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Velocity

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DRAFT

Office Correspondence

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To Mr. Kichline

From Staff*

Subject: Analysis of San Francisco Federal Reserve Bank Study "The Case for M_2"

The staff rejects the San Francisco Bank's proposal to replace 50-50 M_1 - M_2 weighting with 100% M2 weighting. They favor focusing on the narrowest possible aggregate

Summary.

The San Francisco Federal Reserve Bank staff proposes that in the year ahead the FOMC should abandon its 50-50 weighting of M_1 and M_2 and place 100 percent weight on M_2 in determining monetary aggregate targets. They advance several arguments to support this recommendation:

First, the results of their reduced form approach for examining the relation between GNP and the monetary aggregates suggest that M_2 has provided closer forecasts of GNP than M_1 since 1975Q1. Second, they point out the apparent breakdown of the demand function for M_1 since mid-1974. Third, they argue that interest rate-induced shifts in savings deposits tend to be offset by shifts in the "other time" component of M_2, lending a relative stability to the growth of M_2. Finally, they argue the M_2 is just as controllable as M_1 with a monetary base instrument.

This memorandum begins with a discussion of the changing attributes of M_1 and M_2. A discussion of the various arguments presented by the San Francisco Federal Reserve Bank staff follows. Beginning with a critique of their primary arguments, a brief summary of our principle findings is enumerated below.

* Contributors to this memorandum include John Kalchbrenner, David Lindsey, Richard Porter, David Wyss, Flint Brayton, Jerry Enzler, and David Pierce.

1. We report alternative reduced form equations for GNP which, unlike the San Francisco Federal Reserve Bank's equations, show very little deterioration in either the M_1 or M_2 variants. The tendency of either equation to underpredict GNP does not emerge until 1976, although the underprediction is slightly greater for the M_1 equation.

2. However, the apparent stability of their M_2 to GNP equation may be illusory. A different historical administration of Regulation Q need not have produced as stable a relation between M_2 and GNP. Moreover, because they did not adequately deal with the problem of the endogeneity of quarterly monetary growth, their M_2 equations further overstate the closeness of the M_2 to GNP relationship.

3. On balance, it does not seem advisable to abandon M_1 in favor of M_2. This position is supported both by theoretical considerations and empirical evidence.

4. As financial institutions continue to evolve, theoretical considerations suggest that the narrowest monetary aggregate should measure all nonbank public transactions balances regardless of their form or location.

Changing Attributes of M_1 and M_2

What distinguishes M_1 from other monetary aggregates? The traditional answer to this question was that M_1 is the principle circulating medium of exchange in the economy. It followed that the demand for M_1 ought to depend importantly on the level of transactions in the economy and, therefore, be closely related to GNP. Until recently, empirical estimates of the demand for M_1 were quite stable, as were the separate estimates of the demand for the components of M_1, demand deposits and currency. A highly developed theory linked the quantity of M_1 to aggregate demand through interest rate and wealth channels. Large scale econometric models successfully incorporated empirical estimates of these relationships. In view of these considerations, it made sense to set monetary policy in terms of M_1.

Recent events--such as the introduction of NOW accounts and credit union share drafts and other transaction-related balances which may not be measured in M_1--could be expected to have altered the traditional relationships between M_1 and GNP. All or at least some large portion of the balances held in these new forms are close substitutes for M_1 and, therefore, could be added to M_1 in computing the effective medium of exchange. Because several of these new balances are interest bearing, the net interest elasticity of demand for such an extended transactions-related monetary aggregate may

differ from that of M_1. Nevertheless, the theoretical mechanism linking this extended monetary aggregate to GNP is much like the traditional theory linking M_1 to GNP. The research problem suggesting itself involves accurately measuring the amounts of the various components outstanding, estimating their demand elasticities with respect to various interest rates and to GNP, and determining the demand and supply characteristics of the total extended aggregate.

From the standpoint of theory, the relevance of M_2 is less obvious, particularly in the currently evolving financial environment. Analytical considerations suggest that a stable relationship between M_2 and GNP would only be observed by coincidence. The first consideration is that the demand for several of the components of M_2 is only peripherally related to GNP. Admittedly, passbook savings accounts may partly serve as transactions balances as a result of telephone transfers and automatic bill payments and may, hence, depend on GNP as well as various interest rates through the public's demand function. But the other two components of M_2--consumer-type certificates of deposit and large nonnegotiable CD's at weekly reporting banks together with all large CD's at other banks--less importantly share this transactions-related character. Demand for these components still depends on various interest rates but depends more on the public's portfolio allocation response to changes in wealth than to changes in GNP.

The foregoing argument implies that the degree of stimulus inherent in any specific M_2 level depends crucially on the mix of the M_2 components. Although M_2 may be controllable, each of its separate components can not be simultaneously controlled with a single reserve aggregate or Federal funds rate tool. Thus, for example, changes in the mix of other time and savings deposits caused by a shift out of passbook accounts into nonnegotiable CD's could leave M_2 unchanged but nevertheless produce lessened economic stimulus.

Another consideration undermining the idea of a stable relationship between M_2 and GNP is the similarity between components of other time and savings deposits and various accounts excluded from M_2. The public likely regards passbook accounts and consumer-type CD's at MSB's and S&L's as very close substitutes to similar balances at commercial banks. Likewise, large negotiable CD's at weekly reporting banks are close substitutes for all large CD's at other banks.

Hence, shifts in the mix of similar accounts between commercial banks and thrift institutions would change M_2 without any accompanying change in monetary stimulus. If the Federal Reserve acted to restore the original level of M_2, it may inadvertently be altering the degree of monetary stimulus. Redefining the higher order aggregates according to the type of deposit rather than according to type of institution would help solve this problem.

Money and Income: Answers from a Reduced Form Approach

The San Francisco study relies on a comparison of forecasts of two reduced form equations to justify their claim of recent superiority of M_2 over M_1 in predicting GNP. Rather clear-cut evidence is presented to the effect that of the two forecasting equations in Table 2 of the Appendix, the second equation, containing M_2 as an explanatory variable, does a better job of forecasting GNP in 1975-76 than does the first equation, in which the explanatory aggregate is M_1. To infer from this, as the memorandum does, that "M_2 has steadily outperformed M_1 as a predictor of nominal GNP since the recession trough in 1975.1" requires that the specifications of these two equations be adequate, regarding both the inclusion of all relevant variables and the appropriate form for the variables that do appear. That is, their results would simply be specific to the model selected if adding another variable or changing the functional form of their equations altered the observed performance of M_1 and M_2.

Maintaining fidelity to the spirit of their approach, Lindsey reports estimated reduced form equations which considerably mute the force of their results.[1/] Both of his equations, containing a fiscal and strike variable in addition to M_1 and M_2 growth, easily pass a Chow test of coefficient stability when the post-1973Q2 period is both included or excluded from the sample period. Moreover,

1/ See David Lindsey, "Relation of M_1 and M_2 to GNP," memo to Mr. Kalchbrenner, June 1, 1977.

both his M_1 and M_2 equations display superior post-sample simulation properties to the two reported by the San Francisco staff. In his results, the M_1 and M_2 equations provide indistinguishably accurate one-quarter ahead forecasts in 1975 and 1976 as measured by root mean square error or mean absolute error. Only in 1976 does a bias toward overpredicting GNP show up in either equation, and the one-quarter ahead mean error of forecast of GNP in 1976 is about .5 and .2 percent of GNP for his M_1 and M_2 equations, well below the equations' standard errors of estimate of about .8 percent. These results do not suggest that a significant shift in the relative forecasting ability of M_1 or M_2 has occurred.

Moreover, when the monetary growth rates from 1975Q4 on are adjusted to account for the distorting effects of recent regulatory changes and financial innovations--as estimated by Paulus and Axilrod[1/]--Lindsey's M_1 equation actually outperforms his M_2 equation in post-sample forecasting as measured by all the summary statistics. In particular, the mean error in 1976 falls to .12 percent of GNP for M_1 and rises to .22 for M_2. To the extent that these institutional influences on money demand could have been predicted in advance, this evidence suggests that an emphasis upon M_1 over M_2 would have been warranted over the past two years.

Moreover, several drawbacks inherent in the reduced form approach for evaluating monetary aggregates suggest themselves.

1/ See John Paulus and Steven Axilrod, "Recent Regulatory Changes and Financial Innovations Affecting the Growth of the Monetary Aggregates," November 2, 1976.

The first applies particularly to equations involving M_2: the stable relationship picked up by the regression equation may be in large part illusory, in the sense that it reflects the effects of regulatory actions, rather than underlying private economic behavior. Since the early 1960's major regulatory changes--such as the authorization of new types of deposits and increases in interest rate ceilings--would have had the effect of raising M_2 demand and lowering M_2 velocity, other things equal. However, these depressing effects have been by and large just offset by the effects of the "other things" working in the opposite direction. As a result, V_2 has shown a remarkable secular stability since the early 1960's.

It is difficult to estimate precisely the effects of these regulatory actions.[1/] But a sense of their importance can be readily seen. Since the early 1960's, V_2 has displayed a sawtooth pattern. Relative peaks in the V_2 sawtooth are typically associated with high interest rates and with increases in Regulation Q interest rate ceilings. Prior to the peak as other time and savings deposits grow more slowly

1/ There are a number of technical reasons for this statement, but the principal one is statistical and has to do with the relatively small number of observations representing Regulation Q changes. An increase in the rate ceilings at commercial banks has two immediate effects on the demand for M_2. It lowers the demand for demand deposits and increases the demand for time and savings deposits. Presumably, the second effect dominates and M_2 demands increase with an increase in the ceiling. It has been argued that conventionally estimated demand deposit demand functions overstate the effect on demand deposits as a consequence of aggregation bias; see Farr, Porter, and Pruit, "The Demand Deposit Ownership Survey," pp. 34-35, in Staff Studies for the Committee on Monetary Statistics, forthcoming.

or even begin to decline, V_2 increases sharply. An increase in Regulation Q ceiling rates then typically occurs, which permits banks to increase offering rates on these deposits. Over time funds tend to be drawn away from competing market instruments and into M_2. Ultimately, the spurt in V_2 is reversed. The attached memo by Dave Wyss provides an estimate of such an effect for the January, 1970 increase in Regulation Q using the Board's quarterly econometric model.[1/] The simulations indicate that V_2 would have remained significantly higher if the Q ceilings rates had not been raised.[2/]

The secular stability of V_2 since the early 1960's is replicated on average in the San Francisco Federal Reserve Bank staff's M_2 equation because the sum of money and income coefficients equalling less than unity just counteracts the positive time trend. But because the equation does not capture the depressing impact of the Regulation Q changes on V_2, it must necessarily underestimate the effects working in the other direction of the "other things" mentioned above. It basically averages out the two effects. Hence, if Regulation Q were administered differently in the future than it has been in the past, their M_2 equation should be expected to systematically misforecast GNP.

The second drawback of the reduced form approach is that it can not solve the problem of simultaneous interaction between

1/ David Wyss, "Effect of Regulation Q Changes in the MPS Quarterly Model," memo to Mr. Porter, June 1, 1977.

2/ The effect on V_2 would have been larger if the disaggregation argument of the previous page's footnote is valid.

the monetary aggregate and GNP. The Federal Reserve's control over quarterly monetary growth is not exact. Nor, throughout most of the sample period, has the Federal Reserve attempted to closely control the monetary aggregates, and even less so for M_2 than for M_1. As a result, quarterly money growth would, through the demand side, generally have an endogenous component as it is affected by current GNP. Both the San Francisco Federal Reserve Bank's equations and the Lindsey equations contain a current quarter's money term to help explain current GNP. Despite their protestations to the contrary, the San Francisco Federal Reserve bank staff's causality tests do not rule out a causal influence going from current GNP to current M_1 and M_2.[1/] The existence of simultaneous feedback from income to money, via a money demand function would imply an artificially good fit of their reduced forms and a bias in at least the coefficient of the current quarter's money aggregate in their equations and in all the monetary aggregate coefficients in the Lindsey equations fit by Almon lags. The effects on GNP of deliberate policy manipulation of the aggregate could prove to be at odds with

1/ Their memorandum asserts that "the causal tests are important because the lack of feedback allows us to assign the relatively strong contemporary correlation between income and money to the relations explaining income with money" (p. 27). This statement is in error. Tests of causality in the Granger sense are silent on the question of the direction of contemporaneous causality. The San Francisco Federal Reserve Bank staff's tests suggest only that current money is independent of lagged GNP, not current GNP. The statement that "R_1 will be zero if and only if P_1 is zero" (p. 25) is not true because only a contemporaneous relationship may exist.

the forecasts of either sets of equations. In particular, if the Federal Reserve switched to an M_2 targeting procedure and, thus, altered the behavior of this aggregate over time, there is every reason to expect that the coefficients of the "reduced form" equations would be systematically altered and that the predictive ability of the estimated equations would break down.[1/]

The third limitation of the reduced form approach for determining which aggregate provides closer projections of GNP is procedural in nature. The Board staff and the FOMC do not rely solely upon formal econometric model simulations in making projections or determining policy actions. A great deal of other information is brought to bear in an attempt to compensate for emerging errors in econometric relationships. A wide variety of techniques, some of them purely judgmental, are employed in determining projections of nominal GNP. It is highly uncertain whether such "pooled" forecasts would have been better if the San Francisco Federal Reserve Bank's reduced form with M_2 had been included as one of the inputs and the M_1 equation had been excluded.

A related point is that the theory of optimal forecasting suggests that both the M_2 and M_1 equation's predictions should be considered in arriving at a pooled GNP forecast.[2/] The optimal

1/ See Robert Lucus, "Econometric Policy Evaluation: A Critique," in Carnegie-Rochester Conferences Series on Public Policies, Vol. 2.

2/ See John Kalchbrenner and Peter Tinsley, "On Filtering Auxiliary Information in Short-Run Monetary Policy," Board of Governors of the Federal Reserve System mimeograph.

weights to apply to each equation's predictions depends on the variance and covariance properties of the equation's errors. The point to be made here is that only in pathological cases would a weight of 100 percent be assigned to one equation's predictions and a weight of zero be assigned to another equation's predictions.

Errors in Estimates of the Demand for Money

It is unquestionably true that the standard specification of the demand for demand deposits as in the Board staff FMP quarterly model as well as alternative specifications[1/] fail to explain the slow demand deposit growth relative to changes in GNP and interest rates since mid-1974. The Paulus and Axilrod adjustments are by no means sufficient to account for the errors. Unfortunately, to our knowledge the explanation for the entire shortfall in M_1 has not been provided.

However, Goldfeld has fit demand equations for M_2 and other time and savings deposits, which predict recent levels quite closely when adjusted by the Paulus and Axilrod figures. But the implicit M_1 equation embedded in Goldfeld's M_2 and time

1/ See, for example, Jared Enzler, Lewis Johnson, and John Paulus, "Some Problems in Money Demand," BPEA, 1:1976, pp. 261-80 and Stephen M. Goldfeld, BPEA, 3, 1976, pp. 683-739.

and savings functions is rather odd, to say the least, and we are inclined to doubt that Goldfeld's M_2 equation is much more than a statistical fluke.[1/]

Moreover, regardless of one's view of Goldfeld's M_2 demand equation, its relationship to the San Francisco Federal Reserve Bank's M_2 reduced form equation remains totally unspecified. The properties of a structural equation do not necessarily apply to a reduced form and vice versa.

Changing Response of the Time and Savings Component of M_2 to Interest Rate Movements

As noted above, the components of M_2 are not homogeneous but are imperfect substitutes for each other. The San Francisco Federal Reserve Bank staff appears to make a virtue out of this heterogeneity by arguing that the inclusion of some large CD's in M_2 has recently been beneficial over the last 1½ years. Using

1/ Shown below are the elasticities of M_1 with respect to real income and the Treasury bill rate implied by the Goldfeld equations in Table 16 (p. 723):

Real Per Capita GNP		Bill Rate	
Short Run	Long Run	Short Run	Long Run
.12	1.23	.003	-.027

These are based on weights of 3/7 for M_1 and 4/7 for other time and savings. Note that the bill rate has a positive coefficient in the short run and a very small elasticity in the long run. Also, the elasticity with respect to real income is greater than one suggesting M_1 is a luxury good. In most periods, this equation would give rather poor predictions.

this reasoning, however, the impact on M_2 growth of the runoff of large CD's included in M_2 has roughly been offset by the increase in interest-sensitive business savings deposits at commercial banks. As Brayton indicates in the attached memo,[1/] there is no reason to expect that this offsetting tendency will continue to hold in the future. The large CD component of M_2 is roughly ten times greater than business passbook accounts. Moreover, a large fraction of the growth in these business accounts was a one-time occurrence reflecting portfolio adjustments resulting from the new opportunity to hold these accounts. Thus, the future behavior of M_2 may be influenced more than in the recent past by its large CD component. Thus, M_2 may come to behave more like the past behavior of M_4 than that of M_2.

The upshot of this line of reasoning is that one should look at the relationship between M_4 and GNP as a guide to the future strength of relationship between M_2 and GNP. When this is done, Brayton finds that of the four aggregates, (M_1, M_2, M_3, and M_4), M_4 performs worst both within and outside the sample period.

1/ See Flint Brayton, "Comments on the San Francisco Memo," memo to Mr. Kalchbrenner, May 25, 1977.