detail in the following sections are: the concepts behind monetary indexes;[1/] the measurement of both types of monetary indexes (p. 10);[2/] and the empirical behavior of the experimental indexes in comparison with the conventional aggregates (p. 13).

II. Concepts Behind Monetary Indexes

Index numbers in general are used to measure aggregate quantities in situations where the components are dissimilar. In most applications, the component quantities differ in economic value. For example, because not all types of industrial output are valued equally, the quantity of

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1/ Appendix B gives specific examples comparing the properties in principle of the monetary indexes and the conventional monetary aggregates.

2/ Appendix C contains further discussion of measurement issues.

industrial production is measured as an index number, instead of simply as, say, total tonnage.

Monetary indexes are based on the idea that monetary assets are dissimilar, at least with respect to some characteristics, despite their common $1 unit of account. In the transaction money stock indexes, developed by Spindt (1985), monetary assets are seen as differing in the volume of transactions financed per dollar. In the monetary services indexes, developed by Barnett (1980), money assets are seen as differing in the value of the flow of services provided per dollar. Conventional aggregates do not make these distinctions and so are measured simply as sums of dollars.

Transaction money stock indexes focus narrowly on the role of money as means of payment. The index MQ is designed to measure the transaction money concept contemplated in the income version of the equation of exchange, MV = PQ. The two variables on the right side are measured as index numbers--Q is the index of real GNP and P is the implicit GNP deflator--because the final goods and services included in GNP are not each of equal economic value--as evidenced by their different prices. MQ (and VQ) were developed as index numbers on grounds that all payments instruments are not used identically in financing GNP transactions--as evidenced by their different GNP turnover rates. Some means-of-payment assets such as MMDAs and Super NOW accounts, for example, serve a significant investment function and, per dollar, support only a relatively small volume of GNP transactions. Others, such as currency and demand deposits, are used intensively for transactions and support larger volumes of GNP spending relative to their dollar stocks.

Monetary services indexes reflect a broader conception of money. Following Friedman (1956), monetary assets are regarded as rendering to their holders a variety of monetary services. The value, per dollar, of the services provided by a monetary asset is measured by its opportunity, or "user," cost, which is the interest foregone by holding the monetary asset instead of an alternative higher-yielding nonmonetary asset. An index number is used to measure the aggregate quantity of monetary services afforded by a collection of monetary assets on grounds that the services provided by the different components, per dollar, are not identically valued.

Index numbers are only designed to make comparisons over time, so the current magnitude of an index number has no significance except in relation to past or future magnitudes. As a result, monetary indexes are not dimensioned as so many billions of dollars, but instead are just conveniently scaled pure numbers. In addition, the growth rate of an index-number aggregate, to a first approximation, is equal to a weighted average of the growth rates of its components. As shown in table 2, this is also implicitly true for growth of a conventional monetary aggregate, in which case the weights on a component's growth rate simply is its dollar share in the total. For monetary indexes, the weights on component growth rates reflect not only differences in dollar amounts across components but also differences in the characteristics per dollar of each component.

In the transaction money stock indexes, where each component, per dollar, may support a different volume of spending, the weights are either the shares of GNP spending (for MQ) or the shares of total spending

Approximate Growth Rate Calculations for Conventional and Indexed Monetary Aggregates

Growth rate of monetary aggregate	Equals	Weighted average of component growth rates
Growth rate of conventional aggregate	Equals	Average of component growth rates weighted by quantity shares
Growth rate of M1	Equals	$\left(\frac{\text{Currency}}{\text{M1}}\right) \times \left(\text{Currency growth}\right)$ $+ \left(\frac{\text{Demand deposits}}{\text{M1}}\right) \times \left(\text{Demand deposit growth}\right)$ and so on.
Growth rate of MQ	Equals	Average of component growth rates weighted by GNP spending shares
	Equals	$\left(\frac{\text{GNP spending with currency}}{\text{GNP}}\right) \times \left(\text{Currency growth}\right)$ $+ \left(\frac{\text{GNP spending with demand deposits}}{\text{GNP}}\right) \times \left(\text{Demand deposit growth}\right)$ and so on.
Note: GNP spending with component	Equals	$\left(\text{Stock of component}\right) \times \left(\text{GNP turnover rate for component}\right)$
Growth rate of MS	Equals	Average of component growth rates weighted by monetary services shares
	Equals	$\left(\frac{\text{Monetary services of currency}}{\text{Total monetary services}}\right) \times \left(\text{Currency growth}\right)$ $+ \left(\frac{\text{Monetary services of demand deposits}}{\text{Total monetary services}}\right) \times \left(\text{Demand deposit growth}\right)$ and so on.
Note: Monetary services of component	Equals	$\left(\text{Stock of component}\right) \times \left(\text{Opportunity cost of component}\right)$
	Equals	$\left(\text{Stock of component}\right) \times \left(\text{Benchmark rate less component's own rate}\right)$

(for MT) financed by each component.1/ Thus, growth in an intensively used component, such as demand deposits, that accounts for a large fraction of spending, contributes more heavily to the growth of a transaction money stock index than similar growth in a low-activity component, such as MMDAs, that accounts for a small fraction of spending. In the monetary services indexes, component assets are distinguished by the value of the services, per dollar, each provides. The weight on the growth rate of each component is the share of the total value of monetary services accounted for by that component.2/

Whether growth in some component of MQ makes the growth of MQ higher or lower than the growth of a conventional aggregate (which includes the same assets) depends on whether the fraction of GNP spending accounted for by that component is higher or lower than its quantity share in the conventional aggregate. Whether growth in some component of MS makes the growth of MS higher or lower than growth of a conventional aggregate (which includes the same assets) depends on whether the fraction of the total value of monetary services accounted for by that component is higher or lower than its quantity share in the conventional aggregate.

The more similar are the characteristics of the component assets, the less difference is there between the conventional quantity share weights and the monetary index share weights. If, for example, each means-of-payment asset supported, per dollar, the same volume of GNP spending,

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1/ Spending for GNP transactions (GNP debits) for each component equals its outstanding stock times its final product or GNP turnover rate. Spending for total transactions (total debits) for each component equals its outstanding stock times its total transactions turnover rate.

2/ The value of monetary services provided by each component equals its outstanding stock times its opportunity cost.

then the expenditure-share weights in the growth of MQ would equal the quantity-share weights in the growth of a conventional aggregate of MQ's components, and the behavior of the two aggregates would be identical. The less similar are the component assets, however, the more the behavior of monetary indexes differs from that of conventional aggregates. Specific examples of the conceptual advantages and disadvantages of monetary indexes compared with conventional aggregates are discussed in Appendix B.

Some index numbers, such as the Commerce Department's index of real GNP, use weights that, once calculated in some base period, are held fixed for an extended period of time. Others, called chain index numbers, involve weights that are recalculated each period and so evolve through time. For monetary indexes, chaining has the advantage that it automatically tends to adjust for changes in the transaction/investment characteristics of components--to the extent that these are reflected in changing turnover rates or opportunity costs--and in principle can incorporate some alterations in the menu of financial assets without shift adjustment or redefinition. All of the experimental monetary indexes discussed in this paper are chain index numbers.

III. Measurement of Monetary Indexes

Measurements of the turnover rates of means-of-payment assets and the opportunity costs of a broader collection of monetary assets are used in the calculation of the share weights for the monetary indexes, as discussed above. Details concerning the current methods used to measure these variables are presented in Appendix C.

For MQ, direct measures of the turnover rates at which money assets circulate in GNP payments are not collected in any ongoing data-gathering program. In practice, these turnover rates are estimated from available data sources according to procedures (described in Appendix C) that exploit accounting identities. Gauging the measurement error in the resulting estimates is impossible without knowing the actual GNP turnover rates, but the sensitivity tests reported in Appendix C indicate that the empirical behavior of MQ is fairly insensitive to most possible measurement inaccuracies in these turnover-rate estimates. However, the possibility of mismeasurement in two of the estimation steps, involving gross turnover rates on other checkable deposits and the allocation of spending on intermediate goods among monetary assets, could mean a significant misestimate of MQ. The quality of the GNP turnover-rate estimates could be improved by periodically acquiring accurate measurements of key quantities and proportions, as was done in the 1984 Survey of Household Currency and Transaction Account Usage.[1/]

In the case of the monetary services indexes, the opportunity cost of each asset included is needed, which requires data on the own yield for each asset and the yield on the nonmonetary benchmark asset. The main area of measurement uncertainty for these indexes is the benchmark yield. In the current measures, this yield is simply taken to be either the Baa bond rate or the maximum own rate on assets in conventional L, whichever is greater. Although normally the benchmark rate is the bond rate, during periods when the yield curve is sharply inverted, the benchmark rate switches to a short-term yield and at least one of the assets included in the MS aggregate then

1/ See Avery, Elliehausen, Kennickell, and Spindt (1986).

has a zero opportunity cost. For example, when the rate on overnight repurchase agreements is highest, the monetary services provided by this highly liquid asset arbitrarily are treated as zero. But even when the bond rate is the benchmark, changes in the slope of the market yield curve relative to differently adjusting own rates can produce anomalous variations in the average of measured opportunity costs.[1/] Appendix C shows that the MS indexes are quite sensitive to the choice of the benchmark yield. Uncertainties also are involved in measuring own rates, specifically in the treatment of tax-preferred interest (especially implicit interest on business demand deposits), explicit service charges, risk premiums, and yields on components that include a range of maturities.

The estimated turnover rates or opportunity costs are used to construct the expenditure or value shares that weight the growth rates of components in determining the growth rates of the various monetary indexes. Examples of these estimated weights are depicted in chart 1, in which the quantity shares that are the implicit weights in the growth rates of conventional aggregates also are charted for comparison. The quantity share of currency in M1, in panel 1, is now about the same as its share of GNP transactions used in MQ. Currency has a larger weight in MSL than in M2 because the value of the monetary services provided by currency as a percentage of the total volume of monetary services is greater than its quantity share in M2.

The fraction of GNP spending accomplished with demand deposits in MQ (panel 2) rose secularly through 1980 before declining after the

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1/ Pages 21 and 22 of the next section and Appendix B, table B7, address this point in more detail.

nationwide extension of NOW accounts, which compete with demand deposits for household checking balances. Still, this share is higher than the quantity share of demand deposits in M1, which declined sharply in the early 1980s. The recent rapid growth in other checkable deposits, which includes both NOW and Super NOW account balances, is transmitted less strongly into MQ than into M1 (panel 3). The value share of OCD in MSL, however, is quite close to its quantity share in M2. Finally, the weight on MMDA growth in MQ growth, in panel 4, is small because these balances are used inactively, despite their checkability, and support only a small volume of GNP spending. On the other hand, MMDAs amounted to nearly 20 percent of M2 by 1985.

IV. Empirical Properties of Conventional and Indexed Monetary Aggregates

Relative Levels. The levels of the various conventional monetary aggregates and monetary indexes are shown in chart 2 relative to their 1970:Q1 values. The level of each aggregate is represented as 100 times the ratio of its value in any quarter to its value in 1970:Q1. (If one aggregate is higher than another on the chart, the first has grown faster on average since early 1970.)

Conventional measures of narrow money, which appear in the top panel, began to diverge in the late 1970s owing to the spread of ATS accounts and, in the northeast, NOW accounts. The impact on M1-A of the introduction of NOWs nationwide in early 1981 is represented by the staff's adjustment to add back the estimated volume of funds shifting out of demand deposits into NOWs. A smaller impact on M1 is indicated by the estimates of funds shifting into NOWs from non-M1 sources. The introduction around the beginning of 1983 of MMDAs, which are not included in M1, and Super NOWs, which are, was estimated to have had no net effect on M1, but to have depressed M1-A slightly further.

The conventional broader aggregates are represented in the middle panel. Shifts of funds from market instruments into MMDAs and perhaps also Super NOWs in early 1983 boosted M2. The effect on M3 and L apparently was minimal. These broadest aggregates have registered roughly similar movements since early 1970, with M3 having shown somewhat more rapid average expansion.

Four monetary indexes are given in the bottom panel. The MQ aggregate lies between those monetary services aggregates that are based on components of M3 or L (MS3 or MSL) and the total-transactions aggregate (MT). With demand deposits estimated to have a much higher share in total transactions than in GNP transactions, their relatively slow growth, especially in the 1980s, has a bigger effect in depressing MT than MQ.1/ MT has grown slightly more slowly than even M1-A in the 1980s, as the share of demand deposits in total transactions also exceeds its share in M1-A. MQ, which today stands at about 2.6 times its early 1970 level, has been between the M1-A and M1 measures relative to their early 1970 levels since 1980.

Growth Rates. The annual growth rate of MQ, displayed on the top left panel of chart 3, has been surrounded by a faster growth of M1 and a slower growth of M1-A since other checkable deposits (OCDs) became important in the late 1970s.2/ This pattern continued during 1985, as shown in the

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1/ The weights on the component growth rates in calculating the growth rate of the total aggregate are determined by these shares, as noted earlier. In 1985, demand deposits are estimated to account for 52 percent of GNP transactions, but 96 percent of total transactions.

2/ Appendix table A1 gives growth rates for a variety of financial aggregates.

top right panel. The rapidly expanding OCDs receive a lower weight in MQ than M1.[1/] But OCDs get no weight at all in M1-A, which excludes all NOW account-type assets. Since the weights on the non-M1 components that are included in MQ are quite small, their rapid growth in recent years has had little effect on MQ growth.

The annual growth rates of the standard broader monetary aggregates, in the middle panels, have shown less variation since 1970 than the growth rates of the monetary services indexes, in the bottom left panel. Some similarity between M2 and the MS3 and MSL aggregates can be seen through 1978. But M2 growth then stabilized, while expansion of the monetary services measures was depressed markedly from 1979 through 1981. Over these three years, which generally were characterized by high market rates and an inverted yield curve, the benchmark rate typically became a short-term own rate on a component of L.[2/] The opportunity costs of rapidly growing liquid assets accordingly declined, as did their weight in the monetary services indexes. Subsequently, with the decline in market yields, the benchmark rate reverted to a long rate and growth of these indexes rebounded.

Relative Velocity Levels. Velocities of the narrow aggregates, normalized to set 1970:Q1 values equal to 1.0, are shown in the top panel of chart 4. In the 1980s, V1-A on balance has moved higher and V1 lower. V1 has recorded an increasingly sizable shortfall from a 3 percent trend growth path that starts in 1970:Q1, as shown in the second panel. (M1

1/ The share of OCDs in M1, at 30 percent, is larger than their estimated 14 percent share of GNP expenditures.

2/ See Appendix chart C1.

velocity increased at a 3 percent average rate from the early 1950s through the 1970s.) Some of the shortfall is to be expected, because interest rates, represented in the bottom panel by a two-quarter moving average of the 3-month Treasury bill rate (charted relative to its 1970:Q1 value), have moved down on balance since late 1979. This rate decline contrasts to the uptrend over earlier decades that doubtless had boosted the observed growth trend of the velocities of conventional narrow money measures to the 3 percent area.

Since 1980, the velocity of MQ "splits the difference" between V1-A and V1, both before and after adjusting these conventional measures for deposit shifting in response to new accounts. The deviation of VQ from a 3 percent trend path in recent years (shown in the third panel) has been smaller than for the conventional narrow money measures--even without any benefit of special adjustments for deposit shifts.

The relation with interest rates appears rather loose for all the velocity deviations, although it seems somewhat more erratic for the conventional measures than for VQ in some episodes. For example, over the mid-1974 to mid-1975 period of substantial interest-rate declines, when M1 demand registered a much-studied downward shift, the V1 deviation from trend remains around zero (when it would have been expected to have deviated by more in a downward direction) and, in fact, becomes positive after mid-1975. By contrast, the VQ deviation initially moves more noticably in a negative direction than does V1, and it does not become significantly positive until 1978.

Relative velocities of the broader monetary aggregates, together with interest rates, are shown in chart 5. The fall in V2 on balance in the 1980s, after shift adjustment, returned its velocity to about its early 1970 value, while the general declines in the velocities of M3 and L represented accelerations of the downtrends that characterized the 1970s. On the other hand, the velocities of the monetary services measures considered, MS3 and MSL, rose on balance over the 1980s, owing to continued sharp increases early in the period. These strong velocity increases reflect the depressed growth of MS3 and MSL associated with the higher market rates and the switching of the benchmark rate discussed earlier. Among the velocities of the broader measures, V2 exhibits the closest general association with short-term market interest rates.

Velocity Growth Rates. A comparison of annual growth rates of the velocities of the various aggregates is provided in chart 6.[1/] Starting in the late 1970s, VQ growth lies between growth rates of V1-A and V1. The sharp jump in actual V1-A in 1981, reflecting shifts from demand deposits to nationwide NOWs, is muted in VQ, but the VQ rise is still somewhat anomalous. As chart 3 showed, MQ itself declined slightly on balance over the four quarters of 1981, producing the sizable upward thrust to its velocity that year. MQ would be distorted over this period if the funds flowing out of household demand deposits into NOWs had been less active than

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1/ Appendix table A2 gives growth rates for the velocities of a variety of financial aggregates.

the demand deposits that remained--that is, if the shifted funds had been used by their holders much the same as NOW balances.1/

The range of variation of growth of the velocities of the monetary services indexes, shown in the bottom panel, is more comparable to that of V2 growth than to the variation of the growth of V3 or VL. During 1985, however, the pattern of growth in VMS3 and VMSL was similar to that of their conventional aggregate counterparts, as shown in the lower right panels.

Money Demand Properties. The stability of standard demand equations in the 1980s for the various aggregates as functions of real GNP, prices, and the 3-month Treasury bill rate is examined in chart 7. The equations were estimated from 1971:Q2 through 1979:Q4 and simulated thereafter.2/ The resulting annual growth rate errors (Q4 to Q4) are shown in the left panels. The equations' sample period next was extended through

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1/ In that case, MQ inappropriately would have treated these outflows as high activity balances and the large weighting attached by MQ to the negative change in demand deposits would be reinforced in this index by the relatively low weight on rapid NOW growth. M1 would be less distorted, in this instance, because the share of NOW deposits in M1 was much greater than their estimated share in GNP spending and so provided a larger offset to the negative growth in demand deposits. (However, another source of distortion associated with funds shifted into NOWs from outside M1 likely affected M1 more than MQ.) A practical procedure for dealing with this type of problem that deserves further study would be to alter the construction of MQ by weighting negative growth in a component by a share weight that is adjusted for the turnover rates of the components exhibiting positive growth. The assumption would be that the characteristics of the outflowing funds are more like those of the components into which they presumably are deposited.

2/ These equations represent a variant of the Goldfeld specification that uses natural logs of current and lagged values of real GNP, the price level, and the Treasury bill rate to explain the natural log of money. The demand for each aggregate also is constrained to respond proportionately in the long run to a change in prices. The start of the sample period could not be pushed further back in time because data on the monetary indexes are not at present available for earlier years.

1984:Q4 and simulated over 1985.1/ The annual 1985 errors of these reestimated equations are represented by the diamonds in the left panels, while their individual quarterly errors last year are shown in the right panels.

The MQ errors generally fall between those of shift-adjusted M1-A and M1. In 1981, although MQ's sizable negative error exceeds those of the shift-adjusted conventional measures, it remains well below the error for actual M1-A. That year's misforecast of MQ growth probably owes to the distortion mentioned above, arising from shifts of relatively inactive demand deposits into nationwide NOWs. But MQ's performance is substantially better than M1's in 1982 and 1983, when M1 grew much faster than its demand equation predicted. And MQ, which grew about 2 percent more slowly than M1 in 1985, does somewhat better in that year, when the equations for both aggregates exhibited record underpredictions of actual growth, particularly in the third quarter.

Among the broader measures, M2's demand emerges as quite stable, both in absolute and relative terms, especially after shift adjustment in 1983 for MMDAs. M3's equation underpredicts noticeably in 1982, while the

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1/ When fit through 1984, the shift-adjusted M1-A and M1 equations show elasticities for real income and the market interest rate or opportunity-cost terms that are virtually identical to the MQ elasticities. (When fit only through 1979, however, the real income elasticity for MQ falls from around .80 to around .65, but for M1-A and M1 stays between .75 and .80 in the opportunity-cost specification.) The shift-adjusted M2 elasticities with respect to real income and market interest rates for the sample period through 1984 are a little higher than for the transaction measures but well below the estimated monetary services elasticities, though the latter are not as statistically significant as for M2. Compared with these shift-adjusted M2 elasticities, M3's real income elasticity is a bit higher and interest-rate elasticity substantially lower, though both are not as statistically significant. For more detailed results and discussion of these tests, see Kretzmer and Porter (1986).

monetary services equations underpredict by less that year but show relatively large overpredictions in 1980, 1981, and 1983.

In light of the authorization of new accounts and deregulation of most offering rates since the late 1970s, a more accurate picture of the comparative degree of true demand predictability might be shown by replacing the short-term market rate in the equations with the "average" opportunity cost for each aggregate.[1/] To implement this approach for the conventional and MQ aggregates, we constructed the average opportunity cost as the difference between the 3-month bill rate and a "weighted-average" offering rate for each aggregate as a whole. The offering rate on each component of conventional measures was weighted by the share of that asset in the aggregate. The offering rate on each component of MQ was weighted by the same GNP spending share used in constructing MQ's growth rate. Finally, for each monetary services index, the "average opportunity cost" is measured by the index of the "price" or "user cost" that is implied in the construction of the MS "quantity" index itself.[2/] Then, these opportunity-cost measures replaced the bill rate in otherwise identical regressions and simulations.[3/]

1/ Ignoring offering rates on the monetary components, as in the standard specification just examined, would be appropriate if, over the entire 1970 to 1985 period, such rates either were fixed or stably related to the included short-term market rate. Using average opportunity costs instead of the bill rate would incorporate any evolution over time in the relations between market rates and offering rates.

2/ Since price times quantity equals value, this "price" is calculated by dividing the total value of monetary services by the MS quantity index. The analogy with the implicit GNP price deflator is direct.

3/ Although the other variables again are expressed as natural logs, the average opportunity cost is not, entering simply in percentage points. This specification implies money holders react consistently to absolute changes in spreads, rather than percent changes. An implication is that the elasticity with respect to the spread declines as the spread declines. Brayton and Mauskopf (1985) and Brayton (1985) suggest that this is a good approximation to the underlying transactions demand for money.

The results of this experiment appear in chart 8. The relative performance of the three narrow aggregates is essentially unaffected, although the absolute underpredictions of M1 growth in 1982 and 1983 are reduced somewhat, as is the overprediction of MQ growth in 1981. The performances of the M2 and M3 equations are qualitatively the same as before, with the M2 demand equation again showing rather accurate predictions for every year since 1979, after shift adjustment in 1983. (Some sizable quarterly errors in 1985 are evident for M2, in the right panel, though they are partly offsetting.)

A surprising result is the severe deterioration in 1984 and 1985 of the monetary services equations, the bottom panel, when, as is "theoretically correct," the index of opportunity costs replaces the bill rate in the equations. Overall, their errors in chart 8 are discouragingly large. The reason appears to be an anomaly in the behavior of MS indexes. When short-term rates decline substantially relative to long-term rates, as from 1984:Q3 to 1985:Q3, opportunity costs tend to rise in the current construction of MS, since the benchmark rate remains relatively high. But flexible offering rates, such as on small time deposits, fall by more than fixed or sluggish own rates on some heavily weighted components, such as savings deposits and OCD. This narrowing spread induces inflows of funds to the highly weighted accounts, and bolsters the growth of the MS index. A positive relation between average opportunity costs and MS growth is induced, which is at variance with the negative relation between the index of average opportunity costs in MS and MS demand estimated to have held over the 1970s.

This anomaly of recent years suggests that opportunity costs in the MS indexes are substantially mismeasured from a conceptual perspective.1/

Indicator Properties. The indicator properties of the aggregates in foreshadowing nominal GNP are another relevant aspect of an evaluation of their comparative characteristics. The predictive performance of the aggregates in St. Louis-type reduced-form models explaining the current quarter's nominal GNP growth by the current and lagged values of money growth and a fiscal measure is shown in chart 9. Similar to the money demand experiments the equations were estimated from 1971:Q3 through both 1979:Q4 and 1984:Q4, and simulated thereafter.2/

It should be noted that these regression equations fit the data very poorly over the 1970s and, except for M3 and shift-adjusted M2, the closeness of fit deteriorated even further when the sample period was extended through 1984.3/ During the 1970s, the equation for M1 explained only about 22 percent of the variation in quarterly GNP growth, and the M1-A and MQ equations only 13 to 14 percent. But the equation for M3 exhibited very little explanatory power during the 1970s and the equations for M2 and the monetary services aggregates showed no explanatory power at all.

1/ Owing to variations in the slope of the market yield curve relative to differently adjusting own rates, only once in the ten consecutive quarters from 1982:Q4 to 1985:Q2 did the Treasury bill rate and the opportunity-cost index for MSL even move in the same direction. The opportunity-cost index for MS3 did so in only two quarters. Appendix C, table B7, gives an example of the conceptual deficiency in the monetary services procedure for measuring opportunity costs that accounts for this implausible pattern.

2/ The equations were constrained to produce a one percentage point long-run response in nominal GNP growth to a sustained one percentage point faster growth rate of the monetary aggregate.

3/ This was the case with or without the constraint described in the previous footnote.

Among the narrow aggregates, the results for the 1980s using MQ again are between those for M1-A and M1. The models for all three narrow aggregates predicted considerably more GNP growth than actually occurred in 1982 and 1985, and made smaller, but nonnegligible, errors of the same sign in 1983. Reestimation of the equations through 1984 markedly improves their 1985 performance, although sizable quarterly misses remain, as the right panels indicate. In 1981, the shift-adjustment of M1-A reduces its model's underprediction of GNP growth from a huge unadjusted miss to one which is below MQ's error, but shift adjustment worsens the M1 model's performance that year.

The errors in the monetary services equations are large in 1980 and 1981, as well as in 1985. Both conventional broader aggregates' predictions of GNP growth are better than those of the narrow measures or the monetary services indexes in the 1980s. The M3 equation is slightly superior to M2 in predicting GNP. The M2 equation does quite well in three of the years but has difficulty in 1982, 1983 and 1985.

The impression that M3 and, to a lesser extent, shift-adjusted M2 are better indicators of GNP than the other monetary aggregates so far in the 1980s is tempered considerably when their poor average performance in the 1970s, both absolutely and relative to the transaction measures, is recalled. Perhaps their performance in the 1970s (and in the 1960s as well) was thrown off by the presence of binding interest rate ceilings. With the full removal of the ceilings, these conventional broader aggregates might continue to be comparatively reliable indicators of nominal spending. On the other hand, the first half of the 1980s may simply represent a run of relatively good luck, and M2 and M3 may in the future revert to their less reliable behavior of past decades.

Appendix Table A1

Growth Rates of Various Monetary Aggregates
(percent, annual rate)

	Conventional Monetary Aggregates									Monetary Indexes						Memo:		
	M1A	Shift-adjusted M1A	M1	Shift-adjusted M1	M2	Shift-adjusted M2	Simple Sum MQ	M3	L	MQ	MT	MS1	MS2	MS3	MSL	Monetary Base	Domestic Nonfinancial Debt	Nominal GNP
Annual (Q4 to Q4)																		
1971	6.7	6.7	6.7	6.7	13.5	13.5	6.7	14.7	10.4	6.9	6.6	7.3	12.2	13.1	9.4	7.0	9.6	9.4
1972	8.4	8.4	8.4	8.4	12.8	12.8	8.4	14.0	12.8	8.2	8.5	8.8	11.8	12.9	12.0	8.1	10.3	12.1
1973	5.7	5.7	5.8	5.8	7.2	7.2	5.8	11.7	12.2	6.4	5.2	6.8	6.3	7.9	8.3	8.6	11.8	11.9
1974	4.7	4.7	4.8	4.8	5.9	5.9	5.3	8.8	9.6	5.9	3.6	6.2	5.4	5.8	6.1	8.2	9.5	7.3
1975	4.8	4.9	5.0	5.0	12.1	12.1	5.4	9.3	9.2	5.8	3.8	6.1	11.4	9.2	9.1	6.4	9.1	10.6
1976	5.6	5.6	6.1	6.1	13.3	13.3	6.0	11.4	10.7	6.5	4.6	6.5	12.2	10.6	10.1	7.5	10.9	9.9
1977	7.7	7.7	8.1	8.1	11.2	11.2	8.1	12.5	12.4	8.1	7.2	8.8	10.6	11.5	11.5	8.4	12.5	11.9
1978	7.5	7.5	8.2	8.2	8.0	8.0	9.2	11.8	11.9	8.0	6.8	8.6	6.2	8.0	8.1	9.2	13.5	14.8
1979	4.8	4.8	7.5	7.5	8.1	8.1	14.2	10.3	11.7	6.2	3.6	7.5	1.4	1.8	2.5	8.5	12.4	9.5
1980	5.1	5.1	7.5	7.5	9.0	9.0	14.9	9.6	9.2	6.5	3.8	7.9	3.5	3.2	2.8	8.3	9.6	9.9
1981	-6.9	1.8	5.1	2.5	9.3	9.3	21.3	12.4	11.9	-.4	-10.8	7.8	.2	.9	1.3	4.9	9.8	9.3
1982	3.5	4.0	8.8	8.7	9.1	9.0	16.7	10.0	10.2	5.8	1.8	9.0	7.6	8.0	8.2	7.6	9.1	3.1
1983	5.5	6.7	10.4	10.4	12.2	8.5	53.1	10.0	10.5	7.7	4.0	7.5	6.1	5.1	6.0	9.3	11.2	10.0
1984	3.5	3.5	5.2	5.2	7.7	7.7	7.5	10.4	11.8	4.1	1.6	5.7	5.7	7.6	9.1	7.2	14.1	9.0
1985	8.1	8.1	11.6	11.6	8.6	8.6	16.2	8.0	8.8e	9.9	8.6	9.6	8.5	8.0	8.7e	8.9	13.4	5.8
Quarterly																		
1984:Q1	4.5	4.5	6.2	6.2	7.1	7.1	9.8	9.1	10.8	5.1	2.6	7.5	6.0	7.5	9.0	9.4	13.0	16.0
:Q2	4.9	5.0	6.5	6.5	7.1	7.1	8.7	10.5	12.6	5.5	3.7	5.9	6.3	8.6	10.4	6.8	13.5	8.8
:Q3	3.0	3.0	4.5	4.5	6.8	6.8	.4	9.5	12.1	3.2	.5	5.8	4.4	6.3	9.0	7.2	13.4	5.8
:Q4	1.4	1.4	3.2	3.2	9.1	9.1	10.1	11.0	9.7	2.3	-.3	3.3	5.5	7.2	6.8	4.7	13.9	4.2
1985:Q1	6.8	6.8	10.6	10.6	12.1	12.1	25.4	10.7	10.1	9.1	7.7	8.3	10.6	9.6	9.2	8.2	13.5	6.7
:Q2	8.0	8.0	10.2	10.2	5.3	5.3	11.4	5.3	6.0	8.9	8.8	9.8	6.4	6.2	6.7	7.5	11.9	4.4
:Q3	11.0	11.0	15.0	15.0	10.2	10.2	15.8	8.2	9.1	12.9	12.1	12.1	10.3	8.7	9.3	10.2	12.2	5.7
:Q4	5.6	5.6	8.8	8.8	5.8	5.8	8.7	6.7	9.0e	7.3	5.0	7.0	5.8	6.5	8.5e	8.4	13.4	5.8
Memo: Level 1985:Q4 (billions of $)	442.8	442.8	617.8	617.8	2547.6	2547.6	1300.9	3195.8	3815.5e	262.7 1/	182.2 1/	317.4 1/	300.5 1/	317.1 1/	311.0 1/ e	215.2	6633.9	4075.1

1/ 1970:Q1 = 100.

e -- partly estimated.

Appendix Table A2

Velocity Growth Rates for Various Monetary Aggregates
(percent, annual rate)

	Conventional Monetary Aggregates									Monetary Indexes							Memo:	
	M1A	Shift-adjusted M1A	M1	Shift-adjusted M1	M2	Shift-adjusted M2	Simple Sum MQ	M3	L	MQ	MT	MT* 1/	MS1	MS2	MS3	MSL	Monetary Base	Domestic Nonfinancial Debt
Annual (Q4 to Q4)																		
1971	2.4	2.4	2.4	2.4	-3.7	-3.7	2.4	-4.7	-1.0	2.2	2.5	8.5	1.8	-2.6	-3.4	-.1	2.2	-.3
1972	3.5	3.5	3.5	3.5	-.6	-.6	3.5	-1.6	-.6	3.7	3.3	7.4	3.1	.3	-.6	.2	3.7	1.6
1973	5.8	5.8	5.8	5.8	4.3	4.3	5.7	.1	-.3	5.1	6.3	18.2	4.7	5.2	3.6	3.3	3.0	.1
1974	2.5	2.5	2.4	2.4	1.4	1.4	1.9	-1.4	-2.1	1.3	3.6	13.9	1.0	1.8	1.5	1.2	-.8	-2.0
1975	5.5	5.5	5.4	5.4	-1.3	-1.3	4.9	1.2	1.3	4.6	6.5	2.7	4.3	-.6	1.3	1.4	4.0	1.4
1976	4.0	4.0	3.5	3.5	-3.0	-3.0	3.7	-1.4	-.7	3.2	5.0	11.7	3.1	-2.1	-.6	-.2	2.2	-.9
1977	3.9	3.9	3.5	3.5	.6	.6	3.5	-.6	-.5	3.4	4.4	8.3	2.8	1.1	.3	.3	3.2	-.6
1978	6.8	6.8	6.1	6.1	6.3	6.3	5.2	2.7	2.6	6.3	7.5	8.9	5.7	8.1	6.4	6.2	5.2	1.1
1979	4.5	4.5	1.8	1.8	1.2	1.2	-4.1	-.8	-2.0	3.1	5.6	18.0	1.8	7.9	7.5	6.8	.9	-2.6
1980	4.6	4.6	2.3	2.3	.8	.8	-4.3	.3	.6	3.2	5.9	25.0	1.8	6.2	6.5	6.9	1.5	.3
1981	17.5	7.4	4.0	6.7	.0	.0	-9.9	-2.7	-2.3	9.8	22.6	38.5	1.4	9.1	8.4	8.0	4.2	-.4
1982	-.3	-.8	-5.1	-5.1	-5.5	-5.4	-11.6	-6.2	-6.4	-2.5	1.4	10.9	-5.3	-4.1	-4.5	-4.7	-4.2	-5.5
1983	4.3	3.1	-.3	-.3	-2.0	1.4	-28.1	.1	-.4	2.1	5.8	21.0	2.4	3.7	4.7	3.8	.7	-1.0
1984	5.3	5.3	3.6	3.6	1.1	1.1	1.4	-1.3	-2.5	4.7	7.2	11.5	3.1	3.1	1.3	-.1	1.7	-4.5
1985	-2.1	-2.1	-5.2	-5.2	-2.6	-2.6	-9.0	-2.0	-2.8e	-3.7	-2.6	10.4	-3.5	-2.5	-2.0	-2.7e	-2.8	-6.7
Quarterly																		
1984:Q1	11.4	11.3	9.6	9.6	8.7	8.7	6.0	6.7	5.0	10.8	13.4	.9	8.3	9.8	8.3	6.8	6.5	2.9
:Q2	3.8	3.8	2.3	2.3	1.7	1.7	.1	-1.6	-3.7	3.3	5.1	14.1	2.9	2.4	.2	-1.6	2.0	-4.5
:Q3	2.8	2.8	1.3	1.3	-1.0	-1.0	5.4	-3.7	-6.1	2.6	5.3	3.0	.0	1.4	-.5	-3.1	-1.3	-7.3
:Q4	2.8	2.8	1.0	1.0	-4.7	-4.7	-5.8	-6.6	-5.3	1.9	4.5	26.7	.9	-1.2	-2.9	-2.5	-.5	-9.4
1985:Q1	-.1	-.1	-3.7	-3.7	-5.2	-5.2	-17.6	-3.8	-3.3	-2.3	-.9	1.5	-1.6	-3.7	-2.8	-2.4	-1.4	-6.5
:Q2	-3.5	-3.6	-5.6	-5.6	-.9	-.9	-6.8	-.9	-1.6	-4.4	-4.3	21.5	-5.2	-1.9	-1.7	-2.3	-3.1	-7.3
:Q3	-5.2	-5.1	-9.1	-9.0	-4.4	-4.4	-9.7	-2.5	-3.2	-7.0	-6.3	5.3	-6.3	-4.5	-2.9	-3.6	-4.4	-6.3
:Q4	.2	.2	-2.9	-2.9	.0	.0	-2.9	-.9	-3.1e	-1.5	.8	12.2	-1.2	.0	-.7	-2.6e	-2.6	-7.4
Memo:																		
Level 1985:Q4 2/	1.92	1.73	1.38	1.41	.95	.98	.65	.79	.82e	1.56	2.25	7.6	1.29	1.36	1.29	1.32e	1.26	.80

1/ Estimate of the growth of the ratio of total transactions to MT, in contrast to the growth of the ratio of nominal GNP to MT shown in the previous column.

2/ Shown as ratio to value in 1970:Q1.

e — partly estimated.

Appendix B: Conceptual Advantages and Disadvantages of Monetary Indexes Compared with Conventional Monetary Aggregates*/

This appendix provides specific examples of how monetary indexes can differ, in principle, from conventional aggregates encompassing the same collection of components. Throughout, the approximation given in the text is used to calculate growth rates.1/

The example in table B1 considers the comparative growth of a transaction money stock index and a conventional narrow aggregate when an increase in nominal spending is financed purely by increased holdings of a means-of-payment asset that accounts for a larger fraction of spending than its quantity share in a conventional aggregate. The example supposes just two means-of-payment assets, one of which, DD, is used relatively intensively in transactions and the other of which, OCD, has a lower turnover

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*/ Prepared by Paul A. Spindt.

1/ The exact index number formula used for calculating the monetary indexes is the monthly chain Fisher ideal index number formula, which is the geometric average of the chain Paasche and chain Laspeyres indexes:

$$\frac{M_t - M_{t-1}}{M_{t-1}} = \left[\frac{\Sigma m_{it}\, a_{it}}{\Sigma m_{it-1}\, a_{it}} \cdot \frac{\Sigma m_{it} a_{it-1}}{\Sigma m_{it-1}\, a_{it-1}} \right]^{1/2} - 1 ,$$

where the lower case m's are component asset quantities and the lower case a's are either GNP turnover rates, in the case of MQ, or asset opportunity costs, in the case of the MS indexes. The approximation discussed in the text and given below is numerically close.

$$\frac{M_t - M_{t-1}}{M_{t-1}} = \Sigma \left[\left(\frac{m_{it-1}\, a_{it-1}}{\Sigma m_{jt-1}\, a_{jt-1}}\right) \cdot \left(\frac{m_{it} - m_{it-1}}{m_{it-1}}\right) \right] .$$

If all the a's are equal, then this reduces to

$$\frac{M_t - M_{t-1}}{M_{t-1}} = \Sigma \left[\left(\frac{m_{it-1}}{\Sigma m_{jt-1}}\right) \cdot \left(\frac{m_{it} - m_{it-1}}{m_{it-1}}\right) \right] ,$$

which is the implicit growth rate formula for a conventional monetary aggregate.

Table B1

Money and Velocity Growth When a 10 Percent Increase in Nominal Spending is Financed Purely by Increased Holdings of DD

HYPOTHETICAL DATA

Asset	Year 1					Year 2		
	Quantity	Turnover	Spending	Quantity Share	Spending Share	Quantity	Turnover	Spending
DD	200	10	2000	1/2	2/3	230*	10	2300*
OCD	200	5	1000	1/2	1/3	200	5	1000
Total	400	--	3000			430*	--	3300*

* indicates datum is changed from previous year.

GROWTH APPROXIMATIONS

Aggregate	Weighted Growth Rate Formula	Result
MQ	$2/3 \times \frac{(230-200)}{200} + 1/3 \times \frac{(200-200)}{200}$	10%
VQ	GNP growth - MQ growth	0%
M1	$1/2 \times \frac{(230-200)}{200} + 1/2 \times \frac{(200-200)}{200}$	7.5%
V1	GNP growth - M1 growth	2.5%

rate. Initially, outstanding stocks of DD and OCD each amount to $200 billion, and these balances are turned over at annual rates of ten times for DD and five times for OCD, thus supporting $3,000 billion of GNP. These figures imply that 2/3 of GNP is paid for with DD and 1/3 with OCD. Since the quantity shares of DD and OCD in the conventional aggregate are each 1/2, DD growth would have a larger impact on growth in MQ than on growth in the conventional aggregate and OCD growth would have a smaller impact.

Now suppose that nominal spending increases by 10 percent to $3,300 billion. This increment in spending can be financed in a variety of ways. For example, larger stocks of DD and/or OCD could be acquired and circulated at the original turnover rates; such an outcome might be called a pure money stock adjustment since none of the component turnover rates has changed. Alternatively, the increase in spending could be financed with a pure velocity adjustment in which existing stocks of DD and OCD are held constant but turned over more actively. Combination adjustments of both money stock and velocity are also possible. For a pure velocity adjustment, neither MQ nor a conventional monetary aggregate would be affected; VQ would rise 10 percent and so would the velocity of a conventional aggregate.

But consider a pure money stock adjustment with no change in either turnover rate. Suppose that the 10 percent increase in spending is supported entirely by $30 billion increase in the stock of DD, with the stock of OCD remaining at $200 billion. In this situation, as shown in table B1, MQ rises 10 percent and VQ remains unchanged, while the conventional aggregate grows only 7.5 percent and its velocity registers a 2.5 percent increase despite the fact that the adjustment is a pure money stock one (with underlying component velocities constant). Table B2 shows that a pure money stock adjustment concentrated entirely in OCD (in which OCD increases by $60 billion) again results in a 10 percent increase in MQ with VQ constant. The conventional aggregate in this case increases by 15 percent, with its velocity registering a 5 percent decline.

In general, much like the consumer price index, which cannot change unless at least one of the underlying prices changes, VQ cannot change unless one of the component turnover rates changes. Hence, for pure money stock adjustments--that is, when component turnover rates are constant--the growth of MQ is always equal to the growth of nominal GNP. By contrast, the velocity of a conventional aggregate typically will change even under pure money stock adjustments.

Additional insights into the comparative behavior of MQ and a conventional narrow money aggregate can be gained by examining another example, in table B3, that is suggestive of what might have happened in 1983 when interest rates on Super NOW accounts were deregulated (abstracting from the introduction of MMDAs). As before, initial stocks of DD and OCD are each $200 billion and turn over at annual rates of 10 and 5 times, respectively. Now rates paid on OCD balances are deregulated and rise, thereby increasing the relative attractiveness of OCD both as an investment asset and as a repository for transaction funds. Twenty billion dollars in active funds is shifted from DD into OCD (and these funds continue to turn over at the rate of 10 times per year) and an additional $20 billion in investment funds is converted from, say, small time deposits into OCD. Presumably these latter balances are simply "parked" as an investment and so have a zero turnover rate. But when they are mixed with the active funds

Table B2

Money and Velocity Growth When a 10 Percent Increase in Nominal Spending is Financed Purely by Increased Holdings of OCD

HYPOTHETICAL DATA

Asset	Year 1					Year 2		
	Quantity	Turnover	Spending	Quantity Share	Spending Share	Quantity	Turnover	Spending
DD	200	10	2000	1/2	2/3	200	10	2000
OCD	200	5	1000	1/2	1/3	260*	5	1300*
Total	400	—	3000			460*	—	3300*

* indicates datum is changed from previous year.

GROWTH APPROXIMATIONS

Aggregate	Weighted Growth Rate Formula	Result
MQ	$2/3 \times \frac{(200-200)}{200} + 1/3 \times \frac{(260-200)}{200}$	10%
VQ	GNP growth – MQ growth	0%
M1	$2/3 \times \frac{(200-200)}{200} + 1/3 \times \frac{(260-200)}{200}$	15%
V1	GNP growth – M1 growth	-5%

Table B3

Money and Velocity Growth When OCD Becomes More Attractive
as an Investment and Nominal Spending Remains Constant

HYPOTHETICAL DATA

Asset	Year 1					Year 2		
	Quantity	Turnover	Spending	Quantity Share	Spending Share	Quantity	Turnover	Spending
DD	200	10	2000	1/2	2/3	180*	10	1800*
OCD	200	5	1000	1/2	1/3	240*	5	1200*
Total	400	—	3000			420*	—	3000

* indicates datum is changed from previous year.

GROWTH APPROXIMATIONS

Aggregate	Weighted Growth Rate Formula	Result
MQ	$2/3 \times \frac{(180 - 200)}{200} + 1/3 \times \frac{(240 - 200)}{200}$	0%
VQ	GNP growth - MQ growth	0%
M1	$1/2 \times \frac{(180 - 200)}{200} + 1/2 \times \frac{(240 - 200)}{200}$	5%
V1	GNP growth - M1 growth	-5%

moved over from DD, the net consequence is that the aggregate turnover rate of OCD is unchanged. The combined effect of these changes is, as can be seen from table B3, that MQ itself remains unchanged.

This result follows from the specific even mixture of active and idle balances assumed in this example to flow into OCD when rates are deregulated. If, alternatively, only $10 billion in active funds is transferred from DD and $30 billion in investment funds is added from other sources, the mixture of funds flowing into OCD will depress the resulting overall OCD turnover rate below its original value--not unreasonably in light of the increased own rate on OCD--and MQ will increase, as shown in table B4, by 1.6 percent, matching the 1.6 percent decline in VQ. In either case, the conventional aggregate grows, and its velocity declines, by 5 percent. This example illustrates how MQ in principle can to a degree "shift adjust" automatically for certain changes in the transaction/investment character of its component assets.

In practice, this shift adjustment will be imperfect unless all balances within each component circulate at the same turnover rate. When this is not true, then the behavior of MQ as presently calculated can be anomalous. For example, as before DD and OCD are each $200 billion and each turns over at average annual rates of 10 and 5 times, respectively, in support of $3,000 billion of GNP spending. Now, however, even though the "average" DD dollar circulates 10 times per year, total DD balances are actually a mixture of $40 billion in relatively idle balances that turn over at an annual rate of 5 times (the same as OCD) and $160 billion in relatively active balances that turn over at an annual rate of 11.25 times. If the $40 billion in relatively idle DD funds is simply shifted

Table B4

Money and Velocity Growth When OCD Becomes More Attractive as an Investment and Nominal Spending Remains Constant

HYPOTHETICAL DATA

Asset	Year 1					Year 2		
	Quantity	Turnover	Spending	Quantity Share	Spending Share	Quantity	Turnover	Spending
DD	200	10	2000	1/2	2/3	190*	10	1900*
OCD	200	5	1000	1/2	1/3	230*	4.78*	1100*
Total	400	--	3000			420*	--	3000

* indicates datum is changed from previous year.

GROWTH APPROXIMATIONS

Aggregate	Weighted Growth Rate Formula	Result
MQ	$2/3 \times \frac{(190-200)}{200} + 1/3 \times \frac{(230-200)}{200}$	1.6%
VQ	GNP growth - MQ growth	-1.6%
M1	$1/2 \times \frac{(190-200)}{200} + 1/2 \times \frac{(240-200)}{200}$	5%
V1	GNP growth - M1 growth	-5%

to OCD--perhaps, for instance, because NOW account authority is extended--then table B5 shows that MQ declines by 6.7 percent, matching an equal percentage rise in its velocity caused by the increase in the average turnover rate of DD. The conventional aggregate, of course, registers no change, which seems like a more plausible result, since the separate "true" stocks of high and low-activity components actually are unchanged, as are their turnover rates. The anomalous behavior of MQ in this situation is due to the grouping of components into insufficiently refined categories; if "active" and "inactive" DD instead were treated as separate components, then, as shown in the memo items in table B5, MQ and its velocity each would register zero growth given the shifting of funds in this example. These considerations may partly explain a sharp decline in measured MQ (and especially MT) in 1981, as discussed in the text. Absent data on more disaggregated component groupings, a practical procedure for dealing with this type of problem that deserves further study is to treat outflows from a component as having the average characteristics of the components in MQ that are registering positive growth.

Finally, note that MQ, like conventional transaction aggregates, is not immunized from generalized velocity shocks or secular changes in the relationship of transaction money to GNP. MQ is an empirical measure of narrow money, and to the extent that the behavioral relationship between transaction money and GNP sometimes varies capriciously, MQ will reflect this occurrence.

The remaining examples consider the comparative behavior, in principle, of monetary services indexes and conventional aggregates. A monetary services index measures the aggregate volume of monetary services

Table B5

Money and Velocity Growth When Relatively Idle Funds are Shifted from DD to OCD

HYPOTHETICAL DATA

Asset	Year 1					Year 2		
	Quantity	Turnover	Spending	Quantity Share	Spending Share	Quantity	Turnover	Spending
DD	200	10	2000	1/2	2/3	160*	11.25*	1800
OCD	200	5	1000	1/2	1/3	240*	5	1200
Total	400	--	3000			400*	—	3000
Memo: DD subcategories								
active	160	11.25	1800	2/5	3/5	160	11.25*	1800
idle	40	5	200	1/10	1/15	0*	—	0

* indicates datum is changed from previous year.

GROWTH APPROXIMATIONS

Aggregate	Weighted Growth Rate Formula	Result
MQ	$2/3 \times \frac{(160-200)}{200} + 1/3 \times \frac{(240-200)}{200}$	-6.7%
VQ	GNP growth - MQ growth	6.7%
M1	$1/2 \times \frac{(160-200)}{200} + 1/2 \times \frac{(240-200)}{200}$	0%
V1	GNP growth - M1 growth	0%
Memo: Based on separate treatment of DD subcategories		
MQ	$3/5 \times \frac{(160-160)}{160} + 1/15 \times \frac{(0-40)}{40} + 1/3 \times \frac{(240-200)}{200}$	0%
M1	$2/5 \times \frac{(160-160)}{160} + 1/10 \times \frac{(0-40)}{40} + 1/2 \times \frac{(240-200)}{200}$	0%

provided by its components. The example shown in table B6 assumes just two monetary assets, one of which, OCD, bears a marginal yield of 4 percent and the other of which, small time deposits, STD, pays a marginal investment yield of 10 percent. If the investment yield on the "benchmark" nonmonetary asset is 12 percent, then the marginal opportunity cost of OCD is 8 percent (12 percent minus the own rate on OCD) and the marginal opportunity cost of STD is 2 percent. If the outstanding stocks of OCD and STD each are $200 billion, then 80 percent of the total value of monetary services comes from services provided by OCD and 20 percent from STD. Since the quantity shares of OCD and STD each are 1/2, STD growth would have a smaller, and OCD growth would have a larger, impact on the growth of a monetary services index than on a conventional aggregate. Table B6 shows that if STD increases by 10 percent, the monetary services index grows by 2 percent (the 20 percent value share of STD multiplied by the growth rate of STD, 10 percent) while the conventional aggregate increases by 5 percent (the 50 percent quantity share of STD multiplied by the 10 percent STD growth rate).

While a 10 percent increase in OCD would generate the same 5 percent growth in the conventional aggregate, the monetary services index, because the value share of OCD is 80 percent, would register an 8 percent growth rate. Finally, note that a shift of funds, say, from OCD to STD, will depress the monetary services index but have no effect on the conventional aggregate. In this example, if $20 billion is shifted from OCD to STD, the monetary services index decreases by 6 percent (80 percent multiplied by minus 10 percent for the OCD component plus 20 percent multiplied by 10 percent for the STD component).

Table B6

Money Growth When STD Increases by 10 Percent

HYPOTHETICAL DATA

Asset	Year 1					Year 2		
	Quantity	Opportunity Cost	Value	Quantity Share	Value Share	Quantity	Opportunity Cost	Value
OCD	200	8%	16	1/2	4/5	200	8%	16
STD	200	2%	4	1/2	1/5	220*	2%	4.4*
Total	400	—	20			420*	—	20.4*

* indicates datum is changed from previous year.

GROWTH APPROXIMATIONS

Aggregate	Weighted Growth Rate Formula	Result
MS	$4/5 \times \frac{(200-200)}{200} + 1/5 \times \frac{(220-200)}{200}$	2%
M2	$1/2 \times \frac{(200-200)}{200} + 1/2 \times \frac{(220-200)}{200}$	5%

Changes in own yields or the benchmark yield have no effect on a monetary services index unless the growth rates of the components are different.[1/] But changes in opportunity costs are likely to induce differential growth in quantities as individuals adjust their asset holdings to a new rate environment. If, for instance, in the above example, the own rate on OCD had been kept artificially low under regulation but rose after deregulation, then the lowered user cost of OCD presumably would induce an inflow of funds to that account, including perhaps both funds shifted out of STD and new funds. In this situation, the monetary services index would register higher growth and in principle provide a better measure than the conventional aggregate of the increased demand for money services resulting from the decline in their opportunity cost.

The behavior of the MS indexes, however, can be anomalous. The example in table B7 assumes that in the initial period the own rates on OCD and STD are 8 percent and 12 percent, respectively, and that, because of flatness in the yield curve, the benchmark rate also is 12 percent. These figures imply that the opportunity cost of OCD is 4 percent and that the opportunity cost of STD is zero. In the second period, short-term rates have fallen, and the more rapidly adjusting own rate on STD drops to 8 percent, while the more sluggish own rate on OCD only moves to 6 percent. The example assumes that the benchmark yield declines only to 10 percent, as the market yield curve steepens. This means that the opportunity cost of OCD remains at 4 percent, while the opportunity cost of STD increases

1/ Indeed, a monetary services index cannot change if only component weights change while the stock of each component is unchanged, a property they share with conventional aggregates and the transaction money stock indexes.

Table B7

Money Growth When Funds are Shifted from STD to OCD

HYPOTHETICAL DATA

Asset	Year 1					Year 2		
	Quantity	Opportunity Cost	Value	Quantity Share	Value Share	Quantity	Opportunity Cost	Value
OCD	200	4%	8	1/2	1	220*	4%	8
STD	200	0%	0	1/2	0	180*	2%*	3.6*
Total	400	--	8			400	--	11.6*

* indicates datum is changed from previous year.

GROWTH APPROXIMATIONS

Aggregate	Weighted Growth Rate Formula	Result
MS	$1 \times \frac{(220-200)}{200} + 0 \times \frac{(180-200)}{200}$	10%
M2	$1/2 \times \frac{(220-200)}{200} + 1/2 \times \frac{(180-200)}{200}$	0%

from zero to 2 percent. The fall in the spread between the own rate on STD and the own rate on OCD induces an outflow of $20 billion of STD funds into OCD.

The table shows that, under these circumstances, the monetary services index registers a huge 10 percent growth rate despite the increase in the average opportunity cost of its components. More plausibly, the conventional aggregate in this case shows no growth. Related anomalies with the monetary services indexes may be the reason why their demand in 1984-85 is not well explained by their opportunity-cost measures in chart 8 of the text. For example, as the Treasury bill rate declined from its 1984:Q3 peak, the measured average opportunity cost in aggregates other than the MS measures fell as well. But the indexes of component opportunity costs in MS3 and MS4 were still higher than their 1984:Q3 values four quarters later.1/

1/ A reexamination of the use of a long-term interest rate, unadjusted for the slope of the yield curve, as a benchmark for comparison with shorter-term own rates seems desirable.

Appendix C: Measurement Issues*/

This appendix discusses issues connected with the measurement of the transaction money stock indexes and the monetary services indexes.1/ As in the case of the conventional monetary aggregates, these experimental indexes require the collection of data on the component assets. But in addition, the monetary indexes require auxiliary data used in the construction of the index number weights. Because some of the needed measures are not directly available, they must either be obtained through special surveys or estimated indirectly using existing data.

In the case of the transaction money stock index, MQ, the final product or GNP turnover rate is needed for each monetary component. These turnover rates are not observed directly. In practice, measurements of the required turnover rates are constructed from other available data according to a set of working principles established in Spindt (1985) that exploit known accounting identities. For all the series except currency and money market mutual funds, the basic data are the gross turnover rates reported monthly in the Board's Statistical Release G.6. Similar figures for money market mutual funds are obtained from the Investment Company Institute. For currency, a gross turnover rate is constructed by assuming patterns of encashment of demand deposits and other checkable deposits that are benchmarked to survey data.

These gross turnover rates, together with the levels of the component money stocks, imply a series of gross debits to each account. Such

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*/ Prepared by Arthur B. Kennickell and Garland B. DeMarco.

1/ A more complete review of these issues is given in a separate staff memorandum by Kennickell and DeMarco (1986).

debits are gross in the sense of including a large volume of payments for transactions not included in the final product expenditure concept (GNP) relevant for MQ. These extraneous expenditures include purely money-changing transactions, purchases of intermediate goods and services, and exchanges of existing assets, both real and financial.

Calculation of final-product debits proceeds in three steps. First, "money-changing" debits, or re-allocations of funds within the component monetary assets, are deducted from gross debits.1/ Benchmark patterns of such transfers have been calculated using information for households from the recent Survey of Currency and Transaction Account Usage and the 1984 Survey of Consumer Finances, with adjustments made for nonhousehold behavior. Next, "capital-account" debits, or expenditures for financial assets and used goods, are subtracted. The total of capital-account debits must be equal to the difference between total debits (adjusted for money-changing activity) and total payments associated with the production and distribution of current output. The latter figure can be calculated independently using National Income Accounts data. This identity is exploited in making the capital-account adjustment. Survey data are used to determine the allocation of capital-account debits across assets other than demand deposits. For example, those data suggest that about 85 percent of debits to money market deposit accounts and money market mutual funds reflect financial transactions. The residual volume of capital-account debits is charged against demand deposits.

1/ The set of turnover rates implied by the resulting series of debits is used in calculating MT.

Finally, expenditures on raw materials, other productive factors, and intermediate products must be removed from the capital-account-adjusted debits to get final-product debits, the total of which must equal GNP. At present, the GNP accounting identity is enforced by simply "blowing down" the estimated volume of total-product debits for each component by the ratio of GNP to total-product expenditure. The turnover rates used in the calculation of MQ are based on these final-product debits.

The estimated gross and final-product turnover rates for selected component monetary assets in three recent years are given in the first two columns of table C1. Most striking is the drop from gross to final-product debits for demand deposits of 97 to 98 percent. The GNP spending weights for implied growth rates of these selected components of MQ are given in the next-to-last column of that table.

Absent direct measurements of the true final-product turnover rates, it is not possible to quantify the precision of the measurements derived by these methods. However, some idea of the sensitivity of the calculation may be obtained by examining the key underlying assumptions made in the various steps.

Estimates of gross debits represent the basic starting point in the construction of the MQ index. For demand deposits, money market deposit accounts, and other checkable deposits, these debits are derived from a sample survey of member banks (FR 2573). In 1985, the sampling standard error of demand deposits and money market deposit accounts is less than 5 percent, but that for other checkable deposits is about 13 percent. Given the sizable growth rate of other checkable deposits, this sampling error could present a problem: if the range of error in the final-product debits to this account is also 13 percent, then the contribution

Table C1

Turnover Rates, Opportunity Costs and Share Weights for Selected Monetary Assets

Component	Gross turnover rate	Final product turnover rate	Own rate	Opportunity cost	Quantity share in M1	Expenditure share in MQ	Value share in MSL
	Times per year		Percent		Percent		
1981							
Currency and traveler's checks	21.0	7.1	0.0	17.8	29.0	28.9	15.6
Demand deposits	285.7	7.9	8.5 2/	9.3 2/	55.6	62.3	15.5
Other checkables 1/	14.4	3.7	5.3	12.6	15.4	8.0	5.8
MMDAs	--	--	--	--	--	--	--
1983							
Currency and traveler's checks	20.4	7.1	0.0	13.6	28.8	30.6	11.3
Demand deposits	379.7	8.0	5.2 2/	8.3 2/	47.2	57.5	11.3
Other checkables 1/	15.6	2.8	5.8	7.8	24.0	10.0	5.4
MMDAs	2.8	.1	8.6	5.0	--	1.0	9.9
1985							
Currency and traveler's checks	20.2	7.1	0.0	12.7	28.7	30.3	10.2
Demand deposits	489.5	8.4	4.9 2/	7.9 2/	43.6	54.2	9.5
Other checkables 1/	16.7	3.1	5.6	7.1	27.7	12.6	5.5
MMDAs	3.7	.1	7.2	5.5	--	1.6	12.6

1/ Includes NOW accounts, Super NOW accounts and credit union share draft accounts.

2/ Includes implicit rate on business demand deposits.

to the standard error of measurement of MQ from this source alone is about one percent over the 1984-85 period.[1/] The sampling error for the gross debits to money market mutual funds obtained from the Investment Company Institute is not known. Gross debits to currency are, as noted above, benchmarked to survey data for which the sampling error is fairly small, though the behavior of currency debits at other times is not observable.

In the adjustment of these gross debits to obtain final-product debits, many assumptions are made. However, as discussed in more detail in Kennickell and DeMarco (1985), the calculation of historical MQ growth rates appears fairly robust to variations of most of these assumptions within plausible ranges. The effect of most of these changes is to make slight, and generally nearly uniform changes in the growth rates of MQ while leaving its overall pattern unaffected. The exception involves the allocation of intermediate-product expenditure across the different capital-account-adjusted debits. Variation of this allocation can make significant differences. For example, reducing the proportion of OCD debits allocated to intermediate expenditures increases the effective weight of OCD in the growth rate of MQ, thus causing the series to behave more like OCD itself.

1/ This problem could probably be overcome to a substantial degree by modification of the existing bank report forms to include a separation of household and nonhousehold debits. Household ownership of other checkable deposits has been estimated at about three-quarters of the total, and from survey data it appears that household use of these accounts is relatively stable. State and local governments, the principal other holders of these accounts, are known to finance large and rather erratic shifts of funds between NOW accounts and other financial instruments. Separation of account activity by ownership might well produce a precision of measurement for household OCDs comparable to that for demand deposits; while the measurement error in nonhousehold debits would probably not be reduced, at least the effect of error would be lessened. Similar separation of the other accounts by ownership would also move the index construction closer to the theoretically more appropriate disaggregation of accounts by types of use (see page B5 in Appendix B).

Overall, however, these results suggest that small-scale, periodic surveys, like those mentioned above, tailored to acquire the essential benchmark data, would be sufficient to maintain the measurement quality of the index.[1/]

In the case of the monetary services indexes, measurement of the opportunity, or "user," cost of each component asset in the array of monetary assets is needed. This, in turn, requires measurement of an own yield for each asset and of the yield on a benchmark nonmonetary asset. In theory, the benchmark asset is taken to be one which does not provide any monetary services and which is used only for "transferring wealth between multiperiod planning horizons" (Barnett (1980)). The opportunity cost of each monetary asset is then defined as the difference between the benchmark and its own yield.

Unfortunately, there is no market yield corresponding to the benchmark yield that is both well-defined and currently measured. Any measured yield that is sufficiently illiquid to be an acceptable approximation also includes an undesirably large risk premium. In practice, the benchmark rate typically is taken to be the Baa corporate bond rate. However, because all opportunity costs must be positive, if the Baa bond rate is exceeded by the own rate of any asset included in conventional L, then the latter becomes the operational benchmark rate, implying that for that component, the opportunity cost is zero.[2/] The historical pattern

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1/ Two other areas in the measurement of MQ--concerning the status of U.S. government deposits and spending, and the treatment of debits in payment for foreign produced goods--are important subjects for further research.

2/ For purposes of the monetary services index calculations, all own yields in L, but not the bond yield, are standardized at annualized one-month-equivalent rates using a yield curve adjustment.

of the benchmark rate is plotted in chart C1 together with the Baa bond rate. During most periods when the yield curve is upwardly sloped, the benchmark rate is the Baa bond rate. However, during episodes when the yield curve is sharply inverted, the benchmark rate becomes the maximum of the own rates, which is a short rate. From experiments reported in Kennickell and DeMarco it appears that the monetary services indexes are rather sensitive to the choice of the benchmark rate.[1/]

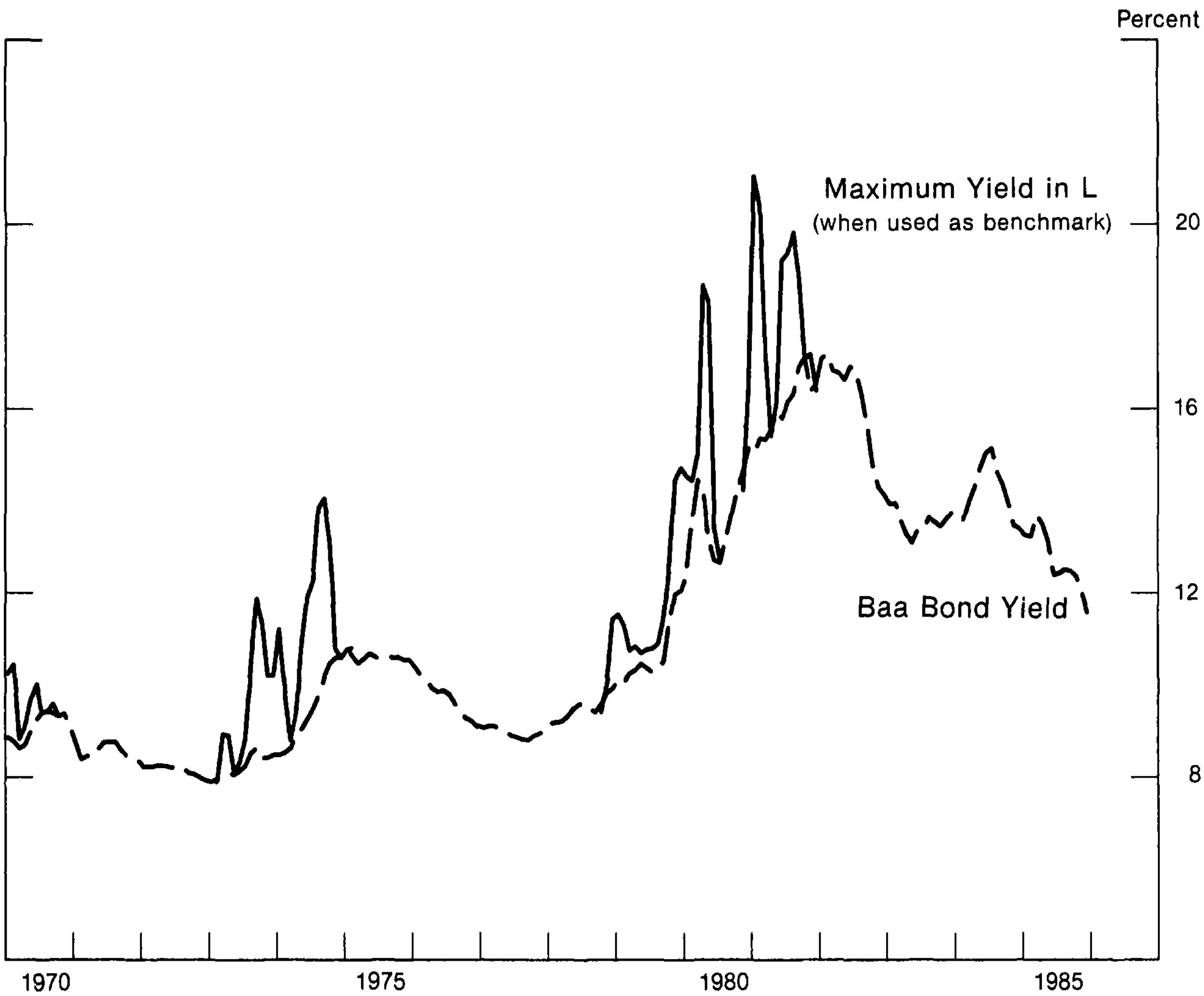
The measurement of the own rates used in the monetary services index calculations is described in detail in Farr and Johnson (1985). The calculated own rates and implied opportunity costs of selected components of MS3 and MSL are shown in the third and fourth columns of table C1 for three recent years. By definition, the opportunity cost and the own rate must sum to the benchmark yield. Because the own rate on currency is assumed to be zero, the opportunity cost of currency is always equal to the benchmark yield. The estimated own rate on demand deposits differs from zero since business accounts are assumed to earn an implicit return in the form of bank services.

Under present procedures, total demand deposits are divided between household and nonhousehold accounts using information obtained from the quarterly Demand Deposit Ownership Survey. Households are assumed to receive no implicit interest on marginal deposits. Given that service charges are often based on tiered balance levels, the validity of this assumption can

1/ As the value of the benchmark rate becomes large relative to the own rates, the behavior of the monetary services index approaches that of the corresponding conventional aggregate.

Chart C1

Benchmark Yield in Monetary Services Indexes



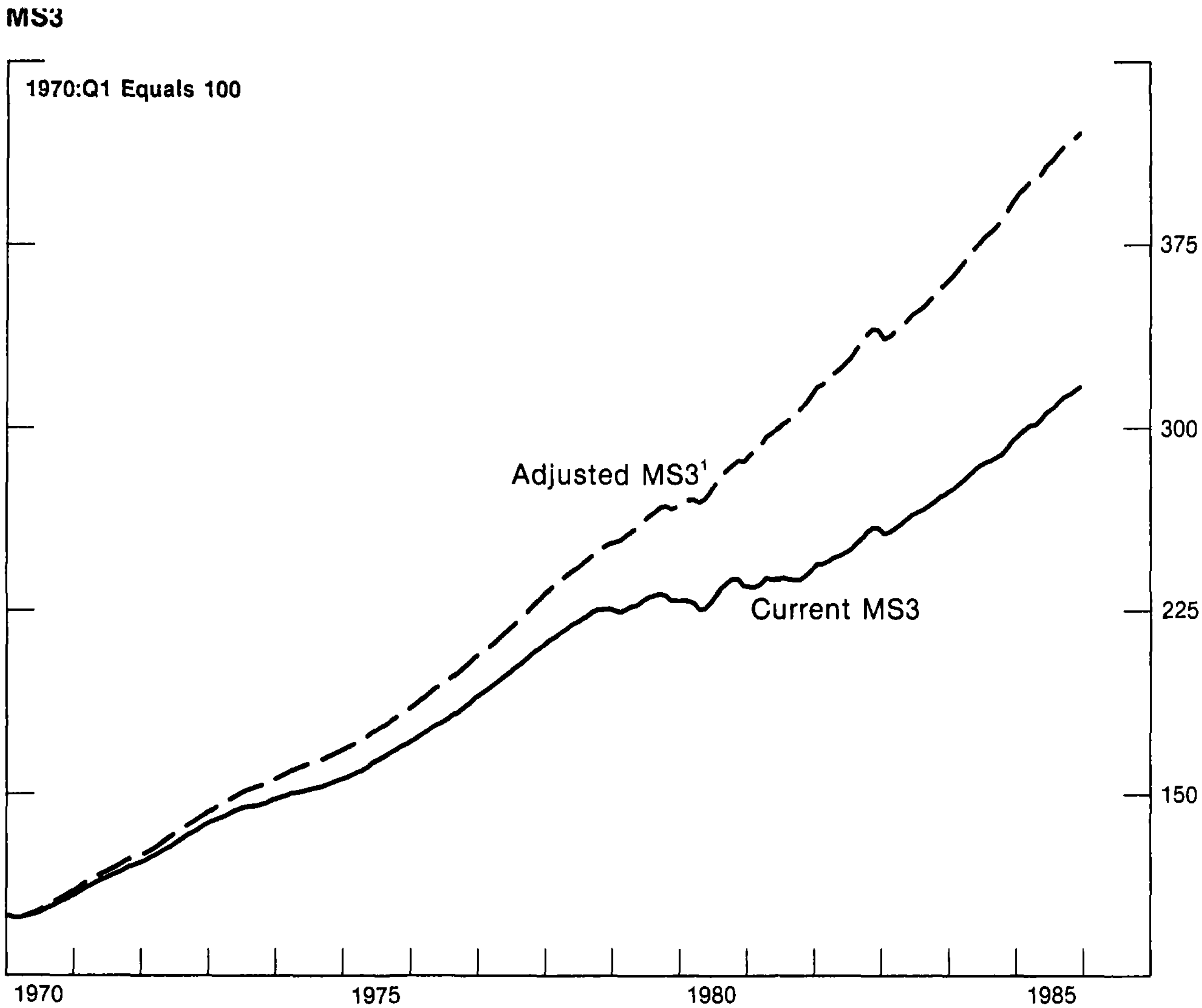
be questioned.[1/] Even so, increases in the assumed own rate for household demand deposits produce a relatively small and approximately proportional change in the levels of the broad monetary services indexes.

In contrast, the monetary services indexes are sensitive to the estimate of the yield on business demand deposits. Nonhouseholds are assumed in the current procedures to receive an implicit marginal return equivalent to the perfectly competitive rate, which in this case is approximated by the yield on commercial paper adjusted for the transaction reserve requirement ratio. Because other own rates in L are measured on a pre-tax basis, this yield, in theory, should be grossed up using the effective marginal tax rate to put it on the same basis as the other rates, though this step is not taken with current procedures. Assuming a marginal tax rate since the early 1970s of 46 percent for all nonhousehold demand deposits to gross up the implied yield causes a dramatic change in pattern of the monetary services indexes, as illustrated in chart C2 for the monetary services index corresponding to the components of conventional M3. In this case, the adjusted yield often is the effective benchmark yield--reducing the weight on growth of business demand deposits to zero. Thus, the chart also illustrates the sensitivity of the calculation to the choice of benchmark yield and reinforces the need for refinement of the measure of the benchmark rate and for further research into better estimates of the actual marginal implicit yield on business demand deposits.

1/ The widespread use of tiered-balance levels for determining service charges and rates paid on NOW accounts also raises questions about the adequacy of using the "most common" rate paid on NOW accounts to represent its marginal own rate.

Chart C2

Monetary Services M3 with Alternate Own Rates on Business Demand Deposits



1. MS3 with estimated yield on business demand deposits adjusted for tax benefits.

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Chart 1

Share Weights of Component Growth Rates in Conventional and Indexed Aggregates

1970 Q1 Equals 1.0

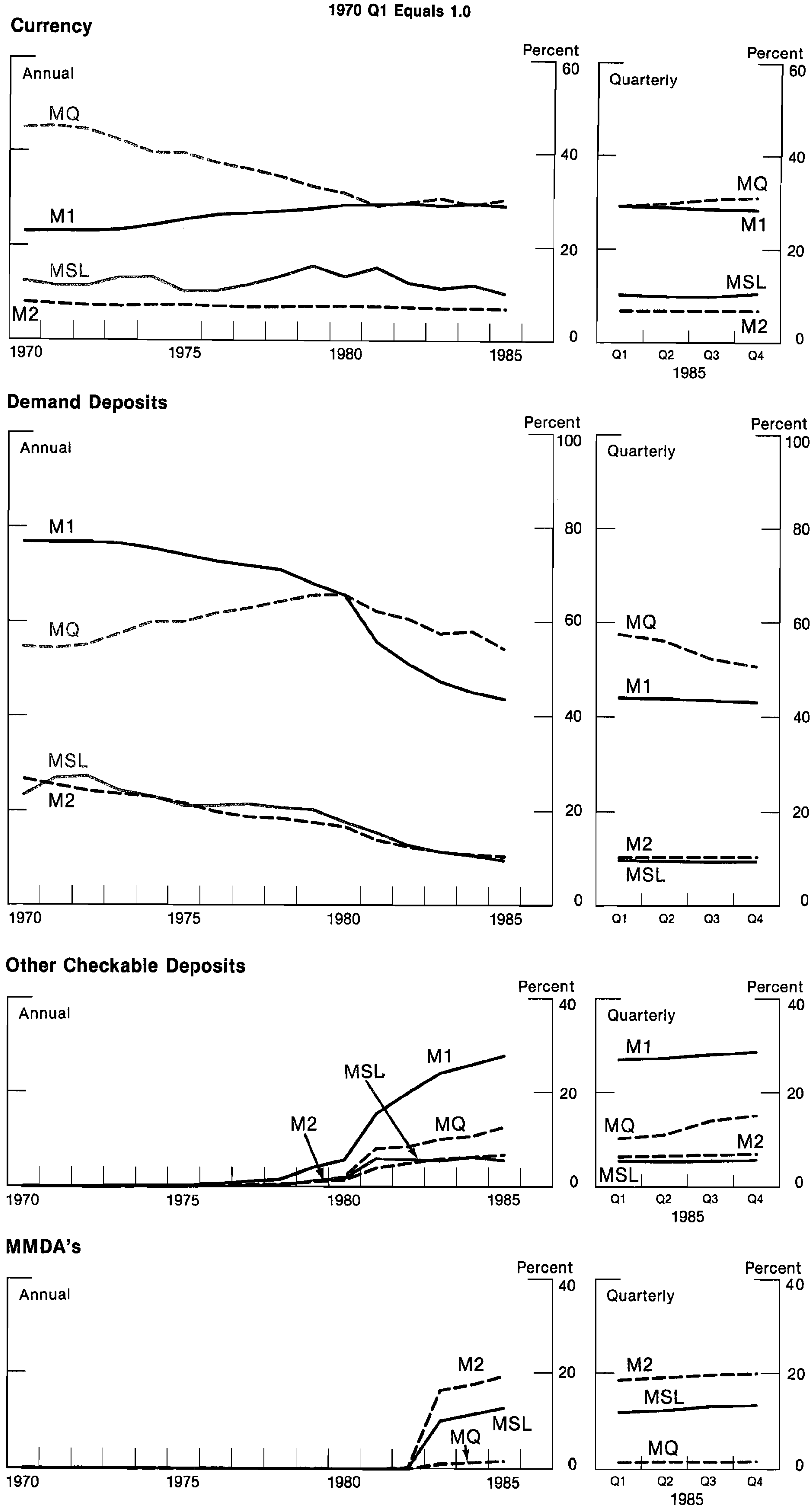
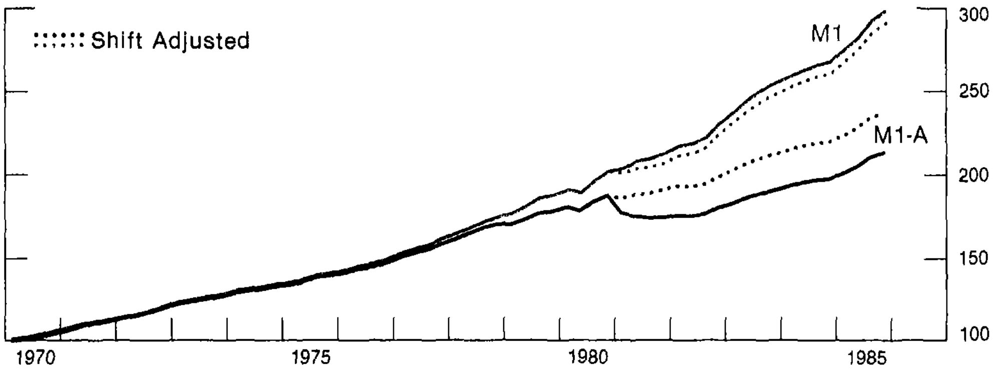


Chart 2

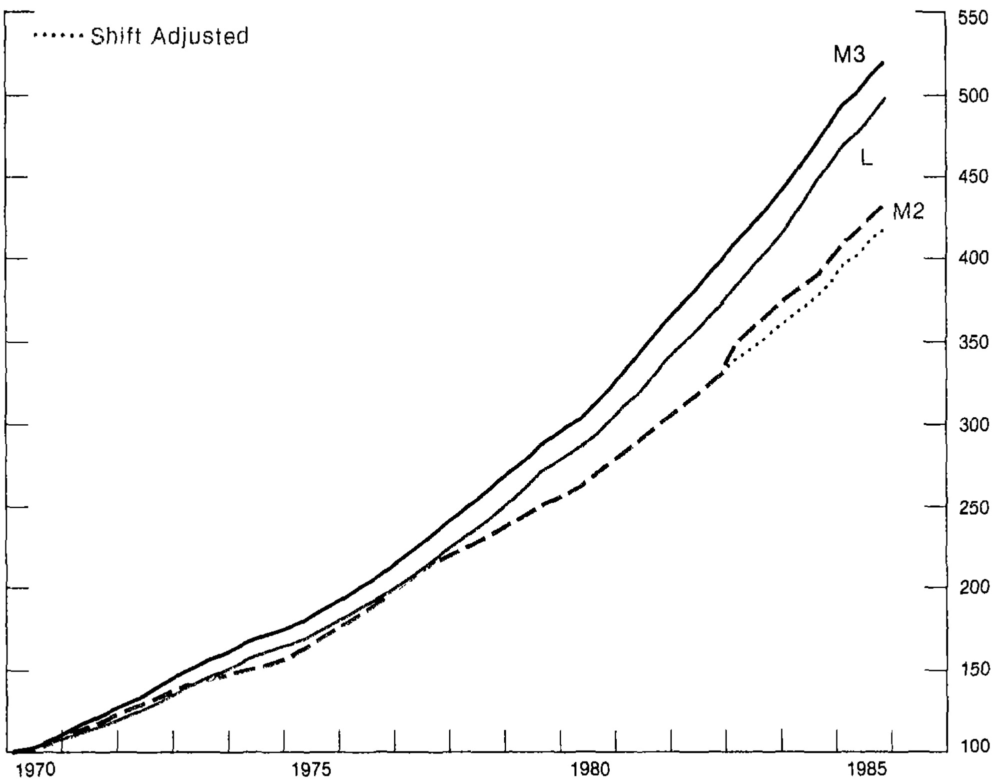
Normalized Levels of Various Monetary Aggregates

1970 Q1 Equals 1.0

M1-A and M1



M2, M3 and L

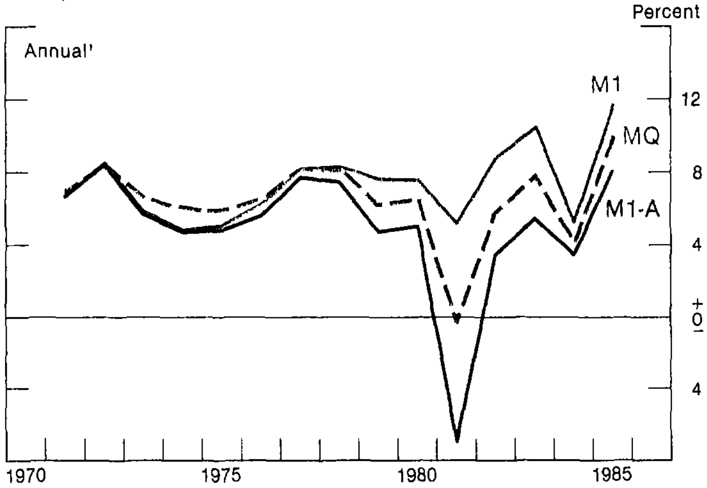


MQ, MT, MS3 and MSL

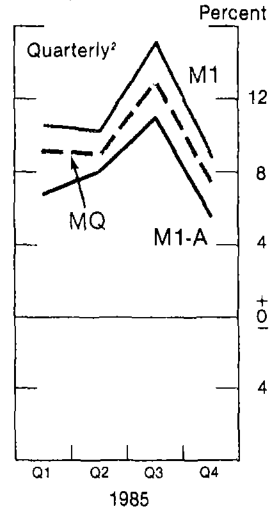
Chart 3

Growth Rates of Various Monetary Aggregates

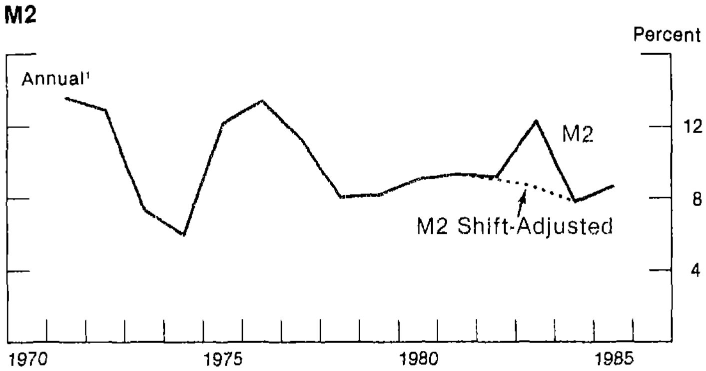
M1-A, M1 and MQ



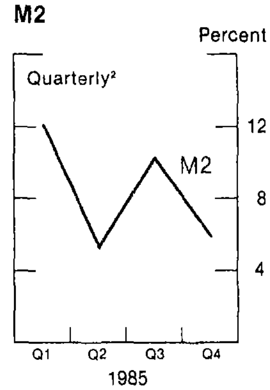
M1-A, M1 and MQ



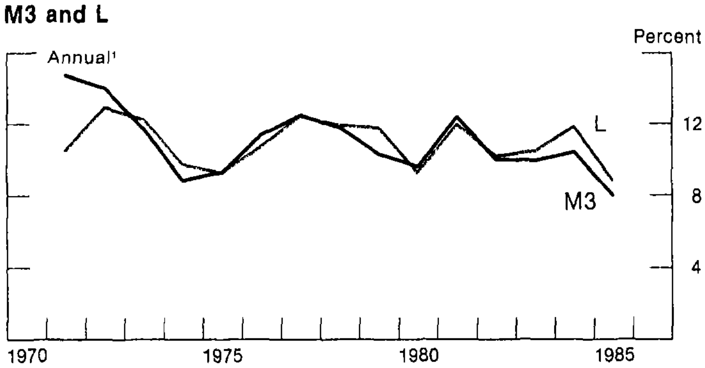
M2



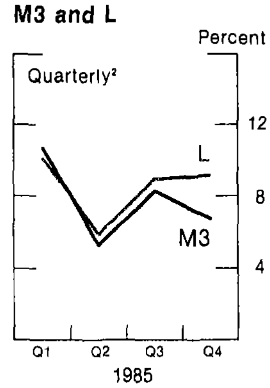
M2



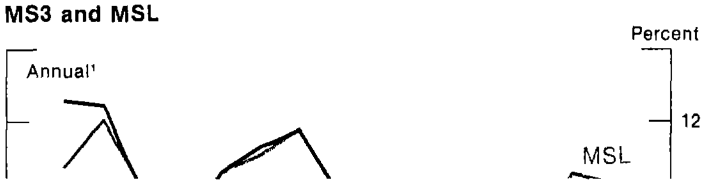
M3 and L



M3 and L



MS3 and MSL



MS3 and MSL

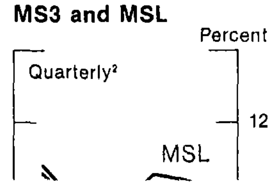
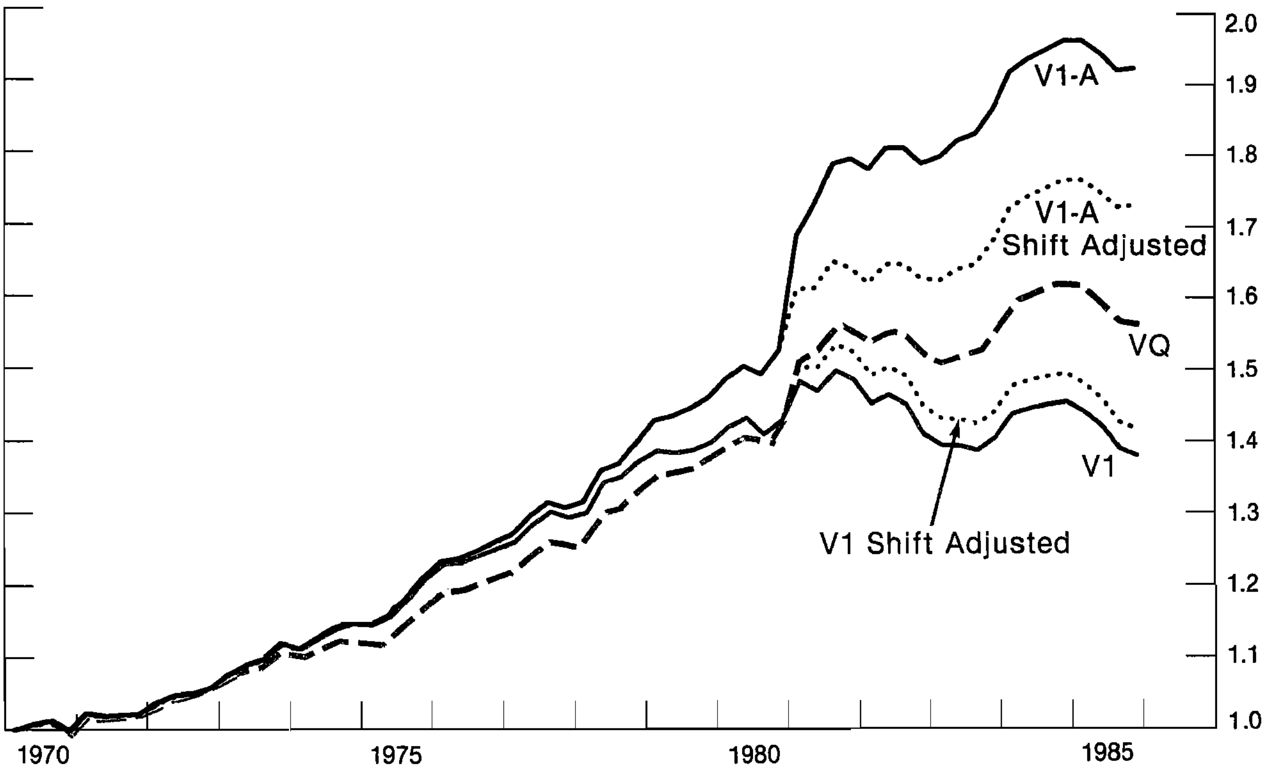


Chart 4

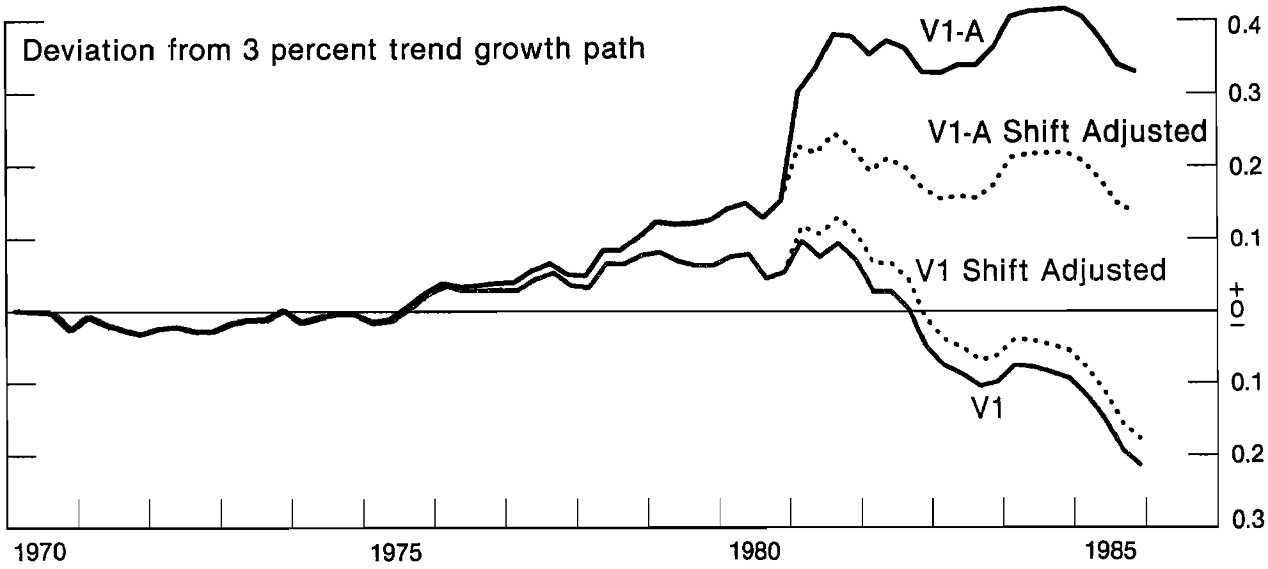
Normalized Velocities of Narrow Monetary Aggregates

1970 Q1 Equals 1.0

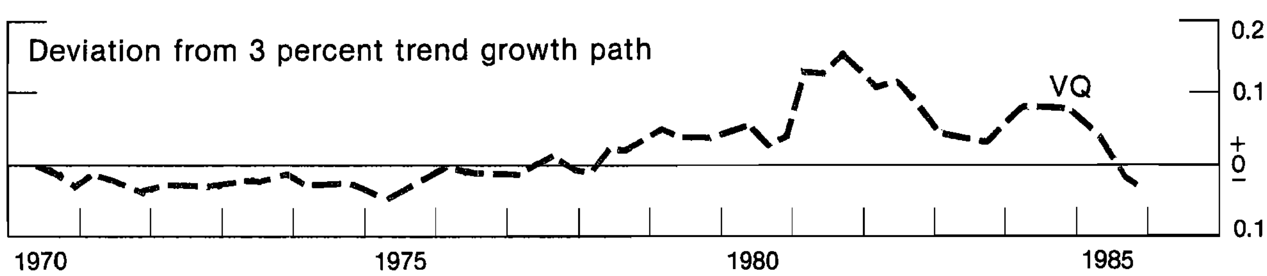
V1-A, V1 and VQ



V1-A and V1



VQ



Three-Month Treasury Bill Rate

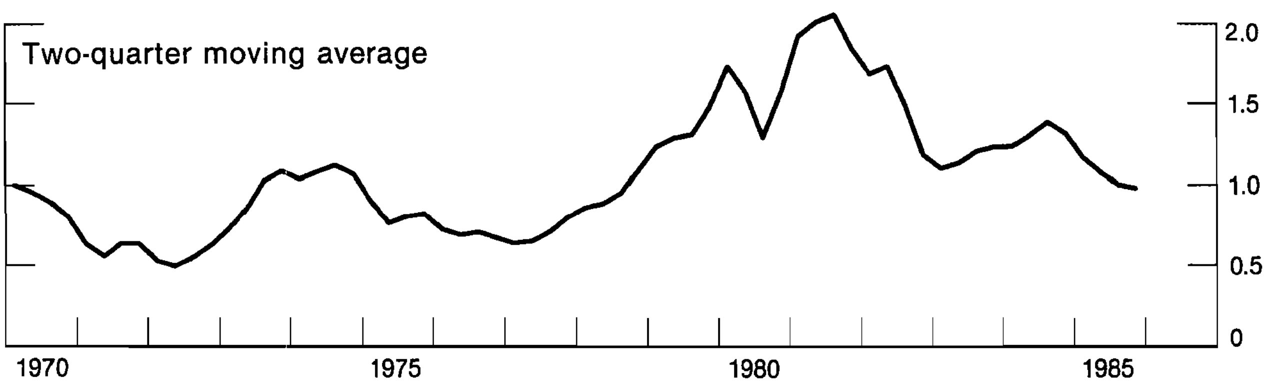


Chart 5

Normalized Velocities of Broad Monetary Aggregates

1970 Q1 Equals 1.0

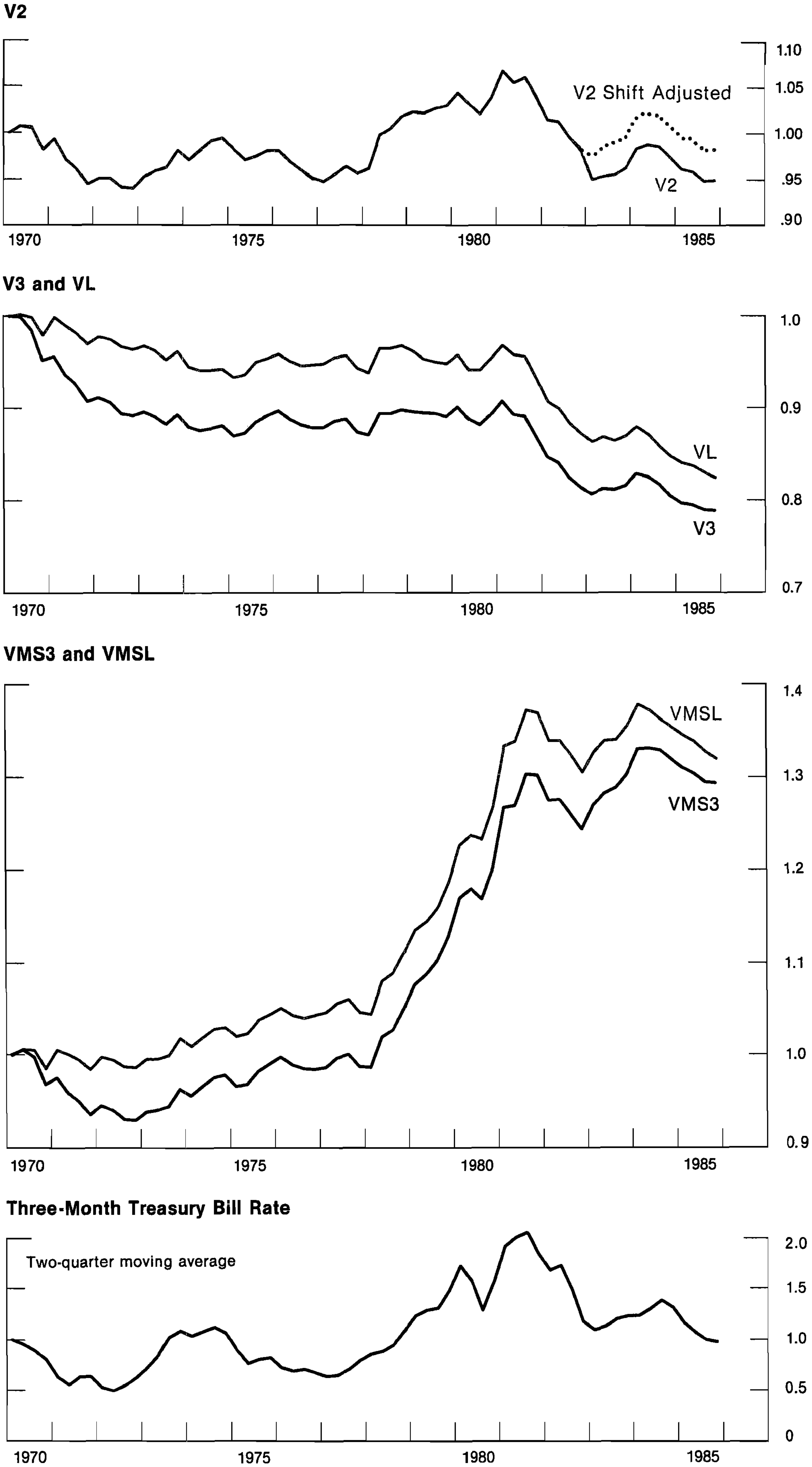


Chart 6
Growth Rates of Velocities of *Various Monetary Aggregates*

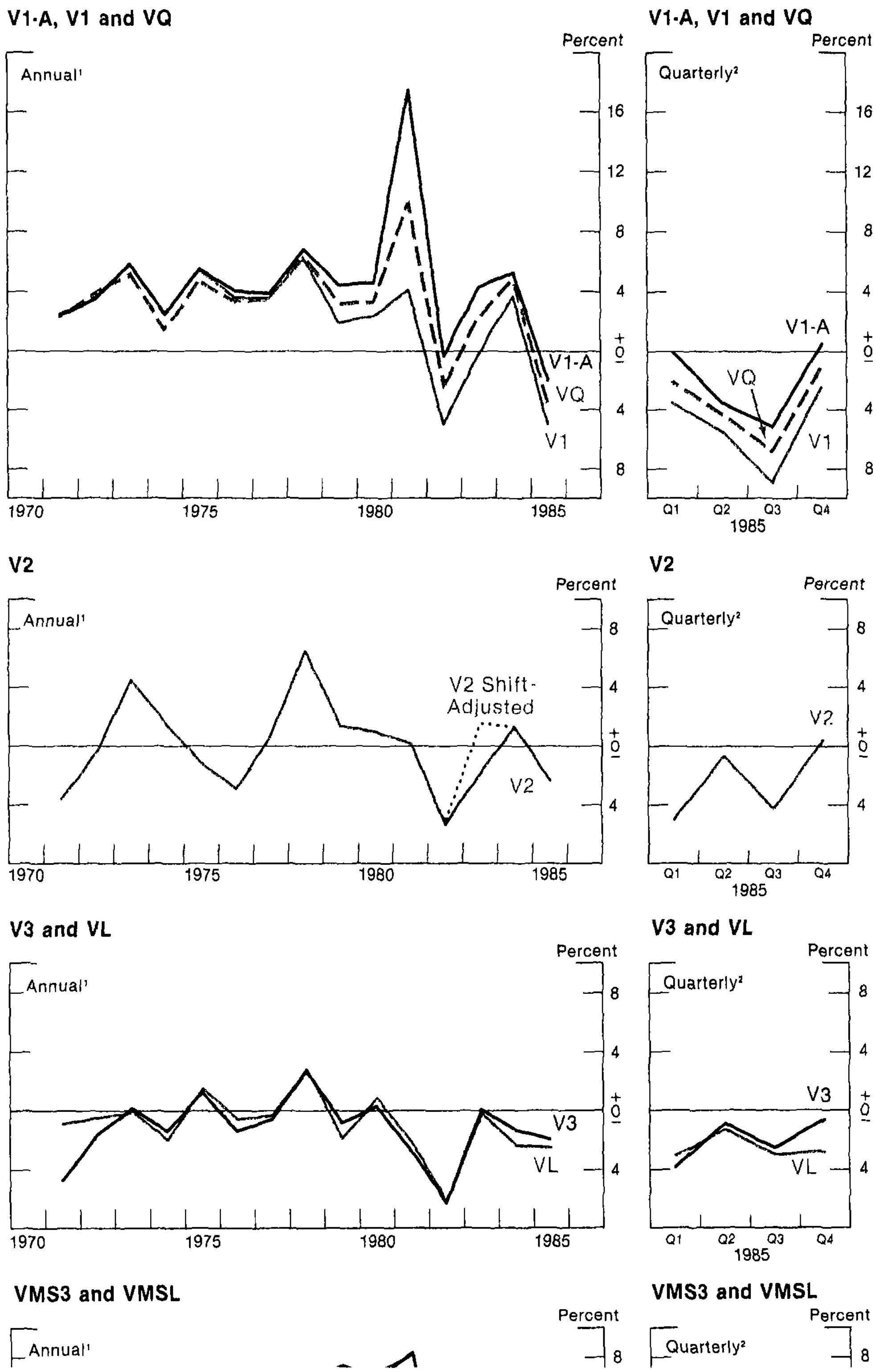
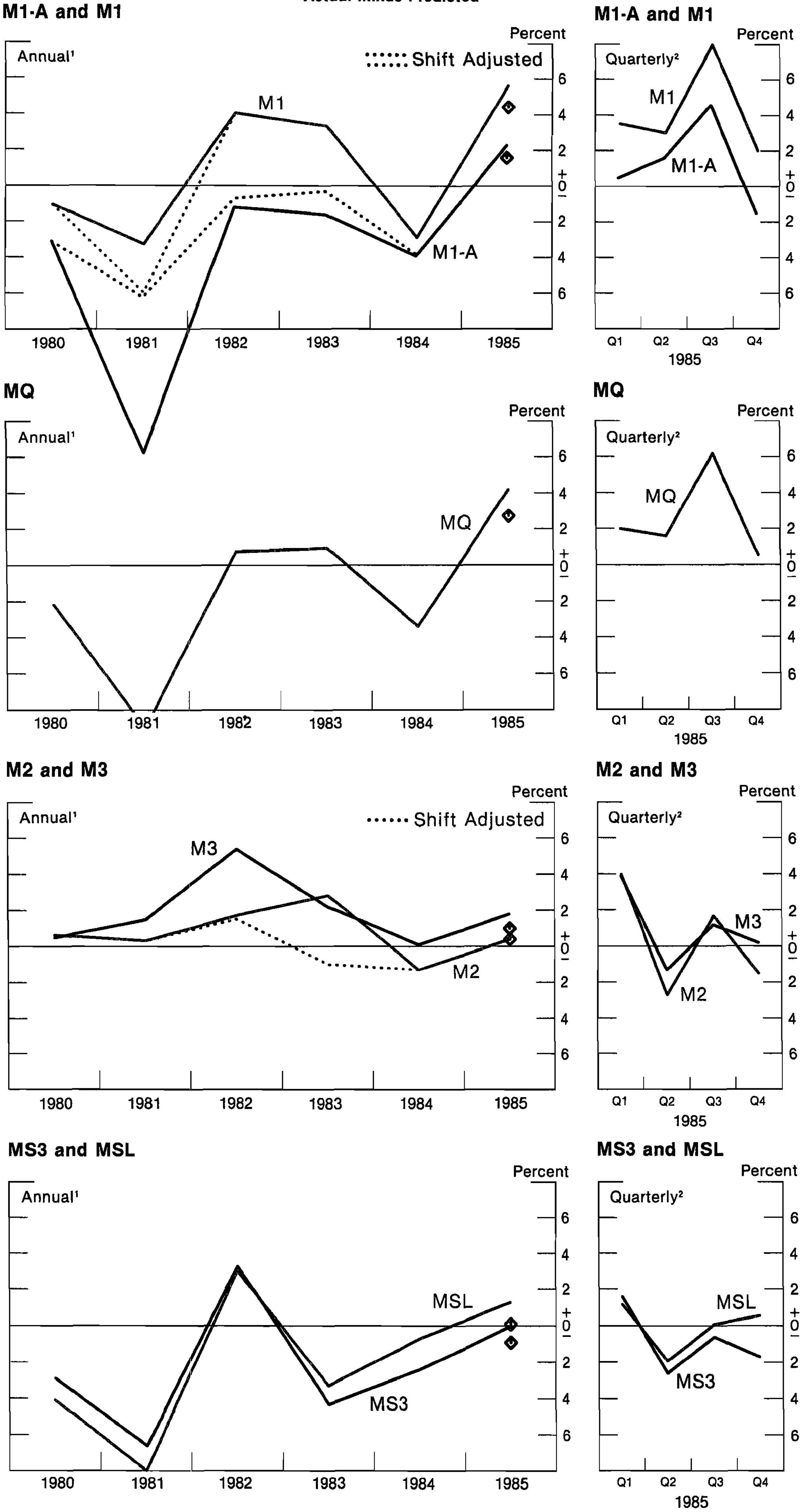


Chart 7

Money Growth Errors in Market-Rate Money Demand Models

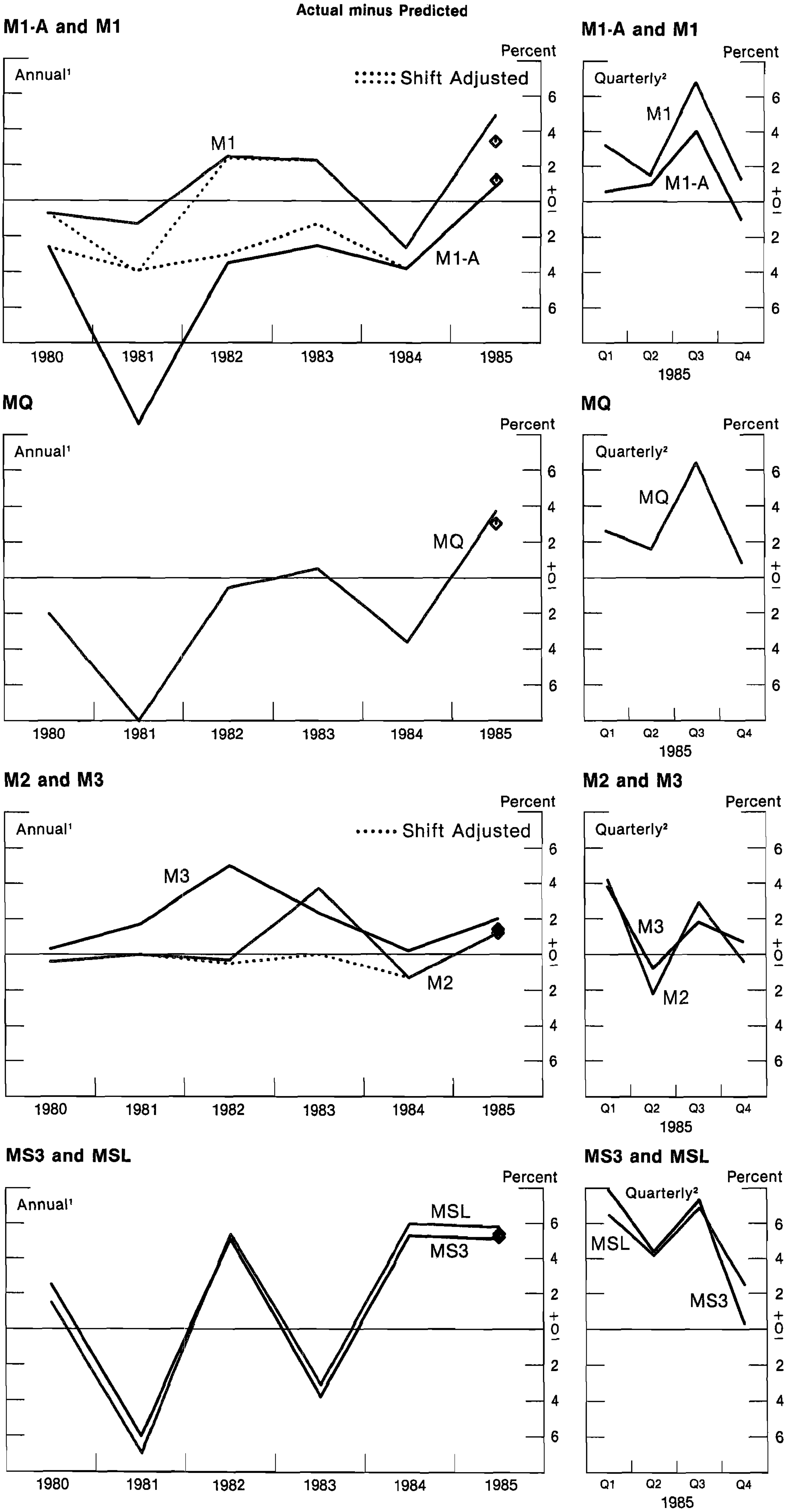
Actual minus Predicted



1. Q4 to Q4; period of fit is 1971-Q2 to 1979-Q4.
2. Annual rate; period of fit is 1971-Q2 to 1984-Q4; M1-A, M1 and M2 fit with shift-adjusted data.
◇◇ --1985 annual error for period of fit 1971-Q2 to 1984-Q4.

Money Growth Errors in Opportunity-Cost Money Demand Models

Actual minus Predicted

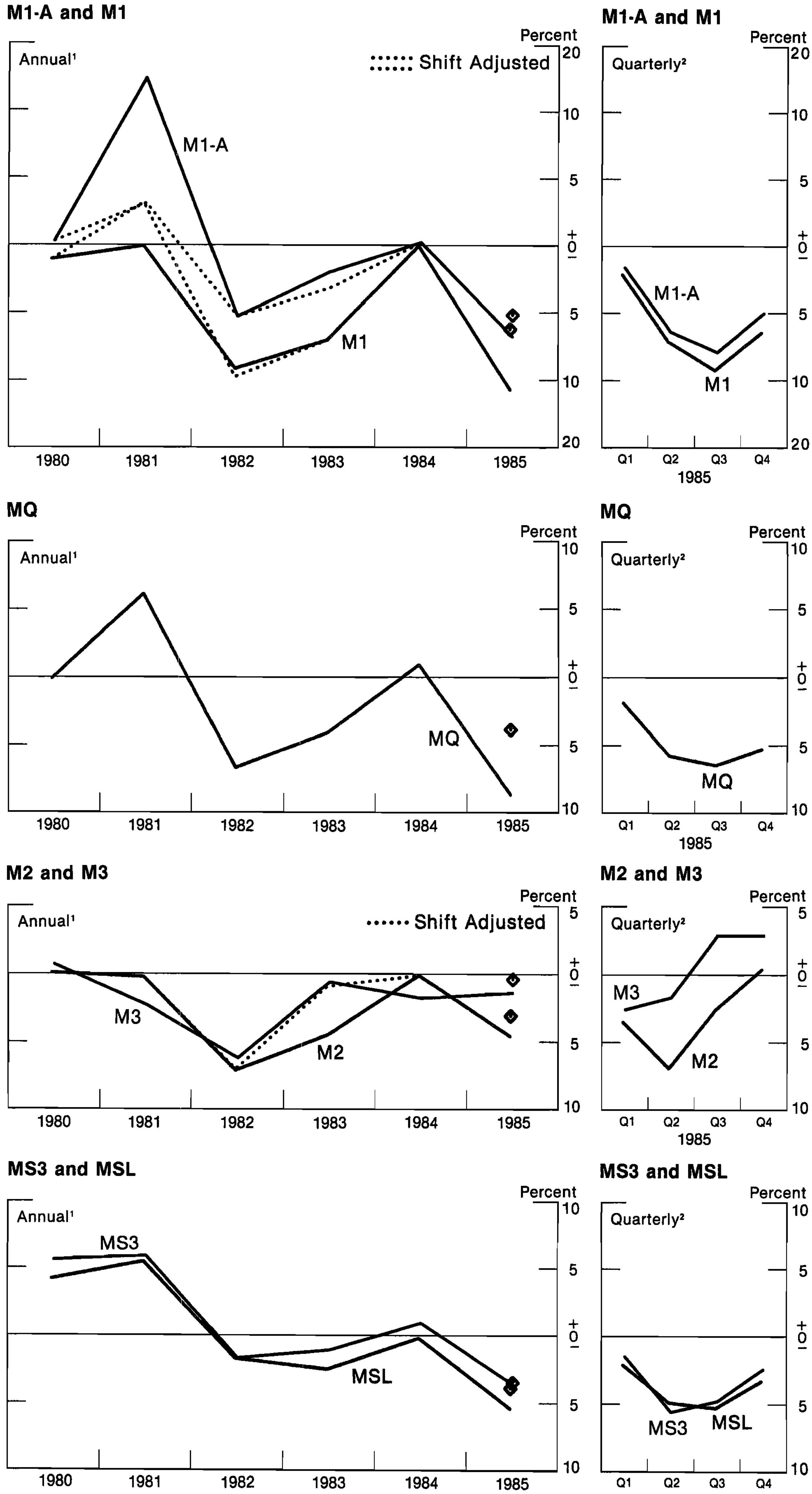


1. Q4 to Q4; period of fit is 1971-Q2 to 1979-Q4.
2. Annual rate; period of fit is 1971-Q2 to 1984-Q4; M1-A, M1 and M2 fit with shift-adjusted data.
◇◇ --1985 annual error for period of fit 1971-Q2 to 1984-Q4.

Chart 9

Nominal GNP Growth Errors in St. Louis-type Reduced Form Models

Actual minus Predicted



1. Q4 to Q4; period of fit is 1971-Q3 to 1979-Q4.
2. Annual rate; period of fit is 1971-Q3 to 1984-Q4.

◇◇ --Annual error for period of fit 1971-Q3 to 1984-Q4.