Remarks on the Measurement
and the Determinants of the Money Supply

In this paper the money supply or money stock is defined in the usual narrow sense as being the sum of (a) notes and coins and (b) sight deposits (demand deposits) in the hands of individuals (private households) and enterprises at a point of time. The money supply in this sense represents the total stock of means of payments which individuals and enterprises (shortly: the private sector or the public) at a given point of time immediately can dispose of for transaction purposes (1).

The renaissance of monetary policy after the second world war has naturally led to an increase of interest not only in the problems of measurement of the money stock and its changes through time, but also in the factors which determine the size and changes of the money stock at any time. A great number of central banks and statistical offices to-day publish statistics relating directly or indirectly to the money stock and its changes (2). The "Bank deutscher Länder" — the forerunner of the Deutsche Bundesbank — began, already immediately after the Monetary Reform (1948), to publish statistics about the money stock (both, in the narrow and in the wider sense) and its changes (3). Since its foundation in 1957 the Bundesbank has continued and enlarged these statistics under the title "Monetäre Gesamtanalyse" (Monetary aggregate analysis); since

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(1) The notion of the so defined money stock has to be distinguished from the money stock in the wider sense, which includes also notes and coins and sight deposits at commercial banks and at the central bank in the hands of public authorities.

(2) A presentation of the work done in this direction until 1956-57 is given by EARL HICKS in *Staff Papers*, International Monetary Fund, Vol. V, 1956-57, pp. 342 ff.

(3) A summary of the results has been published in *Statistisches Handbuch der Bank deutscher Länder 1948-1954* (Frankfurt a.M. 1955); Chapter I.

1965 they are published regularly in the monthly and annual reports under the title "Development and determinants of the money stock" (4).

I. Statistical Aspects of the Determination of the Money Supply

1. The size of the money stock at a given point of time can immediately be seen from a consolidated balance sheet of the banking system (central bank and commercial banks). Such a consolidated balance sheet contains, as is well known, the following positions:

Assets (A)	Liabilities (L)
A I: Central bank loans to domestic non-banks.	L I: Notes and coins in circulation (excluding commercial banks' cash holdings).
A II: Commercial banks' loans to domestic non-banks.	L II: Sight deposits of domestic non-banks.
A III: Foreign claims (incl. gold).	L III: Time deposits of domestic non-banks (incl. savings deposits).
A IV: Other assets (not contained in I-III).	L IV: Foreign liabilities.
	L V: Other liabilities (not contained in I-IV).

The sum of L I and L II represents the *money stock in the wider sense* (i.e. including notes and coins and sight deposits in the hands of public authorities). The money stock *in the narrow sense* is obtained by deducting from L I and L II the part of notes, coins and sight deposits in the hands of public authorities.

2. According to the mechanics of double entry book-keeping the sum of all assets must be equal to the sum of all liabilities; i.e. it must be:

$$A\ I + A\ II + A\ III + A\ IV$$
$$= L\ I + L\ II + L\ III + L\ IV + L\ V.$$

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(4) An extensive comment to these statistics is to be found in the Bundesbank-report for February 1965.

Therefore, the money stock (in the wider sense) L I + II is also given by the algebraic sum:

$$A \ I + A \ II + A \ III + A \ IV - L \ III - L \ IV - L \ V.$$

Any change of the money stock can therefore be expressed by the changes of all terms in this algebraic sum (5).

Change of the money stock *in the narrow sense* in a given period is:

(1) change of loans of all banks (central bank and commercial banks) to domestic non-banks;

+ (2) change of net claims of all banks (central bank and commercial banks) on foreigners;

— (3) change of time liabilities to domestic non-banks;

— (4) change of central bank liabilities and commercial banks liabilities to domestic public authorities;

+ (5) change of other claims (net).

3. Up to this point there should be no problems. What we have dealt with is a statistical ex post-calculation of the money stock and its e.g. yearly or monthly changes. The difficulties begin when one believes — on the basis of observed consolidated balance sheets of the banking system or of time series of, e.g., yearly changes of the money stock — it is possible to draw conclusions with regard to the *determinants* of the money stock and its changes through time. Some central banks give their statistical tables of the above-mentioned type the headline "*Causal* Determinants of the Money Supply", indicating by this title that such a book-keeping identity also allows for a causal analysis to be made of the changes in the money supply in the sense that the five terms in the algebraic sum, discussed above, also are the causal determinants of changes in the money supply. Nothing would be wronger than this conclusion. *Identities never permit causal conclusions.* So it is, e.g., wrong — as is done here and there — to express the five positions in the above-mentioned equation as percentages of the money supply and to say, position [1] had contributed by x %, position [2]

(5) It is this method which is applied by the Deutsche Bundesbank in its reports.

by y %, etc. to the change in the money supply (6). The Deutsche Bundesbank draws *expressis verbis* attention to the fact that "statistical data" do not permit "a consequent causal analysis" (7). The bank also emphasizes that the five components in the above-mentioned equation are factors "which can be separated numerically but between which there exist functional interdependencies" (8). Causal conclusions presuppose the knowledge of these interdependencies. Moreover, it has to be known how the decision making units through their behavior influence the money stock. An analysis of the determinants of the money stock and its changes is possible only within the framework of a model which contains equations expressing this behavior. Without the knowledge of the behavior of the relevant decision making units the problem of the control of money supply cannot be understood and solved.

II. The Problem of the Determinants of the Money Supply

1. The decision making units, relevant for the size of the money stock and its changes, are at any point of time the central bank, the commercial banks, the public authorities, private households, and enterprises. The central bank influences the money stock by its open market operations, minimum reserve requirements, and discount policy. The commercial banks exert their influence through changes in their assets and liabilities; the public authorities contribute to the size of the money stock through their monetary and fiscal policy decisions; the private sector (households and enterprises) influences the money stock by its decisions about the composition of

(6) E.g., G. L. Bell and L. S. Berman, "Changes in the Money Supply in the United Kingdom, 1954 to 1964", *Economica*, New Series, Vol. 33, May 1966, Table 7, p. 162. In a critical comment D. K. Sheppard rightly remarks: "The basic objection to the use of such accounting techniques for depicting a causal relationship is that the results are the products of definitions. Accounting techniques describe how the components of some predefined variable have changed — *and that is the end of the matter*". (The italics are mine. E.S.). D. K. Sheppard, "Changes in the Money Supply in the United Kingdom, 1954 to 1964: A Comment", *Economica*, New Series, Vol. 35, August 1958, p. 299. Further: M. J. Artis, "Two Aspects of the Monetary Debate", *National Institute Economic Review*, No. 49, August 1969, first above pp. 42 ff.

(7) February-report 1965, p. 25. It would have been better to say that they do not at all permit causal conclusions and, therefore, in the headline of the table not to speak of causal determinants but simply of the development of the money supply.

(8) L. c., p. 26.

its assets. *The actual size of the money stock at any moment is the result of all these individual decisions, and its changes are the result of changes in the action parameters of all decision making units.*

The functional relation between the money stock and these action parameters (e.g. a change of the stock of central bank money through open market operations) is, as is well known, called the money supply function (9). The knowledge of this function would enable us to forecast the effects on the money stock of a change in one or more action parameters of the decision making units. This is a reason for the increasing interest in the determination of this function.

2. One often-used way of finding the determinants of the money supply is the following (10):

Let us denote by Z_p central bank money (notes) in the hands of the private sector, by D_p sight deposits of the private sector in commercial banks (11). The money supply M in the narrow sense is then given by:

$$[1] \qquad M = Z_p + D_p.$$

According to its payments habits the private sector divides the total money stock in its hands into the two components: notes and sight deposits. Let us denote this ratio by k:

$$[2] \qquad k = \frac{Z_p}{D_p}.$$

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(9) " A money supply function relates the nominal money supply to a number of policy-controlled variables and instruments, to other financial variables, and to non-financial and exogenous variables. This function provides us with the money supply response to a change in the monetary base, to a change in reserve requirements, to a change in the discount rate and to changes in other variables ". David I. Fand and John E. Tower, "An Analysis of the Money Supply Process in Canada ", *The Canadian Journal of Economics*, May 1968, pp. 380 ff. See also: D. I. Fand, " Some Implications of Money Supply Analysis ", *American Economic Review*, Vol. LVII, May 1967, No. 2, pp. 380 ff.

(10) See e.g. A. Gambino, " Money Supply and Interest Rate in Recent Macro-Economic Conception ", in this Review, No. 30, September 1954, Chapter IV, Statistical Assessments. J. L. Jordan, " Elements of Money Stock Determination ", in *Review Federal Reserve Bank of St. Louis*, October 1969, J. Siebke and Manfred Willms, " Das Geldangebot in der Bundesrepublik Deutschland. Eine empirische Analyse für die Periode von 1958-1968 ", in *Zeitschrift für die gesamte Staatswissenschaft*, Bd. 126, 1970.

(11) It is assumed that private households and enterprises do not hold sight deposits in the central bank.

Then we have:

$$[2a] \qquad \frac{D_p}{M} = \frac{1}{1+k}$$

and

$$[2b] \qquad \frac{Z_p}{M} = \frac{k}{1+k}.$$

The proportion k expresses the behavior of the private sector with regard to the payments habits.

By adding to Z_p the amount of central bank money held by commercial banks (Z_b) we get the so-called *monetary base* Z:

$$[3] \qquad Z = Z_p + Z_b,$$

i.e. the total amount of central bank money in the hands of commercial banks and the private sector.

We introduce further the ratio r:

$$[4] \qquad r = \frac{Z_b}{D_p + T}, \quad (12)$$

where T stands for the time deposits held by the public, and finally the ratio t:

$$[5] \qquad t = \frac{T}{D_p}.$$

r expresses Z_b as a percentage of all deposits (sight and time deposits) of the private sector; and t indicates how the public divides its deposits between sight and time deposits.

If we know the *three behavior coefficients* k, r, and t the five equations [1]-[5] determine the money stock M and the other variables Z_p, Z_b, D_p, T corresponding to a given monetary base Z. The solution of the five equations leads to the result:

$$[6] \qquad M = \frac{1+k}{k + r \cdot (1+t)} \cdot Z.$$

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(12) We assume for simplicity that the public authorities do not hold sight deposits in the commercial banks.

It is important to emphasize that the numerical values of the three behavior coefficients r, k, t and, therefore, the numerical value of the "multiplier" in [6]:

$$\frac{1+k}{k+r \cdot (1+t)}$$

are *actual, observed figures*, determined at any point of time by the behavior of the commercial banks and the public (private households and enterprises). Therefore, one must *not* regard r, k, and t as the *determinants* of the money stock corresponding to a given quantity of central bank money. If it were known how the numerical value of the multiplier changes through time, it would, of course, be possible to predict the money supply corresponding to a given quantity of central bank money. But just this variation of the multiplier through time presupposes the knowledge of the commercial banks' reserve policy and of the public's behavior with regard to its payments habits and to its portfolio decisions. The relation [6] is not a money supply function in the sense that it establishes a relation between the money stock and *policy controlled* variables and instruments. *None of the actual, observed coefficients k, r, t has the character of a policy controlled variable* (13).

Equation [6], therefore, permits no prediction about the influence on the money stock of a variation of the quantity of central bank money. The multiplier is not a constant and does not vary in a regular, predictable way. It is at any time determined by the behavior of the commercial banks *and* the public.

The prediction problem cannot be solved by extrapolation of observed time series for r, t, and k. The statement "The degree of accuracy that can be achieved by the monetary authorities in controlling the money stock is a function of their ability to determine the monetary base, and to predict the net influence of the public's and banks' behavior as summarized by changes in the money supply multiplier" (14) *poses the problem, but does not solve it.*

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(13) In countries where the central bank fixes a legal minimum reserve rate, and *the actual r would always coincide with the legal rate*, the observed r would, of course, be a policy controlled variable.

(14) J. L. JORDAN, "Elements of Money Stock Determination", *l. c.,* p. 19.

In this context it has to be emphasized that the multiplier in [6] must not be confused with the *money creation multiplier*, known from the theory of the multiplying power of bank reserves. This multiplier determines the credit *potential* (credit capacity) of a system of commercial banks on the basis of a given change of central bank money, a given minimum reserve ratio (which is not to be confused with the actual, observed ratio) and a given k and t. Both multipliers are *formally* identical, but *logically* perfectly different. For $t = 0$, e.g., we have:

$$[7] \qquad \Delta K_r = \frac{1+k}{r+k} \cdot \Delta Z \ (15),$$

where ΔZ denotes a change of the quantity of central bank money (e.g. by open market operations) and ΔK_r the corresponding change of the commercial *banking systems credit potential*. Observe that r in [7] indicates the minimum reserve ratio as fixed by the central bank, not, as in [6], the actual, observed reserve ratio. In [7] the multiplier determines the maximum amount of credit the *commercial banking system can* give on the basis of e.g. an influx of new central bank money; in [6] the multiplier determines the *actual money* stock or its change and, therefore, simultaneously the *degree of utilization of the credit potential.*

It is evident that this degree depends as much on the demand for credit by the public as on the willingness of the banks to supply credit.

3. It cannot be emphasized strongly enough that the *actual* money stock at any time is *an endogenous variable*; its numerical value is determined *simultaneously* by the behavior of the decision making units in the real *and* in the monetary sector. The propensities to consume *and* to invest, the budget of the state are determinants of the actual money stock as well as the money supply function and the money demand function *both* for central bank

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(15) For a derivation see E. SCHNEIDER, *Money, Income and Employment*, London, 1962, p. 48.

money and commercial banks' money (16). It is not the banking system (central bank and commercial banks) alone which determines the numerical value of the money stock, and, therewith, the degree of utilization of the credit capacity of the commercial banking system. *It is*, therefore, *impossible to find the determinants of the money stock in the monetary sector alone.*

4. The simple Keynes-model of the "General Theory" does not lead to these results. The reason is obvious. The Keynes-model refers to an economic system with one bank only which autonomously determines the money stock. In this world the actual money stock is always equal to the quantity of money created by the universal bank. In the equilibrium state individuals hold exactly the quantity of money which has been created by the universal bank.

First in a world with a *mixed banking system*, i.e. a central bank surrounded by a group of commercial banks with the power to create bank money, arises the question of what determines the actual size of the money stock and the degree of utilization of the credit potential of the commercial banks (17). Here it becomes clear that the actual size of the money stock depends not only on the behavior of the banks (central bank *and* commercial banks) but also on the behavior of the decision making units in the real sector (households and enterprises) and, therefore, is an endogenously determined quantity within the framework of the total system.

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(16) For a discussion of this problem see: J. J. POLAK and W. H. WHITE, "The Effect of Income Expansion in the Quantity of Money", in *Staff Papers*, International Monetary Fund, Vol. IV, 1955, pp. 398 ff.; L. JOHANSEN, "Bankernes Rolle i en makroøkonomisk Modell", in *Statsøkonomisk Tidskrift*, 1956 (English translation in *International Economic Papers*, London, 1958);K. BRUNNER, "A Scheme for the Supply Theory of Money", in *International Economic Review*, Vol. II, 1961; V. ARGY, "Money Supply Theory and the Money Multiplier", in *Australian Economic Papers*, Vol. 4, 1965, pp. 27 ff.; R. L. TEIGEN, "Demand and Supply Functions for Money in the United States: Some Structural Estimates", in *Econometrica*, Vol. 32, 1964, pp. 476 ff.; R. L. TEIGEN, "The Demand for and Supply of Money", in: W. L. SMITH and R. L. TEIGEN, *Readings in Money, National Income and Stabilization Policy*, Homewood, Ill., 1. edition 1965; A. LEPONIEMI, *On the Demand and Supply of Money: The Evidence from the Quarterly Time Series in the United States, the United Kingdom and Finland 1949-1962*, Helsinki, 1966; R. RICHTER, "Die Rolle der Banken in makroökonomischen Modellen", in *Jahrbücher für Nationalökonomie und Statistik*, Bd. 180, 1967, pp. 441 ff.; N. KALDOR, "The New Monetarism", in *Lloyds Bank Review*, No. 97, July 1970.

(17) This problem, as far as I know, was first touched on by BÖRGE KRAGH in his book *Prisbildningen på Kreditmarknaden* (Uppsala, 1951).

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5. From the fact that the actual quantity of money is an endogenously determined quantity if follows immediately that the *actual* money stock and its changes *cannot be controlled by the central bank*, unless the bank were to know in advance the factors outside its control with regard to their direction and strength. This knowledge is, of course, very difficult, if not impossible, to obtain, which means that in practice the bank has no control over the actual money stock.

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