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A Survey of Selected Issues in Monetary Theory*

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I. The Nature of Our Problem

The development of human knowledge progresses rarely at an even pace. The history of logic covers periods of growth and long decay distributed over more than 2000 years. The history of monetary theory is certainly much shorter. Still, the patterns of growth, stagnation or even decay are clearly visible over 200 years. The "Keynesian Revolution" initiated a period of pronounced stagnation in monetary analysis. Important problems bearing on various aspects of mone-

tary processes were disregarded and did not receive the attention required for an adequate clarification. The analytic paradigm dominating our profession was poorly designed to guide fruitful research into the nature of monetary processes. This phase of our intellectual history produced the Radcliffe Report published in 1959. The timing of the Report is noteworthy. It marked approximately the end of the stagnation phase. Of course, the transition is neither clear nor dramatic. Reservations concerning the ruling paradigm occured throughout its victorious sweep of textbooks and college courses [1]. Moreover, questions about the nature of monetary processes persisted which were difficult to reconcile with the dominant paradigm. Lastly, inflationary experiences and repeated balance of payments problems widened the cracks in the paradigmatic edifice. By the time the National Bureau of Economic Research organized a Conference on Monetary Theory in Pittsburgh (1962) the transition was complete. The discussion at the Conference opened a new phase in the development of monetary theory.

This phase of intellectual ferment and productivity yielded many important contributions. Moreover, the range of participants usefully contributing to our expanding knowledge has been remarkably widened. The recent development of monetary theory exhibits furthermore a new aspect of fundamental importance. Economists traditionally used two distinct, unrelated languages. One language was used to develop and discuss " monetary theory" and an entirely different language was applied to the discussions of monetary policy and the " institutional" arrangements of the banking system or credit markets. This separation of language systems yielded a monetary theory unable to cope with the problems actually confronting policymakers. There also evolved a mode of discussion bearing on monetary arrangements and policy which relied in the absence of appropriate analytic foundations on purely impressionistic responses. Our intellectual schizophrenia thus yielded a monetary theory of dubious relevance and a monetary policy of questionable quality [2].

This division in our language systems has been effectively broken by recent developments of monetary theory. "Monetary theory" has become more than a name covering elaborations of syntactical exercises or the formal manipulation of models with little or no attention to their empirical content or range of relevant applicability. The formulation of theories and hypotheses gradually drifted into a middle ground which provides a common language system both for the meaningful discussion of monetary analysis and the analytic clarification of policy and

[1] Clark Warburton deserves substantial credit in this respect. Throughout the 1940's he insisted on important questions and relevant issues. My own reassessment occurred around 1954. Allan Meltzer was at the time a graduate student at UCLA.

[2] The paper by Paul Samuelson "What Classical and Neo-Classical Monetary Theory Really Was" in the *Canadian Journal of Economics*, February 1968, provides an excellent example illustrating the contention made.

institutional arrangements. Theories and hypotheses become more explicitly constructed. They are also constructed to explain effectively our observable environment and to bear significantly on our serious policy problems. A rationalist tradition and a naive empiricism combined to obstruct over many decades the successful application of empirical science to the range of monetary processes. The residues of these notions are still visible in many discussions and obstruct on numerous occasions the resolution of resolvable issues[3].

The intrusion of empirical science probably intensified the intellectual conflicts. The separation of analytic and policy discussions subtly protected the policy institutions from critical examination by analysts, and protected analysts from intrusion of relevant questions. The mutual exposure of "theory" and "practice" raised new questions and forced a reexamination of many beliefs and conjectures. The level of controversy was thus bound to increase. The discussion of highly constructed issues with little bearing on our environmental problems does not propagate a vehement controversy. The very intensitiy of recent controversies in monetary theory and monetary policy attests therefore to the relevance and relative importance of the issues under examination. A survey of these issues may usefully contribute to clarify the nature of the controversy and delineate more sharply the character of alternative conjectures. Most particularly, a survey should hasten the burial of irrelevant or misconstrued problems and provide tighter information with respect to the analytic and empirical work required to reconcile various positions or effectively discard some competing views.

The survey developed is however neither complete nor exhaustive. Several excellent surveys of monetary theory were published over the past decade and there is little need to duplicate this work[4]. The current survey will omit many issues covered in depth by Harry Johnson, Allan H. Meltzer or Jerome Stein. It will select however a number of problems either omitted or covered somewhat lightly by the three authors. The extent and frequency of attention evidenced in recent disputes guided the selection of major issues included in this survey. We begin in section II with the microfoundations of money. This involves a clarification of the productivity of money and an explication concerning the nature of the

[3] This thesis has been developed in my papers "Assumptions and the Cognitive Quality of Theories", *Synthese*, December 1969, and "A Case Study on the Importance of Appropriate Rules for the Competitive Market of Ideas and Beliefs", *Schweizerische Zeitschrift für Volkswirtschaft und Statistik*, 1967.

[4] The reader should consult particularly Harry Johnson, "Monetary Theory and Monetary Policy" *American Economic Review*, June 1962; Harry Johnson, "Recent Developments in Monetary Theory: A Commentary", a paper presented at the "Radcliffe—Ten Years After", Conference, October 1969; Allan H. Meltzer, "Money, Intermediation and Growth", *Journal of Economic Literature*, March 1969; Jerome Stein, "Monetary Growth Theory in Perspective", *American Economic Review*, March 1970.

services yielded by money. This micro-analysis also subsumes major problems bearing on the optimal stock of money. Section III examines alternative notions concerning the nature of the transmission mechanism. The following section IV discusses some of the most relevant aspects of policy implications associated with alternative views about the transmission mechanism. Section V considers a range of conjectures about the nature of an economy's impulse force and dynamic propagation. These conjectures have immediate implications for the proper course of stabilization policies. The next section (i. e. VI), elaborates some major aspects of the monetarist view. The developments of money supply theory and monetary system analysis is considered in section VII. The controllability of monetary aggregates, the role of the public's behavior and bank behavior relative to the behavior of the monetary authorities, the working of various policy instruments form some of the major issues examined. The central contentions advanced by the New View are also given a critical assessment. The last section ponders the central aspects of monetary policy analysis and the requirements of rational policy making. It will be shown that most policy problems seriously discussed can be subsumed under an information problem, an interpretation problem and a determination problem confronting the monetary authorities of each country.

II. The Micro-Analysis of Money

1. The Problem Inherited

The existence and use of money remained an embarrassing puzzle for monetary analysis. We observe over man's history that social groups without generally accepted media of exchange exhibit poor survival characteristics. Most social groups do not use assets (or commodities) at random in the execution of exchanges. One observes that a small subset of assets is dominantly used in transactions. These transaction-dominating assets are usually referred to as money. The literature contains many suggestive attempts to explain the emergence and role of money. The classic writers made passing references in somewhat pictorial language to the extension of markets and increasing labor productivity induced by the use of a general medium of exchange. This idea has never been systematically developed however.

The allocation of wealth to an asset with no apparent yield remained an unsettled problem throughout the "Keynesian Revolution" and recent monetarist reexaminations of monetary analysis. The motivational classification introduced by Keynes manifested a suggestive force beyond its meagre analytic contribution. It yields no explanation of money demand and accepts the es-

tablished existence of money. Other explanations of the use of money encountered in the literature fail for the same reason. The use of money has been linked on occasion with uncertainty with respect to the price-level, with respect to interest rates or with respect to the timing of expenditures and receipts. On other occasions one notes an inherently non-synchroneous nature of payments and receipts. These phenomena contribute however at most to an explanation of demand for an already existing money. The uncertainties adduced cannot explain the emergence of widely used media of exchange. Uncertainty with respect to the price-level clearly presupposes money, otherwise there would be no price-level to be uncertain about; and uncertainty concerning interest rates only implies per se portfolio adjustments involving securities and other assets. Money is introduced by assumption in order to discuss the portfolio adjustments between securities and money. Similarly, uncertainty about the timing of payments and the non-synchroneous nature of payment schedules only imply the existence of an inventory problem but do not explain the concentration of these inventories on a small subset of assets[5].

Some aspects of recent literature deepen the puzzle. Growth models developed by Tobin and Sidrauski imply that the occurrence of money lowers capital intensity and the real wage. Money appears thus to have a negative total and marginal social productivity[6]. Nevertheless, monetary institutions survive and the public manages to use and hold money. Furthermore, the persistent use of money in hyper-inflation is difficult to reconcile with a negative productivity of money. The observation of substantial readjustment of payment schedules in response to an accelerating inflation reenforces doubts about a position which assigns no or even a negative productivity to money. The historical development of monetary institutions including the contemporary evolution suggests the occurrence of a service yield associated with the use and holding of money. This has been gradually recognized in recent discussions. Friedman explicitly acknowledges such a service yield in his analysis of the optimum stock of money. Pesek-Saving discuss the positive social (total and marginal) productivity of money. Patinkin and Stein introduce both a marginal utility and a marginal productivity into the analysis, i. e. real balances occur as arguments of the utility function and the production function. Johnson on the other hand denied the productivity of money but admitted a utility impact of service yields. Samuelson's vision of

[5] Patinkin's careful work reveals the problem most distinctly. Throughout his micro-analysis of money the use of money is postulated. The Baumol-Tobin inventory model also presupposes the existence of money. The operation of transaction costs only determines the allocation of "working balances" between securities and money.

[6] The reader may consult James Tobin, "Money and Economic Growth", *Econometrica*, October 1965; Miguel Sidrauski, *American Economic Review*, May 1967.

"classical monetary theory" assigns a yield flow to money balances in the budget constraint to be added with real income from labor and real capital, and to be allocated over expenditures. But money also yields in Samuelson's world a utility flow to be acknowledged by suitable incorporation into a utility funciton[7].

This development poses important questions which require analytic clarification. Two pairs of issues should be considered: (a) the choice of a utility yield or a productive yield as a primitive term of monetary analysis, and (b) the relative primacy of the wealth-opportunity effect or the welfare-utility effect of money. The recognition of a yield associated with money formed an important development and it reconciled some puzzling phenomena with monetary analysis. It also directed attention to a new problem. The justifications offered for a utility yield of money presuppose without exception the occurrence and role of a generally used medium of exchange. Once money has emerged, it may also acquire an amenity yield, but this yield forms a consequence of the use of money and cannot explain the role of money as a transaction-dominating asset. An explanation of this role also removes the use of the productivity yield as a primitive term. This investigation of the nature of money thus pushes beyond the primitive terms provisionally introduced into our analysis. An examination of the role of money establishes that its emergence modifies the real opportunity set constraining the choice of non-money objects. This modification of the opportunity set measures the total (and marginal) productivity of the use of money. The wealth-opportunity effect of transaction-dominating assets thus forms the central problem in the microanalysis of money. The welfare-utility effect associated with a particular amentity yield is a secondary phenomenon prone to emerge with the successful adoption of media of exchange by a social group. An explanation of such adoption in terms of the opportunity effect of transaction-dominating assets will be outlined in the next section.

2. *The Productivity of Money*

Standard choice theory considers an agent characterized by given endowment and preferences with fully known prices and perfect information about the quality of goods. The physical redistribution of resources or commodities

[7] Milton Friedman, "*The Optimum Stock of Money*", Chicago 1969; Boris Pesek and Thomas Saving, *Money, Wealth and Economic Theory*, New York, 1967; David Levhari and Don Patinkin, "The Role of Money in a Simple Growth Economy", *American Economic Review*, September 1968; Jerome Stein, "The Optimum Quantity of Money", *Journal of Money, Credit and Banking*, November 1970; Harry Johnson, "Inside Money, Outside Money and the Wealth Effect: A Review Essay", *Journal of Money, Credit and Banking*, February 1969; Paul Samuelson, "What Classical and Neo-Classical Monetary Theory Really Was", *Canadian Journal of Economics*, February 1968.

via the market involves moreover, no costs. These conditions describe standard equilibrium theory. They also characterize a state of affairs in which money has no role. Transactions can be arranged at no cost in any direction and for any combination of goods. There is no reason for optimizing behavior to concentrate on a small subset of assets in the execution of transactions. Still "money" is usually introduced into this analysis. But it remains a name (the n-th good) without any economic function and in order to maintain its occurrence a Schumpeterian fate imposes its holding on the members of the social group. Optimizing behavior generates on the other hand transaction-dominating assets and economic agents find it beneficial to use media of exchange once we abandon the full information world.

Consider a representative agent with an initial endowment e. In order to simplify our account, we disregard the physical transformation of the initial endowment expressed by a standard production funciton. The standard presentations of choice theory concentrates on two options. The endowment is allocated between reservation demand and exchange. This exchange involves a costless transformation at fully known prices into commodities with fully known attributes and qualities. It follows that an allocation of resources to produce information or to execute transactions is useless and wasteful. At this stage we abandon the world of full information. The agent suffers a pervasive uncertainty about prices and qualities of goods in a world of incomplete information. The uncertainty about quality and market opportunities contributes to the dispersion of prices prevailing over the economy. At any given moment the agent has an inherited capital of information about market prices and qualities. He has sampled for many goods a lowest and a highest exchange ratio with respect to other goods. These extreme values of the finite sample encountered contain the agent's relevant market information.

In a world of "frictions" and uncertainty about market conditions and qualities, economic agents find it advantageous to acquire information and exploit opportunities for efficient transaction arrangements. Investment of resources in information production raises the expectation of the maximal value and lowers the expectation of the minimal value of the market prices sampled. Moreover, a larger investment to produce information also raises an agent's information level about attributes and qualities. In addition to the production of information an agent also uses resources to produce market exchanges. The transformation of an initial commodity bundle assigned for exchange into a desired terminal bundle can proceed in many different ways. The agent can choose from a vast array of possible transaction arrangements, including the "double coincidence" procedure and a variety of indirect exchanges. Each transaction arrangement requires some resource inputs for efficient execution.

The new options beyond reservation demand and exchange allocation exploited by the agent radically modify his optimizing behavior. He may find it advantageous to sacrifice a portion i of his endowment to produce more information about market conditions and qualities. This investment lowers the allocation to direct use (reservation demand) or exchange. The resulting loss in welfare is however balanced by a gain in welfare due to better information. Investment in production of information improves the expectation of the best exchange ratios sampled. This improvement implies that a given allocation to exchange yields in the average a larger terminal commodity bundle. This is accompanied by more reliable information about the attributes of commodities. The production of information is optimized when the loss in welfare due to the use of endowed resources in the production of information is matched by the gain in welfare associated with more information.

The last option available to the agent is of particular significance for our purpose. This option is expressed by the choice of transaction arrangement. The significance of this option follows from the agent's uneven distribution of information about the attributes of commodities available. This aspect is of fundamental importance in our account of money and is best summarized by three postulates:

i) The marginal cost C of information is a function of the information level I and the object o. We write thus $C = C(I, o)$. The variance of C for any agent at any given information level over the space of all objects is very large.
ii) The distribution of C for given levels of I possesses some similarity among agents in a social group. The lower tail of the distributions contains common objects for most members of the social group. The dependence of the marginal information cost on the technological properties of objects contributes to establish such patterns of similarity.
iii) Repeated encounters with the same objects in market transactions lowers the marginal cost associated with a given information level.

The term "information level" is used here in the nature of a primitive. It certainly requires explication. But our short outline omits such analytic details. Postulates i) and ii) describe the crucial conditions which offer the representative transactor an opportunity to improve his economic welfare by means of an adroit choice of transaction arrangement. Postulats ii) and iii) outline the condition which govern the social convergence of individually optimal transaction arrangements.

Let us return to our representative transactor. He can exchange on the basis of his inherited information, invest in more information and exchange at better conditions, or exploit the conditions under postulates i) and ii). He will

find it advantageous to exchange portions of his endowment into commodities with relatively low marginal information costs for a large fraction of the social group and convert these commodities ultimately into the terminal bundle. This intercalation of assets or commodities with comparatively low marginal information costs can occur as an array of separate steps forming a given transaction arrangement t. The choice of transaction arrangement thus offers opportunities to save resources from investment in the production of information. By an adroit choice of t exploiting commodities with relatively low marginal information costs the representative transactor can improve the terminal position for any given allocation to exchange and without investing more in the production of information. This trade-off between transaction arrangements and investment in information production defines the productivity of t. The selection of transaction arrangements thus modifies the real opportunities of the agent defined in terms of reservation demand and terminal bundle.

The productivity of transaction arrangements expressed by the modification of real opportunities available to the agent can be described in a slightly more formal manner. Let all symbols denote vectors of assets or commodities. The bundle available for exchange and reservation demand is defined by the expression $[e - i - s(t)]$. The resources s invested in producing transactions are a function of the particular transaction arrangement t selected. The vector introduced describes a point in the non-negative cone of the commodity space which lies on the surface characterizing the market opportunities. In the standard case the surface is a hyperplane in the n-dimensional Euclidean commodity space with slopes defined by the price ratios given independently of any information investment. In the absence of full information at zero costs the surface describing the opportunities is in general not a hyperplane. We need not be concerned at this place about the exact form of the surface. It is sufficient for our purposes to note that both environmental conditions and optimizing behavior affect its position. In the standard case the opportunity plane remains independent of optimizing search behavior and summarizes completely the agent's relevant environmental conditions expressed by a given endowment and perfect information about single price commodities. The admission of incomplete information generalizes the environmental conditions. The given prices are replaced by an underlying frequency distribution of exchange ratios which is partly dependent on the community's information level concerning market conditions and qualities.

Our considerations bearing on the use and productivity of money essentially bypass at this occasion any further analysis of the generalized environmental conditions. The argument concentrates on the role of optimizing behavior expressed by investment i and transaction arrangements t. The choice of i and t affects the position of the opportunity surface via two distinct avenues. An

allocation of more resources to information production lowers the adjusted endowment $[e-i-s(t)]$ and modifies simultaneously the slope properties of the surface. A higher information level resulting from a larger i improves the expectations of the best exchange ratios sampled. The agent has thus acquired a new set of market opportunities which is expressed by a new opportunity surface with different slope properties. Moreover, the higher information level yields also additional information about useful transaction arrangements intercalating commodities with more reliable quality characteristics. But acquisition of information by suitable investment of endowed resources is not the only means available to the transactor to modify the opportunity surface. Such modifications can be achieved by adroit selections of transaction arrangements.

These ideas can be expressed by means of the following formulations. Let b denote the vector describing the intersection of the opportunity surface with the coordinates surrounding the positive cone of the commodity space. The vector b is an expected value and is a function of the adjusted endowment, the level of investment i in the production of information and the choice of transaction arrangements t_i, $i = 1 \ldots n$, summarized by the vector t.

$$b = T[e-i-s(t), i, t]$$

The function T expresses the market transformation of the adjusted endowment $[e-i-s(t)]$ according to the expectation of best exchange ratios sampled. These expectations actually define the transformation for any given transaction arrangements. The number of transaction arrangements t_i equals the dimension of the vector. A particular i-th arrangement t_i is associated with the i-th coordinate b_i. In a two-dimensional case the vector b refers to the intercepts on the two coordinates which are connected with the point representing the initial endowment. The slope of the two lines connecting intercepts with endowment represent the expectation of the sample extrema of the relevant exchange ratio for given transaction arrangements. The expectation of the sample extrema of exchange ratios depends on the volume of resources invested in the production of information. Moreover, each transaction arrangement uniquely implies a sequence of exchange ratios, and conversely every sequence of exchange ratios a transaction arrangement. It follows therefore, that the information investment and the transaction arrangement affect the vector b. Larger information investments change the expected sample extrema and different selections of transaction arrangements change the sequence of exchange ratios defining the slopes of the lines connecting the intercepts with the adjusted endowment. The investment required to produce a given information level and the transaction arrangements occur thus as arguments of the function T linking adjusted endowment with the intercepts con-

stituting the vector b. Each intercept coordinate of b has the traditional interpretation. It describes the maximal amount of the particular asset (or commodity) associated with the respective coordinate obtainable under the given information and transaction condition in case the total adjusted endowment were applied to acquire this asset. The choice of i and t obviously exerts both a direct and indirect effect on b. The direct effect of i via the adjusted endowment lowers b and the indirect effect expressed by the second argument raises b. The market transformation function T implies that for any triplet $[(e-i-s(t), i, t]$ constituted by adjusted endowment, information investment i and transaction arrangement t there exists a unique opportunity surface S. The function T associates a unique b with the triplet, and given b and the adjusted endowment all connecting lines are defined and thereby the opportunity surface constituted. It follows that S is a function $\sigma(e, i, t)$ of initial endowment, information investment and transaction arrangement.

The wide distribution of information costs between assets in general and the common social pool of information concerning *some* assets yields a significant responsiveness of the opportunity surface to variations in t. The crucial implication of postulates i) and ii) can now be stated in terms of the opportunity surface S confronting the agent's preference system. Postulates i) and ii) assure us that variations in t over the class of possible transaction arrangements induce corresponding variations over a class of opportunity surfaces for any given endowment e and information investment i. This class contains a surface touching a lowest utility contour and another surface touching a highest utility contour. The difference between these utility levels indexes the productivity of transaction arrangements. This productivity can be expressed in terms of equivalent changes of the original endowment. The utility level $U(\bar{S})$ associated with the maximal surface $\bar{S}(e, i, \bar{t})$ can also be obtained in case an agent insists on replacing the optimal transaction arrangement $\bar{t}$ with the worst arrangement $\underline{t}$ which determines the minimal surface $\underline{S} = s(e, i, t)$. Providence must provide for this purpose a suitable increase in the original endowment to offset the replacement of $\bar{t}$ by $\underline{t}$. This increase in the endowment, appropriately valued according to the slope properties of the optimal surface expresses the total productivity of the optimal transaction arrangement $\bar{t}$. A total productivity can be indicated in a similar manner for any member of the class of possible transaction arrangements.

The optimizing search of economic agents thus determines with the allocation of the endowment between reservation uses, market exchanges and information production, also an optimal transaction arrangement. The choice of such arrangements is not irrelevant. Its effect on the agents' real opportunities implies that transaction arrangements will not be distributed randomly over the possible arrangements. The patterns circumscribed in postulates i)

and ii) direct the arrangements actually executed towards a dominant use of assets with comparatively lower information (and transfer) costs. The two postulates thus assure a clustering of actually occurring transaction procedures. This clustering tends to narrow further with time as a result of the condition stated in postulate iii). The more frequent occurrence of goods with comparatively lower information costs in the group's transaction chains spreads information about these goods and lowers consequently their marginal information costs. The social use of optimal transaction patterns thus converges to a narrow range and the assets intercalated by the chains between initial and terminal position emerge as transaction dominating assets, as the group's media of exchange or monies. This analysis does not imply that individual transaction patterns converge to a single medium of exchange, a single asset used as money. It explains the occurrence of several types of money and also the occurrence of non-money transactions in highly developed economies[8].

3. Some Issues Associated with the Productivity of Transaction-Dominating Assets

The interpretation concerning the productivity of money implies that money is a substitute for human wealth and labor. By using money, individuals reduce the amount of information they must acquire, process, or store and the number of transactions in which they engage in order to exchange their initial endowments for optimal baskets of goods. The use of money increases the welfare of each money user by reducing uncertainty, the length of transaction chains, the variance of price ratios and by increasing expected wealth and time available for leisure. Individuals will find it advantageous to allocate a portion of their wealth to assets typically used in dominant transaction chains. With an inventory of such assets they can initiate exchanges at lower cost. Moreover, individuals with such inventories raise their own welfare by contributing to the transactions associated with the optimal transaction chains of others. An inventory of transaction dominating assets increases the likelihood for a potential transactor to be incorporated in any given transaction chain instituted by others. In particular, it increases the likelihood of incorporation at comparatively advantageous exchange conditions. The social convergence of optimal transaction arrangement thus generates a demand for the media of exchange independent of inherited uses assigned to the medium of exchange assets.

Once the range of transaction dominating assets is well defined the magnitude of average inventories depends on the relation between the net marginal

[8] The reader will find a more detailed account of the analysis summarized in the paper by Karl Brunner and Allan Meltzer, "The Uses of Money: Money in a Theory of Exchange", forthcoming.

productivity and marginal cost of the inventories. The marginal cost expresses the marginal utilities forfeited through allocation of wealth to such inventories. The net marginal productivity measures the net marginal utilities achieved by modifications of the opportunity surface via appropriate selections of transaction arrangements. This modification of the opportunity surface has been shown to be equivalent to a change in the endowment, a change allocable to i or s. The net marginal productivity consists thus of two components, one derived from relative savings of information costs and one derived from relative savings of transfer costs. The operation of the second component becomes particularly important at the margin in the determination of the transactor's optimal inventory. Its relative contribution to the net *marginal* productivity varies probably positively with the average inventory in a highly developed economy. This circumstance shaped perhaps some of the discussions in monetary analysis to be considered in a subsequent paragraph.

The emergence of a social pattern in the use of transaction dominating assets creates the separation of expenditures and receipts and the non-synchronous nature of their flows. Money is thus not held because these flows are non-synchronous. On the contrary, we observe the non-synchronous character of such flows because individuals' optimizing behavior yielded a small range of transaction chains which substitute for resources in the production of information. The emergence of money also affects the intertemporal allocation of resources. The spreading use of assets with low marginal information costs encourages contracts extending into the future. Borrowing, lending and the development of credit expands when a standarized asset with well known properties becomes available.

The analysis developed yields a radically different description of the role of money than the Baumol-Tobin tradition of transaction analysis[9]. The Baumol-Tobin framework removes our central problem by fiat, money already exists. Actually, in the context of Baumol's square root formula analysis, money and securities are simultaneously used without distinction as media of exchange. In Tobins's more developed analysis or in Baumol's extended analysis, the use of money as a unique exchange medium is postulated. This is closely associated in their procedure with narrow constraints on possible transaction arrangements. A small subset of possible transaction patterns pertaining to arrangements involving money and securities is admittedly subject to optimizing behavior. The mass of transaction arrangements bearing on non-financial assets are unalterably fixed by fate and imposed on man. Under

[9] William Baumol, "The Transaction Demand for Cash: An Inventory Theoretic Approach", *Quarterly Journal of Economics*, November 1952. James Tobin, "The Interest Elasticity of the Transaction Demand for Money", *Review of Economics and Statistics*, August 1956.

these circumstances money holdings appear as a consequence of non-synchronous expenditures and receipts. The volume of transactions and transfer costs govern the choice from the remaining minor subset of possible arrangements. Thus emerged Samuelson's "shoe-leather theory" of monetary productivity. Inventories of money save resources used in transfer operations between securities and money or between super market inventories and household inventories, dramatized by the use of shoe-leather (and time) in running to and from banks or appropriate market places. Transfer costs certainly affect the optimal choice of transaction arrangements, but they do not govern the explanation of money. Unfortunately, the concentration on transfer costs becomes unavoidable once the existence of money is postulated and the crucial portions of the transaction arrangement preordained. But this analysis seriously misconstrues the nature of monetary productivity and underestimates its magnitude. Our analysis and the Baumol-Tobin analysis may yield similar results at the margin however. The crucial difference lies in the description of the total wealth contribution made by money through modifications in real opportunities. In our analysis the emergence of transaction dominating assets changes the social group's opportunity set radically. It was argued above that the choice of an optimal transaction chain enables the representative transactor to enlarge the set below the opportunity surface at unchanged allocations to information production. The "shoe-leather theory" on the other hand, determines a small and relatively minor contribution to economic welfare and wealth.

This difference in the wealth implications of money follows from the radical difference in the class of transaction arrangements over which an optimizing behavior is admitted. Our analysis exhibits an optimization over all possible transaction arrangements. The Baumol-Tobin analysis curtails the admissible class to a tiny subclass of the class defined in our analysis. It follows that the *total* productivity attributable to money in the Baumol-Tobin analysis is almost the same as the *marginal* productivity established by the information cost approach. It is easily understandable therefore, that the "New View" found little basis to differentiate between money, i.e. media of exchanges, and financial assets which are not media of exchanges. The analytic frame chosen prevents recognition of the magnitude and nature of the productivity associated with money. The failure to recognize the productivity of money and the essential difference between media of exchange and other assets is a fundamental weakness of the "New View". The existence of substitutability relations between transaction dominating assets and other assets cannot justify the "New View's" disregard of the medium of exchange function. These substitutability relations may affect the marginal productivity, with little significance for *total* productivity. The reduction of the admissible class of transac-

tion arrangements executed by the Baumol-Tobin procedure contributed of course to exaggerate the importance of the substitutability relations. Once total productivity is reduced (approximately) to the level of our marginal productivity, the temptation increases to assert that the substitution relations overshadow everything, with money and non-money substitutes barely distinguishable[10].

The magnitude of the net social productivity characterizing optimal transaction chains deserves some further examination. This magnitude increases with the range of potential transactors experiencing substantial uncertainties about the properties and market conditions of a wide range of goods. There exists also an important connection between frequency and extent of changes in underlying conditions and the (marginal and total) productivity of money. More generally, conditions which raise the marginal information cost of goods relative to the marginal information cost of transaction dominating assets raise the marginal (and total) productivity of money. Accelerated technological changes and innovations which expand the stream of new types of products would thus contribute to increase monetary productivity. Moreover, larger economic fluctuations impose larger information costs on the economy and tend to raise the marginal productivity of money. Our analysis thus implies that the demand for the transaction dominating assets will increase in periods of rapid change and decline in periods of gradual movements of the economy.

The *net* social productivity also depends on the assets selected as media of exchange. Once individuals learn to use money, the private and social cost of making exchanges can be reduced by introducing claims against commodities in place of commodity money. The use of claims or paper money reduces the amount of resources used to make exchanges in three main ways. First, paper money is frequently produced and transferred at lower resource costs. This somewhat less than general proposition is justified in a subsequent paragraph. Second, paper money permits society to develop a fractional reserve money system. This reenforces the savings of resource costs. Third, the acceptability of claims encourages the development of so-called inside money and with it the development of the payments system. The cost of acquiring information about the qualities of paper money, whether inside or outside money, is lowest if the paper money starts as a claim against commodity money. The development of monetary institutions introduced many devices which lowered the

[10] Samuelson's paper developing his interpretation of classical and neo-classical monetary theory (see footnote 2) mentions in passing the quantum jump associated with a qualitative change resulting from the emergence of a transaction dominating asset. The analysis disregards however, this quantum jump and concentrates on the "shoe-leather theory" based on transfer costs.

marginal information or transfer costs of assets already used with some frequency in optimal transaction chains. Coinage is an early step in a long sequence currently experiencing the impact of bank credit cards. These devices widen the existing information costs differential and thus extend the use of the asset involved. They lower in particular the marginal information and transfer costs of deposits. This evolution will modify the relative use of currency and bank deposits and consequently change the currency ratio.

Consider now the reservation noted above concerning the saving of resources associated with paper money. The replacement of metallic (or commodity) money by paper money is usually interpreted to involve a gain in welfare. This account is somewhat incomplete and disregards the relevant operation of information costs. Suppose the paper money is issued by many different sources as a claim on commodity money. Under these circumstances the public will suffer substantially larger information costs than in the case of standardized commodity money. The lower resource cost of producing money is thus partly offset by the higher information cost borne by the paper money using public. It is therefore not possible to conclude without adequate specification that a change from metallic to paper money raises economic welfare. The legislation of the 1860's which replaced private banknotes by US notes appears thus as a device which lowered substantially the public's information costs bearing on paper money. It formed one of the institutional changes alluded to above which raises economic welfare by developing monetary institutions with lower information costs. It should also be noted that frequently the spreading use of banknotes did not occur because metallic money was replaced by paper money. It emerged spontaneously from the public's continuous search for optimal transaction chain. Even assets with larger information costs than already existing money can thus be drawn into the range of transaction dominating assets in response to a rising demand for money, provided a substantial margin still remains relative to information and transfer costs of most other assets[11].

The fundamental postulates do not imply covergence to a single transaction dominating asset. Different types of assets will occur in the transaction chains adopted by the group. This outcome results from differences in marginal information and transfer costs conditioned by the nature of the transaction and the circumstances involved. It follows that monetary productivity attaches to distinct assets, depending only on their use in dominant transaction chains. In particular, the productivity of money and the contribution of money to wealth is not limited to outside money. Both inside and outside money are

[11] The occurrence of information costs attached to private money issues assures the existence of a solution at finite prices for competitively produced private "paper money".

productive, and at the margin, equally productive. This classification of money thus contributes no useful information concerning the effect of money on a social group's real opportunities. It also becomes explainable that even highly developed economies with extensive monetary institutions can exhibit large scale transactions which by-pass the use of money. Such cases always involve an application of specialized human wealth which permits selection of a transaction arrangement with lower transfer cost. Furthermore, sectors of an economy that develop specialized information about the properties of particular assets often find it useful to develop specialized media of exchange.

The analysis outlined centers on the medium of exchange function and this medium of exchange has been identified with money thus far. In particular, the outline above characterized the economic role of the medium of exchange and described the nature of its productivity. The identification of money and media of exchange has been criticized on two grounds however. Tobin is one of the last in a long line emphasizing the existence of close substitutes for money. This position has already been discussed in a previous section. Friedman and Schwartz also criticize the notion that money is a medium of exchange. They describe money as a "temporary abode of purchasing power" and argue that the term medium of exchange is an a priori notion devoid of empirical content. As an example of the deficiency of the medium of exchange concept, they cite the difficulty of using units of currency with large denominations or using checkable deposits in unfamiliar environments.

The Friedman and Schwartz observations are correct and entirely consistent with the analysis summarized. The use of large denominations and checks often involves substantial costs of acquiring information. It is not surprising therefore that five and ten thousand dollar notes never circulated widely but were used primarily for transactions between banks where the marginal cost of acquiring information about the properties of the notes was low. With the development and extension of the Federal funds market and other lower cost means of making interbank transfers, the use of bills of large denomination has declined markedly. Lowering the cost of acquiring information about issuers of checks also increases the use of deposits. Credit cards centralize information about deposit users, lower the sellers' cost of acquiring information, encourage the separation of payments and purchases that is characteristic of a developed monetary economy and thereby increase (relatively) the use of deposits as a medium of exchange.

Moreover, defining money as a temporary abode of purchasing power does not distinguish between properties of assets or between a monetary and a barter economy in a manner independent of the medium of exchange function. Transactors hold intermediate goods temporarily in a barter economy—as part of their transaction chain—if their best information suggests

that by doing so they can make more advantageous exchanges. In this and similar usage, the temporary abode of purchasing power is not distinct from the medium of exchange. On the other hand, the relative length of the holding period for various assets and the extent to which they are temporary abodes is not independent of the way in which the asset renders productive services as a medium of exchange. Both money and durable consumer goods are temporary abodes of purchasing power.

The recognition of the central role of a medium of exchange does not imply that the collection of assets that serve as medium of exchange is most appropriate for explaining movements of the general price level. A definition embracing a larger collection of assets is appropriate if there are close substitutes for the medium of exchange on the supply side. In this case, slight changes in relative prices reallocate output between the medium of exchange and other assets, and the collection of assets most useful for explaning changes in the general price level differs from the assets that serve as medium of exchange. However, even if evidence suggests that a broader collection is justified empirically and the term money is used to refer to the broader collection, the significance of the medium of exchange function and its importance for explaning the productivity of monetary assets remains. In particular, whatever substitution relations exist, the medium of exchange function differentiates the behavior of a small group of assets from all other assets. This funcion explains the increase in real opportunities associated with the use of money and also explains the possible emergence of a utility yield justifying the incorporation of money as an argument of the utility function[12]. These yields are however, characterized by amenity features attached to most items of wealth. The analysis summarized denies the occurrence of an original "convenience yield" properly expressed by a marginal utility. The use of money modifies and extends real opportunities contraining the maximization of utility. And in case the transaction dominating assets are devoid of any previous non-monetary use their utility yield is derived and dependent on their medium of exchange function. The latter assures a positive marginal private (and social) productivity to money and thus determines a positive allocation of individuals' wealth to money inventories. Once such inventories occur as components of individual wealth positions, a utility yield may naturally attach to them, a utility yield similar to the utility yield attached to other wealth items apart and beyond their marginal productivities measured by incremental accruals of real income associated with their possession.

[12] The reader may consult Milton Friedman's, *The Optimum Quantity of Money*, or the paper by Milton Friedman and Anna Schwartz on "The Definition of Money", in the *Journal of Money, Credit and Banking*, February 1969 for an analysis based on the utility yield.

4. *The Neutrality and Optimum Quantity of Money*

The new development in the micro-analysis of money contributes to the clarification of an old issue in monetary theory. The "neutrality of money" has been discussed at length over the decades. It is important to distinguish between two logically independent problems covered by the same label. Neutrality of money in a first sense asserts that variations in the money stock do not modify the magnitude of real variables. In a second sense neutrality means that no modifications of nominal balances can change the total productivity of money.

The discussion of neutrality in the first sense requires an examination of four cases. They are defined according to two pairs of criteria, listed as follows:

(1 a) Anticipated price-level and current price-level coincide.
(1 b) Anticipated price movements disrupt equality between current and anticipated price-levels.
(2 a) Information and adjustment costs are constant proportions of prices.
(2 b) Marginal information and adjustment costs are neither uniform nor constant proportions of prices.

The traditional case discussed refers to state (1 a, 2 a), with the special restriction that costs of information and adjustments have vanished to zero. It has been generally accepted that in this case money is neutral in the first sense. Recent discussions demonstrated however, that the result does not transfer necessarily to neutrality (in the first sense) with respect to each single instrument of monetary policy. Even with neutrality of variations in the money stock some specific instruments of policy can be non-neutral (e.g. ceiling rate, reserve requirements).

The classical state (1 a, 2 a) with the special restriction possesses however, a tenuous relation to our observable environment. There occurs a more fundamental problem however. The classical state contains no money. Our analysis outlined that money, i.e. a small subset of transaction-dominating assets, results from economic agents' innovational response to the operation of information and adjustment costs. In the absence of such costs, exchanges can be arranged in random directions at zero costs. The social group does not generate a subset of transaction-dominating assets and there will consequently be no money. In the absence of money the question of neutrality becomes pointless. The attribution of money to such an economy is also incompatible with the conditions characterizing its state.

This criticism applies to the formulation of the classical idea but not to its intent. The basic idea of monetary neutrality concerns the longer-run effects of monetary impulses. And the characterization (1 a, 2 a) should be understood

as a first approximation to the description of longer-run effects of monetary impulses on real variables. In order to assess the nature of this approximation, states (1 a, 2 b) or (1 b, 2 b) should be considered. Both states acknowledge that information about market opportunities and adjustments of inherited patterns of resource utilization are costly to produce. The "new micro-economics" emerging in the late 1960's develops the implications of these cost functions on resource allocation. Two implications are of particular importance for monetary analysis. The occurrence of non-vanishing marginal costs of information and adjustment implies that market prices do not represent the relevant costs or returns confronting the agent. The relevant costs for the buyer include both price and the marginal cost of information and adjustment. Similarly, for the seller information and adjustment costs must be subtracted from the market price in order to obtain the relevant net market return. Homogeneity of behavior functions with respect to total costs involves in general non-homogeneity with respect to market prices only. It follows furthermore that longer-run behavior functions are approximately homogeneous with respect to prices and nominal values, whereas shorter-run behavior functions are definitely non-homogeneous in terms of prices. This divergence between longer and shorter-run follows from the behavior of information and adjustment costs in the two runs. Average and marginal information costs vanish in the long-run. Similarly, average and marginal adjustment costs tend to a small (positive) magnitude in the long run. The second major implication of the two cost functions studied by the "new micro-economics" is the reversal of the Marshallian ordering of output and price adjustment velocities. The short-run adjustment velocity of quantities exceeds the corresponding velocity of prices in all cases requiring substantial costs of producing information about prevailing market opportunities. Relative short-run price inflexibility thus emerges as a rational consequence of wealth-maximizing behavior in the context of incomplete market information and costly information production. The two major implications of the "new micro-economics" eliminate neutrality of money over the shorter-run. Changes in monetary impulses necessarily modify real variables, total output, employment and the real rate of interest. The same impulse gradually induces an adjustment of the price-level with a speed determined by the load imposed with the impulse and the nature of the cost functions governing production of information and adjustments. Eventually the monetary impulse will be absorbed to a major extent by the response of prices. This longer-run consequence thus justifies the classical state (1 a, 2 a). This description should not be used too literally with the idea that relative prices and other allocative aspects are rigidly invariant in the longer-run. The description remains a useful approximation provided we interpret it to describe essentially aggregative effects. The invariance with respect to the allo-

cative detail should be reinterpreted into a non-systematic influence with pronounced random effects bearing on the full array of relative prices. It is however, important to recognize that the description (1 a, 2 a) yields no analytic foundation for the range of problems confronting the policy maker. These problems pertain without exception to the shorter-run and involve propositions about the shorter-run responses of an economy to monetary and fiscal policy. An aggregative analysis which can be usefully exploited for stabilization purposes thus requires the foundations prepared by the "new price theory". Some major implications of this development will be considered in later chapters of this survey.

The useful development of shorter-run monetary analysis stimulated by price-theoretical reconsiderations also influences our long-run analysis. Once we admitted the role of an information problem into our analysis, condition 1 a) becomes difficult to maintain. The information problem also encompasses the anticipated price movements. It has been customary to constrain the range of relevant information bearing on anticipated price movements on the observations of past price movements. This appears to be an unwarranted constraint. Economic agents probably use a variety of other information channels guided by their conception of price formation in order to assess future price movements. This is an unsettled issue barely approached in monetary analysis[13]. Whatever the appropriate information process governing price anticipations may be, these anticipations should be built into our analysis. They assume a significant role in many short-run problems and most particularly in any attempt to assess the social cost of terminating inflation. Incorporation of anticipated price movements enables us also to generalize the description of the longer-run solution of the shorter-run adjustments. The state (1 b, 2 a), the last of the four combinations resulting from the two pairs of conditions can be interpreted as a useful approximation to the trend underlying the actual economic evolutions. The condition should not be understood to mean the actual prevalence of vanishing information and adjustment costs. It simply means that constant load factors imposed on the process yielding a steady state eliminate substantial variations in marginal costs of information or adjustments. Approximate constancy of these marginal costs is expressed by condition (2 a). The neutrality problem is thus extended to the modified classical state (1 b, 2 a). The previously developed analysis of the medium of exchange function implies that money is not neutral in this state. Variations in the anticipated rate of price movements change the private marginal cost of holding money. The resulting adjustments in real balances modify the marginal productivity until it coincides with the new level of marginal costs. This implies also a change in the total productivity of

[13] The analysis of "efficient markets" recently developed for investigations of security markets could offer a useful avenue for future exploration.

real balances and consequently a corresponding change in the real opportunity set of the social group. The modification of the real opportunity set reveals existence and measures extent of the long-run non-neutrality of money. This same analysis also disposes of neutrality in the second sense. Variations in (nominally measured) monetary impulses can be used to change the volume of real balances via changes in the anticipated rate of inflation (or deflation). This effect assures according to our previous analysis also an adjustment in total productivity.

The non-neutrality of money revealed by the modification of the real opportunity set, poses an issue much discussed in recent years, i. e. the optimal quantity of money. Once it is recognized that money modifies the social group's real opportunity set, the problem of optimal resource allocation extends to the use of money. An optimal allocation assuring an efficient use of resources requires that social and marginal productivity of money be equal to the social and private marginal cost of money. The optimality problem arises as a result of the usual assumption that the social (marginal and average) cost of producing the real volume of money is zero. The private marginal cost of holding money on the other hand is positive and induces thus a real volume with a positive private marginal productivity. It is also postulated that private and social marginal productivity coincide.

Two procedures are available to restore an optimal use of money. One procedure is proposed by Milton Friedman and the other is championed by Harry Johnson[14]. Both proposals involve the creation of a supplementary yield of money, independent of its marginal productivity as a medium of exchange. This supplementary yield disrupts the inherited equilibrium between marginal productivity of money and marginal productivity of real capital, which expresses the marginal cost of holding money. If the supplementary yield is equal to the marginal product of capital, the portfolio responses of economic agents raises the real volume of money via lowered prices induced by the initial excess demand for money. Real balances will expand in response to portfolio adjustments until the marginal productivity has been driven to zero. At this point the optimality conditions equating marginal social cost and productivity is satisfied and the maximal real opportunity set has been squeezed out of the monetary institution.

The difference between the two proposals appears in the nature of the supplementary yield. Friedman advocates an optimal rate of monetary deflation which generates an anticipated rate of price decline (equal to the actual rate) which coincides with the group's rate of time preference. The latter coincides on

[14] Milton Friedman, *The Optimum Quantity of Money*, *op.cit.;* Harry Johnson, "Inside Money, Outside Money, Income, Wealth and Welfare in Monetary Theory", *Journal of Money, Credit and Banking*, February 1969. The reader should also consult the review article by Jerome Stein, "The Optimum Quantity of Money", *Journal of Money, Credit and Banking*, November 1970.

a steady state path with the marginal product of real capital. The expected deflation rate defines under this procedure the supplementary yield on money balances. Johnson proposes on the other hand the payment of interest on money balances equal to the marginal product of capital. Such interest on money would again reduce the marginal productivity to the zero level of marginal social cost.

The difference between optimal deflation and interest payments involves more than variations on elegant manipulations of formal models. Johnson presented some cogent arguments on behalf of interest payments as against the deflation procedure.

> It seems to me irrational to accept institutional arrangements that lead to economic inefficiency on the one hand, and on the other hand to try to persuade government to manipulate the growth of the money supply so as to offset the inefficiencies that result. Either government is unaware of the inefficiencies its practices cause, in which case it should be possible to persuade it to change those practices, specifically to terminate the prohibition of interest payments on demand deposits, to pay interest on reserve deposits of commercial banks at the Federal Reserve and on vault cash, and possibly to seek means of paying interest on the public's currency holdings. Our government is quite aware that it makes a profit out of these practices, and is determined to hold on to it, in which case, as controller of the behavior of the money supply, it will certainly not act so as to deprive itself of those profits.
>
> Assuming that government could be persuaded to eliminate the obviously and easily remediable institutional sources of inefficiency in the money supply—prohibition of interest on commercial bank demand deposits, non-payment of interests on commercial bank deposits at the Federal Reserve and on commercial bank cash—the remaining source of inefficiency in the provision of money (assuming for the moment the maintenance of price stability) would be the non-payment of interest on currency. Here there would be a double source of inefficiency: under present arrangements the holder of currency receives no interest but bears none of the costs of printing and minting required to create and to maintain the currency stock, whereas under efficient arrangements he would receive competitive interest on his bank deposit but pay charges for using bank money for payments. There would thus be incentives to economize on currency holding but to use currency rather than cheques for making payments.
>
> Would the resulting welfare losses be sufficient to justify the adoption of a policy of deflating prices at the current rate of return on capital in order to avoid them? It seems very doubtful, though it may be worth someone's while to quantify. (With currency in circulation among the public running at about five percent of GNP, and the elasticity of substitution between currency and interest-bearing bank deposits probably rather low, the welfare loss calculated on Friedman's lines would probably be a negligible fraction of national income.) The answer would be even more doubtful if, following Friedman's suggestion, commercial banks were allowed to experiment with the issue of interest-bearing notes[15].

Some additional considerations are also relevant. The social cost of moving to the optimal state is usually neglected in the discussions. In particular it is usually

[15] Harry G. Johnson, "Is There an Optimal Money Supply", *Journal of Finance*, May 1970.

assumed that the price-level is adjusted at zero social cost. This position has been reflected in Friedman's formulation of the optimality problem in terms of an externality argument. According to this argument an agent releases real resources whenever he wishes to accumulate real balances. These resources will be absorbed at zero social cost by other agents via suitable price adjustments. The new price theory rejects this argument and emphasizes the social cost of price adjustments. The social cost of an anticipated rate of deflation is negligible, but the transition to this state involves most probably substantial costs. Similarly, the institution of interest payments is not costless. Resources must be invested to execute such arrangements. But it appears probable that the present value of the social costs of transition associated with the two procedures reenforces Johnson's case on behalf of the interest payments.

There remains an almost impossible implementation problem for Friedman's proposal. His analysis contains no operational specification of the (optimal) rate of time preference which governs the optimal rate of monetary deflation. Neither does it describe a mechanism which guides the process to institute a spontaneous search procedure converging to the optimal rate of monetary deflation. Friedman's analysis of an optimal quantity of money thus remains a remote exercise with no relevant application to our observable environment. There is consequently no serious discrepancy between his older monetary rule of a constant monetary growth approximately equal to the average of past growth rates at moderately stable prices and the optimal allocation rule. The older rule remains as a relevant guide line. Its rationale will be considered in a later chapter on monetary policy. We note at the moment that the older rule was designed for purposes of shorter-run adjustments as a means to minimize the social costs of adjustments imposed by substantial and irregular variations in monetary growth. This cost minimization bearing on the degree of variability must be supplemented by cost minimization pertaining to the average inventory of real balances. The latter involves an efficient use of our resources expressed by a marginal social productivity of money equal to the (probably non-vanishing) marginal social cost of producing money. Johnson's proposal can be combined with Friedman's older rule to assure achievement of both efficiency consideration. Moreover, the proposal can be implemented. It certainly would require substantial institutional modifications in order to establish competition with free entry. But such institutions would introduce a spontaneous search behavior converging to the optimal rate of interest on money, equating the marginal social cost of producing money with the marginal productivity of money.

III. The Transmission Mechanism

The nature of the transmission mechanism linking monetary impulses with economic activity and price levels remains a central issue of monetary theory. The views about the transmission process influence the evaluation of monetary policy and the task assigned to policy. They determine expectations concerning the reliability and effectiveness of various instruments available to monetary authorities. Lastly, the role attributed to monetary impulses in explanations of economic fluctuations is partly shaped by our perception of the transmission mechanism.

Three distinct conceptions can be discerned. The inherited Keynesian position dominated textbooks and policy discussions for many years. A modified Keynesian position supplemented by credit-theoretic notions advanced by Central Banks emerged from detailed discussions of credit policy. And lastly, a thorough reconsideration of relative price theory initiated in the early 1960's yielded a price-theoretical framework applicable to the explanation of aggregate output, employment, and the price-level[16]. The following sections of this chapter characterize the dominant views contending for our attention.

A well established framework guides the organization of our material. The earliest interpretations of Keynes' *General Theory* introduced a pair of curves in the income-interest rate plane. The IS-LM curves have become a standard equipment of every textbook in macro-economics. Both curves describe a relation between an index of market rates of interest and national income (deflated or at current prices). The two curves are graphical representations of two equations derivable for any macro-theory containing financial assets and interest rates. The equation representing the IS curve is derived from the subsystem constituted by all the expenditure equations, and the LM equation is derived from the remaining subsystem of a given theory[17]. The relations of each subsystem are used to remove all variables except one interest rate (or index rate) and a measure of income or economic activity. The resulting equations present the index rate as a function of income, and can be inter-

[16] An excellent sample of this reconsideration can be found in the book edited by Edmund Phelps, *Microeconomic Foundations of Employment and Inflation Theory*, New York, 1970. The paper by Karl Brunner on "The Relative Price Theory of Output, Employment and Money", in *Kredit und Kapital*, February 1970, discusses the relevance of this price theoretical development for monetary analysis.

[17] This rule also subsumes models containing equations describing international transactions, production processes, wage behavior, etc. Equations describing current transactions belong to the subsystem underlying the IS curve, whereas equations describing international capital movement should properly be assigned to the subsystem underlying the LM curve. Production function and wage equation can be usefully assigned to the LM subsystem.

preted as reduced equations *relative* to the respective subsystems. The distinct conceptions concerning the nature of the transmission mechanism can be expressed by suitably specified properties of the IS-LM curves.

1. The Keynesian View

The standard Keynesian position is expressed by an array of income-expenditure models. The Keynesian view also influenced the construction of the large scale econometric models. The characteristic properties of this view can be described for our purposes in terms of the slope and position of the IS and LM curve. The slope of each curve depends on structural properties of specifiable subsystems of a given model. The slope of the IS curve is dominated by properties of the expenditure functions, and the slope of the LM curve by properties of the money demand and money supply function. The respective positions are determined by the set of relatively predetermined magnitudes such as fiscal and monetary policy variables. It is not necessary that the position of the two curves be independently determined. The two positions are in most cases governed by overlapping sets of conditions such as wealth effects of fiscal and monetary actions. Some interdependence between the positions is thus quite consistent with the Keynesian view[18]. Such interdependence is even acknowledged for monetary impulses. It is restricted however to the occurrence of a real balance effect or an interest effect on wealth among the expenditure functions. Apart from these effects incorporated on occasion into the Keynesian view, the crucial linkages transmitting monetary impulses to the pace of economic activity are provided by two sets of interest elasticities. One set pertains to the interest elasticities of the "money market", particularly of the money demand function, and the other set refers to the interest elasticities of the expenditure functions. These sets of interest elasticities are reflected by the slopes of the two curves. Algebraically large or (numerically small) interest elasticities of the expenditure functions yield steep slopes of the IS curve. In the limit the IS curve bcomes vertical. Algebraically large or (numerically small) interest elasticities of the money market yield also a very steep slope for the LM curve. Pronounced interest sensitivities (i. e. algebraically small and numerically large values) yield, on the other hand, two relatively flat curves. It is well known that the slopes of the two curves govern the outcome associated with monetary impulses. A vertical IS curve or a horizontal LM curve disconnect monetary impulses and monetary policy from the pace of economic activity. The relevant operation of monetary processes thus requires according to the Keynesian view that the IS curve be sufficiently removed from a vertical position and the LM curve sufficiently pushed away

[18] Appendix II presents the simple syntax of the Keynesian system.

from a horizontal position. The combination of a comparatively large (algebraically) net interest elasticity of the money market and a comparatively small (algebraically) interest elasticity of aggregate demand for output thus assures an effective transmission of monetary impulses.

The Keynesian view also offered an interpretation of these interest elasticities. The theory of liquidity preference provided the foundation for the interest elasticity of money demand. The interest elasticity of aggregate demand was based on the other hand on a specific interpretation of the role of interest rates. This role is expressed by the "relative borrowing cost theory of interest elasticity". Interest rates affect investors' decisions according to the magnitude of borrowing costs relative to the total investment costs per unit period. The (absolute value of the) interest elasticity of aggregate demand became thus positively associated in the Keynesian view with the range of expenditure categories exhibiting relatively large borrowing costs. A relatively small range of such expenditure categories describes a state of affairs, according to the analysis under review, which weakens the transmission of monetary impulses and obstructs the useful execution of monetary policy.

2. *The Bank-Credit Modification of the Keynesian View*

The Keynesian view assigns to monetary impulse a single channel depending on the interest elasticities of money demand and aggregate demand for goods and money. Many arguments advanced by academic economists, staff members of the Council of Economic Advisors or staff members of the Federal Reserve system cannot be subsumed under the straight Keynesian view. The arguments to be considered share a common emphasis on the role of bank credit in the transmission process. This credit theoretical view has never been formalized in a manner comparable with the standard paradigm discussed in the previous section. The arguments occurring in discussions of monetary policy are sufficiently explicit to permit our own construction of a credit-theoretical modification of the Keynesian position. We cannot guarantee that the translation of these vague ideas into an analytic framework offered in appendix III is the only acceptable explication. However, this discussion does contain the crucial building blocks suggested by the arguments insisting on the role of bank credit. In the absence of a formulation offered by the advocates of this view our own version is advanced for the necessary clarification. This clarification is particularly important in view of the influence exerted by the Credit View on recent monetary policy and selected institutional arrangements in the USA.

The Credit View stresses foremost the "availability" of bank credit. The flow rate of total bank credit occurs as an additional argument in the aggre-

gate demand function. A larger flow of new bank credit to customers thus raises aggregate demand. The effect of the flow rate of bank credit on aggregate demand, expressed by the appropriate marginal propensity, depends on the composition of credit extension. The ideas associated with the Credit View suggest that the marginal propensity to spend with respect to loan-extension is unity, but substantially below unity in case the credit extension results form acquisition of securities. The marginal propensity thus depends on the proportion of "loan-money" relative to "investment money" in the total bank credit extension.

The central role assigned to the flow rate and the stock of outstanding bank credit requires an important modification of the standard Keynesian position. The latter does not include a description of creditmarkets. In particular, according to Keynesian analysis interest rates are not determined by the interaction of demand and supply on creditmarkets. Their determination is usually described by means of the (Walrasian) money market equation supplemented on occasion with a term structure formulation in order to explain simultaneously several interest rates. The Credit View incorporates an explicit description of the creditmarket which explains proximately both the determination of interest rates formed on the (bank oriented) credit market and the volume of bank credit. Interest rate and volume of bank credit are determined by the interaction of the public's demand for bank credit and the banks'supply of credit. Both demand and supply function describe flow rates. The public's demand flow rate depends on interest rates, income and the stock of bank credit. The description of the banks' supply rate is particularly important. It formulates the free reserve hypothesis of bank credit adjustment. This conception of the money and banking process dominated for decades the views of the Federal Reserve authorities. It postulates that the banks' desired rate of bank credit adjustment depends on the level of free reserves, money market conditions and the discount rate. This adjustment rate also describes the supply rate of bank credit. The interaction of demand and supply rate described in Appendix III jointly determines interest rates and the time rate of change in the stock of bank credit. An increase in free reserves lowers in this view interest rates and raises the time rate of change of the stock of bank credit.

The incorporation of a credit market description modifies the role traditionally assigned by the Keynesian analysis to the money market equation. The Credit View does not require this equation to determine interest rates. It assumes a different role and explains proximately the real rate of return on real capital (i. e. Tobin's "required real rate" on real capital). In summary we can state three major analytic differences separating the Credit View from standard Keynesian analysis: (a) the role of the flow rate of bank credit in aggregate demand, (b) the central role of the creditmarket and the banks' adjust-

ment behavior, and(c) the new role assigned to the "money market" equation. These differences modify substantially the nature of the transmission mechanism. Apart from a possible real balance effect restricted to "outside money", monetary impulses were confined to a single channel by the Keynesian framework. The Credit View broadens the transmission mechanism. Two channels conduct monetary impulses to the pace of economic activity, one operates via interest rates and the other via the adjustment of bank credit.

The operation of the IS-LM curves reflects the difference between Keynesian and Credit View succinctly. According to the Credit View, monetary impulses shift simultaneously both the IS *and* LM curve. According to the Keynesian view monetary impulses only shift the LM curve in case we disregard real balance effects which offer no critical differentiation between the two views. Is follows that the crucial properties of the transmission mechanism under the Credit View cannot be summarized by the slopes of the two curves. Apart from real balance effects the standard Keynesian position described the response of income to a monetary impulse completely in term of these two shapes. As a matter of fact, this response can be expressed in general by the following formulation[19].

$$\frac{\partial Y}{\partial M} = \frac{\dfrac{\partial i}{\partial M}\,(\mathrm{LM})}{\dfrac{\partial i}{\partial Y}\,(\mathrm{IS}) - \dfrac{\partial i}{\partial Y}\,(\mathrm{LM})}$$

where $\partial i/\partial Y$ (IS) and $\partial i/\partial Y$ (LM) denote the slope properties of the two curves and $\partial i/\partial M$ designate the vertical shift of the LM curve. The formulation for the response of income to a monetary impulse derived in appendix III exhibits the difference implied by the Credit View. We obtain

$$\frac{\partial Y}{\partial B} = \frac{\dfrac{\partial i^2}{\partial B}\,(\mathrm{IS}) - \dfrac{\partial i^2}{\partial B}\,(\mathrm{LM})}{\dfrac{\partial i^2}{\partial Y}\,(\mathrm{IS}) - \dfrac{\partial i^2}{\partial Y}\,(\mathrm{LM})}$$

where B denotes the monetary base, Y national income and i^2 refers to the real rate of return on real capital. The response appears as a ratio of two sums viz. the sum of the vertical shifts in the position of the two curves divided by the sum of their respective slopes. The expressions $\partial i^2/\partial B$ (IS) and $\partial i^2/\partial b$

[19] The reader should consult appendix II.

(LM) denote vertical shifts of the two curves induced by a unit change in the monetary base. The operation of the transmission mechanism thus involves structural properties beyond the slopes of the two curves. These properties are expressed by appropriate shifts in both curves which actually reenforce each other. One might note in conclusion that the LM curve becomes steeper under the Credit View, i.e. $\partial i / \partial Y$ (LM) is lowered. This actually raises the responsiveness of income to monetary impulses[20].

3. The New Price Theory and Its Implications

The Credit View still accepts the borrowing cost interpretation of interest rates in the aggregate demand function. It nevertheless broadened the channels transmitting monetary impulses beyond a small fraction of private investment expenditures. This broadening occurred however by means of ideas which were introduced in a somewhat ad hoc manner without reflection in terms of general economic theory. But such ad hocery has been a major symptom of the intellectual crises encountered by economists in the 1930's. The reception of Keynes' *General Theory* by our profession mirrors the depth of the intellectual crises prevailing at the time. Economists were brutally confronted with mass unemployment, and economic theory was incapable of adequately explaining this phenomena. The central issue posed by Keynes in his *General Theory* was the very failure of inherited price theory to explain unemployment. This failure must be clearly acknowledged. But the failure is even more pervasive than formulated by Keynes. Inherited price theory could not explain unemployment of *any* asset, whether the asset assumes the form of labor or houses, for instance. Such phenomena remained essentially unintelligible, unless one contrived to introduce arbitrary constraints justified by theoretically extraneous "social conventions". These conventions pertained however to behavior which could not be integrated with inherited price theory.

Keynes attempted to recast both "value theory" and macro-theory in a manner designed to broaden the useful application of relative price theory. The Keynesian reinterpretation of Keynes discarded however, price theory. It also developed macro theory as an independent field partly conflicting with relative price theory. Thus resulted the Keynesian position described in the first section[21].

A reflection on Keynes' essentially price-theoretical problem suggests however an alternative approach to the analysis of monetary transmission mecha-

[20] The necessary information is contained in appendix III.

[21] The reader may usefully consult on these issues Axel Leijonhufvud, *On Keynesian Economics and the Economics of Keynes*, Oxford, 1966.

nism. This alternative involves fundamentally the reconsideration of Keynes original program, viz. a thorough application of reformulated price theory to the explanation of monetary mechanisms and unemployment. This reformulation extends to an explanation of fiscal mechanisms, and also to unemployment of any asset, not just labor. Price-theory need not be abandoned in the manner implicitly suggested by standard macro theory. With all its failures concerning short-run unemployment problems, price-theory contains propositions bearing relevantly on our observable environment. These propositions are highly confirmed and yield powerful explanations of observable patterns which cannot be dismissed. Standard macro-theory yields nothing in this respect and only poor results in its own realm. It has been contended therefore that it would appear appropriate to reconstruct price theory in order to carry out both Keynes' and Irving Fisher's original program.

This reconstruction requires essentially two developments. Responses to market stimuli must be generalized to assets and liabilities and their yields or costs. Furthermore, the cost functions previously introduced in order to explain the role and productivity of money assume also a critical role for adequate explanations of the transmission mechanism. Neither information nor readjustments of resource utilization patterns are produced at zero marginal (or average) cost. The production, processing, and comprehension of information involves investment of resources with alternative uses. Similarly, the readjustment of resources requires application of other resources. The pervasive occurrence of information and readjustment costs has been thoroughly disregarded by traditional formulations of price theory. Their full recognition permits a satisfactory resolution of otherwise perplexing observations pertaining to "inflexible wages and prices". The proposed reformulation does not involve any radical break with the evolution of economic analysis. It is on the contrary a most natural outgrowth of this evolution. It removes the troublesome failures of inherited price theory and effectively enlarges its explanatory power. This development also erodes the separation of economics into two distinct and logically unrelated branches, micro theory and macro theory. There is only one piece of economic analysis, price-theory. The only difference occurs in the realm of application and range of problems. The price-theory of monetary and fiscal processes proceeds on a substantially more aggregative level than other applications of price theory.

A semi-intuitive discussion of monetary and fiscal mechanisms has been developed on several occasions. These mechanisms center on the interaction between assets, liabilities and current output. The crucial linkages are provided by the substitution relations existing over the whole range of assets, the substitution relation between newly produced and already existing real capital, and the substitution between assets and their yields. These substitution processes are moreover reenforced by adjustments to changing wealth positions induced by fiscal and

monetary impulses[22]. A more explicit formulation of the price-theoretical conception of the transmission mechanism is offered in appendix IV. It should be emphasized however, that the formulation has been severely simplified. In particular, the interaction between labor market and output market, the analytical underpinning for the behavior of the output price-level and the government sector's budget constraint have been omitted[23]. Still, the major outline of the transmission process is retained. Aggregate demand is a function of wealth and relative prices (incl. interest rates, which are after all relative prices). Taxes operate on the economy via the public's wealth position, or, in case of excise taxes, via relative prices. Once again, we have an explicit description of credit markets for the proximate determination of interest rates. But the conception of the credit market is radically changed relative to the Credit View. The linkage between policy instruments and monetary aggregates (i. e. money stock or bank credit) is not centered on free reserves. The Credit View assigned to free reserves a central position in the causal nexus. This is explained by the occurrence of free reserves as an important argument of the function exhibited in appendix III which explains the banks' desired rate of adjusting the volume of bank credit, i. e. the supply rate of bank credit. The price-theoretical approach denies this role of free reserves. Money stock, bank credit and interest rate emerge from the joint interaction of the public's and the banks' behavior in response to the behavior of monetary authorities. The public's behavior is expressed by the allocation of money balances between currency and demand deposits, the allocation of bank liabilities between different types of deposit and non-deposit liabilities, the demand for bank credit (expressed by the public's supply of assets to banks), and the demand for money. The banks' behavior is reflected by the allocation of assets between reserves and earning assets, the allocation of reserves between borrowed and unborrowed reserves, and the setting of conditions governing the supply of liabilities to the public. The monetary authorities' behavior is described by the monetary base, the reserve requirements, the discount rate and the ceiling rates on various deposit types. These conditions are summarized by the formulation of the creditmarket and money market equation. The latter determines proximately the asset price-level of existing real capital and implicitly the real rate of return on real capital.

We refer the reader once more to the appendix at this stage. He will find in appendix IV a summary of the crucial properties of the transmission mechanism. The discussion has again been organized in terms of the IS-LM diagram. In this

[22] A more detailed description may be found in my article published in *Kredit und Kapital, op. cit.*, footnote 15.

[23] A more developed analytical formulation can be found in Karl Brunner and Allan H. Meltzer, "A Monetarist Hypothesis of Economic Fluctuations", to be published in the *Konstanz Symposium on Monetary Theory and Policy;* the same authors' paper on "Fiscal and Monetary Policy in a Non-Keynesian World" also bears on the same problem.

case however, the LM curve has been replaced by a CM curve representing the combination of interest rates and output constrained by the creditmarket equation after proper substitution of variables proximately determined by some other equations. Such replacement is unavoidable once the money market equation is assigned another task than proximate determination of interest rates. The last formula in appendix IV states the response of output to a monetary impulse. We repeat it here for the reader's convenience.

$$\frac{\partial y}{\partial B} = \frac{-\dfrac{\partial i^1}{\partial B}(\mathrm{IS}) - \dfrac{\partial i^1}{\partial B}(\mathrm{LM})}{\dfrac{\partial i^1}{\partial y}(\mathrm{IS}) - \dfrac{\partial i^1}{\partial y}(\mathrm{LM})}$$

where i^1 refers to financial rates of interest[24]. The response appears again as a ratio of two sums. The numerator is the sum of the vertical shifts of the IS and LM curves resulting from a change in the monetary base. The denominator measures on the other hand the sum of the two slopes. The slope properties of the two curves are thus not a sufficient description of the linkages defining the transmission process. The relative price and wealth adjustment process opens two additional channels for monetary impulses beyond the traditional Keynesian channel. Changes in the position of the IS curve actually play an essential role in the response of economic activity to monetary impulses. The operation of the new channels depends crucially on the asset price P of real capital. Monetary (and fiscal) impulses thus modify the relative prices of financial and real assets, and also the relative prices of existing and newly produced real assets. The first element is expressed by means of the pair (i, P) of interest rates on financial assets and the asset price on real capital, and the second element is formulated by the pair (P, p) of asset price and output price. It should be noted that P is closely related to Tobin's required rate of return on real capital[24].

A suitable modification of the formula above defining $\partial Y/\partial B$ expresses probably the central role of the market value P of existing real capital more effectively. This modification clarifies also some aspects of Tobin's approach to monetary analysis. The CM and IS curves derived in appendix IV were defined for the (i^1, y) plane in order to maintain the standard formulation.

[24] Let ϱ denote Tobin's rate of return and let n be the expected net real return on real capital, and K be the stock of real capital measured in present value of output units. We can write

$$\varrho = \frac{pn}{PK}.$$

They can be replaced however, by two curves in the (P, y) plane, one derived from the Walrasian money market equation with the aid of appropriate substitutions, and the other in similar fashion from the output equation. The terms in the expression constituting $\partial Y/\partial B$ appear in this case as derivatives of P with respect to B and y obtained from various subsets of relations in the model. The term $\partial P/\partial B$ (LM) in the numerator describes the response of the asset markets expressed by the market value of existing real capital to a monetary impulse independent of any feedbacks via the output market. This response of the asset markets typically forms Tobin's proxy measure used in assessing the effectiveness of monetary policy. The appropriate measure is of course the derivative of output $\partial Y/\partial B$. The selection of $\partial P/\partial B$(LM) as a proxy for $\partial Y/\partial B$ results from the usual confinement of Tobin's analysis to the asset markets. His analysis desregards the IS curve and the interaction with the LM curve. Yale's general equilibrium approach has concentrated so far on the equations underlying the LM curve. Tobin sensed quite correctly that P assumes a critical role in the transmission of monetary impulse. In the absence of relations describing the interaction between output and asset markets he used the derivative of P with respect to monetary policy variables as a proxy for the desired response in total output. This emphasis on P (or the required real rate on real capital) contributed usefully to the development of the relative price approach. But essential aspects of the relative price process remained obscured however by Yale's usual disregard of the interaction between output and asset markets expressed by the assumption that output prices are constant. Important consequences of the relative price process are thus not adequately covered. An excess supply of money is never absorbed by adjustments in output prices and must be digested by the asset markets alone. Variations in interest rates, portfolio adjustments of financial institutions and highly developed (endogenous) adjustability of the money stock are consequently assigned substantial weight in Yale's analysis. Once we follow the lines of the relative price process and do not prohibit by fiat the spillover of monetary pressures into the output market in response to the adjustment imposed on the asset markets, a somewhat different pattern emerges[25].

[25] The reader should consult the article by James Tobin, "A General Equilibrium Approach to Monetary Theory", *Journal of Money, Credit and Banking*, February 1969, and also his chapters in *Financial Markets and Economic Activity*, ed. by Donald D. Hester and James Tobin, New York, 1967. It is noteworthy that the title of the book is barely consistent with an analysis that confines itself to an LM curve.

IV. Issues Associated with Alternative Views on the Transmission Mechanism

The issue concerning the nature of the transmission mechanism bears on many different aspects of monetary analysis and monetary policy. Some problems associated with this issue will be discussed in this chapter. The first section considers some recent discussions bearing on the interpretation of the IS and LM curve. This includes the nature of the wealth and real balance effect, the role of the traditional multiplier and of the substitutability of money. The role of fiscal policy in the context of differing views of the transmission mechanism is discussed in the second section. The third section examines the implications bearing on the role of interest rates and the burden of monetary policy. Section four considers the effect of various views of the transmission mechanism on the choice of policy instruments. The last section addresses Keynes' problem and the nature of price-wage adjustments.

1. A Reexamination of Some Wealth Effects

The relation between money and wealth has attracted much attention in recent years. The "New View" launched by Gurley-Shaw and interpreted by Yale denied the occurrence of any significant relation between money and wealth. Pesek and Saving initiated several years ago a thorough reexamination of this issue[26]. The resulting clarification explicitly distinguished between two logically (and empirically) separate issues which were on occasion submerged by misleading formulations. One issue has already been noted and discussed in chapter I. It pertains to the productivity of money. This aspect of the relation between money and wealth concerns the effect of money on the real opportunity set constraining the choices made by economic agents. We concluded that variations in the real volume of money modifies a representative agent's real opportunity set. This conclusion thus rejects one strand of the "New View" which seemed to recognize in money an artifice of no social significance, or a device with at most a zero social productivity[27]. But there remains a second strand associated with another aspect of the relation between money and wealth. This aspect pertains to the question whether and to what

[26] Boris Pesek and Thomas Saving, *Money, Wealth and Economic Theory*, Macmillan, 1967.

[27] The following quote from James Tobin seems appropriate on this point: "...as viewed by the inhabitants of the nation individually, wealth exceeds the tangible capital stock by the size of what we might call the fiduciary issue. This is an illusion...", "Money and Economic Growth" *Econometrica*, October 1965.

extent money forms a direct component of the public's wealth. The question had been motivated by the introduction of the Pigou effect. It was soon argued that money issued against private liabilities could not form a component of the public's wealth. This position became codified in the discussion of inside-outside money developed by Gurley-Shaw and interpreted by Patinkin[28]. This codification established that only outside money could be included as a component of the public's wealth. The determination of wealth proceeded essentially by a consolidation of balance-sheets summarizing the public's and the banks' position. Two stylized balance-sheets are used for our discussion, both are already consolidated statements for their respective sectors. The magnitude NWP expresses the public's net wealth traditionally described by

Banks	Public
Assets	Assets
R = reserves	C = currency held by public
L = loans to public	D = deposits
S_b = government securities held by banks	S_p = government securities held by public
K_b = real capital of banks	NWB = bank ownership
Liabilities	K_p = real capital held by public
D = total deposits	Liabilities
A = liabilities to Central bank	L = liabilities to banks
NWB = net worth of banks	NWP = net worth of public

consolidation of the two balance-sheets. It is immediately evident that $NWP = B + S + K$ where B is the monetary base $(= R + C)$, S measures the total interest bearing government debt $(= S_b + S_p)$, and K the economy's real capital $(= K_b + K_p)$.

The traditional procedure and conclusion was effectively challenged by Pesek and Saving. The major thrust of the discussion initiated by Pesek and Saving is however, not directed to the problem whether and to what extent inside money

[28] John G. Gurley and Edward S. Shaw, *Money in a Theory of Finance*, Washington, 1960.

Don Patinkin, "Financial Intermediaries and the Logical Structure of Monetary Theory", *American Economic Review*, March 1961.

is a component of the public's wealth. The clarification of the Pesek-Saving issue by the ensuing discussion settled of course the conditions governing the inclusion of inside money into the public's wealth rather conclusively. More important analytically is not so much this result, but the rejection of the argument based on consolidation of balance-sheet with standard accounting values. Pesek-Saving's major contribution extends capital theoretic analysis to liabilities and thus opens the way for an economic analysis of the conditions which determine whether and to what extent liabilities of the non-government sector should properly be included as components of the public's wealth[29]. An application of capital theory determines the present value of deposit liabilities as the present value of the future stream of outlays associated with these deposits including the realization of the " repurchase clause". The present value of deposit liabilities appears thus as a function of the costs associated with operation and maintenance of deposit accounts, the probability distribution governing realizations of the repurchase clause and the rate of time discount. Two cases were distinguished by the discussion, according to the nature of competitive or monopoly arrangements. In case a single monopoly bank issues deposit liabilities which can be produced and maintained at no cost whatsoever, and the probability of realizations of the repurchase clause is zero, the present value of the monopoly bank's deposit liabilities (to the bank) is zero. A balance-sheet of the bank would thus exhibit the accounting value of deposits in the usual way and the market value of assets. But in order to express appropriately

Monopoly Bank	
Assets (market value)	Deposits (accounting value)
Value of monopoly rights	Net worth

that the economic value of deposit liabilities is zero, a new item is introduced on the left side of the balance-sheet, the value of the monopoly right. In the special case discussed, the value of this right is equal to the accounting value of deposit liabilities. Consolidation of balance-sheets along the lines indicated above establishes that the public's net worth will contain under the circumstances,

[29] The reader may wish to consult in this respect, Don Patinkin, "Money and Wealth: A Review Article", *Journal of Economic Literature*, December 1969; Allan H. Meltzer, "Money, Intermediation and Growth", *Journal of Economic Literature*, March 1969; James Buchanan, "An Outside Economist's Defense of Pesek and Saving", *Journal of Economic Literature*, September 1969.

the " value of the bank's monopoly right" as a component. It is the monopoly right and its value which form and immediate component of the public's net wealth. It is somewhat elliptical to argue that inside money becomes under the circumstances a component of net wealth. It is also confusing to argue that inside money "contributes" to net wealth. The circumstances described simply imply that a magnitude equal to the accounting value of inside money enters net wealth of the social group. Identification of this magnitude with the entity "inside money" involves a reification conducive to substantial confusions on occasion.

The analysis can be usefully generalized. Consider the banking sector's balance sheet as represented by the equation

$$A + V = D + NWB$$

where A denotes total assets, D are the deposit liabilities at accounting value, NWB measures the sector's net worth and V is the value of the sector's operational position. The magnitude V is defined by the relation

$$V = D - PVD$$

where PVD refers to the present value of the deposit liabilities. In the previous case PVD remained zero and V was consequently equal to D. The sector's contribution to net wealth was under the circumstances *equal* to D but not *identical* to D.

Let us consider now the case of non-vanishing probabilities of realizations of the repurchase clause. We still exclude however any costs of producing or maintaining deposits by the single monopoly bank. The present value PVD is now positive but less than D. There remains a contribution to net wealth equal to $(D - PVD)$ which is less than the total volume of inside money. The net contribution can be rationally equated to the volume of inside money net of reserves held by the monopoly bank. In case deposits involve positive costs of production, V declines further in response to a PVD reflecting the present value of such costs. The monopoly position of the bank implies however that PVD remains less than D. It is instructive to ponder that the bank's net contribution to the public's wealth changes with variations in the probability distribution governing the realization of the repurchase clause. Increasing probabilities of realizations raises the present value PVD and thus lowers the bank's contribution to net wealth.

The inequality $PVD < D$ which defines the occurrence of a net contribution to wealth is not attributable to the existence of inside money or some particular property of inside money. It results from the monopoly right defin-

ing the bank's operational position. The case of a competitive banking sector with free entry and no constraints on interest payments on deposits reenforces this interpretation. The open competition between banks drives the present value PVD to equality with the accounting value D. The associated net worth NWB is then equal to the market value of bank ownership at competitive rates of return. So long as $PVD < D$ the actual value of bank ownership exceeds the costs of investment into banking. The same situation may also be described to involve an actual rate of return on the invested bank capital which exceeds competing returns on alternative investments. This state offers incentives to raise interest payments on deposits and also attracts new entrants. The competitive mechanism ultimately removes the divergence of PVD and D. It follows that in competitive equilibrium with free entry and no constraints inside money contributes nothing to the public's wealth position. More precisely, the value of the banks' operational position expressible as a portion of inside money, has vanished under the circumstances specified. There remains however, a contribution to the public's net wealth which is made by the banking sector. This magnitude is determined by the market value of the real capital K_b invested in the banking sector. An open competitive equilibrium only removes the "wealth contribution of inside money", i.e. the value of the operational position of a bank.

The same analysis extends to closed competition with no constraints on interest payments and to the case with constraints in the context of both open and closed competition. Closed competition eliminates free entry with banks competing for the limited supply of base money and competing for customers and deposit accounts. This competition is sufficient, even with closed entry, to drive the value V of a bank's operational position towards zero. Closed entry does not modify our results bearing on the "wealth contribution of inside money". Even constraints on interest rates are not sufficient to assure a positive value V of a bank's operational position in competitive (closed or open) equilibrium. The constraints on interest payments modify the channels of competitive stimuli, but not the end result with respect to wealth. The potential gains signaled by an inequality $PVD < D$ induces banks to substitute valuable services offered to customers for interest payments. These services are produced at positive costs. With a value PVD less than D, banks will offer more expensive or more services to attract accounts and base money until PVD equals D. It follows thus that only monopoly rights are sufficient to assure a long-run contribution to wealth by the banking sector, *expressible* as a portion of inside money. Constraints on interest payments and closure of entry are not equivalent in this respect to the grant of a monopoly right to produce inside money. The magnitude of V is zero in competitive equilibrium with or without constraints and with free or closed entry. The occurrence of

constraints on interest payments exerts however, a relevant economic effect even in the absence of a wealth contribution. The constraints lower the economic welfare of the representative agent. Their effective application replaces receipts of money allocable to finance preferred acquisitions by specific services. Even with services produced by banks at a cost equal to the prohibited interest rates the representative agent will find himself positioned in general on a lower utility contour. This welfare effect is reenforced by a *negative* wealth effect disregarded thus far in our account. The representative agent's information cost about the nature of bank services exceeds the information cost about interest payments. In case the banks absorb these costs, services of lesser value are produced. But if the agent bears the information costs he has to allocate more resources to produce information about the banking market in case constraints depress interest payments. This allocation lowers the real opportunity surface relative to the case of interest payments.

The analysis established that a competitive equilibrium is incompatible with a "wealth contribution of inside money", i.e. a positive V. But competitive equilibria and monopoly do not exhaust the relevant states of the world. We do experience persistent states of competitive disequilibria. Such states involve in general non-vanishing values V of banks' operational position. Suppose for example that probabilities governing realizations of the repurchase clause suddenly increase. The value of V could easily be negative. Similarly, a rapid decline in the probabilities of deposit withdrawals pushes V into a positive range for some time. Quite generally, changes in the underlying situation confronting banks will modify V and temporarily generate a "wealth-contribution". Persistent but unanticipated disturbances which impose ever new adjustment loads on the competitive process can thus generate a persistence deviation of V from zero. The relative allocation of capital to the banking sector in a growing economy would reveal the occurrence of persistent non-vanishing disequilibrium values of V. We conclude thus the analysis of the second aspect of the relation between money and wealth with the following propositions: The banking sector contributes to the public's wealth position by virtue of monopoly rights granted to produce inside money, as a result of a persistent flow of competitive disequilibria, or both conditions in some combination.

The clarification of an issue, even a successful clarification, does not assure relevance and importance of the result. The clarification may however, eliminate serious confusions or misconceptions and thus prevent some *negative* results. Actually, Warren Smith recently questioned the relevance and importance of the analysis initiated by Pesek and Saving and carried forward by Milton Friedman, Harry Johnson, James Buchanan, Don Patinkin, Allan H. Meltzer and others. Warren Smith concludes his somewhat cursory examina-

tion with the following passage: "As a practical matter, there appears to be little or no basis for believing that commercial bank demand deposits should to any appreciable extent be regarded as wealth... It surely is very close to the truth to say that since monetary policy operates entirely through voluntary exchanges of one financial asset for another, it is incapable of increasing wealth by creating assets to which there are no corresponding liabilities"[30]. This quote asserts that the actual value of V associated with existing monetary systems is vanishingly small. An examination of such a proposition usefully considers both the empirical and analytic case made on behalf of the statement. It is noteworthy that the author only offers his personal assurance to the reader, without any reference to any evidence. Evidence is usually not just a matter of happenstance. Observations are not automatically relevant evidence. They form evidence relative to a developed piece of analysis, and in the absence of such analysis there is no evidence, just a heap of unstructured observations. The absence of considerations beyond a personal feeling in Warren Smith's account is conditioned by the lack of a suitable analysis of the issue. The short passage attending to the Pesek-Saving problem conveys to the reader the general impression that the question raised about the role of inside money is somewhat irrelevant and should be disregarded in future developments of monetary analysis. This in an unfortunate regression by almost a decade.

The analytic survey presented above establishes that a combination of monopoly positions and persistent disequilibria are sufficient to maintain a non-vanishing V and thus a "wealth-contribution of inside money". Both conditions seem to prevail for most banking systems. Substantial direct evidence seems required before we accept an easy dismissal of a non-vanishing value V[31]. More important immediately are several analytic aspects. The analysis developed opens the door for the construction of a theory of the firm applicable to financial institutions. Such a theory is still missing and its construction would usefully contribute to the analytical foundation for descriptions of a bank's reserve behavior, the proper interpretation of credit rationing[32], or a bank's behavior concerning the setting of conditions on deposits. It would also

[30] Warren Smith, "On Some Current Issues in Monetary Economics: An Interpretation", *Journal of Economic Literature*, September 1970.

[31] A preliminary result obtained by Tanner in the context of an empirical examination of Pesek-Saving's proposition with the aid of Canadian data yielded a proportion of V relative to total deposits (at accounting value) of 20. Tanner obtained that $V = .2D$. Still, this is most provisional and tentative; J. Ernest Tanner, "Empirical Evidence on the Short Run Real Balance Effect in Canada", *Journal of Money, Credit and Banking*, November 1970.

[32] Credit rationing is usually described as an allocation occurring independently of price stimuli. This is a very poor interpretation conditioned by standard price theory

provide tools for the conceptual clarification of the private and social cost of regulations imposed on banking. It follows that the analysis initiated by Pesek and Saving and carried forward by Buchanan and Patinkin could prove exceedingly important independent of the evidenced magnitude of V.

The analysis contributes also to a useful clarification of the nature of wealth effects and the role of real balance or real financial effects in the transmission process. These issues inherited from previous discussions bear quite immediately on changes in the position of both IS and LM curves resulting from "wealth effects". Our previous analysis of the "wealth contribution of inside money" provides the tools to distinguish three separate effects: the wealth effect of a change in monetary variables, the real wealth effect or real financial effect of a change in the output price level, and the effect of a change in the banking system's value V of its operational position. These distinct strands of "wealth effects" have frequently been tangled together into a composite problem. Each of the separate effects will be seen to operate via suitable shifts in the IS and LM curve. In order to clarify the separate strands the wealth term included in the behavior functions of appendix IV must be replaced by two distinct wealth terms, non-human wealth W^n and human wealth W^h. The two terms are defined as follows

$$W^n = PK + (1 + v)B + \pi(i, u)S$$

$$W^h = W^h(y^a, \tau, p^a)$$

where K refers to the economy's total real capital ($= K_b + K_p$ according to previous balance-sheets), B is the monetary base, S the stock of outstanding government securities, i an index of interest rates on S, and u the average maturity of S. The market price π per unit of S is a function of i and u. The terms y^a and p^a refer to anticipated real income and output price-level, and τ summarizes the tax schedule. The term v is the banking system's net worth multiplier and is defined by the relation $V = vB$. The analysis of V thus carries automatically over to the net worth multiplier v. It should be noted that the specification of non-human wealth assumes that the present value of private financial liabilities other than money is approximately equal to the value of these items as assets to the owners. A justification of this assumption requires again an application of the theory of the firm mentioned above.

Our first strand to be disentangled considers the direct wealth effect induced by a change in the monetary base. We reproduce for convenience the

applied to situations involving large information costs. The phenomenon meant by the term is similar to job rationing and consumer search for durables. In each case, allocation occurs in response to properly construed cost stimuli to be measured by both market price and information costs.

term defining the shift in the IS curve induced by a change of the base. The term is found under (3a) of appendix IV. We obtain the following expression

$$\frac{\partial i^1}{\partial B}(\mathrm{IS}) = \frac{\dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial B} + \dfrac{\partial \alpha}{\partial W^n}\dfrac{\partial W^n}{\partial B}}{\dfrac{\partial \alpha}{\partial i^1} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial i^1}} .$$

This expression is easily transformed into an elasticity $\epsilon(i^1, B \mid \mathrm{IS})$ describing the shift of the IS curve. The second component of the sum defining the numerator summarizes the wealth effect to be separated. It is defined by the expression

$$\epsilon(\alpha, W^n)\,\frac{(1+v)B}{W^n}$$

A similar expression can be obtained for the wealth effect operating on the CM curve. It appears now that even if we accept the estimate for V of approximately 1 derivable from Tanner's examination of Canadian banking, the ratio multiplying the wealth-elasticity of aggregate demand α remains of the order of .01 to .02. It follows therefore that even with a substantial net worth multiplier the wealth effect induced by variations in the base remain comparatively negligible. The shifts of both IS and CM curves resulting from changes in B via the direct wealth effect are thus quite small compared to the shifts determined by the operation of the relative price mechanism and expressed by the first component in the numerator of the shift expression above.

The real balnce effect introduced through the work of Pigou, Haberler, and codified by Patinkin, defines our second strand. This effect has been traditionally attributed to a change in the output price-level p. It was usually argued that the change in price-level modifies real wealth via changes in the real value of financial assets. The price-theoretical analysis outlined in appendix IV implies that the traditional argument is misleading. The real wealth effect of a price change does not coincide with the real financial effect. The first effect exceeds the latter by a large multiple. This can be demonstrated in the following manner. Real wealth w is given by the expression

$$w = \frac{P}{p}K + f$$

where f denotes the real volume of financial net wealth, where F denotes its nominal volume. The elasticity of real wealth with respect to the

$$f = (1+v)\frac{B}{p} + v\frac{S}{p} = \frac{F}{p}$$

output price-level can be immediately derived and we obtain

$$\epsilon(w, p) = [\epsilon(P, p) - 1]\frac{PK}{W^n} + \epsilon(f, p)\frac{F}{W^n}.$$

It emerges thus that the response of real wealth to a change in the output price level consists of two components. The first component in the sum measures the contribution to the change in real wealth (measured in output units) emanating from non-financial wealth and the second component describes the contribution from financial wealth. The elasticity $\epsilon(P, p)$ is negative in the price-theoretical analysis summarized in appendix IV. It follows that the bracketed expression in the first component is less than minus one. The elasticity $\epsilon(f, p)$ is on the other hand equal to minus one. Moreover, the coefficient PK/W^n is approximately 9 times the coefficient F/W^n. It follows that the first component in the sum defining $\epsilon(w, p)$ measures about 10 times the second component. The real wealth effect induced by a changing output price-level is thus dominated by modifications in non-financial wealth measured in output units. The real financial wealth effect is small in comparison to the total real wealth effect. This result depends critically on the relative price approach to an explanation of the transmission mechanism. The traditional analysis following Patinkin restricted the range of assets to money and bonds. An admission of real capital involving an asset price relative to prices both of bonds and new production radically modifies our conclusion. A substantial real wealth effect shifts the positions of both IS and LM curves. But the real balance and the real financial effect contribute only marginally to the real wealth effect induced by changes in the output price-level.

The last strand in the analysis of wealth effects pertains to the impulses emitted via changes in the monetary systems "value of operational position" expressed by the net worth multiplier v. It was noted in our discussion of the magnitude V that it depends on a variety of factors, monopoly structure of banking, the probability distribution governing the realization of the repurchase clause, the speed of changes in underlying conditions affecting the first two elements and banks' market situation relative to the cost of adjustments and information etc. Under certain conditions exhibited for example by events experienced in 1930–1933, v probably changes quite substantially. The impact of v on the IS curve can be determined with the usual procedures. Inspection of the appropriate expression describing the shift induced by a change in v yields an interesting result. The response in the position of the IS

curve to a given change in v depends crucially on the relative magnitude of the two ratios

$$\frac{\epsilon(\alpha, i)}{\epsilon(\alpha, P)} \quad \text{and} \quad \frac{\epsilon(\lambda, i)}{\epsilon(\lambda, P)}.$$

The closer these ratios are the greater is the shift in the IS curve induced by a given change in the net worth multiplier v. It follows thus that the relative similarity of the order patterns with respect to interest and asset price elasticities of money demand and aggregate demand determines the responsiveness to variations in v. Changes in a banking system's monopoly structure and a pronounced variability in the flow of disequilibrium states thus affects economic activity substantially provided aggregate demand and money demand exhibit a similar elasticity ordering.

2. *The Role of Fiscal Policy*

Fiscal policy formed the proud centerpiece of the Keynesian position. It became enshrined in the "New Economics" popularized by the Council of Economic Advisers during the Kennedy-Johnson Administration. The emphasis on fiscal policy followed from the Keynesian assessment of the slope properties in the IS-LM diagram. The borrowing cost interpretation of the interest elasticity associated with aggregate demand for output narrowed the channel transmitting monetary impulses to a small range of expenditure categories. It was thus frequently concluded, particularly in the earlier half of the postwar period, that the interest elasticity of aggregate demand is negligible or unreliable.

A vanishing elasticity of aggregate demand was supplemented with a significant interest elasticity of money demand. Empirical studies have generally confirmed the non-vanishing interest elasticity of money demand and we can speak about a professional consensus in this respect. It followed that a very steep IS curve became juxtaposed with a flatter LM curve. The Keynesian view thus implied that monetary policy was unreliable. Fiscal policy on the other hand operates without obstruction and apparently does not depend on unreliable interest elasticities. The proper tools of stabilization policy were thus centered in fiscal policy.

The Credit View modifies this relative assessment of fiscal and monetary policy somewhat. This follows from the circumstance that the effect of monetary impulses are not completely conditioned by the slope properties of the IS-LM diagram. The shifts of the IS position became significant in this respect. Still, the linkage connecting fiscal policy with economic activity appears more reliable in this view. "Monetary" impulses continue to depend on

doubtful interest-elasticities and the portfolio behavior of banks with respect to loans and investments. These considerations are reenforced by changes in the marginal propensity to spend in response to a shifting loan-investment ratio in banks' portfolio.

The Credit View introduces thus no radical reassessment of the role of fiscal policy. Such reassessment follows however, from the relative price conception of the transmission mechanism. The simplified version in the appendix cannot adequately represent in this respect the implications of the relative price approach bearing on fiscal policy. Changes in government expenditures or tax parameters operate on economic activity via the same relative price mechanism which conveys monetary impulses. The Keynesian notion of a "direct influence" exerted by fiscal variables as against an "indirect effect" of money working through a complex chain loses all meaning in the context of a relative price analysis of the transmission mechanism[33]. The response to an increase in government expenditures or larger taxes depends crucially on wealth and substitution effects once we have discarded a world of constant supply prices governed by "horizontal supply curves".

Three types of government expenditures should be distinguished for our purposes, expenditures on existing real assets, on current output of goods and on current labor services. The consequences of increased expenditures on these distinct categories are somewhat different. An increase in expenditures (i.e. government demand) for existing real assets raises the appropriate asset price and by a chain of substitution, other asset prices. This effect increases the real wealth (in output units) and thus accelerates private demand. Private demand is further stimulated by the *relative* decline in the price of newly produced output associated with the increase in asset prices. The resulting substitution effect encourages private demand for new production of assets. Both wealth and substitution effect combine in this case and yield an unambiguously expansionary result. But consider now the consequences of an increase in government demand for currently produced goods. Prices of such goods increase to an extent depending on supply elasticities. But in the absence of infinitely elastic supply functions the increase in government demand induces some contraction of private demand for these goods. Once more, a chain of substitution and wealth effects is set in motion by the initial increase in price of some outputs. The wealth position of the producers experiencing the initial

[33] This notion is actually analytically indefensible even for Keynesian analysis. The fiscal policy mulipliers depend on the same structural properties—in a different manner—as the monetary multiplier. The notions seems to depend on an impressionistic response to the occurrence of government expenditures in the expenditure equation. It is however easy to show that such occurence is neither a necessary nor a sufficient condition for income to react to fiscal policy.

increase in demand improves and this effect raises private demand. On the other hand, if the initial impact affects substitutes for existing real capital, the resulting substitution effect lowers specific segments of private demand. Other substitution effects redirect private demand from the initial impact area to other goods. The resulting expansion in the output of other goods replaces to some extent the compressed private real demand in the initial area of government spending. The secondary reactions in output prices induced by the substitution processes yield further adjustments. The net direction depends particularly on the substitution relation between the outputs affected and the existing stock of real capital. In summary, we note that an increase in government expenditures for currently produced goods induces a variety of cross currents. The net effect on private demand and the level of economic activity depends substantially on various combinations of supply and demand elasticities and particularly the substitution relation between the currently produced outputs affected and the existing real capital stock. The cross currents outlined are probably sufficient to confine the net expansionary effect of increased government expenditures on current output into a range with moderate upper bound. Moreover, these cross currents are probably quite sensitive to the distribution of the initial impact effect. It follows therefore that one should expect a substantial variability in the responsiveness of total output to a given increase in government expenditures.

Our last case pertains to government demand for labor services. An increase in this demand raises human wealth (in output units) and consequently expands private demand for output. There is however also a substitution effect which lowers the private sector's demand for the labor services involved. This repercussion moderates the magnitude of the wealth effect. Moreover, the substitution effect transmitted via labor markets lowers the supply of output associated with given output prices as a result of "tighter labor markets". This raises output prices and lowers the quantities actually produced and demanded. Once again we trace some cross currents induced by wealth and substitution effects. The net effect depends on the relative weight of these effects. In particular, the occurrence of a wealth effect with sufficiently dominant weight assures a net expansionary influence on economic activity, whereas the pronounced occurrence of various substitution effects influences the outcome into an inconclusive or even negative direction.

The consequences of a tax increase are not elaborated at this occasion. It would be necessary to examine separately the effect of an increase in excise taxes on existing financial assets, on existing real assets and on current output, increases in taxes on yields from non-human wealth (real and financial) and from human wealth. A detailed price-theoretical analysis would again uncover substantial differences between the various tax categories expressed

by the extent of cross currents induced by various combinations of wealth and substitution effects[34].

The outline of a relative price analysis of fiscal policy thoroughly buries any notion of a "direct and reliable" influence on economic activity[35]. It suggests on the contrary that the response of economic activity to fiscal policy remains at most quite moderate. It indicates, moreover, why this response is probably rather volatile. Changes in the composition of government expenditures and different combinations of tax measures yield substantially modified effects on economic activity. This result conflicts radically with the traditional multiplier analysis which yields clear and reliable responses to fiscal policy measures. The conflict follows from the different views of the nature of the transmission mechanism. Systematic application of relative price theory to the balance-sheet, current output *and* most particularly to the interaction between balance-sheet magnitudes and current output yields a different conception about the role of fiscal policy. The Keynesian view essentially abandoned the price-theoretical program visualized by Keynes, and a multiplier emerged with no attention to relative price processes beyond some interest rate responses. The Neo-Keynesian position subjects a larger range to price-theoretical analysis. Relative price analysis is applied to the portfolio adjustments of the balance-sheet, but output and the interaction between output and balance-sheet remain beyond the application of relative price theory. A relative price theory of the balance-sheet is thus combined with a traditional multiplier analysis essentially denying price theoretical considerations. The Neo-Keynesian position thus still adheres to central ideas of the Keynesian view of the transmission mechanism[36].

An examination of the role of fiscal policy is not exhausted without consideration of the feedback effect associated with a persistent deficit or surplus of the

[34] The analysis of a tax change has been outlined in my paper, "The Relative Price Theory of Output, Employment and Money", *op. cit.*

[35] The highly simplified model in appendix IV conveys some of the cross currents induced by a change in government expenditures or taxes. These cross currents operate via the asset markets and the price setting behavior. Under specifiable conditions, the response of private aggregate real demand a to a change in government expenditures is negative.

[36] The Neo-Keynesian position is succinctly stated by Warren Smith, "On Some Current Issues in Monetary Economics: An Interpretation", *op. cit.* We read on page 767 that "integration" of portfolio theory with "the earlier (!) theory of income generation" forms one of the "most striking developments in macroeconomics". We also note on page 773 a description of a portfolio model and the following comments by the author: "...this kind of model is decidedly Keynesian in spirit. A stimulative monetary policy action ... would initially lower interest rates, causing a sequence of portfolio and wealth adjustments which would expand aggregate demand for goods and services. This would set off multiplier and acceleration effects...".

government sector. Standard Keynesian analysis represented by sample selections from textbooks on macroeconomics reflects the built-in disregard of relative price theory also in this respect. The usual formulations imply that a persistent deficit (or surplus) has per se no further effect on the economy. The role of the government sector's budget constraint has recently attracted some attention and recent work has incorporated this constraint into the Keynesian system[37]. The deficit is necessarily equal to the change in the stock of government securities outside the government sector plus the change in base money associated with financing the deficit. A persistent deficit affects thus two stock magnitudes, the stock of securities and the stock of money via the monetary base. The feedback via the money stock can be easily admitted into the Keynesian system; a persistent deficit pushes the LM curve continuously to the right. Income thus expands and the process continues until income has expanded sufficiently to induce a tax increase which eliminates the deficit. There are some problems for the Keynesian position in this account. The standard formulation adheres to a downward sloping IS curve. We obtain thus a continuous decline in interest rates even for an outrageously large deficit pushing the LM curve far to the riht. This implication reveals again the low attention assigned to relative price phenomena. It is difficult to reconcile with our experiences which usually associate rising interest rates with a large deficit financed by an inflationary expansion of the base.

But the difficulties for the Keynesian framework mount with the securities component in the budget constraint. The standard formulation provides no mechanism linking the changes in the stock of securities resulting from a deficit with the economic system. As the system is usually formulated the increase in the stock supply of securities simply has no effect on anything, and most particularly exerts no effect on interest rates[38]. At this stage the rejection of price theory is complete. It results of course from the peculiar structure of the Keynesian system inherited from Keynes' simplification. Keynes admitted two assets into his analysis, money and real capital represented by bonds. He required thus only one asset market and could invoke Walras law for the other. However, issues of government bonds to finance a deficit disrupt the representation used by Keynes. Moreover, real capital and financial assets are less than perfect substitutes. This recognition actually necessitates introduction of an additional market into the analysis supplementing the Walrasian money

[37] Carl Christ, "A Model of Monetary and Fiscal Policy Effects on the Money Stock, Price-Level and Real Output", *Journal of Money, Credit and Banking*, November 1969; William Silber, "Fiscal Policy in IS-LM Analysis: A Correction", November 1970, *Journal of Money, Credit and Banking*.

[38] The reader may wish to consult the introductory chapter by Warren Smith from the book *Readings in Money, National Income, and Stabilization Policy*, ed. by W. L. Smith and R. L. Teigen, Richard D. Irwin, 1970.

market. Keynesian analysis adhered nevertheless to the old framework which precluded an adequate incorporation of the complete feedback effect of a persistent deficit. The only avenue left in the confines of a Keynesian framework was the effect of rising wealth induced by an increasing stock of securities on money demand. To this extent it required however, a modification of the standard formulation centered on a current income hypothesis of money demand interpreted in the mold of a transaction approach. Still, a feedback channel has been opened in this manner which pushes the LM curve gradually to the left in response to a deficit financed by new issues of securities. A persistent deficit financed by new securities thus simultaneously lowers income and raises interest rates. The fall in income lowers taxes and thus raises the deficit. The process initiated is thus basically unstable without additional stabilizing feedbacks admitted into the system. It is also noteworthy that the shift in the LM curve expressed as an elasticity, associated with new security issues is probably around one-tenth of the shift associated with the new issue of base money.

The channel opened via wealth effects of money demand remains incapable to admit an effect of changes in the stock supply of securities on creditmarkets. The "Neo-Keynesian" analysis developed at Yale substantially corrected this omission. Similarly, the price-theoretical approach to the transmission mechanism offers a useful framework for the analysis of persistent deficits (or surplus positions). The operation of the budget constraint can be incorporated into the model in appendix IV. Output can be shown to respond to a persistent deficit according to the distribution of its financing between new issues of securities or new issues of base money. New issues of base money raise the money supply in the Walrasian money market and the banks asset portfolio in the creditmarket. These changes lower interest rates on financial assets and raise the asset price of real capital with substantial expansionary repercussions in the output market. New issues of securities raise the public's asset supply on the creditmarket and raise by a minor amount money demand. The latter event reflects the wealth effect of security issues already incorporated into the Keynesian position. These two changes raise interest rates and probably raise somewhat the asset price of real capital with corresponding ambiguous repercussions on aggregate demand and economic activity. The cross currents generated in the asset markets by the new issues of securities reflect a price-theoretically important fact, i. e. the larger stock supply of securities must be absorbed by the asset market. The relative magnitude of the cross currents depends substantially on the substitutability between money and real capital compared to the substitutability relation between money and financial assets. Increasing predominance of the money-financial assets substitution relation attenuates the weight of the negative components in the cross currents and assures a net expansionary effect on output. But this effect

remains quite small compared with the response induced by a deficit financed by new issues of base money. Still, it is noteworthy that a predominant money-financial asset substitution reverses the effect of a (security financed) deficit described by the modified Keynesian analysis discussed above. The price-theoretical analysis thus establishes a feedback loop from the government sector's deficit to the output market via the asset markets. Both deficit and surplus thus set in motion forces which tend to remove the initial unbalance of the budget.

Recent discussions tended on various occasions to associate the role of fiscal policy with the degree of substitutability between money and financial assets[39]. It was noted in the previous paragraph that this relation does assume some significance in the analysis of fiscal policy. But this role bears on the consequences of a persistent deficit financed by new issues of securities. A radically different role has been attributed however by Samuelson and Goodhart. It has been stated that the greater the substitutability between money and financial assets, the greater is the role of fiscal policy relative to money[40]. This proposition has frequently been combined with similar or related statements associated with the transition from a Keynesian to a Neo-Keynesian position[41]. A detailed examination of these statements yields rarely any support. This holds in particular for the Samuelson-Goodhart proposition. It is advanced as a general statement unconditioned by some particular paradigmatic conception. It is crucially conditioned however by the Keynesian view. We frequently observe that the Keynesian view of the transmission process is advanced as the paradigm within which the substantive conflicts in contemporary monetary analysis should be formulated and resolved. Once one accepts such paradigmatic legislation, the issue between conflicting conjectures bearing on the comparative role of fiscal and monetary impulses is effectively reduced to the degree of substitution between money and other financial assets. It is therefore noteworthy that Goodhart's results establish, inspite of the paradigmatic confinement, no case for the dominant role of fiscal policy with respect to the contours of economic evolution. But Goodhart's result, while still interesting in some respects, does not bear on the relevant issues. These issues are not resolvable *within* the Keynesian paradigm. They involve a substantial conflict between major *alternative* views of the transmission mechanism represented in simplified version by the models in appendices II and IV.

[39] Paul Samuelson, "The Role of Money in National Economic Policy", *Controlling Monetary Aggregates*, Federal Reserve Bank of Boston, 1969. C. A. E. Goodhart, "The Importance of Money", *Bank of England Quarterly Bulletin*, June 1970.

[40] "The greater the degree of substitution between money and other financial assets, the less would be the expected effect from any given change in the money supply", Goodhart, *ibid.*, p. 163.

[41] One such statement formulated by Gurley-Shaw may be considered here: The smaller the proportion of bank liabilities in the total volume of financial institution liabilities the less effective is monetary policy.

A detailed analysis of the price-theoretical model yields a very interesting result bearing on the Samuelson-Goodhart proposition. The degree of substitution between money and other financial assets expressed by the interest elasticity of the money demand function is neither a necessary nor a sufficient condition with respect to any proposition concerning the relative role of fiscal or monetary impulses. In particular, the analysis demonstrates that a very high interest elasticity of money demand is consistent with a dominant role of monetary impulses, provided the interest elasticities on the credit market are even larger. The crucial conditions in the alternative paradigm characterizing the nature of the transmission mechanism refer to the relative order of interest elasticities operating on the credit market and the Walrasian money market. This *relative order* determines, irrespective of the *level* of interest elasticities, the comparative significance assignable to fiscal and monetary policy. The prevalent attitude expressed by Samuelson-Goodhart thus reveals some misconception concerning the content of current disputes. They do not revolve around minor structural detail of a generally accepted paradigm. They involve on the contrary, this very paradigm and bear on different views of central monetary *and* fiscal mechanisms.

3. The Role of Interest Rates and the Burden of Monetary Policy

The initial emphasis on fiscal policy associated with the use of the Keynesian frame was based on the hypothesis of a steep slope for the IS curve reenforced on occasion by the hypothesis of a very flat slope for the LM curve. These assumptions were gradually relaxed over the postwar period. The cumulative effect of many investment studies modified the assessment of the IS slope. This slope became gradually less steep. Moreover, flat LM curves were banished to the alleged liquidity traps of the 1930's. Both Keynesian analysis and Credit View thus recognized the operation of monetary impulses and the relevancy of monetary policy. Nevertheless, fiscal policy remained the centerpiece of stabilization policy for both positions. The modification of empirical assumptions within the inherited paradigm or the substantive difference between standard Keynesian analysis and the Credit View did not affect the central emphasis on fiscal policy. The rationale for this emphasis was changed, however. The assignment of the major stabilization task to fiscal policy was not based any more on the slope properties of the IS-LM diagram. It still depended nevertheless, on the borrowing cost interpretation of the aggregate demand function's interest elasticity. This interpretation implies that investment expenditures and particularly the housing industry form a crucial link in the transmission of monetary impulses. Housing is usually included among the activities which bear substantial borrowing costs relative to total invest-

ment costs. Restrictive monetary policy thus imposes a large burden on an important industry. This industry and the financial institutions related to it acquired increasing political weight during the 1960's. It followed that the goals of economic policy gradually expanded from price-level, unemployment, and balance of payments to include also interest rates and specific lines of production, in particular the production of new housing. The use of monetary policy appeared to be inconsistent in the context of a Keynesian framework with these new goals. The use of restrictive monetary policies seems to retard inflation and economic activity via large repressive effects on housing and related investment expenditures. The extension of economic goals from general aspects of an economy's macro-behavior to specific allocative requiremets constrained the authorities' reliance on monetary policy. Moreover, fiscal policy is much more adaptable to the detailed allocative goal which seems to satisfy our economic planners and also justify their function. In summary, we observe thus over the last decade an increasing recognition of the potency of monetary impulses even in the context of a Keynesian or Neo-Keynesian framework. But this recognition only changed the rationale of the preference for fiscal policy. This preference was now based on goals of economic policy involving crucial constraints on resource allocation and the relative varibiality of the housing industry[42].

It is noteworthy that the relative price theory of the transmission mechanism rejects both the old and the new rationale justifying the dominant use of fiscal policy. The relative price theory offers foremost a different interpretation of the channels transmitting monetary impulses. It follows that the IS curve is flatter in this analysis and moreover subject to reenforcing shifts of position. The older rationale of fiscal policy can thus not be reconciled with the relative price theory. But neither can the new rationale. The relative price theory rejects emphatically the idea that the housing industry forms a focal locus of monetary policy, through which the major force of monetary impulses must be channeled in order to swing the whole economy in the desired direction. The analysis of the transmission mechanism offered by the relative price approach denies in particular, systematic timing differences in the relative position of housing expenditures or even of investment expenditures. The relative price theory implies that consumer expenditures are affected with equal speed as investment expenditures. This effect is not delayed by the prior operation of a multiplier mechanism set in motion by earlier changes of investment expenditures. The view about the transmission mechanism thus

[42] The reader may find it useful to consult Arthur Okun's, *The Political Economy of Prosperity*, New York, 1969. The change in rationale was on occasion tinged with overtones of "Brunner's law": There always exists a goal function and an unsubstantiated hypothesis such that an arbitrarily chosen policy is optimal.

determines the significant use of key industries to be watched in order to assess the economy's response to monetary policy. The Keynesian and Neo-Keynesian view recognizes in major investment categories such key entities. The relative price theory rejects on the other hand any notion of "key industries" and denies the *systematic* occurrence of timing sequences in responses of major activity groups.

The instability of the housing industry over the recent decade is of course incontestable. Keynesian analysis asserts that variations of monetary policy imply the observed instability. The Credit View would add that large variations in Treasury borrowing from the public reenforce this instability. The relative price theory offers an alternative explanation for this phenomenon. It acknowledges that variations in monetary policy and deficits affect the construction industry. But it denies that these variations are sufficient to explain recent instability of the housing industry. This pronounced instability resulted from the variability of monetary and fiscal policies *combined* with a rigid price-fixing in the form of ceiling rates on time deposits and share accounts of savings and loan associations. A restrictive policy pushes interest rates over the shorter-run beyond the ceiling constraining interest rates on liabilies of financial institutions. Investors consequently respond by reallocating their claims from financial institutions to market instruments. The resulting decline of the banks' time deposit ratio and the savings and loan associations' liabilities lowers the supply of new mortgage funds. The resulting increase in mortgage rates sharply curtails the demand for housing and compresses the new production of housing. It is noteworthy that a persistent monetary expansion yields the same result. Interest rates respond over the intermediate run *positively* to a monetary expansion according to the relative price approach, and the positive response increases with the time span over which monetary expansion proceeds. It follows that a persistent monetary expansion also curtails housing, actually more persistently than a restrictive monetary policy. The housing industry would have behaved very differently in the absence of the price-fixing arrangements.

The discussion of the role housing bears on a frequently encountered issue which forms an interesting parallel to the Samuelson-Goodhart proposition. It has been argued that the effectiveness of monetary plicy can be gauged from an examination of records summarizing the role of interest rates in investment decisions. If the increase in interest rates induced by a restrictive monetary policy compresses investment plans by a small proportion, monetary policy is said to be ineffective. This conception is of course governed by the Keynesian view of the transmission mechanism. The alternative view implies that the information adduced, if we accept it at face value, is quite incomplete and is not sufficient to determine the responsiveness of the economy to mone-

tary policy. The frequency of investigations bearing on businessmen's responses to interest rates attests to the successful survival of the Keynesian view. It should be noted however, that the observations collected from businessmen's survey can only yield information about the efficacy of monetary policy in case one already has decided to accept unquestioningly the Keynesian paradigm[43].

The alternative views about the nature of the transmission mechanism clearly bear significantly on major policy problems and the evolution of various policy programs. Quite apparently the conflict between the alternative views is more than a learned game and poses a serious challenge to our cognitive efforts. It is therefore quite important to avoid confusing misconstruals of the alternative positions. One frequently encounters arguments which juxtapose the Keynesian view centered on the interest rate mechanism with an alternative view centered on the money supply[44]. This formulation of the alternative is thoroughly misleading and actually false. The relative price approach centers the transmission process on the play of relative prices over the spectrum of assets, liabilities *and* current production. The interest rate mechanism forms a special aspect of this relative price process. Capital theory informs us that changes in relative prices of goods with different yield streams are equivalent to changes in interest rates. The converse of this proposition is also true. In the case of the simplified schema developed in appendix IV a correspondence can be established between the asset price on real capital and the real rate on real capital, such that an increase in the asset price implies a reduction in the real rate and vice versa. The general role of interest rates does not distinguish therefore between the Keynesian and non-Keynesian positions. The crucial difference occurs in the range of the interest rates recognized to operate in the process. The Keynesian position restricts this range to a narrow class of financial assets, whereas the relative price theory includes interest rates over the whole spectrum of assets and liabilities occurring in balance-sheets of households and firms. The miscontrual of the relevant alternatives becomes quite apparent upon inspection of the model in appendix IV. It is strictly centered on substitution and wealth effects. The money supply does not even occur as a variable in the system. The money supply is thus no variable characterizing the transmission process. Perhaps the inherited confusion will hopefully disappear in

[43] The reader may consult on this point my article on "The Monetarist Revolution in Monetary Theory", *Weltwirtschaftliches Archiv*, Heft 1, 1970.

[44] William Brainard formulates this juxtaposition quite succinctly: "...to regard the structure of interest rates, asset yields and credit availabilities rather than the quantity of money as the linkage between monetary and financial institutions and policies, on the one hand, and the real economy on the other", in "Financial Intermediaries and a Theory of Monetary Control", *Financial Markets and Economic Activity*, p. 96, New York, 1967.

the future so that we may attend to the substantive problems really existing[44a].

4. *The Choice of Policy Arrangements and Policy Instruments*

It has been customary in our public debate to emphasize the role of the Keynesian analysis. It may appear therefore that our description of the Credit View is a redundant nicety covering an esoteric possibility of no real impact. Actually, this view exerted a pronounced influence on recent developments of monetary policy. Congress passed in the fall of 1969, against the wishes of the Administration, a bill empowering appropriate Federal agencies to impose controls on specific credit transactions, most particularly on bank loans to business. In the fall of 1966, a letter was addressed by the Board of Governors of the Federal Reserve System to all member banks linking availability of discount facilities with acceptance of severe constraints on the extension of business loans. The Board also refused to raise the ceiling rate on time deposits during the winter of 1968/69 with the argument that the "disintermediation" induced by rising market rates relative to the ceiling rate retarded the banks' loan expansion. The use of Regulation *Q* was guided on several occasions by similar arguments and we heard repeated arguments that Regulation *Q* is the "cutting edge of monetary policy". The Board of Governors also imposed in 1969 reserve requirements on member banks' Euro-dollar liabilities to their foreign subsidiaries, including any other loans obtained in direct or indirect form from foreign subsidiaries. The change in the arrangement of reserve requirements was justified by the Federal Reserve's need to control the banks' portfolio of business loans. Recourse to the Euro-dollar market permitted US member banks to expand their loan portfolios. An anti-inflationary policy seemed to require suitable measures to control this flow of loans. Lastly, several high officials of the Federal Reserve System recently proposed systematic extension of this requirement procedure. Requirements should be assessed not on deposits but on assets of banks in accordance with the role of these assets in credit markets.

[44a] The chapter on Monetary Policy covers a related confusion, viz. that the best indicator of monetary policy must be a central variable of the transmission process. It can be demonstrated that the dynamic version of the system presented in appendix IV which is outlined in appendix V actually implies that the rate of change of the money stock is the best indicator of monetary impulses. This result is crucially dependent on the Hotelling conditions imposed on the asset markets. The role of the money stock as an indicator is thus shown to be totally independent from its occurrence as a variable in the system. The reader may also consult Warren Smith's article referred to previously. This article assigns substantive significance to the occurrence or non-occurrence of an explicit money supply variable. This issue is a red herring.

None of these measures applied, passed or proposed by our authorities can be rationally justified in terms of the standard Keynesian analysis or the relative price theory. The Keynesian analysis offers no opportunities to examine these measures. According to the standard paradigm these measures are essentially useless. The relative price theory on the other hand offers an opportunity to analyze these measures. They usually modify the relative cost and yields of specific financial assets. The Federal Reserve circular in the fall of 1966 raised the yield of government securities relative to the net yield on business loans in banks' portfolios and thus induced banks to hold larger investments. The act passed by Congress in 1969 exerts a similar effect when actually applied by the Board of Governors. The requirement on Euro-dollar liabilities raises the cost of acquiring funds and thus lowers the supply of loans under the prevailing circumstances. However relative price theory also concludes upon further examination that these measures exert dominantly an allocative effect expressed by modification of *relative* asset yields and interest rates on the credit markets. The average level of interest rates on financial assets is little affected relative to the real yield on real capital. It follows that these measures are essentially ineffective with respect to aggregate demand and economic activity.

Both Keynesian analysis and relative price theory thus imply that the measures introduced or pursued have no useful funciton in stabilization policy. The Credit View on the other hand seems to yield a different conclusion. Some of the measures described lower the marginal propensity of aggregate demand with respect to the "availability" of credit, i. e. the flow rate of bank credit occurring as an argument of the aggregate demand function in appendix III. This follows from the positive dependence of this marginal propensity on the marginal loan-investment ratio. Even with an unchanged growth rate of total bank credit the aggregate demand for output will decline as a result of such measures. Other measures affect mostly the response of the banks' adjustment rate $\mathring{E}$ of bank credit to the prevailing market conditions expressed by the index i^1 of credit market rates. In particular, under Regulation Q the sign of the derivative $\partial\mathring{E}/\partial i^1$ turns negative whenever market rates rise sufficiently above the ceiling rate. This sign reversal in the behavior function of appendix III describing the banks' desired rate of adjusting the portfolio of earning assets offers thus an explication for the notion that the ceiling rate on time deposits form the "cutting edge of monetary policy". Moreover, the requirements on Euro-dollar liabilities also lower the derivative noted above. They also lower $\mathring{E}$ quite directly as an inspection of the equations in appendix IV reveals. All the changes introduced by the measures listed thus appear to have worked in an anti-inflationary direction according to the credit conception of the transmission mechanism.

This conclusion is however based on an incomplete and essentially partial analysis of the Credit View. The conclusion mentioned appears inescapable if one singles out the aggregate demand function and the banks' adjustment function and disregards further feedback effects. An examination of policy discussions suggests that the assessment of the results was essentially guided by such a partial analysis. The results are however radically changed by a more complete analysis which elaborates the full interaction of output market, credit market and "money market". The analysis of a fully developed Credit View presented in appendix IV implies a substantially different conclusion. The measures considered moderate only *temporarily* the prevailing inflationary pressures. Inflationary pressures can only result from a relative expansion of the monetary base or government expenditures, even in the context of the Credit View. Suppose now that the base or government expenditures grow at a specific (exaggerated) rate which produces the observed inflation. Now consider any measures which lower the marginal propensity of aggregate demand with respect to the flow rate of bank credit, raise the average reserve ratio, and depress the response of the banks' credit adjustment rate to market rates. These measures do affect aggregate demand and economic activity, but only in a once and for all fashion. Given the growth rate of the base or government expenditures the measures will dampen for a while the inflationary pressures. But they do not change the underlying situation and inflation will resume after the effects of the measures have been absorbed. Even the Credit View, when properly applied, yields little support for the credit policy approach to stem inflation. The initial appearance of support for the measures pursued both by Congress and the Federal Reserve authorities offered by the Credit View derives from a *partial* and incomplete analysis of the interaction between the crucial relations describing an economy's functioning.

5. The Role of Keynes' Fundamental Problem: The Relative Adjustment Velocity of Prices and Outputs and the Wage Equation

It is argued on occasion that Keynes' basically addressed himself to the possibility of an underemployment equilibrium. In a sense this is a trivial issue. Such a state is of course possible. But this acknowledgment does not bear on our problem. Keynes questioned the inherited paradigm which implied that, apart from institutional constraints in form of minimum wages and labor market monopolies, the economic process continuously absorbs all external shocks in directions converging to a full employment equilibrium This convergence property yields probably a more relevant interpretation of Say's Law than Oscar Lange's or Keynes' own interpretation. Moreover, Keynes can be properly understood to have questioned and rejected this interpretation of Say's Law.

He asserted thereby that under specifiable conditions the economic process does not converge to a full employment equilibrium position.

The price-theoretical argument developed in chapter 2 of the *General Theory* probably motivated the rejection of Say's Law. Keynes recognized very clearly some fundamental difficulties with inherited price theory. The Marshallian framework approximated the flow of events with a sequence of four states, the temporary market equilibrium, the short-run, intermediate-run, and the long-run equilibrium. The differentiation between temporary and short-run equilibrium is of particular importance for our purposes. The distinction is based on the relative speed of price and output adjustments. Inherited price theory postulated a dominant adjustment speed of prices relative to changing market constellations in the shorter runs. Such a theory could not be reconciled with mass unemployment of labor. But the failure of this inherited price theory is not restricted to the labor market. Queuing problems, inventory behavior, variations in the stock of unfilled orders become difficult to explain. The postulate of a dominant adjustment speed for prices thus yielded implications which could not be reconciled with a wide array of observations. Keynes thus reversed the Marshallian ordering of relative adjustment speeds. This was formalized in Keynesian analysis by introducing the price-level or money wage level as an institutional datum. Keynes used the money wage as a fixed point of reference. Similarly, many contributions proceeding in the context of Keynesian analysis either assume prices to be constant or irrelevant.

Keynes' attention was unquestionably centered on a fundamental price-theoretical problem, expressed by the comparatively low adjustment speed of prices in response to changing market conditions. But the problem posed by comparatively "inflexible" prices and wages was only recognized, but remained unexplained. The recognition was expressed by the usual assumption which introduced money wages as an institutional datum up to the full employment level. There occurred of course references to the effect of trade unions, customs, institutions and "money illusion". But these references remained analytically extraneous and arbitrary conventions which yielded no adequate hypothesis about the behavior of money wages and and prices. Keynesian analysis thus distinguished two states of affairs. One was a state with identical movements of real and nominal magnitudes, whereas the other state exhibited in short-run statics only variations of nominal values. All cases of less than full employment form the first state and full employment conditions characterize the second case. It is tempting and easy to criticize this simplistic analysis. Still, it formed a crucial milestone in the development of monetary analysis and price theory. It emerges as a first groping attempt to cope with the difficulties posed by the "Keynesian Revolution" which reversed the Marshallian relative adjustment speeds. Its failure to explain

observable movements of money wages and associated price movements obstructed however, the useful application of the analysis. Most particularly, the classification of all observable conditions into the two states characterized above in terms of nominal and real values remained a somewhat crude approximation.

A major breakthrough in the analysis of monetary processes occurred with the appearance of the Phillips curve analysis. The Phillips curve postulates a depenence of the relative rate of change of money wages on unemployment. Its analytic role can be explained by means of the following system:

1.	$Y = \alpha(i, Y) + G$	output market
2.	$M = \lambda(i, Y)$	money market
3.	$Y = Py$	definition
4.	$y = f(N, K)$	production function
5.	$\frac{\dot{W}}{W} = h\left[\frac{L-N}{L}\right]$	wage adjustment
6.	$P = \frac{W}{f_N(N, K)}$	production equilibrium
7.	$u = \frac{L-N}{L}$	definition of unemployment rate

where the symbols are assigned their standard meaning: $Y =$ income at current prices, $i =$ nominal rate of interest, $y =$ real income ($=$ output), $N =$ employment level, $L =$ labor force, $K =$ stock of real capital, $W =$ money wages and $p =$ price level. The magnitudes M, G, L and K are relatively exogeneous.

We notice that nominal income and interest rate are determined by the first two equations in terms of money stock M and government expenditures G. With the solution of Y from this subsystem and the remaining equations one obtains a differential equation for money wages, namely

$$\frac{\dot{W}}{W} = h\left[1 - \frac{1}{L} N\left(\frac{Y}{W}, K\right)\right].$$

For some positive level of unemployment rate u, money wages will stabilize, i.e. $\dot{W} = 0$. This will occur at an income level in wage units (i.e. Y/W) sufficiently small relative to K which yields the required unemployment rate.

Money wages will increase and govern via equation 6 a corresponding increase in prices at unemployment levels below the wage stabilizing level.

The price theoretical modification of the Keynesian framework by means of the wage adjustment equation expressed by the Phillips curve defined a new policy problem. There emerged the trade-off between unemployment and price stability. The analysis implies that the authorities can lower unemployment to any desired level, provided they accept the associated inflation. In case the wage stabilizing unemployment rate u^* is too high the monetary and fiscal authorities can increase employment at a rate sufficient to assure any desired level $u < u^*$. Suppose a given unemployment rate u is selected as policy target. This implies by the wage adjustment equation some rate of increase $\dot{W}/W$ of money wages. But a constant u implies that with given L and K income in wage units (Y/W) must be constant. It follows that $Y = Py$ must increase at a rate identical with the rate of increase of money wages.

i. e.
$$\frac{dY}{Y} = \frac{dW}{W}.$$

This movement of income can be achieved by suitable combinations of changes in the money stock and changes of fiscal variables.

The nature of the trade-off depends of course on the properties of the wage adjustment process. Two properties were particularly examined by an extensive empirical research. One was the wage stabilizing unemployment level u^* and the other was the derivative of the adjustment function h. The seriousness of the trade-off problem seemed to increase with the level of u^* and the numerical magnitude of the derivative. But the ensuing research and associated discussions gradually yielded some important reconsideration of the original wage adjustment equation. These reconsiderations merge with the price-theoretical reformulation initiated by Keynes' questioning of the inherited paradigm.

The accumulating evidence bearing on the Phillips curve yielded more questions than support. Observations suggested that the curve was unstable between countries and different periods. One attempted of course "to stabilize" the wage adjustment equation by including more variables or by more appropriate measurement procedures for the variables already included. Some portions of this work deserve a serious examination. But other portions, particularly the inclusion of new variables proceeded usually in a rather ad hoc fashion without a coherent analytic idea. There were also attempts to replace the wage adjustment equation by wage setting or wage determination equations. But the most important contributions occurred on an analytic level. The Phillips curve appeared in a rather ad hoc manner as a description of observable gross associations. Some ana-

lytic foundation was subsequently provided by Lipsey and others. But the increasing reservation about the usefulness of the original formulation encouraged further inquiries into labor market adjustment processes. This analysis merged with the new trend in price theory which gradually evolved over the 1960's. The role of the "new micro-economics" was already discussed in previous chapters. The explicit recognition of information and readjustment costs exerted a fundamental influence on monetary analysis. Inherited price theory could not explain the role and productivity of money. Neither could it explain variations in the rate of utilization of human or non-human capital, and particularly the systematic differences in these variations among different types of resources. The inherited theory was more successful in explanations of longer-run phenomena. Such contexts usually involve vanishing marginal costs of information and readjustment. But the explicit recognition of these costs forms a necessary condition for the successful analysis of short-run or intermediate-run phenomena. In particular, variations in the use of available resources are subsumable under a generalized wealth-optimizing hypothesis. Relatively inflexible wages and prices become rationally explainable without recourse to extraneous "institutional data". On the contrary, relevant institutional data become incorporated among the explicata.

Several consequences of the price-theoretical reformulation deserve some attention. Consider the fate of the Phillips curve. The analytic reconsideration guided by the extended price theoretical approach yields an expression of the following general kind.

$$\frac{\dot{W}}{W} = \beta_1 \frac{\dot{W}^a}{W^a} + \beta_2 \frac{\frac{d}{dt} f_N}{f_N} + \beta_3 \frac{\mathring{\omega}}{\omega} + h(u)$$

where W^a is the anticipated wage level, ω is an index summarizing anticipated intermediate run market evolutions, and f_N refers to the marginal product of labor. The adjustment in wage rates is now explained by an interaction of short-run, intermediate-run and longer-run forces. The short-run effect is caught by the last term which was the single term considered by the Phillips' curve analysis. The intermediate-run effect is conveyed by the second and the third term. The coefficient β_2 is constrained to the closed unit interval. If $\beta_2 = 1$ then the markets operate in such a manner that increases in the marginal productivity of labor are completely absorbed by rising money wages. In case however, $\beta_2 = 0$, increasing marginal productivity of labor is absorbed by falling money prices. The first term expresses the longer-run influences conditioned by anticipations of wage movements. All β-coefficients are positive, the derivative of the production function f assumes the usual sign and

the derivative of h is negative. The first three terms of the new wage adjustment equation can now be interpreted to explain the *position* of the old Phillips curve with a slope determined by h. The position depends on productivity experiences expressed by the growth rate of the marginal productivity, the cyclic phase of market evolutions reflected by the third term, and accumulated inflationary (or deflationary) anticipations formulated by the first term. A persistent inflation gradually raises the first term and thus pushes the Phillips curve upwards. The Phillips curve moves higher with the length, speed and persistence of an inflationary experience. This implies that the rate of wage adjustment associated with any particular level of unemployment rises with the length and magnitude of inflation.

The contribution of the new approach in price theory is clearly visible in the role of the first three terms. The operation of information and readjustment costs explains the response of W^a and ω to changing circumstances. They also explain partly the magnitude of the β_2 coefficient. Moreover, the lags generated by information and readjustment costs which retard the full adjustment of W^a and distribute the movement of the index ω over time generate opportunities for monetary or fiscal expansion to lower unemployment over a shorter run. Similarly, the same properties of the economic process convert a deceleration of monetary or fiscal impulses into an increase in unemployment associated with rising prices over a transition period. In both cases of acceleration and deceleration the operation of the two cost functions assures that the movements induced by the changes are constrained to follow the line of the inherited short-run Phillips curve with a position determined by the sum of the first three terms. But persistent movements along the short-run Phillips curves sets other forces in motion which modify the sum of the first three terms. A motion upwards along the short-run curve gradually pushes the whole curve upwards and a motion downwards along the shotr-run curve induces downward revisions of the whole curve. These induced revisions of the curve relating wage changes $\dot{W}/W$ with the unemployment rate u modified the notion of a trade-off. The effect of any given inflation on unemployment was bound to decay by the delayed response of the anticipation terms W^a and ω summarizing the markets information and readjustment processes.

The feedback of movements along the short-run Phillips curve into modifications of its position expressed by the sum of the first three terms, posed an important and still unsettled problem. The issue under consideration bears on the strength of the feedback expressed by the coefficients β_1 and β_3. The discussion has centered particularly on the long-run aspects of the feedback mechanisms summarized by β_1. The issue can also be described as pertaining to the nature of the long-run form of the Phillips curve. Its analytic represen-

tation of this long-run form is obtained by equating W^a and W (and $\dot{W}^a = \dot{W}$ and omitting ω. We obtain thus

$$\frac{W}{\dot{W}}(1-\beta_1) = \beta_2 \frac{\frac{d}{dt} f_N}{f_N} + h(u).$$

Some economists claim that $\beta_1 < 1$, while others assert that $\beta_1 = 1$. Both positions imply that the long-run curve is much steeper than the short-run curve. But the first position implies the occurrence of a trade-off even for the long-run. The conditions of this remaining long-run trade-off are however much worse than the short-run curve might suggest. The second position denies the existence of a long-run trade-off. With $\beta_1 = 1$, there exists a long-run equilibrium rate of unemployment which depends on the relative change of labor's marginal product, the factors shaping the coefficient β_2, and the function h. It is generally acknowledged that β_2 and h are essentially independent of monetary and fiscal impulses and depend on "real factors" bearing on the operation of markets.

The discussion of the most recent past revealed a growing resistance to the theory of a "natural" or "long-run equilibrium rate" of unemployment independent of monetary-fiscal forces. Activist policy conceptions reenforced by the Keynesian view of the transmission mechanism and impulse force find it difficult to accept a hypothesis asserting that monetary-fiscal policy cannot be usefully exploited to achieve an arbitrary long-run target rate of unemployment. Two strands of ideas combine in the critique made by the Neo-Keynesian position addressed to the theory of a natural equilibrium rate of unemployment. One strand emphasizes the relatively moderate contribution of monetary policy for purposes of shorter-run economic stabilization. The other strand insists on the usefulness of monetary policy for longer-run stabilization policy. In contrast, the monetarist position to be examined in a later chapter, asserts the dominant role of monetary impulses in shorter-run stabilization problems. It recognizes the occurrence of substantial output and employment effects induced by monetary accelerations or decelerations. But it denies any "real significance" of monetary policy with respect to the unemployment rate in the long-run. The Neo-Keynesian position thus asserts the existence of a trade-off in the long-run between the rate of unemployment and the rate of inflation (i.e. inflation velocity), the other position denies this trade-off and asserts that instead there exists only a long-run trade-off between the rate of unemployment and the *acceleration* of inflation.

The issue between the two positions can be represented by the coefficient β_1. Some preliminary statistical investigations yielded an estimate substantially below unity. It appeared thus that a trade-off between inflation *velocity* and the rate of unemployment persisted into the long-run equilibrium. This may indeed be the case. But substantially more detailed investigations will be required. Such investigations will have to draw substantially on the analytic foundations prepared by the "new micro-economics". This analysis bears on a crucial aspect of the preliminary statistical results. These results were obtained by assuming that the adjustment coefficient β_1 is constant. This assumption should be carefully reconsidered. The operation of information and adjustment costs would seem to imply that β_1 varies in response to the actual acceleration and velocity of inflation experienced. Actual wage movements are not immediately adjusted to the revisions in anticipated wage movements. Actual wage movements emerge from the stochastic process governing the crucial flows through the labor market. Costs of information and readjustments affect the structural properties governing the delays of wage movements behind revised anticipation and aspiration levels. Such a lag would appear in form of a β_1 coefficient less than unity. According to this explanation estimates of β_1 should therefore be expected to be substantially below unity in comparatively mild or gradually emerging inflation. This should however change with lengthy experiences of moderate inflation velocities or experiences of pronounced inflation accelerations. The delays built into the labor market processes shorten under such circumstances and β^1 converges towards unity. A comparison of radically different inflation experiences could thus provide some useful information concerning the relative status of the conflicting assertions about the form of the long-run Phillips curve[45].

The price-theoretical reformulation which evolved over the past decade thus provides the instrumentation for attending successfully to some unfinished business. The interaction between nominal and real values over the shorts and intermediate-run becomes accessible to analysis. We obtain in particular a rational explanation for the concentration of short-run effects of monetary impulses on output and employment, and the concentration of long-run effects of monetary impulses on prices and wages. The occurrence of economic fluctuations in real variables (output and employment) in contexts of permanent price inflation are also explainable. They will occur whenever substantial monetary accelerations or decelerations occur in the context of a large anticipated inflation velocity with small responsiveness to changes in the actual inflation velocity. This analysis also provides a means to compare the social cost of inflation and the social cost of terminating inflation. Lastly, we

[45] The reader may find some useful material in Warren Smith, *op. cit.*, and the new book edited by Edmund Phelps, *op. cit.*

should note that the price-theoretical foundations recently applied in reconsiderations of the wage adjustment and labor market process are identical with the framework used in the relative price theory approach to the transmission mechanism or the explanation of money. The relative price theory thus offers a unified framework for the analysis of monetary processes. The standard paradigm of Keynesian analysis, whether or not augmented by credit conceptions, is incapable of providing such a framework. It contains irreconcilable price-theoretical flaws which cannot be repaired within the inherited paradigm.

V. Impulse Forces and Dynamics of Economic Fluctuations

1. Some General Remarks

The description of the transmission mechanism does not suffice to explain broad observed movements of an economy. Additional specifications must be imposed which describe the impulse or the driving forces applied to the economic mechanisms. Recent experiences culminating in the crunch of 1966 or the accelerated inflation of 1967 to 1969 and the retardation of 1970, stimulated the controversy concerning the nature of impulses operating on the economic mechanisms.

The economic mechanism can be viewed as a completely endogenous process or a process subject to the influence of factors not systematically explained as an integral part of the mechanism under consideration. In either case scientific inquiries pursue the same goal, viz. to formulate the motor force of the system in terms which promise both cognitive and pragmatic success. This aspect is frequently misunderstood in our discussion and deserves some clarification. It is frequently advanced as a "learned insight" that "everything depends on everything else". It is also fashionable to admit "realistically" that a given phenomenon under study depends on many factors. Such acknowledgments are either empty formulae or advance a methodological convention which would effectively obstruct cognition and the progress of our pragmatic control over the environment.

The research into lung cancer offers an examplary illustration about the nature of scientific inquiry. Suppose we are told that lung cancer is determined or influenced by many factors. Each factor is properly listed and described in the context of an impressive classification by a separate chapter. The result adds little to our comprehension of the world and contributes negligible information about the properties and behavior of the phenomenon studied. Moreover, we remain essentially helpless and fail to acquire any le-

verage over the phenomenon. Similarly, an ascription of inflation to thousands of factors yields neither cognitively relevant information nor pragmatic control. In such a world inflation would be truly uncontrollable.

The history of our cognitive adventure disregarded the injunction that "everything depends of everything else" and rejected the eclectic view that "everything is more or less uniformly influenced by a vast array of factors". These injunctions are essentially empty formulae and our cognitive endeavors pursued another strategy in order to construct hypotheses with empirical content. This strategy also provides in the history of our knowledge the only procedure which yields an adequate promise of pragmatic control. The strategy consists in the deliberate selection of a small subset of factors from the large array admittedly shaping the phenomenon. The incidence rate of lung cancer is probably affected by a large range of conditions. This is not denied by the tobacco hypothesis of lung cancer. The hypothesis singles out however, a small subset from the array of conditions and assigns it particular importance. It asserts that the use of tobacco raises the average incidence rate of lung cancer substantially. Many economists, in a corresponding situation, object to such a hypothesis as "extremist" and prefer to be "eclectic". Such eclecticism usually involves the sacrifice of meaningful theory construction and the retreat to an empty formula. "Eclecticism" has no virtue by itself, and "extremism" in the sense described is no relevant objection. What counts alone is whether a hypothesis submitted to competitive evaluation effectively survives this critical examination. The outcome of such examinations depends crucially on the relation between hypotheses and relevant observation and not on impressionistic reactions of "extremism". According to the canons of scientific inquiry which guide our search for a small subset of conditions, several distinct conjectures about the impulse forces moving our economy have been advanced. It should be noted that all conjectures acknowledge the long-run influence of technology and population on economic growth. Our issue is different. It refers to the conditions which explain the accelerations and decelerations of economic activity and the movement of the price-level within the context of the longer-run technological and population effects.

2. *A General Frame for the Classification of Alternative Classes of Hypotheses*

The nature of alternative conjectures concerning the impulse or motor forces of the economy is usually best reflected in discussions of policy problems. These discussions do not describe detailed conditions and specific structural properties. Such description is usually not necessary for the major purposes of the discussion. The statements at issue require only broad constraints

on the economic process and do not require for their analytic justification detailed structural specification. These alternative constraints on the economic mechanisms essentially define the different positions to be examined. The major alternatives will be discussed relative to a quite general framework which subsumes all ideas under examination.

The economic process is described as a system of differential equations.

$$\mathring{y}^1 = h^1(y, m, f, r, u)$$
$$\mathring{y}^2 = h^2(y, m, f, r, u)$$

expressed by the vector functions h^1 and h^2. The state vector y is partitioned into two components, y^1 summarizes all variables outside the monetary system, whereas y^2 pertains to the monetary system. The vector function h^2 thus describes the adjustment of the monetary system stimulated by the prevailing state and the existing monetary policy, fiscal policy and exogeneous real factors expressed by vectors m, f and r. The vector u denotes an array of random elements. The vector function h^1 describes the adjustment of the non-monetary sector to the stimuli emitted by the inherited position.

The first equation is differentiated with respect to time and we obtain:

$$\frac{d^2}{dt^2} y^1 = H^1 \mathring{y} + H^2 \mathring{m} + H^3 \mathring{f} + H^4 \mathring{r} + H^5 \mathring{u}$$

where the H^i denote suitably selected submatrices from the Jacobian of the h^1-function. These matrices contain together all the derivatives of the h^1-vector with respect to all the arguments of the vector function. It should be emphasized that the derivatives are in general not constants. Our discussion is not restricted to linear systems. Some of the hypotheses to be examined are centered on non-linearity properties expressed by the matrix H^1 which should be understood as a function of the arguments occurring in the h^1-function.

The conjectures to be discussed bear essentially on the behavior of economic activity and do not pertain directly to the behavior of the full state vector y. In order to characterize the alternative conjectures properly the vector equation in the non-monetary variables y^1 is converted into a single equation centered on the pace of economic activity. The conversion is achieved with the aid of several steps. First we partition the term $H^1 \mathring{y}$ into three components, viz. $H^1 \mathring{y} = H^{11} \mathring{y}^{11} + H^{12} \mathring{y}^{12} + H^{13} \mathring{y}^2$ where y^{11} is a subvector of y^1 containing only coordinates which are components of national output and y^{12} is a subvector constituted by the remaining coordinates of y^1. Secondly, a row vector w is introduced consisting of suitably chosen weights for the com-

ponents of output in the state vector y and zeros for the other components, such that wy^1 is the desired measure of economic activity y^a. We write consequently

$$\frac{d^2}{dt^2} y^a = wH^{11}\mathring{y}^{11} + wH^{12}\mathring{y}^{12} + wH^{13}\mathring{y}^2 + wH^2\mathring{m} + wH^3\mathring{f} + wH^4\mathring{r} + wH^5\mathring{u}$$

a further transformation replaces the vector $\mathring{y}^{11}$ on the right side of the equation. The term $wH^{11}y^{11}$ is replaced by $g^0\,\mathring{y}^a$ where g^0 is a scalar defined by $(wH^{11}\,\mathring{y}^{11})\,(w\mathring{y}^{11})^{-1}$. Moreover, the row vectors wH^i $(i = 3 \ldots 6)$ are denoted by g^i $(i = 3 \ldots 6)$, wH^{12} by g^1 and wH^{13} by g^2. We obtain thus

$$\frac{d^2}{dt^2} y_a = g^0\mathring{y}^a + g^1\mathring{y}^{12} + g^2\mathring{y}^2 + g^3\mathring{m} + g^4\mathring{f} + g^5\mathring{r} + g^6\mathring{u}\,.$$

Our concern is directed to propositions bearing on dominant variability patterns of economic activity. The acceleration (i.e. the second time derivative) is thus measured relative to the acceleration required by a constant growth rate. This constant growth is expressed by gy^a. We subtract for this purpose the term $g\mathring{y}^a$ from both sides. We obtain thus

$$\frac{d^2}{dt^2} y^a - g\mathring{y}_a = [(g^0 - g)\mathring{y}^a + g^1\mathring{y}^{12} + g^6\mathring{u}] + g^2\mathring{y}^2 + g^3\mathring{m} + g^4\mathring{f} + g^5\mathring{r}\,.$$

Squaring and integrating both sides yields a measure of total variability together with a decomposition. The total variability is thus introduced as a sum of five direct terms measuring variabilities of component expressions and of ten terms expressing the covariations. The first term describes the variability generated by the internal dynamic structure of the economic process including the random structure but excluding the motions generated and the impulses emitted by the monetary subsector. The second component inside the first term is of course governed by the portion of the h^1-function corresponding to non-monetary variables which are not components of economic activity. The second term measures the contribution to economic activity emanating from the dynamics of the monetary sector proceeding in the context of a fixed institutional framework independent of the behavior of monetary authorities. The third term measures the contribution to total variability resulting from the behavior of monetary authorities, and the fourth term summarizes the contribution made by the behavior of the fiscal authorities. And lastly, the fifth term describes the operation of real factors not subsumed under the interacting process summarized by the first term. We will now distinguish four major classes of hypothesis bearing on the variability of economic activity.

3. *Dominance of the Internal Dynamics of the Real Sector*

This description refers to the class of hypotheses which emphasizes the internal dynamics of the real sector excluding interaction with the monetary sector. The Marxian ideas belong to this class and so do some aspects of the conception advanced by Arthur F. Burns when characterizing the governing framework used by the National Bureau of Economic Research[46]. The hypotheses in this group share a common property. They assign a dominant portion of the total variability measured by the integral on the left to the first term on the right. The internal dynamics of the real sector produces in this view the major portion of economic fluctuations and also explains the persisence of such fluctuations. The class described admits both linear and non-linear hypotheses, and even linear hypotheses damped relative to the non-random structure of the process. In the latter case the random shocks form the crucial impulse factor perpetuating the fluctuations of economic activity in the context of a stable dynamic mechanism. But other views emphasize the occurrence of non-linear patterns which generate unstable movements over specific ranges.

The Klein-Goldberg econometric model examined by the Adelmans is a representative example of an essentially stable linear structure with random shocks perpetuating economic fluctuations[47]. Economic fluctuations are explained essentially in terms of the internal dynamics of the real sector with negligible reenforcing contributions from the other terms in our partition. Monetary mechanisms and monetary policy are assigned in this view at most a very marginal relevance in terms both of actual contributions to observed variability or as a means to dampen the variability. Fiscal policy is accorded more leverage and it offers the only effective instrument for economic stabilization.

The common notion which recognizes in the internal dynamics of the real sector the motor force maintaining or aggravating economic fluctuations is combined with a variety of supplementary conjectures. These supplementary conjectures yield useful subdivisions into more specialized hypotheses. One particular conception emphasizes properties of the financial structure. It is argued that the likelihood of a rupture in the mesh of indebtedness rises with the length of an expansion phase. The occurrence of such a rupture reenforces any deceleration of the economy and unleashes supplementary deflationary forces. Moreover, contraction phases "flood the economy with liqudity" which eventually dampens and absorbs the deflationary impulse. This conception thus asserts the existence

[46] Arthur F. Burns, *The Business Cycle in a Changing World*, New York 1969.

[47] Irma and Frank L. Adelman, "The Dynamic Model, of the Klein-Goldberger Model", *Econometrica*, October 1959.

of structural properties in the non-monetary sector which convert expansions into contractions and contractions into expansions in an essentially non-linear fashion. The particular subgroup emphasizing the role of the financial structure discounts the usefulness of any activist use of monetary policy. A restrictive policy applied to brake an expansion raises the likelihood of a financial rupture which reenforces the downswing, and an expansionary policy initiated during the downswing is impotent in the short-run (because of the accruing liquidity flood) and inappropriate in the longer-run. It deepens "the flood of liquidity" and thus propels a faster and larger expansion, which only raises the likelihood of a larger financial rupture in the future, etc. This subgroup of hypotheses thus suggests that optimal monetary and fiscal policy should minimize the variability of the third and fourth terms of the total variability partition. The dynamic structure of financial instability implies moreover a positive correlation between magnitude of downswings and magnitude or length of the preceding expansions[48].

Some of the notions frequently advanced in rationalizations of Central Bank policy also belong to this group. The monetary authorities are viewed in such rationalizations to confront a tidal motion of the economy generated by the internal dynamic structure of the real process. The first term in the partition of total variability is clearly assigned a dominant role. The monetary authorities usually describe their function as an adjustment of the time path of the m-vector in such a manner that the covariance of the first term with the sum of the second and third term is negative. The variance of the sum of the first three terms becomes consequently smaller than the variance of the first term only.

4. *The Extended Version of the Dominance of the Internal Dynamics of the Real Sector*

This strand of ideas argues that the variability of economic activity is dominated by the variance of the sum of terms 1 and 5. Economic fluctuations are thus viewed to result from the dynamic structure of the real sector interacting with an impulse force r operating independently from the internal dynamic structure. Keynes offers in his "Notes on the Trade Cycle"[49] an excellent example of this position: "...the essential character of the Trade Cycle ... is mainly due to the way in which the marginal efficiency of capital fluctuates." The author describes economic fluctuations in the mold of cumulative movements which decay under the impact of the underlying variations in the marginal efficiency of capital. Another characteristic of the Trade Cycle

[48] This implication has been disconfirmed by Milton Friedman. The reader should consult the Fourty Fourth Annual Report of the National Bureau of Economic Research.

[49] *The General Theory* London, 1936, p. 313.

is also noted. Keynes refers to the phenomenon of the crises around the upper turning point, i.e. "the fact that the substitution of a downward for an upward tendency often takes place suddenly and violently...". He argues moreover that "the predominant explanation of the crises is ... sudden collapse in the marginal efficiency of capital". The long-run expectations of capital yield or the investors' state of anticipation thus form the crucial element in the r-vector according to Keynes' analysis of the trade cycle. His discussion asserts rather explicity the relative independence of this entity with respect to the economic process or policy: "...it is not so easy to revive the marginal efficiency of capital, determined, as it is, by the uncontrollable and disobedient psychology of the business world. It is the return of confidence ... which is so insusceptible to control... This is the aspect of the slump which bankers and businessmen have been right in emphasizing, and which the economists who have put their faith in a 'purely monetary' remedy have underestimated."

The length of the downswing is not a fortuitous event in Keynes' conception. "The duration of the slump should have a definite relationship to the length of life of durable assets and to the normal rate of growth in a given epoch." Keynes also concludes that adjustments in monetary policy expressed by a negative covariance between the $\mathring{m}$ and $\mathring{r}$ term is an inadequate strategy of economic stabilization. "The market estimation of the marginal efficiency of capital may suffer such enormously wide fluctuations that it cannot be sufficiently offset by corresponding fluctuations in the rate of interest."

We find in summary Keynes' argument to contain emphatic references to the following notions: (a) the internal dynamic structure of the real sector which generates the cumulative movements, (b) the crisis phenomenon generated by a rupture of the financial mesh which reenforces the reversal into a deflationary process, (c) the structural properties of the system associated with patterns of selected endogeneous variables (durability of real capital) and also properties of the r-vector (expressed by normal growth associated with population trends) which influence the length of the downswing, (d) the crucial role of the r-vector expressed by violent, sudden and "uncontrollable" fluctuations of the marginal efficiency of capital, and (e) the uselessness of monetary actions.

5. *The Wicksell-Schumpeter Thesis*

Both Wicksell and Schumpeter emphasized the interaction between the dynamics of the real sector and the monetary sector under the impact of a changing stream of innovations or variations in the natural rate of interest. The cumulative movements discussed in their analysis require that the dynamic structure of the real sector generates a substantial variability. This var-

iability is reenforced by the operation of the monetary system and further amplified by the effect of the r-vector. The Wicksell-Schumpeter thesis thus differs from Keynes' position. Both assign a central role to the first term and the last term in the partition of total variability of economic activity. But they differ in the role of the monetary system. Keynes discounts the significance of the second term, whereas Wicksell-Schumpeter assign a substantial role to the operation of the monetary system. Their discussion suggests that suitable institutional rearrangements would induce a behavior of the monetary system adjusting the market rate rapidly to the natural rate. This implies a pattern of constraints which yields either a vanishing contribution to total variability from the second term or a negative covariance between second and last term which effectively lowers the total variability. Keynes' argument quoted previously denies that monetary rearrangements contribute effectively to economic stabilization.

6. The Fiscalist Thesis

The first three classes of conjectures set the stage for the alternatives most heatedly disputed in the United States over recent years. These alternatives may be usefully labelled as the fiscalist, monetarist and non-monetarist hypotheses.

The fiscalist view accepts a central element of the first three positions; viz. the emphasis on the variability generated and perpetuated by the internal dynamics of the real sector. The private sector is interpreted as a rather unstable process, unstable in the sense that large fluctuations in economic activity are an essential result of its internal mechanism. The basic task of the government's economic policy is to stabilize the pace of economic activity against the instabilities generated by the endogeneous dynamics of the private sector. This conception of the "unstable private sector" expressed by the dominant contribution of the first term to the total variance is supplemented by another notion. This notion asserts that the monetary mechanisms are relatively weak or should contribute relatively little in order to prevent undesired side effects. This implies that the variance contribution of the second and third term remains small and insignificant. It follows that fiscal policy emerges as a more effective instrument of economic stabilization.

These ideas can also be expressed in the following manner. Let M and F denote the classes of admissible strategies in monetary policy and fiscal policy expressed by vector functions, $m(t)$ and $f(t)$, i.e. $m(t) \in M$ and $f(t) \in F$. Moreover, the variability contribution of term 1 is denoted by $V(1)$ and similarly we write $V[1(f)+4(f)]$ to describe the variability contribution of the sum of the first and the fourth term, such that the terms' dependence on the fiscal

policy strategy is explicitly stated. It also should be noted that the term $V(1)$ depends in general on the particular policy strategies pursued. The variability contribution $V[1(f)+4(f)]$ becomes thus a function of $f(t) \in F$. We also write $V[1(m)+2(m)+3(m)]$ to indicate the variability contribution of the sum of terms 1, 2 and 3 with terms 1, 2 and 3 depending on the monetary policy $m(t) \in M$ pursued. The fiscalist hypothesis becomes thus expressible in terms of the following constraints on the economic mechanism.

$$\max_{f \in F} V[1(f)+4(f)] > \max_{m \in M} V[1(m)+2(m)+3(m)] \geqq \min_{m \in M} V[1(m)+2(m)+3(m)]$$
$$> \min_{f \in F} V[1(f)+4(f)]$$

These propositions assert that an optimal choice of fiscal policy effectively lowers the total variability of economic activity by a substantial margin. Moreover, the optimal fiscal policy lowers variability substantially more than optimal monetary policy. This position also implies that a deflation is more effectively retarded or reversed by means of an expansionary fiscal policy than with the application of an expansionary monetary policy. Similarly, an inflation will only be terminated by a proper adjustment in fiscal policy and not through monetary policy. A choice between different fiscal policies thus involves more serious consequence than a choice between different monetary policies. The strongest fiscalist position encountered on occasion can be formalized as follows:

$$\frac{V[1(m,f)+2(m)+3(m)+4(f)+5]}{V} \sim \frac{V[1(f)+4(f)+5]}{V}$$

for all $m(t) \in M$ and $f(t) \in F$, where V denotes the total variability. This proposition implies the previous constraint. But the reverse implication does not hold.

One or the other version of the fiscalist position is revealed in many different ways. The thesis occurs in many textbooks of macro-economics and particularly in the sections covering stabilization policies, and it occurs in Okun's paper devoted to an examination of the tax cut of 1964[50]. It emerges moreover frequently in policy discussions. Metaphors are in this context mostly used to convey images of an impotent monetary policy or of a monetary policy

[50] Arthur M. Okun, "Measuring the Impact of the 1964 Tax Reduction", in *Perspectives on Economic Growth*, ed. by Walter Heller, New York 1967.

with a residual function[51]. The use of such metaphors implicity reveals the comparative assessments of terms 1 plus 4 and term 1 plus 3 in the relative movement of economic activity. Lastly, some quotes from Walter Heller clearly outline a fiscalist position: "Deliberate tax cuts and both deliberate and non-deliberate expenditure increases played the *key role* in the thinking of economic policy makers in official forecasts of the changes in the level of economic activity, and in the actual GNP developments that materialized[52]." Consider also: "I don't see how the economy could have climbed to full employment (in 1964 and subsequently) under the incubus of a $12 to $13 billion full employment surplus[53]." Heller postulates thus most explicitly that no monetary policy could have restored full employment at the indicated full employment budget surplus. Only a tax cut was capable of accomplishing this end.

7. *The Monetarist Conjecture*

Two conditions characterize the monetarist thesis. It attributes in contrast to the fiscalist versions, a fundamental stability to the internal dynamics of the real sector. Moreover, the operation of monetary mechanisms provides the dominant impulse generating observable economic fluctuations. This proposition applies to monetary systems with and without Central Banks. In the absence of a Central Bank the third term disappears and the impulses of the second term are maintained and perpetuated by the evolution of the balance of payments which directly modifies the monetary base. In the presence of a Central Bank, variations in m combine with the balance of payments, to perpetuate the motions summarized by the second term.

Two major subtheses should be distinguished in the monetarist position. One asserts that as a matter of historical fact the monetary processes dominate the observable variability of economic activity. This can be expressed by the following condition

$$\frac{V[1(m)+2(m)+3(m)]}{V} > \frac{V[1(f)+4(f)]}{V}.$$

[51] There is a long history of literature which pondered the drinking habits of obstreperous horses, discussed the pushing quality of strings and generally lamented on the pitfalls and difficulties of getting cups to the lips. These metaphors were *not* applied to fiscal policy and only to monetary policy.

[52] Walter Heller and Milton Friedman, *Monetary versus Fiscal Policy*, New York 1968.

[53] Walter Heller, *ibid.*

This position may be modified on occasion into the proposition

$$\frac{V[1(m)+2(m)+3(m)+5]}{V} > \frac{V[1(f)+4(f)+5]}{V}.$$

It is not asserted that these conditions hold for all $m(t) \in M$ and $f(t) \in F$, but only for a particular subset of M and F which occur with dominant frequencies. This version of the monetarist thesis does not imply that fiscal policy is impotent. The condition characterizing this weak formulation of the monetarist thesis is compatible with a non-vanishing vector g^4 converting variations of the f-vector into accelerations (or decelerations) of economic activity. This position thus asserts consequently that fiscal forces are either weak *or* less variable than monetary impulses.

The stronger monetarist thesis imposes narrower constraints on the economic process. It does assert that fiscal forces are comparatively weak. Fiscal operations essentially affect the allocation of resources between government and private sector and the distribution of the cost imposed by the government on the taxpayer with little effect on the aggregate demand for output and the pace of economic activity. The strong monetarist conjecture thus assigns relatively insignificant values to the g^4-vector. It can be expressed by means of a suitable modification of the conditions characterizing the weak hypothesis. $V(1+2+3)$ or $V(1+2+3+5)$ dominates the total variance and the addition of the fourth term changes only very little. We obtain thus the following condition

$$\frac{V[1(m)+2(m)+3(m)+5]}{V} \sim \frac{V[1(m,f)+2(m)+3(m)+4(f)+5]}{V}$$

for all possible $m(t) \in M$ and $f(t) \in F$.

8. *The Non-Monetarist Thesis*

A third position has emerged in recent years. It can be traced in policy discussions of James Tobin, Paul Samuelson and others. It can be interpreted as an eclectic reaction to the fiscalist and the monetarist thesis or as a transition from the earlier postwar Keynesianism. Both fiscal and monetary forces are acknowledged to exert a significant effect. The conditions characterizing the fiscalist and monetarist theses are thus both denied. A crucial feature of the fiscalist position seems however, to be accepted by the eclectic position. The internal dynamics of the real sector supplemented by random shocks is sufficient to perpetuate aggregative movements of the economy on a substantial scale.

The private sector is thus considered to be essentially unstable. An advocate of this position may admit that some terms may on occasion dominate the total variability for specific episodes. The eclectic position is however rarely inclined to attribute to $V[1(m) + 2(m) + 3(m)]$ a dominating position. Beyond the heavy emphasis on the first term all terms seem more or less equally important in principle. Actual references to events associated with terms 2 and 3 occur less frequently however than references to events associated with terms 4 and 5. Whereas the older Klein-type econometric models were molded according to a Keynesian-fiscalist view, the *FRS-MIT* model moved by intention to an essentially eclectic position. And some of its implications touch on a moderate monetarist position.

VI. An Elaboration of the Monetarist Hypothesis

The previous section formulated some general constraints on the dynamic structure of the economic process which differentiates the monetarist hypotheses from alternative conceptions, most particularly from the fiscalist thesis. These constraints translate some of the monetarists' ideas advanced in recent discussions into a more explicit analytic language. They are also sufficient to justify a variety of empirical tests which have been executed in recent years for an assessment of alternative monetarist and fiscalist propositions.

Our intellectual curiosity would barely be satisfied however, with a description of broad classes of hypotheses in terms of a variance composition. Concern with practical issues of fiscal or monetary policy require some more detailed examinations of monetary mechanisms. Moreover, recent discussions bearing on the role of monetary policy and the nature of monetary mechanisms suggest the usefulness of an analytic clarification of the monetarist hypotheses. This requires in particular a description of the economic process beyond the constraints imposed by the variance partition. It is of course not possible to develop the required analysis fully in this section of our survey. A more detailed analysis will be published at another occasion. Still, the present section should convey an outline of the crucial properties of the monetary mechanism characteristically representing the monetarist position.

Friedman's initial description of the non-Keynesian approach seriously hampered a useful clarification. The quintessence of the "quantity theory" was described in terms of the demand function for money[54]. This description is hardly sufficient. It is consistent with all the classes of hypotheses character-

[54] The reader should consult Milton Friedman's "The Quantity Theory of Money: A Restatement", in *The Optimum Quantity of Money and Other Essays*, Chicago 1969.

ized in the previous sections. In particular, it cannot differentiate the monetarist and fiscalist position. Friedman's general formulation of the demand for money is also quite consistent with all the positions concerning economic fluctuations recognized in our survey. Friedman's original emphasis on the general properties of money demand thus fails to provide a useful criterion or any relevant information about the monetarist explanation of economic fluctuations.

The initial characterization was rapidly followed by a major contribution to empirical money demand theory. The permanent income hypothesis of money demand can be exploited to explain variations of income in terms of money supply behavior. This explanation requires however suitable specifications about the money supply and cannot be extracted from considerations of money demand only. Suitable differentiation of an expression equating money supply and money demand yields a statement which explains the relative change in income as a linear function of the relative change in the money stock and the time derivative of this relative change. Tobin has effectively demonstrated that the timing patterns of this differential equation implied by the permanent income hypothesis of money demand are not consitent with the lead-lag relationships between money supply and economic activity developed in Friedman's empirical work. These lead-lag relationships are particularly centered on the time sequence of accelerations and decelerations of money supply and activity. Tobin's careful examination establishes conclusively that the permanent income hypothesis of money demand cannot generate a central monetarist proposition bearing on the systematic lead of monetary accelerations or decelerations[55].

Both Friedman's general and particular demand criterion for the description of a monetarist position are thus unacceptable. But the argument continues in Friedman's recent work. We read there: "The quantity theory is ... (o)n an analytical level ... an analysis of the factors determining the quantity of money the community wishes to hold; on an empirical level, it is the generalization that changes in the desired real balances (in the demand for money) tend to proceed slowly and gradually or to be the result of events set in train by prior changes in supply, whereas, in contrast, substantial changes in the supply of nominal balances can and frequently do occur independently of any changes in demand. The conclusion is that substantial changes of nominal income are almost invariably the result of changes in the nominal supply of money[56]." The first sentence of the passage quoted repeats the old formula-

[55] James Tobin, "Money and Income, Post Hoc Ergo Propter Hoc", *Quarterly Journal of Economics*, May 1970.

[56] Milton Friedman, "A Theoretical Framework for Monetary Analysis", *Journal of Political Economy*, April 1970.

tion. A distinction between analytical and empirical level is added however which is quite unclear and confusing. In both cases, concerning either the nature of the demand for money or the form of interaction between demand and supply, empirical issues are raised In the absence of such considerations our problem reduces to a purely syntactical exercise. This was indeed almost the case in Friedman's original development. But our problem vanishes in the context of purely syntactical considerations. It only emerges with semantic languages addressable to our observable environment. If the first sentence of the passage quoted above is disregarded, one will note that the substantive proposition can be subsumed under the strong monetarist thesis formulated in a previous section. Friedman chose however to formulate the crucial condition pertaining to the dominant variability patterns of "prices or nominal income" in terms of the interaction between demand and supply of money. It is important to recognize that Friedman's specific description is actually stronger than the strong monetarist thesis described before. The latter imposed no constraints on the money supply process and is compatible with two distinct states of the economic process to be represented by the following statements

1 a.
$$\mathring{y} = h^1(y, m)$$
$$\mathring{m} = h^2(y, m)$$

1 b.
$$\mathring{y} = h^1(y, m)$$
$$\mathring{m} = h^3(z, m)$$
z is independent of y.

System 1 describes a closed simultaneous interaction between monetary and non-monetary processes. The monetary processes are thus endogenous elements of the economic evolution. System 2 on the other hand asserts the existence of a causal ordering (in the sense of Herbert Simon) between monetary and non-monetary sector processes. But the existence of such a causal ordering is not a defining characteristic of the monetarist positions characterized in previous sections. Friedman's description on the other hand introduces such a causal ordering as a defining characteristic. Variations in money demand are presented as a sum of two components:

$$\frac{dM^d}{M^d} = c_1\left(\frac{dr}{r}\right) + c_2\left(\frac{dy}{y}\right)$$

c_1 and c_2 are given coefficients. The term dr/r reflects gradual changes of underlying conditions whereas $\frac{dy}{y}$ is conditioned by the ongoing economic process. We use for our purposes the symbols introduced in the discussion of alter-

native explanations of economic fluctuations, y is the state vector and r a vector of exogenous real conditions. Variations in the money stock are said to be "frequently" independent of money demand, i. e. independent of the factors modifying money demand. This means that dM/M is frequently independent of dr/r or dy/y, and dependent mostly on a third set of forces.

The endogeneity-exogeneity aspects of money supply processes has attracted much attention in recent years. These aspects actually do involve some important issues which will be considered in the next section. But they are completely irrelevant for our purposes. We require a useful delimitation of the monetarist position from alternative ideas. This delimitation can be accomplished without imposing constraints on the causal ordering of monetary and non-monetary sectors. Friedman's causal ordering constraint narrows the class of hypotheses quite radically and yields thus the strongest monetarist thesis. But we submit that at the present stage of our research and discussions, clarification would benefit substantially by separating issues bearing on causal ordering from issues bearing on the nature of dominant impulse and perpetuation forces. Recent discussions exhibited a pronounced tendency to confuse the two issues and center on the causal ordering properties as a defining characteristic for the monetarist position. But once the latter is defined in terms of a specific pattern of variability dominance, the causal ordering of the monetary sector forms neither a necessary nor a sufficient condition. It becomes a separate issue whether or not monetary processes are highly or marginally exposed to feedbacks from the real sector, whether the derivatives of h^2 with respect to y are large or small, or so small that h^3 forms an excellent approximation to the facts. Friedman's description of the monetarist position is certainly quite acceptable as a particular version. But its careless use tends to entrench the confusion between two logically independent properties: the causal ordering expressed by the nature of the h^2 and h^3 functions on the one side and the dominance ordering of the terms in the variability partition associated with properties of the h^1-function.

Friedman's passage raises another question. It appears that emphasis on monetary aspects or monetary forces has been traditionally associated with formulations centered on money demand, money supply and their interaction. Friedman's article also provides an interesting explanation. It refers to "the essence of what has been called the classical dichotomy". Real magnitudes are determined in the real sector and monetary magnitudes in the monetary sector. The same phenomenon may be approached in another way. The dichotomization separates the determination of allocative and aggregative patterns. The equations describing the real sector explain relative prices and associated allocative aspects. The money equation explains the only aggregative aspect admitted into the analysis, i. e. the price-level. But our move into a world with non-vanish-

ing information and adjustment costs and dominant quantity adjustment velocities adds another aggregative aspect to be considered, i. e. output and employment. The traditional function of the money equation was thus naturally extended to include the joint determination of nominal and real (aggregative) values. The move out of the classical world subtly modifies however, the meaning of "dichotomization" appropriate for monetarist analysis. The classical notion of a dichotomy breaks down and becomes inapplicable for shorter-run analysis. "Money illusion", non-neutrality of money, etc. become essential properties of the adjustment process, once we recognize the operation of information and readjustment costs. It would perhaps be more useful to state that the traditional formulations referred to prices which did not adequately represent the relevant opportunity costs governing the responses to evolving stimuli. But whatever formulation is accepted, the operation of the processes envisaged by the relative price approach prohibits the *traditional* dichotomization. It is replaced by another dichotomy to be interpreted essentially in an approximate sense. This new dichotomy applies to variations in allocative patterns of output and changes in aggregate demand. It is asserted that changes in allocative output patterns and aggregate behavior aspects are approximately independent. This idea requires however some analytic explication. Moreover, its representation by means of an interaction between money supply and money demand also requires some justification. Such justification has not been provided at this stage. Friedman recognizes quite clearly in his last attempt to formulate a monetarist hypothesis in terms of the interaction between money demand and money supply that this procedure by-passes some "unfinished business" bearing on the interrelation between monetary and non-monetary sector and the meshing of real and nominal values. His procedure may eventually be very fruitful and yield a powerful empirical hypothesis. It is useful to emphasize however that the logic of the monetarist analysis based on the relative price theory approach requires that attention be directed to the interaction between output market, credit market and Walrasian money market.

This requirement cannot be satisfied by the general framework used by Friedman. This framework is the standard IS-LM analysis offered in an essentially Keynesian spirit. And this very choice of basic framework actually creates the analytical problems clearly recognized by Friedman in his subsequent discussion. Still, his conclusions assert that "almost all economists would accept this framework". Our discussion of the transmission process established however that the standard IS-LM diagram is not a very useful device for the analysis of monetary processes. An analysis can of course be forced into such a frame. This fact was actually used in part II to organize our discussion. But a major weight is thus assigned to unspecifiable shifts in the curves or unexplicated modifications of the functions representing the curves. In summary, the

IS-LM frame obscures essential properties of the monetary process. They can only be "accepted alike by adherents of the quantity theory and the income expenditure theory" in case the "quantity theory" is restricted to the long-run solution involving vanishing marginal costs of information and readjustment. But this is not a very useful restriction when economic fluctuations form our explanandum. Most importantly, Friedman's subsequent explanation of nominal income in terms or relative changes of money supply and money demand, supplemented with an explanation of the division of nominal income changes between price and output reactions, is not related to the IS-LM paradigm. It forms an independent structure connecting income, prices and output to monetary processes. This may be a hypothesis worth exploring. It does yield with suitable constraints some monetarist propositions. But it is not derived from an analysis of the interaction between major markets, bearing on the proximate determination of output, credit market conditions, output price-level or price-level of real capital. Such derivation would be necessary for an assessment of propositions asserting some logical connections between the nature of the semi-reduced equations used by Friedman and some particular subset of structural properties of the general process. An analytic foundation for monetarist positions is thus an urgent task to be clearly acknowledged[57].

This task can undoubtedly be accomplished in many ways differing in the detail of the execution. A simplified version of one approach was presented in appendix IV and its dynamic version in appendix V. This appendix also sketches the derivation of a semi-final equation in output. For many purposes, particularly in applications to empirical analysis, such equations possess substantial pragmatic advantages. The derivation is however important to assure an economic interpretation and enable an evaluation of contentious issues. Our discussion remains somewhat suggestive and will only trace the major outlines.

The discussion is centered on a diagram in appendix V exhibiting possible combinations of the differential of log y (y = output) and the differential of dy/y. The horizontal axis measures the relative rate of change in output (i.e. dy/y) and the vertical measures the change in the relative rate of change in output [i.e. $d(dy/y)$]. The semi-final equation obtained in appendix V from the "assumption" that output markets adjust slowly compared to credit markets and the money market can be represented by a descending line in the

[57] The reader may consult on this point my paper, "The Monetarist Revolution in Monetary Theory", in *Weltwirtschaftliches Archiv*, Heft 1, 1970; and also the paper jointly authored with Allan H. Meltzer, "A Monetarist Hypothesis of Economic Fluctuations", to appear in the *Konstanz Symposium on Monetary Theory and Policy*, Volume I, 1971.

diagram. The slope and position of this line summarize the nature of the process and the forces at work. The line associates with any given magnitude of the relative rate of change in output (i.e. to any value of dy/y), a specific acceleration $d(dy/y)$ of output. The slope determines the speed at which the economic process absorbs impulse forces. The inherited state of the economy is represented by a point in the diagram. The line through this point reflects the forces at work governing the line's position and summarized by the parameter b in the appendix. The point on the line is always pushed by the dynamics of the process along the line towards the line's intersection with the horizontal axis. This intersection defines an equilibrium growth rate relative to the forces shaping the line's position. The absorption speed of the process is proportional to the steepness of the slope, i.e. the movement along the line toward the horizontal accelerates as the line steepens. In periods of comparatively low utilization of an economy's resources the line flattens, and becomes steeper with increasing utilization of available resources. The slope thus summarizes all structural properties bearing on the dynamic behavior of the system.

The forces governing the position of the line require particular attention. These forces are divided into three sets:

Set 1: $\frac{dM}{M}$: the relative change of the money stock

$\frac{dF}{F}$: a linear combination of relative changes in fiscal policy variables

$\frac{d\pi}{\pi}$: the relative change of the anticipated rate of inflation π

$\frac{dn}{n}$: the relative change of the anticipated yield on real capital

$\frac{dS}{S}$: the relative change in the stock supply of government securities

Set 2: $\frac{dK}{K}$: the relative change in the stock of real capital

$\frac{d\omega}{\omega}$: the relative change of the index summarizing anticipated market conditions over the shorter to intermediate-run

$\pi =$ the anticipated rate of inflation

Set 3: A catchall for the remaining forces and erratic shocks.

The first set affects the position of the descending line positively and the second set affects it negatively. Every increase in the magnitudes of set 1 raises the vertical intercept and pushes the line to the right and every increase in the magnitudes of set 2 moves the line to the left and lowers the vertical intercept.

These directional properties are not sufficient to characterize the monetarist thesis. Two groups of propositions are required for this purpose. The first group constrains the relative magnitudes of the entities governing the line's position. These propositions can be derived as consequences of a fully developed hypothesis constructed in the general form of appendix IV. The most important proposition asserts that the relative effect of dF/F is comparatively small and unreliable, whereas the effect of dM/M is comparatively dominant and more reliable. This effect is consistent with a money demand function exhibiting a non-vanishing interest-elasticity. Moreover, the larger the interest sensitivity of the creditmarket, the *greater* becomes the effect on the line's position of a given change in monetary impulses measured by dM/M.

The second group of propositions asserts that all the remaining magnitudes in set 1 and set 2 can be represented as a sum of three terms. The first term depends on the more or less recent history of the economic process and thus to a major extent on the past evolution of monetary impulses. This applies particularly to dK/K, $d\omega/\omega$, $d\pi/\pi$ and π. The second term describes erratic short-run movements and in case of π, $d\pi/\pi$ and $d\omega/\omega$ depends particularly on the public's information absorption of major current events. The last term describes longer-run influences of a comparatively gradual nature. This applies most particularly to dK/K and dn/n. Moreover, the hypothesis asserts that the last terms contribute little to economic fluctuation by shifting the position of the line. They essentially affect the equilibrium rate of growth, i. e. they contribute to the average position of the line. The second terms combine with the catchall item and contribute to minor fluctuations, particularly the irregularities in the growth rate. The dominant forces explaining the major outlines of economic fluctuations are thus impounded into the first terms.

The interaction of the various components can best be outlined with the aid of a simple example tracing the evolution of monetary impulses. The second graph in appendix V shows the effect of an accelerated monetary impulse, i. e. an increase in dM/M on the state of the economy represented by a point in the diagram. Suppose the state was at point A. The internal dynamics of the system pushes the point downwards towards the horizontal at a speed dictated by the slope of the line. An accelerated impulse on the other hand pushes the line to the right. This is more correctly represented as an upwards shift. Two forces

thus operate simultaneously on the state point, one pushing downwards along the line and one vertically upwards. The point moves actually along a vector of the two forces. The larger the acceleration and the slower the economy's absorption speed the steeper is the vector governing the motion of the state point.

Consider now the movement of the state point beyond a single burst of acceleration. This is outlined in diagram c. The initial position is A. A rapid acceleration moves the point steeply up, but this motion moderates subsequently. Increasing utilization of resources steepens the line's slope and thus raises the force of the vector pushing down along the line towards the horizontal. Moreover, the rate at which dM/M increases declines. These two changes in the conditions turn the path of the state point and it gradually descends. Suppose now that acceleration of monetary impulses ends and dM/M is held constant. The path will not continue along the line with constant position passing through state point B marking the end of acceleration. The consequences of past accelerations are still distributed over the system and are gradually absorbed by the process. It is precisely the function of the relative price theory of the transmission mechanism to explain the basic properties of the process causing this distribution over time and gradual absorption. In the context of our analytic framework the results of past accelerations are reflected by the movement of dK/K, $d\omega/\omega$ and π. The magnitudes continue to rise for some time and their increase pushes the line backwards to the left from point B. The extent of this shift depends on the nature of the past acceleration. The larger these accelerations and the more abruptly they are terminated, the greater will be the delayed effects working via dK/K, $d\omega/\omega$ and π on the position of the descending line. It follows that large and abruptly terminated accelerations induce a greater deceleration of economic activity than large and gradually terminated accelerations. Termination of accelerations thus induces, in general an economic readjustment expressed by the leftward shift of the descending line which lowers the expansion rate of economic activity. This effect will be reenforced in case monetary impulses actually decelerate. Such deceleration moves the line even more rapidly to the left. And this shift to the left continues until monetary deceleration has been terminated. A rapid deceleration following a sharp and suddenly terminated acceleration moves the lines much further to the left than a gradual acceleration replaced by a gradual deceleration. If the deceleration persists long enough to make the path of the state point cross the vertical at point C economic activity actually declines. The time interval from state point B to state point C measures in this case the length of the so-called Friedman lag. Our analysis thus reveals that the length of this lag depends on the monetary deceleration relative to the previous acceleration, it also depends on the monetary deceleration relative to the movement of other determinants of the line's position. Under the circumstances we

should expect a large variability of this lag. A more detailed development of this analysis yields testable propositions concerning the conditions which cause a long or a short Friedman lag.

Some major implications of the analysis deserve some further attention. These implications cannot be subsumed under the inherited standard paradigm. The reader will have noted that inflationary expectations exert two distinct effects on the line's position. An increase of inflationary expectation, expressed by an increase of π, lowers the line, whereas an acceleration of inflationary expectations raises the line. This pattern reenforces the short-run deflationary effect of a monetary deceleration designed to break an inflationary process. This reenforcement depends however on the speed with which the public revises inflationary expectations. If inflationary expectations are revised rapidly $d\pi/\pi$ falls to an algebraically small level for a short period and dominates the effect of π. The effect of monetary deceleration becomes thus reenforced by the rapid revision of inflationary expectations. But this reenforcing effect will not last very long under the circumstances. The value of $d\pi/\pi$ will converge towards zero and the effect of a declining π-value will dominate the two opposite inflationary effects. The decline of π tends to raise the line and thus to dampen the impact of anti-inflationary policy. Previous analysis disregarded the distinct effects exerted by $d\pi/\pi$ and π on economic activity or interest rates.

The coexistence of fluctuations in real variables and persistent price-inflation is difficult to reconcile in the context of Keynesian analysis. But our analysis explains the simultaneous occurrence of price inflation and fluctuations in output and employment by the variability of monetary impulses around a large average impulse. The latter has shaped inflationary expectations measured by π. The effect of the monetary impulse dM/M on output is consequently offset to a large extent by the value of π. This offsetting effect is expressed in the diagram by the position of the descending line. The line is essentially in the same position characterizing absence of inflationary expectations combined with a long-run magnitude of the monetary impulse compatible with a stable price-level. The large dM/M pushes the line up and the large value of π pushes the line down. Moreover, the inherited momentum of an inflation determines a state which severely constrains the variability of π relative to the monetary impulse. The persistent recurrence of monetary accelerations and the persistence of the actual price movements makes $d\pi/\pi$ quite insensitive to shortlived and temporary monetary decelerations. Inflationary expectations thus are comparatively stable in accordance with the experience of actual price movements over several years. Recurrent attempts to moderate inflation by monetary deceleration never persist very long. The decelerations consequently lower the line. This downward shift increases with

the magnitude of the deceleration relative to the speed $d\pi/\pi$ with which inflationary anticipations are revised downwards. A rapid deceleration thus lowers the line to a position intersecting the vertical axis below the horizontal axis. The internal dynamics of the system thus moves the state point along the line with the lowered position into the range of negative growth rates of output. The rapid monetary deceleration thus lowers output and employment. Price inflation still continues and is maintained by the inherited momentum and the persistence of a large monetary impulse. The decline in output and employment resulting from the monetary deceleration does not persist however. It would decay with the termination of deceleration and even in the absence of renewed acceleration. The persistent experience of a lowered monetary impulse dM/M eventually induces a readjustment of inflationary anticipations. The initial effect of the revisions expressed by a negative value of $d\pi/\pi$ lowers the position of the descending line even further and thus reenforces the deflationary pressures. But the subsequent effects of a lower value of π eventually dominate. A falling π raises the position of the line. This revision of π-values is however distributed over a lengthy span of time. The increasing social cost associated with the transition to a lower rate of inflation usually induces political pressures which lead to reversals of policies and renewed acceleration of monetary impulses. The divergence between monetary impulse dM/M and inherited inflation anticipations π is thus removed not by the gradual revision of π but by the increase in dM/M.

An adequate analysis of this process requires careful distinction between the role of the growth rate of M (i.e. dM/M) and the role of accelerations (or decelerations) represented by $d[dM/M]$. This distinction is also important in order to explain the onset of economic retardations or expansions at vastly different levels of the monetary impulse measured by the growth rate dM/M. Our analysis implies that the growth rate affects essentially the longer-run price movements. The word "essentially" is used to acknowledge possible second or third order effects of different long-run growth rates on real magnitudes along arguments suggested by growth models. Accelerations (or decelerations) on the other hand influence the rate of economic activity *independent* of the prevailing growth rate. This follows from the nature of the economic system as a communications network operated by market interrelationships. This communications network absorbs, revises and distributes information through all the channels. The speed of this information absorption is governed by the cost functions governing the production of information and changes in resource utilization. Every change of impulses dM/M or dF/F thus imposes a load on the communications network, involving an adjustment to new information. The knowledge of the existing growth rate of M is thus not sufficient to determine the course of economic activity. We need to know the

recent history of this growth rate. In particular, a 10% increase p.a. in the money stock is deflationary with respect to economic activity in case the growth rate has declined from a previous level of 20% p.a. This decline lowered the descending line in the diagram quite radically. Moreover, once π or $d\omega/\omega$ are somewhat adjusted to a given impulse dM/M, then we obtain the following result: Whatever dM/M may be, any given decline in this impulse, i.e. any given deceleration, lowers the line by the same magnitude independent of the inherited level of the growth rate dM/M. This emphasis on the central role of *accelerations* of the money stock irrespective of the growth rate itself forms probably the most important implication of the monetarist analysis of economic fluctuations. The distinct roles of monetary growth and acceleration follow essentially from the price-theoretical conceptions underlying the analysis.

VII. The Supply and Control of Money

1. Process and Decay of Money Supply Theory

Harry Johnson commented in his first survey of Monetary Theory published in 1962 that money supply theory had been thoroughly neglected in monetary analysis. This neglect reveals at least one aspect of decay in monetary theory from the earlier thirties to the late fifties. During the 1920's until about the middle thirties money supply analysis made substantial progress. We do not observe in this period the emergence of a fully articulated and coherently explicated empirical theory of the money supply process. But we do observe the emergence of clearly discussed ideas and several potentially useful analytic building blocks. These developments can be grouped into two distincts strands. One strand consists of the Federal Reserve's conjectures bearing on the money supply process and the other strand gradually developed the academic analysis of the same phenomenon. The separate strands continued for many years without mutual recognition. Textbooks of Money and Banking presented the inherited academic pieces without reference to the alternative elaborated by staff members of the Federal Reserve System.

The Federal Reserve conjectures were first discussed publicly by Burgess and Riefler in the late 1920's[58]. Their discussion can be translated into an explicitly articulated theory which is centered on the creditmarket behavior of commercial banks[59]. The events of the 1930's effectively destroyed the Burgess-Riefler theory

[58] Warren Randolph Burgess, *The Reserve Banks and the Money Market*, New York and London, 1927; Winfried Riefler, *Money Rates and Money Markets in the United States*, New York and London, 1930.

[59] The reader may find an explication of the Burgess-Riefler theory in the appendix of our forthcoming book *Theory and Practice of Central Banking*, Chicago.

soon after publication. It was not capable of explaining the behavior of a banking system exhibiting a zero volume of indebtedness to the Federal Reserve Banks. Still, this theory exerted a pronounced influence on policy makers at the Board of Governors and the policies actually pursued. It convinced the majority of the Board that Federal Reserve policy was very expansionary during 1930 and that an increase of requirement ratios in 1936/37, even by 100%, could not possibly have any deflationary effect on the monetary system or the economy. But the conflict between the Burgess-Riefler theory and observable reality induced a gradual reformulation. The major work in this respect was still accomplished in the early 1930's. Laughlin Currie published in 1934 a book with a title I copied for this section[60]. Currie's work is not only remarkable because of the useful reformulation of the Federal Reserve's initial conjecture. He applied the money supply theory to a careful examination and interpretation of institutional arrangements. He also emphasized the crucial importance of distinguishing between credit and money. The two magnitudes were still confused by the Chairman of the Board almost 30 years later. Currie also used his analytical framework for a searching assessment of monetary policies pursued in the early 1930's, and severely criticized the Federal Reserve's description of the period 1929–1933. The Federal Reserve authorities presented a history of valiant attempts to dam a tidal wave of deflation. But the best attempts failed when confronted with the uncontrollable forces of deflation. Currie's excellent use of a money supply analysis framed in the tradition of the Federal Reserve's approach demonstrated the real cause of ineffectual monetary policy. Monetary policy exerted no influence on economic activity for a very simple reason according to Currie. He essentially tells us that in the absence of any gasoline fuelled into the engine, a car driver should not expect his car to run. Currie's analysis of the authorities, actual behavior established that they did very little over this period and in particular, that they did never attempt an expansionary policy. Thus Currie suggests that the problem was associated with the policymakers and not with monetary mechanisms.

The academic strand essentially began to attract economist's attention with the work by Phillips[61]. Phillips analyzed the credit expansion of banks. His approach has influenced the discussion of money supply theory to the present phase. This work was elaborated in some detail by Angell-Ficek and Rogers over the earlier part of the 1930's[62]. However the academic strand never reached the

[60] Laughlin Currie, *The Supply and Control of Money in the United States*, New York, 1968.

[61] Chester Arthur Phillips, *Bank Credit*, New York, 1920.

[62] James A. Angell and Karel Ficek, "The Expansion of Bank Credit", *Journal of Political Economy*, February 1933; James Harvey Rogers, "The Absorption of Bank Credit", *Econometrica*, 1933.

level of relevant application exhibited in Currie's work. The Phillips tradition attempted to derive the responses of the banking system from an analysis of the process absorbing the authorities' injection of reserve money. But the formulations were never completed and remained patchwork' unrelated with economic analysis.

The development of both strands of money supply analysis stagnated thoroughly after 1935. There is however ample evidence that the basic notions continued to dominate the policymaking procedures and the interpretation of policies actually pursued[63]. There occurred also some minor changes in the detail of the formulation. The description of the monetary sector associated with the Credit View in appendix III is based on the most recent discussion of the Federal Reserve's traditional conception. Appendix III thus offers some information concerning the nature of the money supply process envisaged by the monetary authorities. The academic strand actually decayed somewhat over the decades. Even the best presentation offered less than the discussions of the early 1930's. Money supply theory suffered from a scandalous intellectual neglect over a major portion of the postwar period.

The intellectual neglect was not a symptom reflecting the absence of any relevant problems. Policy documents and policy discussions abound with assertions about the nature of the money supply process and the role of policy instruments. It is frequently asserted that the behavior of the money supply is dominated by the public's demand for loans, or the public's demand for money or its stock demand for securities. On occasion a major role is assigned to the bank's responses with respect to the allocation of their assets or with respect to the conditions governing the supply of their liabilities. And there remains always a question concerning the role of the policy instruments and one wonders whether open market policy, changes in requirement ratios and the discount rate are on all occasions effectively transmitted to the monetary system. One surmises furthermore, that the controllability of the money stock is influenced by the institutional arrangements imposed on the banks. The arrangements governing reserve requirements have been substantially complicated and ceiling rates have multiplied. These propositions, questions or events are not the inventive creations of learned exercises. They bear immediately on the evaluation of policy problems and are of substantial interest to anybody concerned with monetary policy. But they cannot be answered intelligently without the construction of an explicit theory of the money supply process.

The problems, particularly those associated with the requirements of monetary control are clearly recognized at this stage. Money supply analysis has at-

[63] The volume jointly authored by Karl Brunner and Allen Meltzer, *The Federal Reserve's Attachment to Free Reserves*, develops this point. The Volume was published by the Banking and Currency Committee of the US House of Representatives, 1964.

tracted increasing attention over the past decade. One may distinguish four separate groups of theories or approaches to the analysis of money supply processes: The Federal Reserve explanations, the monetarist hypotheses, the monetary subsectors of major econometric models and lastly the so-called New View. It is important to recognize that these hypotheses share some common views. They uniformly explain the behavior of the money stock, bank credit and interest rate by the interaction of public, banks and monetary authorities. The authorities inject base money into the system, set requirement ratios, the discount rate and the ceiling rates. Banks and public adjust their wealth position in response to the behavior of the authorities and evolving market conditions. The Banks' behavior pertains particularly to the allocation of assets among major classes of assets and the adjustment of the supply conditions of liabilities. The public's behavior bears on the allocation of money between currency and demand deposits, or the allocation of deposits between demand and time deposits, or the allocation of non-demand claims on banks between time deposits and various types of non-deposit liabilities. There is also the public's asset supply to banks. There exist of course substantial differences in the detail of the formulation and the extent to which various ideas or frameworks have been developed into a fully articulated empirical theory. It cannot be our purpose to discuss the analytic detail of all or even the major construction. Three samples are presented in the appendices, appendix III contains a simplified form of a recent version of the Federal Reserve hypothesis, appendix IV presents a summary of the Brunner-Meltzer (non-linear) money supply hypothesis and appendix VI outlines my explication of Tobin's "New View" hypothesis. We may refer on occasion to these appendices in our subsequent discussion of major comparisons between the alternatives.

2. *The Role of the Monetary Base*

All hypotheses bearing on the behavior of the monetary system assign a major function to the monetary base. The base consists of money directly supplied by the authorities. This magnitude is defined by listing all balance-sheets of the government sector containing monetary liabilities, i. e. liabilities used as a medium of exchange in some social group. The sum of monetary liabilities of the consolidated statement for the government sector describes the monetary base. The consolidated statement also yields a full description of all the magnitudes which determine the volume of base money issued by the monetary authorities. The measure of the base and the determination of the source components contributing to changes in the base is conditioned by the institutional arrangements of a particular economy. In some countries the appropriate measure consists of deposit and note liabilities of the Central Bank augmented with the currency issued by the Treasury, which occurs as a liabil-

ity in a suitable Treasury account. In other countries the demand liabilities of the postal checking system or demand claims on Euro-dollar liabilities of foreign banks may have to be included. Whatever measure the detailed institutional arrangement may determine, for our analytic purposes the monetary base summarizes the behavior of monetary authorities concerning the supply of base money and also describes the sources which govern this supply.

The Federal Reserve View, the monetarist position represented by the Brunner-Meltzer hypothesis and the Tobinian formulation assign an important causal role to the base with respect to money supply and bank credit. This causal role is independent of the processes which determine the base. The existence of this causal role must be sharply separated from the issue whether or not the base is endogenous or exogenous. Full recognition of an endogenously determined base does not modify the effect of a given change in the base on monetary aggregates explained by the various hypotheses. It is noteworthy that the marginal multipliers of money stock or bank credit with respect to the base implied by the Federal Reserve and the monetarist hypothesis are comparatively close in magnitude. Moreover, the two (marginal) multipliers exhibit the same order pattern under the two hypotheses. The marginal multiplier of the Tobinian hypothesis on the other hand is probably smaller than the corresponding magnitudes associated with the other two hypotheses. Its magnitude depends crucially on the derivative of the marginal productivity of excess reserves with respect to the volume of excess reserves. The smaller this derivative the smaller becomes the marginal multiplier of total deposits with respect to the base. In the limit, with the derivative converging to zero, the multiplier still approaches a positive number below unity.

There exist both substantial differences and similarities between the various hypotheses with respect to the conditions which govern the magnitude of the marginal multipliers. The monetarist hypothesis implies that a large interest elasticity of the public's asset supply to banks raises the responsiveness of the money stock to the base. The same implication holds for the Federal Reserve hypothesis. The Tobinian hypothesis is somewhat more complicated on the other hand. As the interest elasticity of the public's asset supply approaches zero the marginal multiplier converges towards $(1 + k)^{-1}$, i.e. the reciprocal of unity plus the currency ratio. This is less than unity, but not less than about $3/4$. As the interest elasticity of the public's asset supply converges towards minus infinity, the marginal multiplier converges to an expression which is approximately the reciprocal of an average of 1.3 and .35 with weights determined by the derivatives of the marginal productivity of excess reserves with respect to the volume of excess reserves, and the derivative of the marginal gain of earning assets with respect to the volume of earning assets. With equal weights the marginal multiplier would be very little above

unity. With a negligible derivative of the marginal gain of earning assets with respect to their volume, Tobin's marginal multiplier is slightly less than three. A somewhat more elaborate analysis of the Tobin hypothesis would introduce the role of information and readjustment costs. The operation of these costs could be shown to affect the marginal net gain of earning assets in such a way that the marginal multiplier would exhibit a cyclic pattern. It would be close to three during the upswing and fall back in a downswing.

An increase in the banks' interest sensitivity lowers the marginal multiplier of both monetarist and Federal Reserve hypotheses. But convergence towards infinity of the banks' interest elasticity yields different implications under the two hypotheses. Under the monetarist hypothesis the marginal multiplier converges to a small but definitely *positive* number. The Federal Reserve hypothesis implies convergence to zero in this case. The Tobinian hypothesis implies on the other hand, that *equal* increases in the interest sensitivities defined for the banks exert non influence on the marginal multiplier. Differential shifts in the interest sensitivity of the marginal productivity of excess reserves and the marginal gain of earning assets will however affect the marginal multiplier in a manner depending on specific circumstances.

All three hypotheses examined uniformly assign a major role to the monetary base in the determination of money stock, bank credit and interest rates. A similar role is also attributed to the base by econometric models constructed to explain the monetary system. This statement holds even in case the model apparently replaces the base by the volume of unborrowed reserves. The structure of such models (e.g. the FRS-MIT system) determines that variations in unborrowed reserves imply equal variations in the base. An initial change in the base is equivalent to a change in unborrowed reserves, because currency responds only with a long lag to the initial change in the base.

It is useful to summarize for our purposes the response of demand deposits, time deposits and currency to a change in the monetary base and national income according to four different econometric models. These four models were selected according to the attention invested to descriptions of the monetary system. Two models were constructed by Ronald Teigen, one was contributed by Frank de Leeuw to the Brookings model, and the last draws on the efforts of the FRS-MIT group[64]. Tables I and II contain the crucial results. Table I describes the response to a billion dollar increment in the base and Table II the response to a billion dollar increment in national income. The relative

[64] The models are described by Joseph R. Zecher in his extensive examination of the logical and empirical content of these models. The reader should consult Zecher's *An Evaluation of Four Econometric Models of the Financial Sector*, Economic Papers, Dissertation Series Number 1, Federal Reserve Bank of Cleveland, January 1970. The discussion in the text is based entirely on Zecher's work.

Table I: Six Quarter Simulations to Assess the Impact of a One Billion Dollar Increase in the Adjusted Monetary Base on Key Monetary Variables[a]

Quarter	Teigen I	Teigen II	de Leeuw	FRS-MIT
	Demand Deposits			
I	1.96	1.56	1.05	2.12
II	1.94	2.12	2.17	2.80
III	2.23	2.51	2.63	3.12
IV	2.53	2.75	2.74	2.14
V	2.46	2.82	2.77	3.34
VI	2.63	2.86	2.88	2.30
	Time Deposits			
I	0.79	0.92	2.16	1.87
II	1.38	1.39	2.65	2.30
III	1.76	1.84	1.71	3.00
IV	2.12	2.22	2.13	3.42
V	2.49	2.54	0.98	3.98
VI	2.80	2.83	1.05	4.30
	Currency			
I			0.16	0.00
II			0.34	0.00
III			0.42	0.00
IV			0.48	0.01
V			0.51	0.02
VI	—0.20	—0.36	0.54	0.03

[a] For FRS-MIT the shocked variable is unborrowed reserves rather than the adjusted base. All dollar magnitudes are in billions of dollars, and all interest rates are in percentages.

Table II: Six Quarter Simulations to Assess the Impact of a One Billion Dollar Increase in Income on Key Monetary Variables[a]

Quater	Teigen I[a]	Teigen II	de Leeuw	FRS-MIT
	Demand Deposits			
I	0.10	0.02	0.04	0.04
II	0.10	0.04	0.06	0.04
III	0.13	0.04	0.04	0.05
IV	0.12	0.04	0.03	0.04
V	0.13	0.04	0.01	—0.04
VI	0.12	0.04	0.00	—0.04
	Time Deposits			
I	—0.03	—0.01	—0.05	—0.05
II	—0.06	—0.02	—0.10	—0.04
III	—0.08	—0.03	—0.12	—0.04
IV	—0.12	—0.02	—0.12	—0.03
V	—0.16	—0.03	—0.22	—0.04
IV	—0.20	—0.05	—0.22	—0.03
	Currency			
I			0.01	0.03
II			0.02	0.04
III			0.03	0.05
IV			0.03	0.06
V			0.03	0.07
VI	—0.06	—0.02	0.04	0.07

[a] For Teigen I "Income" equals his autonomous expenditure variable, and for de Leeuw "Income" equals disposable personal income.

order and timing of the response patterns deserve our attention. All four models show uniformly a very substantial responsiveness of deposits to changes in the base. The smallest multiplier of the exclusive money stock after six quarters measures 2.43 and the largest is 3.42. This range is compatible with the estimates derived from the monetarist hypotheses which cluster towards the lower end of the range indicated. A comparison of the three components of the inclusive money stock shows the response of currency to vary most and the response of demand deposits to vary least among the models. It is moreover, noteworthy that income exerts a comparatively small effect on all components listed. The longer-run effect on demand deposits vanishes in the de Leeuw model and turns even negative in the FRS-MIT model. The effect on time deposits is uniformly *negative* for all periods and all models. They imply consequently that the observed growth in time deposits cannot be explained by a growing economy and is essentially independent from causal influences operating from the real sector. All econometric models examined so far in some detail, thus establish the central role of the monetary base in the money supply process[65].

3. The Reverse Causation Problem

The existence of a close interrelation between money and national income has been observed for many different periods and different countries. The observed facts are generally acknowledged. But the interpretation of these facts is still disputed. Every serious researcher grants however that the correlations observed are not a matter of chance but do reflect a systematic association linking money with economic activity and prices. There remain thus three major interpretations. One asserts that the causal influence from money to economic activity generates the observed pattern. Another reverses this causal influence, and a third acknowledges a mutual interaction. The last interpretation occurs in several forms, differentiated according to the relative weight of the mutual influences in short-run and longer-run. These issues became

[65] The reader should also note the timing patterns of the response of deposits. All models exhibit substantial time lags. These lags imply some highly testable propositions bearing on the behavior of the average monetary multiplier in periods of rapid acceleration or deceleration of the base. For instance, if a rapid growth in the base is suddenly terminated the average monetary multiplier is still expected to increase for some quarters according to these models. Similarly, the models also imply that accelerations in the base lower the currency ratio and decelerations raise the currency ratio. These implications of the econometric models are logically inconsistent with the monetarist hypotheses and thus provide an opportunity for detailed evaluation of the alternatives.

prominent in recent discussions of monetarist work. Some portions of this work were based on regressions connecting measures of economic activity with indicators of monetary and fiscal thrust[66]. This procedure was frequently criticized on the grounds that the statistical results exaggerated the actual causal influence of money on national income. The occurrence of a reverse causation from income to the money supply was asserted to bias the regression coefficients. The impressive contributions, bearing on the role of money, jointly authored by Milton Friedman and Anna Schwartz have also been questioned. Such questioning was addressed most particularly to the data collections exhibiting the pattern of timing relations. These timing relations were succinctly summarized by the concept of a Friedman lag between turning points in economic activity and turning points in the growth rate ofthe money stock. Tobin has recently criticized this evidence from timing relations[67]. He demonstrated that the timing relations observed by Friedman-Schwartz are consistent with a thoroughly non-monetarist hypothesis which combines the Keynesian view about the transmission mechanism with the Keynesian view of the motor force driving the economy. Tobin achieves his result by supplementing this "double Keynesian" hypothesis with a description of Central Bank behavior which is centered on the choice of interest rates as an intermediate policy target. It should be fully understood that Tobin's argument effectively shows that the timing relations observed are *per se* irrelevant observations. They yield no discriminating evidence, they are consistent with the monetarist hypothesis and also its denial.

The critique of the regression analysis and of the timing relations between money and income thus relies heavily on the idea of a "reverse causation" running from economic activity to the behavior of the money supply. It invokes consequently propositions about the nature of the money supply process. A detailed examination of money supply processes thus becomes an important portion of the analysis and evidence bearing on the hypotheses of the economy's motor force. Moreover, the monetarist case cannot simply rest with the observed instability of the money stock and the observed sequences of accelerations and decelerations. It requires an analysis of the processes which govern the observed historical instability of monetary growth.

Two distinct examinations are of particular importance for a clarification of the "reverse causation" problem. In order to strengthen or weaken the case on behalf of the monetarist explanation of economic fluctuations we require a systematic investigation of money supply processes under a wide variety of institu-

[66] Leonall Andersen and Jerry Jordan, "Monetary and Fiscal Actions: A Test of their Relative Importance in Economic Stabilization", *Review* of the Federal Reserve Bank of St. Louis, November 1968.

[67] James Tobin, "Money and Income, Post Hoc Ergo Propter Hoc, *op. cit.*

tional arrangements and subject to widely different policy strategies. Some of this material has been carefully examined by Milton Friedman and Anna Schwartz. Philip Cagan and Michael Keran also made important contributions[68]. But more extensive examinations are required. The monetarist thesis would be substantially confirmed by such inquiries in case the time sequence of monetary acceleration (deceleration) and economic acceleration (deceleration) holds for episodes with and without Central Banks, with Central Banks following an interest strategy and with Central Banks following a different strategy, or episodes with Central Banks following an interest strategy where the pressure on interest rates is due in some cases to the marginal efficiency of real capital and in some cases to other factors. The deceleration of the US money stock in 1946/48 was due essentially to the large surplus of the Treasury's budget which was applied to retire outstanding debt. This raised security prices above the official support price and the Federal Reserve authorities, guided by their traditional concern for "orderly markets" and "stable interest rates", adjusted their open market operations in a direction which decelerated rapidly the monetary base. The money supply simply followed the monetary base. Similarly, the monetary deceleration in the USA in 1920, 1936/37, 1966 or 1969 were initiated by specific and occasionally abrupt policy actions on the discount rate, the requirement ratios and the portfolio of government securities of the Federal Reserve Banks. It would be difficult to explain these events as a response to a decelerating economy or a fall in the expected yield in real capital. The experience of countries with an open economy strongly meshed with other countries also offers useful information. This is particularly the case whenever the growth rate of the monetary base is closely determined by the contemporaneous balance of payments. These countries offer interesting episodes of money supply changes not attributable to internal feedbacks from the real sector. Even the fullest recognition of the admirable research executed thus far should be matched with an awareness that the rich material cast up by many different experiences, particularly European experiences, has barely been systematically examined. But the investigations made over the past decade tentatively support the conclusion that the timing relation between money and economic activity occurs independently of the particular arrangement governing the money supply process. These observations are difficult to reconcile with the hypothesis of a pronounced or even dominant reverse causation. But much more work is needed on these aspects to substantiate the tentative knowledge accumulated.

[68] Milton Friedman and Anna Schwartz, *A Monetary History of the United States 1867-1960*, Princeton, 1963; Philip Cagan, *The Determinants and Effects of Changes in the Stock of Money, 1875-1960*, New York, 1965; Michael Keran, *Monetary Policy and the Business Cycle in Postwar Japan*, unpublished Ph. D. dissertation, University of Minnesota, 1966.

Our problem permits an alternative and supplementary approach. A systematic money supply analysis can be used to examine the possible channels, linking money supply with economic activity. The nature and role of these channels can be assessed and the magnitude and conditions of "reverse causation" be explored in detail. This approach was particularly applied in evaluations of alternative explanations of the observed pro-cyclic growth rate of the US money stock. Three alternative explanations were examined. The Wicksell-Keynes hypothesis asserts that the pro-cyclic behavior of monetary growth ensues from the cyclic variations in the public's asset supply to banks. These variations result from the cyclic variability in the Wicksellian natural rate of interest or the Keynesian marginal efficiency of real capital. The cyclic changes in the public's asset supply induce via the adjustment of market rates of interest, changes in the banks reserve ratio and borrowing position. Borrowed reserves will increase and reserve ratios decline simultaneously over the upswing and raise consequently the money stock. And falling interest rates during the downswing raise the reserve ratio and lower the borrowing position of banks and the money stock retards. The Wicksell-Keynes hypothesis has an ancient history and is frequently encountered. Gramley-Chase offered another explanation which attributes the major portion of pro-cyclic monetary growth to the interaction of public and banks. Their hypothesis is centered on the sluggish adjustment of interest rates offered on time deposits relative to market rates of interest and the associated investor responses concerning the allocation of financial assets in wealth positions. A cyclic upswing raises interest rates and this movement of interest rates lowers the time deposit ratio (i. e. time deposits per unit of demand deposits) as investors increasingly substitute market instruments for time deposits. The reduction of the time deposit ratio raises the monetary multiplier (measured as the ratio of money stock over the base) and consequently the money stock. A cyclic downswing operates via the same channels to raise the time deposit ratio and thus to retard the money stock. The third explanation emphasizes the role of the monetary authorities and the public's behavior pattern expressed by the currency ratio. It asserts that cyclic movements in the monetary base modified by cyclic movements of the currency ratio explain the dominant portion of the observed fluctuations in the growth rate of the money stock[69].

These alternative hypotheses were examined in detail. If one of the first two hypotheses were true, one would observe that movements of the monetary multiplier over half-cycles dominate the corresponding movement of the money stock. Both hypotheses deny the dominant operation of the base over half-cycles. The data collected for the past 60 years exhibit however, a different pattern. The

[69] The Gramley-Chase hypothesis has been developed in the paper prepared by the authors and included in *Targets and Indicators of Monetary Policy*, ed. by Karl Brunner, San Francisco, 1969.

half-cycle changes of the money stock are dominantly correlated with changes in the base. Changes in the multiplier do occur and contribute to variations in the money stock even over the half-cayle. Still, the observed patterns are not consistent with the Wicksell-Keynes or Gramley-Chase hypothesis. It follows that these observations disconfirm the first two hypotheses and support the last hypotheses. Another assessment decomposed the relative changes of the money stock over half-cycles into the contributions made by the proximate determinants. Each of the three alternative hypotheses selects a different subset of the total set of proximate determinants as the dominant subset. The contributions selected according to each hypotheses were summed up and correlated with the observed changes of the money stock. The same procedure was also applied to the volume of bank credit. The results are presented in the following table[70].

Table III

	Money Stock	Bank Credit
Hypothesis 1	+.143	—.333
Hypothesis 2	+.045	+.381
Hypothesis 3	+.905	+.333

Three aspects of these results are interesting. We note first that the last hypothesis is strongly confirmed as against the first two. But we also notice that the patterns governing the behavior of the money supply do not apply to bank credit. The time deposit substitution mechanism operated just as significantly as the monetary base on the cyclic behavior of bank credit growth. Lastly, the negative correlation of bank credit with the Wicksell-Keynes mechanisms is probably somewhat surprising to many economists.

These results do not establish the absence of any "reverse causation" from economic activity to the money supply via the banks' or the public's behavior. The results only establish that such reverse causation does not dominate the observed fluctuations of the money stock over the business cycle. It is noteworthy that all econometric models examined thus far confirm this result. The effect of income in table II was quite small compared with the impact of the monetary base. The most important channels conveying influences from economic activity to the money supply were however neither the public's asset supply to banks nor the public's money demand. Induced adjustments in the time deposit ratio in response to changing creditmarket conditions and ad-

[70] The material was presented in my paper, "The Role of Money and Monetary Policy", *Review*, Federal Reserve Bank of St. Louis, July 1968.

justments in the currency ratio, formed in the US postwar experience the most important channels for the "reverse causation" effect. The role of such reverse causation, particularly in the short-run behavior of the money stock still requires further investigations. The problem has become acute with the growing interest to use the money supply as a short-run target of monetary policy. It is questioned on occasion whether the existence of the various influences on the money supply emanating from the public's and the banks' behavior permit an effective control over the money stock by the authorities. This is a relevant question, but it also changes the nature of the problem originally associated with "reverse causation". The latter was addressed to the dominance patterns over an intermediate run. The new problem bears on the structure of the money supply process in the short-run. The preliminary examination by various groups of the new issue suggest that weekly control over the money stock is not attainable, monthly control somewhat improbable, whereas control over quarterly changes seems reasonably achievable. Both the old reverse causation problem and the new control problem deserve extensive additional inquiries. The comparative analysis of many different monetary systems can be expected to be particularly useful for this purpose.

4. The New View

The monetarist hypothesis of the money supply process assigns to the behavior of the monetary authorities an important role in the determination of money supply behavior. The role of the public's and the banks' behavior is fully acknowledged however by the monetarist analysis. This behavior dominates in particular the shortest run (weekly) variations of the money stock but declines in relative importance beyond the shortest run. Investigations of different periods and countries establish thus far that the longer the period or the larger the relative change of the money supply, the greater is the role of the monetary authorities in the behavior of the money stock. This proposition can be reformulated in the following way: Let $M(t)$ be the money stock at an initial period t and let $M(T)$ be the money stock at a terminal period $T>t$. Similarly, let B denote the monetary base in the sense defined and measured by the Federal Reserve Bank of St. Louis. It includes thus reserve adjustments attributable to fiat changes in reserve requirements. The monetary base is also measured for the same initial and terminal period. A major implication of the monetarist hypothesis can now be stated as follows: The correlation between the ratios

$$\frac{M(T)}{M(t)} \quad \text{and} \quad \frac{B(T)}{B(t)}$$

increases with the size of the money supply ratio, for any terminal or initial points. The public's and the banks' behavior thus generate comparatively moderate movements or erratic short-run changes. Both types of motions remain however within a range which narrows with the length of the time horizon under consideration. It is noteworthy in this context that substantially more than 50% of the variations in monthly *changes* of the money supply observed over the postwar period in the USA can be explained by changes in the monetary base and Treasury deposits occurring during the same month and one month earlier. These implications of the monetarist hypothesis, strengthened by substantial observations bearing on the money supply process, assign to the monetary authorities a major responsibility. Monetary authorities determine essentially the intermediate and longer-run behavior of the money stock.

This result exemplifies rather pointedly the remarks made in the introduction. The development of a monetary analysis directed to the systematic explanation of our environment naturally intensified intellectual ferment and conflict. The conclusions developed from the work guided by the monetarist hypothesis placed a serious responsibility on the monetary authorities. It also induced a searching examination of the Central Banks dominant policy making patterns. A countercritique rapidly emerged and launched its arguments under the flag of the New View. The term was introduced by James Tobin in a well-known paper which forms the founding paper of the New View.[71] The ideas were admittedly stimulated by the work of Gurley and Shaw attempting to integrate banks and non-bank financial institutions within a unified analytical framework[72]. Three major themes were advanced by the New View. It emphasized the basic similarity between money and non-money substitutes, and between banks and non-bank financial intermediaries. It also directed attention to the operation of an economic mechanism governing the banks' asset acquisition and deposit supply.

The New View followed in its first theme some aspects of the Radcliffe Report. It blurred the distinction between money and other financial assets. This was justified in terms of close substitution relations. The argument usually concentrated however on the substitutability relations on the demand side and disregarded the supply side. These substitution relations are probably quite relevant. But they do not, contrary to the suggestive assertion made by Gurley-Shaw and perpetuated by portions of the New View, impair the efficacy of monetary policy or obstruct the transmission of monetary impulses. It is precisely the existing substitution

[71] "Commercial Banks as Creators of Money", in *Financial Markets and Economic Activity*, Cowles Foundation for Research in Economics at Yale University, monograph 21, edited by Donald D. Hester and James Tobin.

[72] John G. Gurley and Edward S. Shaw, *Money in a Theory of Finance*, Washington, D.C., 1960.

relations which convey the monetary impulses to the pace of economic activity. Substitution relations moreover, do not blur the distinction between money and financial assets. the distinction is blurred because the New View never examined the nature of money, and the character of its marginal productivity. The nature of this analytic shortcoming and the consequences for monetary analysis were discussed in chapter II.

The similarity between banks and non-bank financial intermediaries was associated partly with the blurred distinction between money and other financial assets. Additional arguments were adduced however. Both banks and other intermediaries supply liabilities to satisfy the preference of the ultimate lenders. An analogous argument could establish that watchmakers and ice cream makers are essentially similar, they both satisfy the preferences of ultimate consumers. The New View's similarity arguments are thus essentially based on a formula with minimal content. The smaller the range of defining characteristics the larger will be the range of "similar entities". Such arguments contribute little to our systematic knowledge and yield no informative hypotheses.

The last theme of the new View deserves a more detailed examination. It assigns a central role to the public's and banks' behavior patterns in the money supply process. The banks' marginal cost of attracting and maintaining deposits is balanced against their marginal gain of asset acquisition and this economic mechanism determines the scale of a bank and of the system. It follow that "for bank-created money ... there is an economic mechanism of extinction as well as creation, contraction as well as expansion". A proposition with far reaching implications is also advanced: "If bank deposits are excessive relative to public preferences, they will tend to decline, otherwise banks will lose income." Moreover, "the demand for bank deposits can increase only if the yields on other assets fall"[73]. It is also suggested that the linkage between money supply and policy is slippery and possibly unreliable. In particular, the impressive variability of net free reserves (relative to required reserves) is adduced to evidence a "loose linkage between reserves and deposits"[73]. We note lastly: "Without reserve requirements, expansion of credit and deposits by the commercial banking system would be limited by the availability of assets at yields sufficient to compensate banks for the cost of attracting and holding the corresponding deposits... When reserve requirements and deposit interest rate ceilings are effective, the marginal yield of bank loans and investments exceeds the marginal cost of deposits to the banking system. In these circumstances additional reserves make it possible and profitable for banks to acquire additional earning assets. The expansion process lowers interest rates generally enough to wipe out the banks' margin between the value and the cost of additional deposits[73]." The last quote asserts that in the

[73] All quotes are from James Tobin, "Commercial Banks as Creators of Money", *op. cit.*

absence of requirements and ceiling rates, the money supply is not tied effectively to the monetary base. Injections of base money cannot induce an expansion in bank credit and money stock without these institutional constraints. They enforce a "coerced" equilibrium on the banking industry with marginal gains from asset acquisitions above marginal costs of deposits. In a competitive banking system not subject to requirements and ceiling rates, the expansion of deposits is severely limited. Banks converge in the absence of constraints to a position equating the marginal discounted value of net earnings from asset acquisitions with the marginal discounted value of costs associated with deposit expansion. The formulation quoted suggests that this position is insensitive to injections of base money. This analysis implies that in the absence of requirement ratios and ceiling rates the money supply and bank credit are independent of the monetary base. It furthermore, implies that a positive response of the monetary magnitudes to the base depends on the two policy constraints.

The New View's analysis of the monetary system poses both an analytic and an empirical issue. We wish to determine on the analytic level whether the selected behavior necessarily imply the system's asserted insensitivity to variations in the base. The optimal volume of bank earning assets emerges in Tobin's description from the interaction between the marginal gain g of earning assets A and the marginal cost of deposits c. We specify therefore the following condition describing the banks' behavior in the absence of constraints

$$g(A, m) = c(D, v)$$

$$g_1 < 0 < g_2 \quad \text{and} \quad c_1 \geqq 0 < c_2$$

where D indicates total deposits, m the market conditions and v is an index of conditions (incl. interest payments) offered on deposit accounts. The index v is a function $v(m)$ of m. We add two more equations, a statement covering the consolidated position of the monetary sector

$$B + A = M = (1 + k)D$$

and the other statement describing the public's asset supply to banks.

$$A = s(m, \ldots), \qquad s_1 < 0$$

where B is the base, s the asset supply function and k denotes the currency ratio C/D. These specifications are consistent with Tobin's discussion and offer an admissible explication.

Suitable substitution reduces the system to two equations:

$$g(A, m) = c\left[\frac{B + A}{1 + k}, v(m)\right]$$

$$A = s(m, \ldots).$$

The derivative of A with respect to B can now be obtained by appropriate differentiation and we have

$$\frac{\partial A}{\partial B} = \frac{-s_1 c_1}{-s_1 [g_1 (1+k) - c_1] + (1+k)[c_2 v_1 - g_2]} .$$

Inspection of the formula immediately determines that a constant marginal cost of deposits (i.e. $c_1 = 0$) forms a necessary and sufficient condition for changes in the base to have no effect on the volume of earning assets. Rising marginal costs are necessary and sufficient even in the absence of ceiling rates on v and requirement ratios.

But suppose now that the marginal costs of deposits are constant and c_2 thus vanishes. In this case effective constraints imposed by reserve requirements and ceiling rates do become necessary conditions for the monetary system's responsiveness. We denote the average requirement ratio with r and the public's currency ratio with k and we obtain thus:

$$A \leqq \frac{1-r}{r+k} B$$

i.e. the volume of earning assets is at most equal to the right side expression. If the constraints are really effective we obtain a volume A equal to the limiting expression which is smaller than the unconstrained volume determined by the system above. It follows therefore that

$$g\left[\frac{1-r}{r+k} B, m\right] > c[\ldots, \bar{v}] .$$

With $\bar{v}$ fixed at the ceiling rate the marginal cost is constant and also held below g by the constraints r and $\bar{v}$. The constraints thus completely determine A and the market determines m according to the equation $A = s(m\ldots)$. Under these circumstances an increase in the base will induce an expansion in A, *provided* that the resulting reduction in m and increase in A do not lower the marginal gain g below the marginal cost c. Thus even with the constraints at work, an increase in the base beyond a magnitude determined by the difference $(g-c)$ and the numerical size of the derivative g_1 will exert no effect on the monetary system.

The analytical clarification of Tobin's proposition reveals the source of the problem. One need not harp on the constancy of the marginal cost of deposits which is required to establish the result. Let us accept such constancy as a relevant first order approximation. The problem is fundamentally characteristic of Yale's monetary analysis which has difficulty in recognizing the role of

money and its effects on the real opportunity set. In this particular case the analysis of the banks' behavior completely misses the role of cash assets. Tobin's analysis *assumes* that cash assets in excess of the required volume are zero. This very assumption creates Tobin's problem. Tobin properly emphasized the application of economic analysis to balance-sheet position, but this should include all balance-sheet items, even cash assets. And recent research bearing on the banks' excess reserve position provided new insights into the productivity and function of such excess reserves[74]. It follows thus that Tobin's description of the banks' optimizing behavior is incomplete. The marginal productivity p of excess reserves must be introduced simultaneously with the marginal gain g of earning assets. This will enable an examination of the conditions which cause vanishing excess reserve or large excess reserve holdings by banks. The detail of the analysis has been developed in appendix VI. We summarize the major results bearing on our issue. The interaction between the marginal productivity of the reserve position and the marginal gain of earning assets with the marginal cost of deposits modifies the results substantially. Tobin's basic proposition does not hold. The existence of constraining reserve requirements and ceiling rates is neither a necessary nor a sufficient condition for the monetary system's responsiveness to variations in the base. And this responsiveness persists even with a marginal cost of deposits which is insensitive to the volume of deposits.

A more complete analysis recognizing the function of reserve positions thus denies a major proposition of the New View. This analytic clarification is however not sufficient to determine the relevance of Tobin's proposition. Observations on the relative behavior of money stock and monetary base are required for this purpose. Tobin's proposition would be confirmed provided the responsiveness of money stock and bank credit to changes in the base is positively associated with the level of reserve requirements and the currency ratio and negatively with the level of ceiling rates. Moreover, data from unconstrained banking experiences are particularly useful in this context. A preliminary survey of the observations yields little support for Tobin's proposition.

The intellectual appeal of the New View for Central Bankers is largely attributable to the relative weights assigned to monetary authorities and to the role of banks' or public preferences in the causal process governing the money supply. Some of these issues were already considered in the section attending to the reverse causation. But there remains an analytic problem associated with the framework used by the Yale position to discuss the money supply process. The

[74] Peter A. Frost, *Banks' Demand for Excess Reserves*, unpublished Ph.D. dissertation, University of California at Los Angeles, 1966; Peter A. Frost and Thomas Sargent, "Money Market Rates, the Discount Rate and Borrowing From the Federal Reserve", *Journal of Money, Credit and Banking*, February 1970.

central issue bears on the role of the public and banks. The New View asserts that an excess supply of deposits yields essentially a contraction of deposits. The monetarist hypothesis implies that such an excess supply expands output and affects price-levels. The difference follows from some crucial analytic characteristics of the New View. Its analysis proceeds in the confines of a framework which omits the interaction between existing stocks and new production flows. The analysis is restricted to turnover flows of existing stocks and the substitution between these entities. Within these confines an excess supply of deposits can only lower asset yields until an expanded deposit demand, higher reserve ratio and currency demand restore equilibrium. And it is, of course, quite correct that the volume of deposits can only increase in case of an expanded deposit demand. And within the constraints imposed on the analysis this will occur only if asset yields fall. Of course inflations and deflations become somewhat mysterious experiences in this case, except that they are thoroughly dissociated from monetary evolutions. An excess supply of money causes no inflation, however large this excess supply, it only lowers interest rates and the money supply. But this again leads us back to a notion that monetary equilibrium, i. e. equality between desired and actual *nominal* balances is restored by continuous adjustment of the monetary multiplier. Once more, the relevant observations yield no evidence supporting such a contention. It follows that desired and actual balances are not adjusted by interest rates of substitutable assets only. The substitution reaches effectively beyond existing assets and is not confined by the paradigmatic framework which implicitly assumes the price-level to be held constant whatever adjustments may occur.

The extended range of substitution is clearly implied by the marginal productivity theory of money. This marginal productivity is expressed by a permanent stream of yields associated with a unit of real balances. The substitutions considered by the New View thus play between alternative expected future streams of utilitites associated with different assets. But Irving Fisher, also from Yale, emphasized an additonal direction for substitution, viz., an intertemporal substitution. This involves substitution between permanent yield streams of money (or other assets) and current consumption utilities. If the marginal productivity of real balances falls sufficiently low, the current value of the permanent yield drops below a current consumption utility and some real balances are replaced by consumption. This substitution involves a movement along an intertemporal indifference surface and thus lowers the internal rate of discount. An excess supply of money described by Tobin consequently lowers initially the marginal product of money. This means that the disocunted values of permanent yields associated with real balances are lowered relative to the discounted values of yields associated with other assets or current consumption utilities. Money holders thus adjust their position not only be-

tween alternative permanent-yield streams but also intertemporally. Both market rates and internal rates of discount change simultaneously. It follows from this modification of Yale's New View with the help of Yale's older view, that an excess supply of money is not removed by a substantial reduction in the money stock. It is dominantly removed by an expansion in demand induced through lower asset yields and larger consumption raising the exchange volume, and eventually by rising prices.

The discussion was based thus far on Tobin's arguments cast in the mold of a theory of the firm approach to money supply theory. But there remain some other pieces of analysis to be examined which were offered by Tobin and Brainard[75]. These authors constructed an explicit framework describing the interaction of asset markets and of financial institutions operating on these markets. This framework differs from the theory of the firm approach explored above. The Tobin-Brainard framework remains however a formal exercise with minimal content. It can be supplemented with order constraints which implicitly assign a comparatively minor role to the agents stressed by the New View. But such constraints are probably inconsistent with the theory intended with the suggestions. So far, however, the record of observations yield little promise for the intended theory. The basic framework developed by Tobin and Brainard remains however independent of this intended theory. It is actually quite close to the formal properties of some monetarist money supply theories. Tobin-Brainard center the money supply process similar to Brunner-Meltzer on a description of credit markets. Money stock, interest rates and bank credit emerge from the interaction of demand and supply on these markets. As a matter of fact, inspite of the apparent differences in the descriptions, there exist suitable and purely formal manipulations which transform the Brunner-Meltzer frame into the Tobin-Brainard frame and conversely[76]. It is remarkable, moreover, that the interpretations of the New View offered by Gramley-Chase and Warren Smith[77] actually diverge in the same general and fundamental manner from both the Tobin-Brainard and

[75] The framework referred to has been elaborated in papers published by James Tobin and William Brainard. The reader may usefully consult monograph 21 of the Cowles Foundation, *op. cit.*

[76] The Brunner-Meltzer money supply theory was discussed in the following two papers, "A Credit Market Theory of the Money Supply", *Essays in Honor of Marco Fanno,* Padua, 1966; and "Liquidity Traps for Money, Bank Credit and Interest Rates", *Journal of Political Economy,* January 1968.

[77] Lyle E. Gramley and Samuel B. Chase, "Time Deposits in Monetary Analysis". The paper appears together with a critical assessment by Karl Brunner in *Targets and Indicators of Monetary Policy,* San Francisco, 1968, ed. by Karl Brunner. Warren Smith, "On Some Current Issues in Monetary Economics: An Interpretation", *Journal of Economic Literature,* September 1970.

Brunner-Meltzer framework. The latter separates the public's money demand and asset supply to banks whereas the former identify these behavior patterns. It follows that the Gramley-Chase-Smith version is incompatible with the basic program of the "New View"[78].

A final word concerning the New View may be appropriate. It has contributed to the development of monetary analysis in several respects. Its systematic emphasis on the application of relative price theory to the balance-sheet positions moves economic analysis into the range of financial and monetary phenomena. The details of portfolio analysis poses however a new issue: how much detail is useful for an explanation of aggregative monetary processes. One should probably recognize another conflict between the monetarist position and Yale's position on this score. The monetarist hypothesis implies that the details of the financial structure and particularly the asset structure of commercial banks possess little significance with respect to the macro-responses of the system to monetary impulses. The New View would probably contend the opposite. This issue still requires further examination in the future.

The New View's programmatic emphasis on a theory of the firm approach to banking behavior appears particularly promising. This opens a field of analysis which has been neglected and could provide important analytic foundations for empirical money supply theories. But the New View has contributed little to the formulation of such theories. It reacted to the stagnation in money supply theory still observed by the end of the 1950's, and the academic heritage in this field with an emphatic program to extend economic analysis to this range of problems. The monetarists proceeded meanwhile to assemble the inherited building blocks into empirical hypotheses explaining the dominant contours of the money supply process. The difference in approach has been expressed by serious substantive conflicts. But on several important aspects, e.g. the systematic exploitation of price theory, and the firm theoretic foundation for an explanation of banking behavior, the monetarist position and Yale are quite compatible and reenforce each other.

VIII. The Analysis of Monetary Policy

1. The Information Problem

The examination of monetary policy can be usefully subdivided into three major groups of problems: the information problem, the interpretation prob-

[78] The reader may find a more detailed analysis of this issue in my chapter "Monetary Analysis and Federal Reserve Policy", *Targets and Indicators of Monetary Policy, op. cit.*

lem, and a determination problem. All the major issues discussed in the literature or confronting the policy-makers can be subsumed under this partition. Our survey covers the information problem only in passing. The Board of Governors of the Federal Reserve System and the Federal Open Market Committee (FOMC) are the institutions responsible for deliberate execution of monetary policy. In order to implement their responsibility, these policy bodies continuously assess the general movement of our economy, the pace of economic activity, the pressures on the price level and the trend in our balance of payment. Even the most cursory study of the published Record of Policy or the available minutes of the FOMC convinces a reader that the collection of relevant information as well as the assessment of the major trends is effectively organized. Substantial investment of additional resources to improve the quality, or speed up the summaries available to the policy-makers, would yield a comparatively small marginal productivity. Our policy institutions exhibit an excellent record with respect to this information problem.

This evaluation, however, was sharply contested in the early 1960's. Statistical studies of the movement of monetary aggregates appeared to reveal a pronounced "inside lag" of monetary policy. This inside lag consisted of two parts, a recognition lag and an action lag. The recognition lag measures the time elapsed between the actual change in the pace of economic activity and its explicit recognition by policy makers, whereas the action lag measures the time intervening between such recognition and suitable action by the appropriate policy bodies. The substantial length assigned to the "inside lag" by several statistical measures which related movements of monetary aggregates with the changing pace and pressures of economic activity, seemed to result mostly from the recognition lag. However, a detailed examination of the published Record of Policy and the minutes of the FOMC does not support this contention. The published record permits a rather definite specification of the time at which the policy makers explicitly recognize a change in economic movements. A comparison of these months of recognition with the prior peaks or troughs in economic activity measured according to the established procedure of the National Bureau of Economic Research, yields an average recognition lag of at most two or three months. This is actually an excellent record and should be fully appreciated. This record attests to the fact that knowledgeable men of affairs capable of efficient summary assessments were appointed to our policy bodies. The only substantial delay in recognition can be found for the postwar period in 1957. But a detailed examination of discussions by economists, journalists, legislators and administrators recorded in this year shows a pronounced uncertainty about the basic trend in economic activity. Economic activity was drifting unclearly for a lengthy period and made a decisive assessment quite difficult for anybody.

2. *The Interpretation Problem*

a) On Background and Relevance

The separation of monetary analysis from the discussions of actual policy problems noted in the introduction affected the analysis of monetary policy. The issues considered in academic discussions of economic policy usually had little relevance for the policymaker. They rarely dealt with the questions which concerned him. The selection of problems in the quantitative analysis of economic policy is frequently guided by the analytic apparatus and not by the nature of actual problems which confront the policymaker. The mastery of a sophisticated analytic apparatus subtly dominates the kind of questions asked and seriously discussed. Questions and problems which cannot be subsumed under the paradigm are naturally dismissed as irrelevant or uninteresting. What cannot be fitted into the acquired mathematical machinery attracts no attention. This fate befell essentially the indicator problem of monetary policy. Economists attuned to the Tinbergen-Theil analysis of economic policy exhibit some natural difficulties in appreciating even the existence of a problem and are inclined to follow Herrn von Korf's (or was it Palmstrom) example when he concluded "messerscharf, nicht sein kann, was nicht sein darf."

So what is the indicator problem? It should be noted first that it is a problem formulated by the policymakers and not by academic economists. But it would appear important for academic economists to accept and examine this problem. The consequences of misconceived and poor solutions of this problem are too serious to leave it entirely to the concern of Central Bank officials. A student of the Federal Reserve's history who pages carefully the minutes of the Federal Open Market Committee and the predecessor Committees, will rapidly encounter the indcator problem. During the early phases of the Great Depression the members of the Board of Governors frequently pondered and explicitly discussed the question *how to interpret monetary policy*. They wished to know how to assess the thrust conveyed by the monetary system and the strategy pursued by the authorities. In particular, they were looking for a measure which yields reliable information about the monetary thrust transmitted to economic activity. They usually settled at the time on market rates of interest as their preferred choice of an indicator expressing the thrust conveyed by monetary policy. The higher interest rates were, the "tighter" policy, and the smaller is both the power applied by policy and the thrust from monetary forces pushing on the pace of economic activity. The lower interest rates on the other hand, the larger in this view is the thrust applied by monetary policy. This solution of the indicator problem exerted a disastrous influence on ensuing events. Interest rates had fallen to low levels not because of an expansionary policy push-

ing on economic activity, but because low levels of activity had shrunk the demand for funds. The Federal Reserve thus attributed the low interest rates to its policies when they actually emerged as natural consequences of the economic deflation. The resulting belief that its policies *were* already expansionary formed the major reason that a really expansionary policy was never systematically pursued during the Great Depression. This misconceived belief about its own policies also explains the views which have entered many textbooks inspite of Laughlin Currie's early attempt to expose the fallacy. Once the Federal Reserve authorities believed it was pursuing an expansionary policy and also observed together with many newspapers, politicians, and academic economists who had uncritically accepted the Federal Reserve's interpretation, that economic activity did not respond, there emerged the legend of a powerless monetary policy. The monetary authorities behaved in this respect analogously to the car driver who bitterly complains about the power failure of his engine when the car grinds to a halt because he applied the brake in lieu of the accelerator.

The same indicator misled the Federal Reserve also on many other occasions. The Annual Report for 1949 asserts that the authorities pursued an aggressively expansionary policy. Interest rates indeed fell and actually induced the Federal Reserve to *sell* large quantities of government securities on the markets. Table IV presents some relevant information bearing on this period. The first column shows the percentage change of the money stock between three month moving averages separated by one month. The second column measures the contributions by the monetary authorities to the total percentage change. The reader should note the unrelenting negative sign of the authorities' contribution to the growth rate of the money stock. In 1950 and 1951 on the other hand the money stock grew at more than 4% per annum pushed to a major extent by the behavior of the monetary authorities. Nevertheless the Annual Report states that policy was moderated and turned gradually restrictive. Many other episodes could be selected in order to demonstrate how the Federal Reserve's choice of interest rates as an indicator of monetary policy caused the systematic negative association between what they said they were doing and what they were actually doing[79].

Somewhere during the earlier postwar period the Federal Reserve authorities shifted from the dominant use of interest rates as an indicator of policy to a more frequent use of free reserves (excess reserves minus total borrowing

[79] My article on "The Role of Money and Monetary Policy", *op. cit*, contains some more material bearing on this issue. The reader is also referred to the work jointly authored with Allan H. Meltzer and published by the Banking and Currency Committee of the US House of Representatives in 1964: *Some General Features of Federal Reserve Policy Making; The Federal Reserve's Attachment to Free Reserves.*

Table IV: Percentage Changes of Money Stock and The Contribution Made by the Authorities

	Money Stock	Contribution by Authorities
1/1949	—2.59	—2.59
2/1949	—2.12	—2.18
3/1949	— .95	—1.07
4/1949	.12	— .26
5/1949	.60	— .54
6/1949	.36	—1.49
7/1949	— .60	—1.70
8/1949	—1.19	—1.52
9/1949	—1.43	— .55
10/1949	— .84	— .83
11/1949	0	— .59
12/1949	1.09	— .62

from the Federal Reserve Banks). The Federal Reserve hypothesis of the money supply process supplemented with the Credit View of the transmission process seemed to suggest such a choice. A larger volume of free reserves accelerates the adjustment rate $\dot{E}$ of bank credit and thus raises the volume of aggregate demand. Larger free reserves appear thus to convey a larger monetary thrust on economic activity. Once again, the reader of the Federal Open Market Committee's minutes will note detailed and extensive discussions about the adequacy of the selected indicator. President Sprouls of the Federal Reserve Bank of New York entered in 1956 an extensive paper bearing on this issue into the minutes. It advocates explicitly the use of free reserves to guide the systematic interpretation of the policy line pursued by the authorities. It also offered a classificatory scale based on the level of free reserves ranking policies between "very tight" and "very easy". The change in the scale used by the authorities to gauge the monetary thrust did not change the fundamental misinterpretation of policy and evolving monetary situations. It was shown at another occasion that the Federal Reserve's verbal description of its policy correlated very highly with the movement of free reserves. We observe on the other hand a negative correlation between this verbal description and the authorities actual behavior expressed by the monetary base. In 1958 free reserves swung around by more than $1 billion from a negative to a highly positive level and the Federal Reserve concluded that it had reversed

its policy quite radically. But the growth rate (of a three month moving average) of the money stock fell from 3.21% p.a. in November 1952 throughout 1953 to .41% p.a. by December 1953. And this deceleration was completely dominated by the behavior of the monetary base, i.e. the actual behavior of the monetary authorities.

This discrepancy between the authorities interpretation and actual events may still seem puzzling. A causal glance at our Credit View analysis seems to justify the official interpretation. But here we meet again a problem already encountered, the substitution of an impressionistic inspection of a subsystem of the relevant relations for a complete analysis. An analysis of the structure in appendix III yields no support for the choice of free reserves as an adequate indicator, even with the full admission of the focal role of free reserves in the causal process shaping the adjustment rate of the banks' volume of earning assets. It is noteworthy that the system does *not* preclude a negative association between the equilibrium level of free reserves and the base. The equilibrium position of the creditmarket implies

$$\frac{\partial F^*}{\partial B^a} = \frac{1-r}{1+k} - \frac{r+k}{1+k}\,\frac{\partial E^*}{\partial B^a}$$

where

$$\frac{\partial E^*}{\partial B^a} = \frac{-h_1\, d_1\,(1-r)}{-h_1\, d_1\,(r+k) - h_2\, d_4\,(1+k)}$$

where all the symbols have been explained in the appendices, except F^* and E^* denoting the equilibrium levels respectively of F and E, i.e. free reserves and bank credit. The result depends crucially on the sign of h_2, the derivative of the banks adjustment rate with respect to market rates of interest. This derivative is positive for market rates sufficienctly low relative to the ceiling rate and negative for rates sufficiently above the ceiling rate. At comparatively lower interest rates $\partial E^*/\partial B^a$ is thus less than $(1-r)\,(r+k)^{-1}$ and $\partial F^*/\partial B^a$ is consequently positive. At rates sufficiently high, h_2 becomes so low that $\partial F^*/\partial B^a$ turns negative.

Another aspect of the complete analysis is more important however. The level of free reserves depends critically on other magnitudes. In our simplified version it depends on the level of fiscal policy variables and the expected real yield on real capital. An increase in the latter and of government expenditures lowers free reserves and an increase of taxes raises free reserves. The use of free reserves as an indicator of monetary policy thus attributes frequently effects to monetary policy which actually emanate from other parts of the system. The same problem can also be approached in the following way. Suppose the monetary authorities desire to hold the monetary thrust at a con-

stant level and thus maintain a constant level of free reserves. Suppose now that taxes have been reduced, government expenditures raised and the expected yield on real capital increases. In order to maintain the free reserves at the desired constant level the Federal Reserve will be forced under these circumstances to accelerate the growth rate of the base. But this will also accelerate the expansion of economic activity according to the positive total derivative $\partial Y/\partial B^a$ listed in appendix III. The Federal Reserve thus believes that it holds the monetary thrust on "an even keel" or follows a neutral policy when it actually accelerates this thrust and raises the push exerted by its behavior. A more complete analysis of the Credit View yields thus no analytic support for the initial impressionistic response to the description of aggregate demand function and reserve adjustment statement.

The same analysis can also be used to resolve the apparent conflict between the evidence of a short "inside lag" based on the Record of Policy and the minutes of the Federal Open Market Committee and a lag of several quarters inferred from statistical regressions by Kareken and Solow[80]. These statistical studies regressed the money stock (or bank credit) and free reserves on a combination of variables expressing the alleged major economic goals of the policy makers. The lag structure used in these regressions was interpreted to yield a measure of the inside lag. The reconciliation between the observed lag of the money stock and the short recognition lag revealed by the Record of policy depends on the misinterpretation of policy resulting from the use of free reserves to scale monetary thrust. Whenever activity retards, free reserves increase. This pattern is implied both by the Credit View and the monetarist hypothesis. The increase in free reserves is interpreted by the authorities as a shift to an expansionary policy. But this belief actually retards the proper action necessary to increase the growth rate of the money stock. The rapid increase of free reserves resulting from a pronounced economic retardation frequently induces the monetary authorities even to retard the base and thus to strengthen the economic deceleration, but still believing that policy has been adjusted "to lean into the deflationary winds". Actually, it has under the circumstances contributed to strengthen this wind. The money stock gradually reverses its movements over the downswing as a result of the emerging cyclic decline of the currency ratio. The Hawtrey effect contributes effectively to terminate monetary deceleration and policy frequently follows at a later stage only. The statistical lag observed can thus be interpreted as an action lag generated by a misconceived choice of an indicator or scale guiding the authorities interpretation of evolving monetary situations.

[80] John Kareken and Robert Solow, "Lags in Fiscal and Monetary Policy", *Stabilization Policies*, Commission on Money and Credit, Englewood Cliffs, New Jersey, 1964.

The gradual change from an indicator in terms of interest rates to free reserves reflected the modification of the Federal Reserve hypothesis. The original Burgess-Riefler hypothesis made interest rates a dependent variable linked positively with the banks' borrowing position. This older version was already replaced partly by Currie who made the banks' adjustment rate of bank credit the dependent variable. But the final reformulation came in the 1950's with the result described in appendix III. The Federal Reserve's initial choice of interest rates was thus *not* conditioned by any consideration of Keynesian analysis. Many economists joined subsequently the Federal Reserve's initial choice and argued the case on behalf of interest rates by references to a Keynesian framework. It is usually argued that interest rates provide the crucial linkage in the transmission of monetary impulses. This argument is combined with a "self-evident truth" to the effect that the crucial linkage item provides the most reliable indicator. But this proposition is neither self-evident nor true. Characterization as a central linkage element is neither a necessary nor a sufficient condition for the selection of an optimal indicator. Consider interest rates in the context of Keynesian analysis. The reduced form equation of interest rates shows that interest rates move in response to an array of predetermined variables. The use of interest rates for scaling policy thus again assigns effects to monetary impulses which are due to other causes even in a very Keynesian world. Actually, the simple Keynesian models of textbook fame imply that the growth rate of money stock offers a reliable scale for ordinal measures of monetary thrust. Without detailed knowledge of structural properties the model establishes that ordinal aspects of monetary growth provide a logical basis for comparative statements of monetary thrust[81].

Tobin applied the same linkage argument to his analysis of the transmission process centered on the "required rate of return of real capital". In the context of appendix IV this rate is represented by the asset price P of real capital. Tobin thus proposes essentially the differential $\partial P/\partial B^a \cdot dB^a$ as an indicator of policy. On several occasions in various published papers Tobin actually assesses monetary thrust in terms of a derivative analogous to $\partial P/\partial B$. But an examination of appendix IV establishes that the actual thrust is measured by

$$\frac{\partial y}{\partial B} = \frac{1}{\triangle}\left[\frac{\partial \alpha}{\partial i}\frac{\partial i}{\partial B} + \frac{\partial \alpha}{\partial P}\frac{\partial P}{\partial B}\right]$$

where $\partial\alpha/\partial i$ and $\partial\alpha/\partial P$ are the partial derivatives of the aggregate demand function; $\partial i/\partial B$ and $\partial P/\partial B$ are the derivatives of interest rate and asset price

[81] The first chapter in *Targets and Indicators of Monetary Policy*, *op. cit.*, jointly authored with Allan H. Meltzer analyzes this point in detail.

with respect to the base taking account of the interaction between asset markets but omitting the feedbacks via the output market. Lastly, the expression $\triangle$ describes the net effect of an output change on the output

$$\triangle = 1 - \frac{\partial \alpha}{\partial y} - \frac{\partial \alpha}{\partial i}\frac{\partial i}{\partial y} - \frac{\partial \alpha}{\partial P}\frac{\partial P}{\partial y} > 0$$

market taking account of the full interaction of all asset markets with the output market, and where $\partial i/\partial y$ and $\partial P/\partial y$ are again derivatives restricted to the interaction of the asset markets. It is obvious by inspection that $\partial P/\partial B^a \neq 0$ is not a necessary condition of monetary thrust. It is however a sufficient condition. Moreover, in case we possess perfect information about the structure the differential $\partial y/\partial B^a \cdot dB^a$ would form the appropriate indicator measuring the thrust of policy. And in case of uncertain knowledge of this structure we must use dB^a as an *ordinal* scale. Thus, in case of perfect information the differential specified defines a ratio scale and in case of incomplete information the differential of the base defines an ordinal scale. Thus depending on the degree of our information we can construct different scales justifying interpretative statements of different information content.

b. The General Description of the Indicator Problem

The argument of the last paragraph can be generalized in order to suggest a general solution of the indicator problem. The problem is restated for our purposes as the determination of an optimal scale permitting the measurement in at least an ordinal sense of the thrust applied by the behavior of monetary authorities.

It is useful to reflect once more however on the purpose of such a scale. In order to understand the urgency and relevance of the problem at issue, it is necessary to emphasize several facts. We note first that rational actions by the monetary authorities depend on reliable interpretations of these actions with respect to their consequences, and most particularly with respect to their effects on economic activity. The previous section surveyed the occasionally disastrous consequences of unreliable and unassessed interpretations. We observe secondly that interpretations differ substantially. The same course of events and behavior by the authorities is interpreted to mean something very different in terms of economic activity and prices by various groups. These differences are not just a "matter of words"; they involve substantive assertions about our environment and affect moreover present and future actions. One also notes that such interpretations are made in three distinct forms. They occur as statements based on a classification, as comparative or as numerical

statements. The information content of these statement forms differs of course. Each form also requires different levels of reliable information about the economic process. Moreover, all three types of statements are based on a suitably defined scale. This is perhaps least understood by economists. The fact remains however, that classificatory statements are justified by a nominal scale, comparative statements by an ordinal scale and numerical statements by at least an interval scale. In the absence of such scales the various types of statements completely lack any justification and are totally unfounded. It follows that the choice between competing interpretations involves a selection of a suitable scale guiding our interpretation. The following paragraph describes a procedure which effectively guides the determination of an optimal indicator. It provides consequently also a procedure governing the most reliable interpretation of monetary policy or monetary impulses relative to the available partial knowledge.

Suppose the economic process is described by a differential equation in vector form:

$$\mathring{y} = h[y, m, z]$$

where y is the state vector, m the monetary policy vector and z denotes the vector of remaining predetermined variables. Consider now that at a point in time t_0 the vector m is replaced by $m+\mu$ where μ is a constant added to whatever value the vector $m(t)$ assumes at any $t>t_0$. The evolution of the system proceeds beyond t_0 according to the equation

$$\mathring{y} + \mathring{\boldsymbol{\mu}} = h(y+\boldsymbol{\mu},\ x+\mu,\ z)\,.$$

For the class of piece wise linear systems we can write the results for any particular linear piece

$$\mathring{\boldsymbol{\mu}} = f(\boldsymbol{\mu}, \mu)\,.$$

We also assume that the system satisfies suitable conditions of dynamic stability so that $\boldsymbol{\mu}$ converges for any given μ to a limit expression $\overline{\boldsymbol{\mu}}$ which is a function $\overline{\boldsymbol{\mu}}(\mu)$ of μ. Consider now the sum of coordinates which measure economic activity and denote this sum by $\overline{\boldsymbol{\mu}}_1$. It also becomes a function $\overline{\boldsymbol{\mu}}_1(\mu)$ of μ. In order to express the circumstance that $\overline{\boldsymbol{\mu}}_1$'s dependence on μ is conditioned by the structure h we will write $\overline{\boldsymbol{\mu}}_1(\mu);\ h)$. It is now obvious that in case of perfect information about h the scalar function $\overline{\boldsymbol{\mu}}_1(\mu;\ h)$ offers a reliable scale for measuring the thrust applied by the authorities. The scale defined is a ratio scale with a natural zero and permitting a comparison of differences. Under perfect information the problem is conceptually trivial but the required computational algorithm could still be messy enough. Unfortunately, policymakers do not possess the perfect information available to academic

economists in their classroom exercises. These uncertainties are reflected by the fact that we do not know the true hypothesis h. We know only that h belongs to a class H of hypotheses defined by a group of constraints. Under the circumstances we cannot compute the $\overline{\mu}_1$ associated with any particular μ. Neither can we observe this magnitude, as it forms a highly constructed, theoretical magnitude. One looks therefore, for an observable or a computable substitute to approximate the true indicator which is neither computable nor observable. The possible choices offered for examination are assembled in a set S. The members o of the set S are in general functions of the time paths $y(t)$, $x(t)$, μ and $z(t)$. We write thus $o = o(\mu, x, z)$ as the state vector can be solved out. We also indicate the dependence of the result on the choice of the particular hypothesis h. In order to guide the choice among the alternatives offered in the set S we formulate a correlation function C, and define a correlation c between $\overline{\mu}_1$ and any particular selection $o \in S$ as follows. It should be noted that C involves integration over all the admissible values of μ.

$$c(h, o, x, z) = C[\overline{\mu}_1(\mu, h), o(\mu, x, z, h)].$$

The correlation is a function of h, the choice of o and the time paths x and z. These time paths are constrained by two admissible classes X and Z of policies such that $x \in X$ and $z \in Z$. The optimal indicator is now determined by the application of a decision theoretic procedure. The correlation is maximined with respect to the sequence of arguments in the following manner.

$$\max_{o} \min_{h} \min_{z} \min_{x} c(o, h, x, z)$$

The result of minimizing c with respect to h and the time paths x and z expresses the lowest possible correlation obtainable between $\overline{\mu}_1$ and a given o which is due to our imcomplete information about the structure of the process and the uncertainties of the actual policies pursued. The last operation, maximizing with respect to the choice of $o \in S$, determines the highest possible correlation from among the worst conditions due to our partial ignorance. The particular entity $o \in S$ which maxi-minis the correlator function forms the optimal indicator of thrust resulting from the monetary policies pursued. The procedure followed to select an optimal scale from those offered for systematic examination assures us that its ordering of alternative actions by the monetary authorities is closest to the true, but unknown and noncomputable, ordering. The deviation of the maxi-min value of the correlator function from unity is a measure of the degree of approximation achieved by the optimal indicator selected to interpret monetary policy. It should also be emphasized that the procedure yields in general an ordinal scale which provides a rational basis for

comparative statements about monetary policy. Such statements are usually quite adequate for purposes of rational policymaking.

The last statement has been contested, at least implicitly by James Tobin and others. Tobin essentially denies the relevance or the usefulness of the indicator problem. He argues that the "real dispute is between using any single indicator at all and using a procedure of adaptive forecasting... The FOMC can estimate the difference that alternative instrument settings will make to the future course of the things they are really interested in. They are not really interested in interest rates or money supply, for example, while they are really interested in GNP, unemployment, and price-levels. They can estimate, for example, what difference it makes to the course of those target variables whether or not ... they order the desk to make open market operations... This is the procedure to follow. I am not willing ... to give up on this objective and to settle for some simple indicator on the ground that our knowledge is so poor about the way the economy operates that we can't make policy the way it ought to be made"[82].

Tobin's description requires reliance on a single hypothesis. His procedure thus involves elimination of competing hypotheses about the structure of monetary processes. Once we have accomplished this, his procedure appears to be most excellent. But his advice regresses to the economist's world of perfect information usually presupposed in policy analysis. But we do observe alternative and competing hypotheses with little evidence (as yet) to discriminate between their comparative cognitive status. Doubtful readers are invited to examine the various econometric models mutating and multiplying at amazing speed and ponder whether we are rationally entitled to select one particular hypothesis as the obviously best established in terms of relevant evidence. The reality of our knowledge situation thus rationally imposes the decision theoretic procedure described above. One last note of caution should be added. The optimal scale gauging monetary policy and the scale for interpreting monetary impulses are in general quite distinct and involve separate issues. The general formulation of the problem in the paragraphs above is constrained to the optimal selection of a scale gauging monetary policy.

3. The Determination Problem

At least two distinct problems deserve a serious examination. The first considers the optimal strategy guiding the monetary authorities' behavior in the

[82] James Tobin, discussion of paper presented by Alan R. Holmes, *Controlling Monetary Aggregates.* The Federal Reserve Bank of Boston, 1969.

context of prevailing institutional arrangements. The second examines on the other hand the institutional arrangements. The strategy problem is more usually referred to as the target problem and involves the optimal choice of a short-run target governing the continuous adjustments of the policy makers control variables. The second problem bears on the optimal arrangement of monetary institutions.

The target problem is considered first. Its origins are found again in the discussions of policymakers and not in the classrooms of academic economists. Policymakers had to execute their policies in the face of substantial uncertainties about the detailed structure of the economic response mechanism. This uncertainty was reenforced by the information lag concerning important aspects of the economic situation. Moreover, even the money supply or bank credit are somewhat nebulous entities looking out from the desk of the account manager executing the directives of the Federal Open Market Committee. It was thus not by deliberate design but essentially a result of institutional pressures which induced many Central Banks to use one or the other variety of money market conditions as a short-run target. This meant that policymakers adjusted their instruments according to the movement of the selected target magnitude. The desired target values were of course frequently modified in the light of evolving market situations. The Federal Reserve authorities selected on occasion free reserves as a target and on other occasions Treasury bill yield or the Federal Funds rate or a combination of several entities. The choice of a short-run target governing the adjustment of monetary policy forms essentially a strategy problem. The central issue bears on the choice of a strategy, i. e. a target, which optimizes in some sense the consequences measured in terms of economic performance. The Federal Reserve hoped of course that an adjustment of open market policies according to the movement of money market conditions was well designed to yield good results for the economic process. This is of course much contested.

It is important to understand that the existence of a strategy problem to be solved by the Central Bank is generally recognized. At issue in current discussion are the particular selections made. Some economists have argued persistently and persuasively on behalf of monetary growth as a proper target. Others argued on behalf of long term interest rates, the Wicksellian natural rate of interest, or the growth rate of total bank credit. The question of an adequate choice of the strategy expressed by a suitable target adjustment procedure has come very much to the foreground in recent analysis of monetary policy. It naturally stimulated efforts to provide an analytic formulation in order to approach a better substantiated resolution of the problem.

One procedure which attracted some attention recently is the "variance approach". It emerged originally with a natural generalization of the Tinber-

gen-Theil analysis of economic policy[83]. The essential properties of the variance approach may be characterized in general terms as follows: Let the economic process be described by a vector function in implicit form;

$$g(\mathrm{y}, \mathrm{x}, \pi) = 0$$

y is the state vector, x the policy vector and π is a vector of parameters. This vector is not known with certainty. Its knowledge is governed by a probability distribution p. The utility function is quadratic in the state vector:

$$U = -y' Ky$$

where K is a (non-singular) symmetric matrix. The admissible strategies available to the policy maker are circumscribed by a class of functions S, such that every $s \in S$ is a vector function associating values of the policy vector with the state vector y, i.e. $x = s(y)$. The building blocks of the strategy problem have been introduced and the logical structure of the problem is described as follows: The policy maker selects the strategy $s \in S$ which maximizes the policy evaluation function U subject to the constraint of the economic process. U is of course a random variable, because it is a function of y, which is itself an implicit function of a random variable. Maximization applies thus to the expectation of U, i.e. EU. This function is expressed by

$$EU = E[-y' Ky]$$

Consider now any particular $s \in S$ and replace x in $g(y, x, \pi) = 0$ with $s(y)$. We obtain thus y as an implicit function of s and π. It follows consequently that the expectation of U is a function of s, given p. This circumstance is formulated explicitly as follows:

$$E[y(s, \pi)' Ky(s, \pi)]$$

where the expectation operation is applied to π by means of the distribution p. It follows that EU appears as a function of s, given K and p, i.e.

$$EU = \mu(s; p, K).$$

The optimal strategy s_0 is now determined by maximizing EU with respect to $s \in S$. The maximizing s_0 forms the optimal strategy and the arguments of

[83] Jan Tinbergen, *Economic Policy: Principles and Design*, Amsterdam, 1956; Henry Theil, *Optimal Decision Rules for Government and Industry*, Amsterdam/Chicago, 1964. The variance approach can be found in papers published by William Poole, "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model", *Quarterly Journal of Economics*, May 1970. Gregory Chow, "Optimal Stochastic Control of Linear Economic Systems", *Journal of Money, Credit and Banking*, August 1970.

s_0 with non-vanishing derivatives form the optimal choice of targets in a combination defined by the derivatives of s_0.

This analysis has many attractive features and easily appeals to the sophisticated analytic instincts of economists. There remains a serious reservation however. The logical structure of the variance approach excludes the most important aspect of the target problem actually confronting policymakers. The optimization procedure minimizes a contemporaneous variance in the cross section of the time path. The resolution of this problem assures us that the variability expected at any time point due to our incomplete information has been minimized by a suitable choice of policy adjustments. But we obtain no assurance from this procedure about the variability or instability of the process *over time*. Whatever the variability over the *time profile*, variability due to stochastic structure has been minimized in the *cross section* of time. The variance approach provides thus only a very partial answer and applies probably to the pragmatically least important portion.

The complete answer should obviously combine the two variability aspects, the time profile and the stochastic structure (or stochastic information about the structure). The description of the extended analysis is unavoidably restricted to a sketchy outline. The economic process is again described by a vector differential equation:

$$\mathring{y} = h(y, x, z, \pi)$$

with the meaning already assigned to the variables y, x and π; z is a vector of predetermined variables. The parameter π is governed by a probability density $p(\pi/h)$ which depends on h. Moreover, h is a member of a class H. We combine thus uncertainty with respect to the true hypothesis with either incomplete (stochastic) information "within" h or a stochastic structure of h. The adjustment of the policy vector is governed by an admissible strategy $s \in S$ drawn from a set S of relevant alternatives. The general form appears thus

$$\mathring{x} = s(y, x) \qquad s \in S.$$

We still require a performance function. This utility function is specified in two steps. We begin with

$$U = -(\mathring{y} - g)' K (\mathring{y} - g)$$

where g denotes a vector of desired growth rates and K is again a symmetric matrix. First, one obtains a variance function which impounds the variability in the cross section of time associated with the stochastic properties. This variance function is defined by

$$V = -\text{trace}\, K \int [h(y, x, z, \pi) - E[h(y, x, z, \pi)]]^2\, p(\pi|h)\, d\pi_i - (E-g)^1\, K(E-g)$$

where the expectation E of $\dot{y} = h(y, x, z, \pi)$ is taken with respect to the density p governing the random parameter π. The description of V thus determines that V is a function of y, x, z given p and h. We express this circumstance by

$$V = V(y, x, z; p, h)\,.$$

This variance function occurs now as integrand of the function describing performance over the time profile. We obtain in this manner the performance function P

$$P = \int_o^T V(y, x, z; p, h)\, dt\,.$$

The last step in our analytic outline is obtained by solving the differential system describing the joint movements of y and x over time. The result can be written in the form

$$y = \alpha\,[z(\theta);\, s,\, h]$$

$$x = \beta\,[z(\theta);\, s,\, h]$$

where α and β are functionals of the time path $z(\theta)$, the strategy s and the hypothesis h of the process. Suitable substitution for y and x in the performance function thus yields ultimately

$$P = P[s, h, z; p]$$

i. e. the performance depends on the time path $z(\theta)$, the strategy s and the hypothesis h. And the optimal strategy can be decided upon either by a Baysian procedure in case of incomplete stochastic information pertaining to the class H of hypohteses or in the absence of such knowledge by a suitable maxi-mini decision. The latter would in particular apply as follows

$$\max_s \min_z \min_h P(\min, h, z; p)\,,$$

i. e. the optimal strategy minimizes the worst variabilities over time attributable to our partial ignorance about the process expressed by h and the time path of z. Moreover, these variabilities over time take account of the cross section variability according to the construction of the performance function.

The outline may look more forbidding than the basic idea. Still, the reader should question where it all leads. The crucial function of the procedure is to provide the conceptual clarification necessary for a successful examination of the target problem. The outline was not presented with the idea that we should devote attention to computational algorithms which will determine optimal policy functions. Perhaps one day—who knows. But this would be quite prematurely ill-advised at the present stage and would only encourage learned exercises. But there is another aspect, frequently overlooked, to such conceptual clarifications. They can, when properly developed, usefully guide an essentially experimental approach to the examination of specific targets (or policy functions) seriously considered by the policymakers. It is noteworthy that such an experimental approach has emerged among the research work proceding at the Board of Governors. This development deserves much credit and encouragement. Most interestingly it forms precisely the kind of investigation which the conceptual clarification would suggest in the absence of a useful algorithm to execute actual optimization. James Pierce used the FRS-MIT econometric model for this purpose and considered several decision rules seriously discussed by economists. These rules include a constant monetary growth "subject to maximum allowable changes in interest rates. For example, if the interest rate constraint is violated during any period, the money stock could be changed sufficiently to bring the interest rate back to its allowable range. By varying the severity of the interest rate change constraint, the rule could range all the way from a Friedman rule, where any change in interest rate is tolerated, to a pure interest rate rule, where no interest rate change is tolerated at all. Narrow constraints would be appropriate when it is likely that short-run shifts in the money demand functions are an important source of instability. The relationship between money growth and interest rates should be made negative if the source of large interest rate changes is shifts in the savings and investment function"[84]. Pierce considers secondly "an interest rate rule ... subject to a money growth constraint. Thus, the interest rate rule would be pursued singlemindedly provided the growth in the money stock did not fall outside some predetermined range... By varying the width of the allowable range of growth rates, the rule can range all the way from a pure interest rate policy, in which any money growth rate is allowed, to a Friedman rule, in which only one growth rate is allowed, and the interest rate is free to vary. Narrow growth rate ranges would be appropriate when it is likely that shifts in the saving and investment functions are the source of instability"[84]. It should be noted that Allan H.Meltzer proposed in a discussion one of the targets partly examined by James Pierce: "State the target as

[84] James Pierce, "Some Rules for the Conduct of Monetary Policy", *Controlling Monetary Aggregates*, The Federal Reserve Bank of Boston, 1969.

a growth rate of the quantity of money, or of the monetary base ... Set a range of fluctuations in interest rates as the new proviso clause"[85]. The simulation of the economy's performance determined by the various target choices yields important information. Proper execution of such simulations outlines both the temporal and stochastic variability of the crucial goal variables. Of course, the performance characteristics are determined relative to a given theory contained in the econometric model used for the simulation study. This is equivalent to a comparison of the P-values in the previous performance function resulting from alternative selections $s \in S$ under the same $h \in H$. The experimental approach guided by the conceptual clarification now indicates that we need to repeat the simulation in the context of alternative theories. The same choices of $s \in S$ should be examined under all seriously advanced empirical hypotheses. Such an endeavor has become quite manageable. The results would be very instructive for our purposes. In case we obtain similar performance characteristics and a similar ordering of the various strategies considered under all hypotheses available, we would have acquired strong evidence in support of one particular strategy. In case the performance patterns vary substantially with the hypotheses chosen, further analysis of the differences becomes necessary. Most importantly, a serious evaluation of the major alternative hypotheses and a careful ranking of their cognitive status would be essential for rational policy making. The systematic evaluation and assessment of alternative theories has been thoroughly neglected thus far by most econometricians. We may hope that the requirements of rational policy procedures will encourage the development of the necessary research in the near future.

The second major determination problem bears on the useful adjustment of the institutional structure imposed on the monetary system. The efficiency of resource allocation and the stability of the monetary process form the major criteria in the analysis of institutional arrangements. It is not feasible to cover appropriately the full range of issues associated with aspects of resource allocations or stability. Unfortunately, serious problems do exist on both counts and some were discussed in chapter II. The institutional arrangements of US banking probably impose a resource allocation pattern which is substantially inefficient. These inefficiencies are supplemented by various controls on interest rates which probably exert a regressive effect on wealth distribution[86]. The issue of an optimal stock of money and an optimal volume of bank reserves

[85] Allan H. Meltzer, discussion of paper presented by James Duesenberry, *Controlling Monetary Aggregates, ibid.*

[86] Ed Kane, "Short-Changing the Small Saver: Federal Government Discrimination Against Small Savers During the Vietnam War", *Journal of Money, Credit and Banking,* November 1970.

also belongs to this subject, where optimality is expressed in terms of efficient resource allocation. These issues were discussed in chapter II.

The exchange rate problem belongs both to the efficiency and stability aspects. The disputes between advocates of a flexible system and those adhering to a rigid system continue unabated. One wonders on occasion what evidence or analysis would admittedly weaken the one or the other side's argument. It is however interesting to note that some recent work on the crawling peg attempts to develop some compromise solution. This solution should assure the operation of an adjustment mechanism which is however constrained by institutional considerations frequently advanced by Central Bankers.

Our disregard of these issues does not convey a sense of their unimportance. They are quite important. But we select for our last discussion one particular problem of the stability aspect which has been quite neglected in recent work. It appears actually most urgent that economists address their questioning to this problem. We notice in the USA for instance, a remarkable complication of the arrangements governing reserve requirements. The institution of ceiling rates has also been complicated in recent years. But this is not all. Some Governors propose that distinct reserve requirements be imposed on every different asset category of commercial banks. The German Bundesbank prides itself for having developed the "best" arrangements concerning reserve requirements. They probably still have the most complex arrangements at the moment. Other examples could be mentioned bearing on various controls and constraints. It is remarkable that the complexity of these measures and their extensive application has never been supported with any substantiated analysis. This holds both for Regulation Q and reserve requirements in the USA. Actually, they pose a serious problem to the controllability of monetary aggregates. This issue probably requires some extensive studies in the near future, most particularly as we approach a trend in policymaking more conductive to the control of monetary aggregates.

The problem may be described as follows. Let $p^1(m|\pi, n)$ designate the probability distribution of short-run changes in the money supply. The distribution is conditional on the policy vector π and a vector of changes n in non-policy proximate determinants of the money stock. The controllability of the money supply now involves two aspects of the conditional distribution. One pertains to the role of n and the other bears on the variance of p^1. The first aspect involves the derivation of a distribution $p^2(m|\pi)$ with the effect of n suitably integrated out. It is not necessarily the case that the variance of p^2 exceeds the variance of p^1. This is precisely a matter for careful examination. In a first approximation we can define the authorities' controllability over the money stock as the reciprocal of the variance of the density p^2. This measure informs us about the controllability in the context of behavior patterns concerning non-policy proximate determinants (as for instance the currency ra-

tio, the time deposit ratio, the excess reserve ratio) governed by a distribution $d(n)$. A second approximation will move to the reciprocal of the variance of p^1. In this context the authorities will have to develop a framework for the shorter-run prediction of n guided by $d(n)$. The relevant probability distribution thus depends in the second approximation really on n^*, i.e. we obtain $p(m|\pi, n^*)$, where n^* is the predicted value of n. A comparatively poor experience in forecasting n, i.e. discrepancies between n^* and n bias the mean of p^1 and increase most probably the observed variance. The conditions governing the assessment quality of the Central Banks' staff become thus quite important. We mention only one of the conditions which also affects the variance of p^1 and p^2 quite directly and not only via the quality of n^*. The nature of the institutional arrangements assume a crucial role in this respect. It is surmized that the complications of Regulation Q and of the reserve requirements increased the variance of both p^1 and p^2. This would imply a loss in controllability over the money stock. There occurs also a serious question pertaining to the arrangements governing the issue of base money in Germany. It is doubtful that the prevailing arrangement assures the German Bundesbank the degree of controllability which is required for an effective execution of economic stabilization policies.

A systematic analysis of institutional arrangements is thus urgently necessary at this stage. Demanding tasks are increasingly assigned to the monetary authorities without much thought as to whether or not these tasks can be effectively accomplished under the existing arrangements. More importantly, arrangements are complicated, and extended without much thought concerning the consequences for rational policy making. A reexamination of existing and proposed arrangements in terms of the requirements for an effective stabilization policy appears to form a next step in the analysis of monetary policy.

The problem can be molded in terms of the framework used for the target analysis. The argument can also be enlarged to include constraints on the policymaking process. Such constraints occurred recently in form of allocative goals or equity considerations pursued by the Board of Governors. The institutional arrangements exemplified by Regulation Q and reserve requirements affect the structure expressed by h. Variations of arrangements thus yield h's with different structural properties. Once these properties have been clearly delineated we can compare the performance characteristics of alternative institutions in a systematic manner. Similarly, supplementary goals or constraints on the policymaking process appear in form of additional constraints on the performance integral. A generalization of the Le Chatelier principle immediately suggests that this tends to impair the performance characteristics of any arbitrarily selected strategy. Supplementary allocation goals or political constraints thus involve a trade-off between aggregative stabilization perform-

ance by the Central Bank and satisfaction of these additional goals. Once the social cost of these supplementary goals is clearly understood a Central Bank could be expected to present a better case, if such exists, for the growing propensity to satisfy essentially political goals.

Appendix I: List of Variables

Y = income at current prices
y = output (real income)
Y^d = disposable income
α = aggregate demand function of private sector
E = volume of bank credit (i.e. earning assets of commercial banks)
G = government expenditures
t = tax revenue function
i^1 = index of interest rates formed on bank credit market
i^2 = market index of interest rates formed on other creditmarkets
F = free reserves of banks
B^a = source base adjusted for discounts and advances
k = currency ratio (relative to public's deposits)
M^1 = exclusive money stock
r = average requirement ratio on all deposits.
λ = money demand function
d = the discount rate
g = real volume of government expenditures
K = stock of real capital
p^a = anticipated price-level of output
ω = index of anticipated market evolution over the intermediate-run
P = the price-level of real capital
π = anticipated rate of price inflation
n = expected real yield on real capital
p = output price-level
a = banks' earning asset multiplier
S = outstanding stock of government securities
σ = the public's asset supply function on creditmarket

m = monetary multiplier
W = stock of wealth
τ = parameter summarizing tax schedules
M^2 = inclusive money stock
D = total deposits
v = an index of conditions offered by banks on deposits
cm = an index of creditmarket conditions
C^p = currency held by the public
X = excess reserves
ϱ = required rate on real capital

Note: All function signs with subscripts denote derivatives. The number occurring as subscript describes the position of the argument with respect to which the derivative is defined.

Appendix II: The Standard Keynesian System and Associated IS-LM Diagram

A. Description of the System

1. The output market

$$Y = \alpha [i, Y - t(Y)] + G$$

$$\alpha_1 < 0 < \alpha_2 ; t_1 > 0 .$$

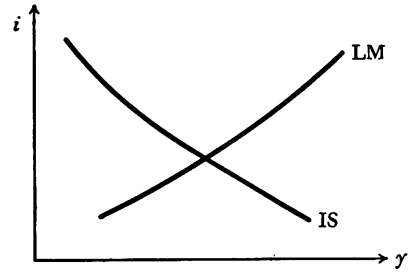
2. The "money market"

$$M = \lambda (i, Y) ; \lambda_1 < 0 < \lambda_2 .$$

B. The IS-LM Diagram

1. The IS curve is defined by equation 1. This equation defines an implicit function $i = a(Y, G)$ depicted in the diagram.

2. The LM curve is defined implicitly by equation 2. We obtain $i = b(Y, M)$ depicted also in the diagram



The position of IS is determined by G and the position of LM by M. The slope of IS is given by

$$\frac{\partial i}{\partial Y}(\text{IS}) = \frac{1-\alpha_2(1-t_1)}{\alpha_1},$$

and the slope of LM is given by

$$\frac{\partial i}{\partial Y}(\text{LM}) = -\frac{\lambda_2}{\lambda_1} > 0.$$

C. A Complication

Suppose we replace the above equations by

1. $$y = \alpha(i, y) + g$$

2. $$\frac{M}{p} = \lambda(i, y)$$

3. $$y = f(N, K)$$

4. $$P = f_1(N, K)\, W$$

where N = employment level, K = stock of real capital, W = money wage, f_1 = marginal productivity of labor. The other variables are defined in appendix I. Moreover, real government expenditures g, M and W are exogenous. The two curves are defined by

$$y = \alpha(i, y) + g$$

and

$$M = \lambda(i, y) f_1[N(y, K), K]\, W$$

where $N(y, K)$ is the partial inverse of the production function in equation 3. The position of IS depends on g and the position of LM on K and W. An increase in either variable moves the LM curve to the left.

Appendix III: Formulation of a Bank Credit Theory

A. Statement of the System

1. Description of output market

a)
$$Y = \alpha(i^1, i^2, Y^d, \dot{E}, n) + G$$

$$\alpha_1 < 0 > \alpha_2, \alpha_3 > 0 < \alpha_4.$$

b) Definition of disposable income

$$Y^d = Y - t(Y) \qquad t_1 > 0.$$

2. Description of bank credit market

a) The banks' portfolio adjustment

$$\dot{E} = h(F, i^1, d)\, h_1 > 0 < h_2, h_3 < 0.$$

b) The public's demand for bank credit

$$\dot{E} = \sigma(i^1, i^2, Y, E, n)$$

$$\sigma_1 < 0 < \sigma_2; \quad \sigma_3 > 0 > \sigma_4; \quad \sigma_5 > 0.$$

c) Definition of F

$$F = B^a - \frac{r+k}{1+k} M.$$

d) The consolidated statement of the monetary sector

$$B^a + E = M^2.$$

3. Description of the money market

$$M^2 = \lambda(i^1, i^2, Y, n)$$

$$\lambda_1 < 0 >_2; \quad \lambda_3 > 0 > \lambda_4.$$

B. Definition of the IS-LM Curves Derived from the System

1. Equations 2a and 2b can be solved for $\dot{E}$ and i^1 in terms of i^2, Y, B, E and n. We obtain thus from the creditmarket equations

$$\dot{E} = e(i^2, Y, B, E, n, d)$$

$$i^1 = j(i^2, Y, B, E, n, d).$$

The functions e and j have the following properties

$$\frac{\partial e}{\partial i^2} = \frac{d_2 h_2}{h_2 - d_1} > 0; \qquad \frac{\partial e}{\partial Y} = \frac{d_3 h_2}{h_2 - d_1} > 0$$

$$\frac{\partial e}{\partial B} = \frac{-d_1 h_1}{h_2 - d_1} \cdot \frac{1-r}{1+k} > 0; \quad \frac{\partial e}{\partial E} = \frac{d_1 h_1 \dfrac{r+k}{1+k} + h_2 d_4}{h_2 - d_1} < 0$$

$$\frac{\partial e}{\partial d} = \frac{-d_1 h_3}{h_2 - d_1} < 0; \quad \frac{\partial i}{\partial i^2} = \frac{d_2}{h_2 - d_1} > 0; \quad \frac{\partial i}{\partial Y} = \frac{d_3}{h_2 - d_1} > 0$$

$$\frac{\partial i}{\partial B} = -\frac{h_1 \dfrac{1-r}{r+k}}{h_2 - d_1} < 0; \quad \frac{\partial j}{\partial E} = \frac{d_4 + h_1 \dfrac{r+k}{1+k}}{h_2 - d_1} \gtrless 0; \quad \frac{\partial j}{\partial d} = \frac{-h_3}{h_2 - d_1} > 0.$$

2. Replace $\dot{E}$ and i^1 in the α-function by means of the e and j functions. Replace similarly i^1 by means of the j-function in the λ-function. We obtain thus

a) $$Y = \beta(i^2, Y, B, E, n, d) + G$$

b) $$B + E = \lambda(i^2, Y, B, E, n, d).$$

The equation a) defines implicitly the IS curve and equation b) defines the LM curve. The slope and position properties of the two curves are stated as follows.

a) The IS curve.

i. The slope defined as $\dfrac{\partial i^2}{\partial Y}$

$$\frac{\partial i^2}{\partial Y} = \frac{1 - \frac{\partial \alpha}{\partial Y} - \frac{\partial \alpha}{\partial i^1} \cdot \frac{\partial j}{\partial Y} - \frac{\partial \alpha}{\partial \dot{E}} \cdot \frac{\partial e}{\partial Y}}{\frac{\partial \alpha}{\partial i^1} \cdot \frac{\partial j}{\partial i^2} + \frac{\partial \alpha}{\partial i^2} + \frac{\partial \alpha}{\partial \dot{E}} \cdot \frac{\partial e}{\partial i^2}} .$$

ii. The position with respect to B, E, G defined as a vertical shift

$$\left(\text{i.e. } \frac{\partial i^2}{\partial x}, \ x = B, E, G \right)$$

$$\frac{\partial i^2}{\partial B} = - \frac{\frac{\partial \alpha}{\partial i^1} \frac{\partial j}{\partial B} + \frac{\partial \alpha}{\partial \dot{E}} \frac{\partial e}{\partial B}}{\frac{\partial a}{\partial i^1} \frac{\partial j}{\partial i^2} + \frac{\partial \alpha}{\partial i^2} + \frac{\partial \alpha}{\partial \dot{E}} \frac{\partial e}{\partial i^2}} > 0$$

$$\frac{\partial i^2}{\partial E} = - \frac{\frac{\partial \alpha}{\partial i^1} \frac{\partial j}{\partial E} + \frac{\partial \alpha}{\partial \dot{E}} \frac{\partial e}{\partial E}}{\frac{\partial \alpha}{\partial i^1} \frac{\partial j}{\partial i^2} + \frac{\partial \alpha}{\partial i^2} + \frac{\partial \alpha}{\partial \dot{E}} \frac{\partial e}{\partial i^2}}$$

$$\frac{\partial i^2}{\partial G} = - \frac{1}{\frac{\partial \alpha}{\partial i^1} \frac{\partial j}{\partial i^2} + \frac{\partial \alpha}{\partial i^2} + \frac{\partial \alpha}{\partial \dot{E}} \frac{\partial e}{\partial i^2}} > 0 .$$

b) The LM curve

i. The slope defined as $\frac{\partial i^2}{\partial Y}$(LM)

$$\frac{\partial i^2}{\partial Y} = - \frac{\frac{\partial \lambda}{\partial i^1} \frac{\partial j}{\partial Y} + \frac{\partial \lambda}{\partial Y}}{\frac{\partial \lambda}{\partial i^1} \frac{\partial j}{\partial i^2} + \frac{\partial \lambda}{\partial i^2}} > 0$$

ii. The position expressed as a vertical shift $\left(\text{i.e. } \frac{\partial i^2}{\partial x},\ x = B, E\right)$

$$\frac{\partial i^2}{\partial B} = \frac{1 - \frac{\partial \lambda}{\partial i^1}\frac{\partial j}{\partial B}}{\frac{\partial \lambda}{\partial i^2}\frac{\partial j}{\partial i^2} + \frac{\partial \lambda}{\partial i^2}} < 0$$

$$\frac{\partial i^2}{\partial E} = \frac{1 - \frac{\partial \lambda}{\partial i^1}\frac{\partial j}{\partial E}}{\frac{\partial \lambda}{\partial i^1}\frac{\partial j}{\partial i^2} + \frac{\partial \lambda}{\partial i^2}} < 0 .$$

3. The response of income with respect to B, E and G expressed in terms of slope and position properties of the IS-LM curves.

$$\frac{\partial Y}{\partial B} = \frac{-\frac{\partial i^2}{\partial B}(\text{IS}) + \frac{\partial i^2}{\partial B}(\text{LM})}{\frac{\partial i^2}{\partial Y}(\text{IS}) - \frac{\partial i^2}{\partial Y}(\text{LM})} > 0$$

$$\frac{\partial Y}{\partial E} = \frac{-\frac{\partial i^2}{\partial E}(\text{IS}) + \frac{\partial i^2}{\partial E}(\text{LM})}{\frac{\partial i^2}{\partial Y}(\text{IS}) - \frac{\partial i^2}{\partial Y}(\text{LM})} \gtrless 0$$

$$\frac{\partial Y}{\partial G} = \frac{\frac{\partial i^2}{\partial Y}(\text{IS})}{\frac{\partial i^2}{\partial Y}(\text{IS}) - \frac{\partial i^2}{\partial Y}(\text{LM})} \cdot \frac{1}{1 - \frac{\partial \alpha}{\partial Y} - \frac{\partial \alpha}{\partial i^1}\frac{\partial j}{\partial Y} - \frac{\partial \alpha}{\partial E}\frac{\partial e}{\partial Y}} .$$

Appendix IV: A Price-Theoretical Approach

A. Description of the System

1. Description of the output market

a)
$$y = \alpha\,[i^1, p, P, W] + g$$
$$\alpha^1 < 0 > \alpha_2; \quad \alpha_3 > 0 < \alpha_4.$$

b) The price-setting function

$$p = p(y, K, \omega, p^a)$$
$$p_1 > 0 > p_2; \quad p_3 > 0 < p_4.$$

2. The creditmarket

$$a(i^1, P, d)\,B = \sigma\,[i^1, p, P, W, S]$$
$$a_1 > 0 < a_2; \quad a_3 < 0 > \sigma_1; \quad \sigma_2 > 0 > \sigma_3; \quad \sigma_4 > 0 < \sigma^5.$$

3. The "money market"

$$m(i^1, P, d)B = \lambda\,[i^1, p, P, W]$$
$$m_1 > 0 > m_2; \quad m_3 < 0 > \lambda_1; \quad \lambda_2 > 0 < \lambda_3; \quad \lambda_4 > 0.$$

4. The description of real wealth

$$W = W(y, \tau, B, S, n), \quad W_1 > 0 > W_2; \quad W_3 \geqq 0 < W_4; \quad W_5 > 0.$$

B. Definition of the IS-CM Curves

1. Solve the money market equation for P, and replace p by 1*b*. We obtain

$$P = P(i^1, y, K, \omega, p^a, d, B, S)$$

$$\frac{\partial P}{\partial i^1} = \frac{\lambda_1 - m_1 B}{m_2 B - \lambda_3} > 0$$

$$\frac{\partial P}{\partial y} = \frac{\lambda_2 p_1 + \lambda_4 W_1}{m_2 B - \lambda_3} < 0\,; \qquad \frac{\partial P}{\partial K} = \frac{\lambda_2 p_2}{m_2 B - \lambda_3} > 0$$

$$\frac{\partial P}{\partial \omega} = \frac{\lambda_2 p_3}{m_2 B - \lambda_3} < 0\,; \qquad \frac{\partial P}{\partial p^a} = \frac{\lambda_2 p_4}{m_2 B - \lambda_3} < 0$$

$$\frac{\partial P}{\partial d} = \frac{-m_3 B}{m_2 B - \lambda_3} < 0\,; \qquad \frac{\partial P}{\partial B} = \frac{-m + \lambda_4 W_3}{m_2 B - \lambda_3} > 0$$

$$\frac{\partial P}{\partial \tau} = \frac{\lambda_4 W_2}{m_2 B - \lambda_3}\,; \qquad \frac{\partial P}{\partial S} = \frac{\lambda_4 W_4}{m_2 B - \lambda_3} < 0\,.$$

2. Replace P in the α-function and creditmarket function by the solution obtained from the money market equation. We obtain thus

a) $y = \alpha\,[i^1, p(y, \ldots),\ P(i^1, y, d, B, \tau, S),\ W(y, \tau, B, S)] + g$

b) $a\,[i^1, P(i^1, y, d, B, \tau, S),\ d,\ W(y, \tau, B, S)]\,B =$
$\sigma\,[i^1,\ p(y, \ldots),\ P(i^1, y, d, B, \ldots),\ W(y, \tau, B, S), S]$

Equation a describes the IS curve and equation b defines the CM curve.

a) Properties of the IS curve

i. The slope

$$\frac{\partial i^1}{\partial y}(\mathrm{IS}) = \frac{1 - \dfrac{\partial \alpha}{\partial p}\dfrac{\partial p}{\partial y} - \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial y} - \dfrac{\partial \alpha}{\partial W}\left(\dfrac{\partial W}{\partial y}\right)}{\dfrac{\partial \alpha}{\partial i^1} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial i^1}}$$

ii. The position measured by vertical shifts

$$\frac{\partial i^1}{\partial B} = -\frac{\dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial B} + \dfrac{\partial \alpha}{\partial W}\dfrac{\partial W}{\partial B}}{\dfrac{\partial \alpha}{\partial i^1} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial i^1}} > 0$$

$$\frac{\partial i^1}{\partial d} = -\frac{\dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial d}}{\dfrac{\partial \alpha}{\partial i^1} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial i^1}}$$

$$\frac{\partial i^1}{\partial K} = -\frac{\dfrac{\partial \alpha}{\partial p}\dfrac{\partial p}{\partial K} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial K}}{\dfrac{\partial \alpha}{\partial i^1} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial i^1}}$$

$$\frac{\partial i^1}{\partial \omega} = -\frac{\dfrac{\partial \alpha}{\partial p}\dfrac{\partial p}{\partial \omega} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial \omega}}{\dfrac{\partial \alpha}{\partial i^1} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial i^1}}$$

$$\frac{\partial i^1}{\partial p^a} = -\frac{\dfrac{\partial \alpha}{\partial p}\dfrac{\partial p}{\partial p^a} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial p^a}}{\dfrac{\partial \alpha}{\partial i^1} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial i^1}}$$

$$\frac{\partial i^1}{\partial g} = -\frac{1}{\dfrac{\partial \alpha}{\partial i^1} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial i^1}}$$

$$\frac{\partial i^1}{\partial S} = -\frac{\dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial S} + \dfrac{\partial \alpha}{\partial W}\dfrac{\partial W}{\partial S}}{\dfrac{\partial \alpha}{\partial i^1} + \dfrac{\partial \alpha}{\partial P}\dfrac{\partial P}{\partial i^1}} .$$

b) Properties of the CM curve

i. The slope

$$\frac{\partial i^1}{\partial y}(\mathrm{CM}) = -\frac{\dfrac{\partial \sigma}{\partial p}\dfrac{\partial p}{\partial y} + \left(\dfrac{\partial \sigma}{\partial P} - \dfrac{\partial a}{\partial P}B\right)\dfrac{\partial P}{\partial y} + \left(\dfrac{\partial \sigma}{\partial W} - \dfrac{\partial a}{\partial W}B\right)\dfrac{\partial W}{\partial y}}{\Delta}$$

where $\triangle = \left(\frac{\partial \sigma}{\partial i^1} - \frac{\partial a}{\partial i^1} B\right) + \left(\frac{\partial \sigma}{\partial P} - \frac{\partial a}{\partial P} B\right) \frac{\partial P}{\partial i^1} < 0.$

ii. The position

$$\frac{\partial i^1}{\partial B}(\mathrm{CM}) = -\frac{\left(\frac{\partial \sigma}{\partial P} - \frac{\partial a}{\partial P} B\right) \frac{\partial P}{\partial B} - a + \left(\frac{\partial \sigma}{\partial W} - \frac{\partial a}{\partial W} B\right) \frac{\partial W}{\partial B}}{\triangle} > 0$$

$$\frac{\partial i^1}{\partial d}(\mathrm{CM}) = -\frac{\left(\frac{\partial \sigma}{\partial P} - \frac{\partial a}{\partial P} B\right) \frac{\partial P}{\partial d} - \frac{\partial a}{\partial d} B}{\triangle}$$

$$\frac{\partial i^1}{\partial S}(\mathrm{CM}) = -\frac{\left(\frac{\partial \sigma}{\partial P} - \frac{\partial a}{\partial P} B\right) \frac{\partial P}{\partial S} + \left(\frac{\partial \sigma}{\partial W} - \frac{\partial a}{\partial W} B\right) \frac{\partial W}{\partial S}}{\triangle} > 0.$$

3. The response of output

Once again, the derivative of y with respect to any exogenous variable can be expressed in terms of the slope and appropriate position properties of the IS and CM curves. We list only one:

$$\frac{\partial y}{\partial B} = \frac{-\frac{\partial i^1}{\partial B}(\mathrm{IS}) - \frac{\partial i^1}{\partial B}(\mathrm{CM})}{\frac{\partial i^1}{\partial y}(\mathrm{IS}) - \frac{\partial i^1}{\partial y}(\mathrm{CM})} > 0.$$

Appendix V: An Outline of a Monetarist Framework

1. The dynamic system

a) The output market

$$\frac{d}{dt} \log y = h[\log(\alpha + g) - \log y]$$

where α is defined as in Appendix IV and g is again real government expenditures.

b) Credit market and "money market" are described as before.

2. The semi-final equation

It is possible to derive the following semi-final equation in output by differentiation and repeated substitutions.

$$d\left(\frac{dy}{y}\right) = -a_1 \frac{dy}{y} + b_1 - b_2 + b_3$$

and where

$$b_1 = \beta_1 \frac{dM}{M} + \beta_2 \frac{dF}{F} + \beta_3 \frac{d\pi}{\pi} + \beta_4 \frac{dn}{n} + \beta_5 \frac{dS}{S}$$

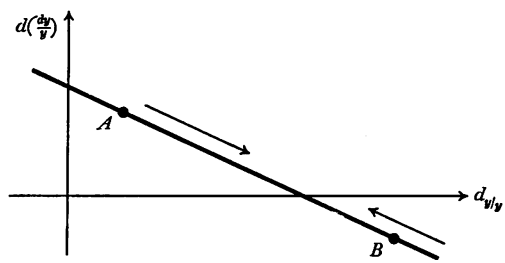
$$b_2 = \gamma_1 \frac{dK}{K} + \gamma_2 \frac{d\omega}{\omega} + \gamma_3 \pi$$

$$b_3 = \text{a remainder term}$$

M = money stock, $\frac{dF}{F}$ = a linear combination of relative rates of change of fiscal policy variables.

3. A diagrammatic presentation

a)



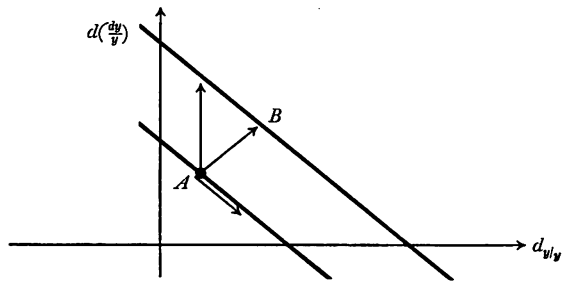
The descending line represents the second order differential equation in the previous section. The slope of the line is represented by $-a_1$ (a_1 is positive). This coefficient is a rational function of the structural properties of the system. It is small at low utilization rates and large at high utilization rates.

The position of the line is given by b, the sum of the b_i, i.e., $b = b_1 - b_2 + b_3$; where b_1 and b_2 are defined as linear combinations of various magnitudes with *positive* coefficients. Any change in b thus shifts the line up or down.

With constant forces operating on the economic process the intercept b defining the position is held constant. The internal dynamics of the system

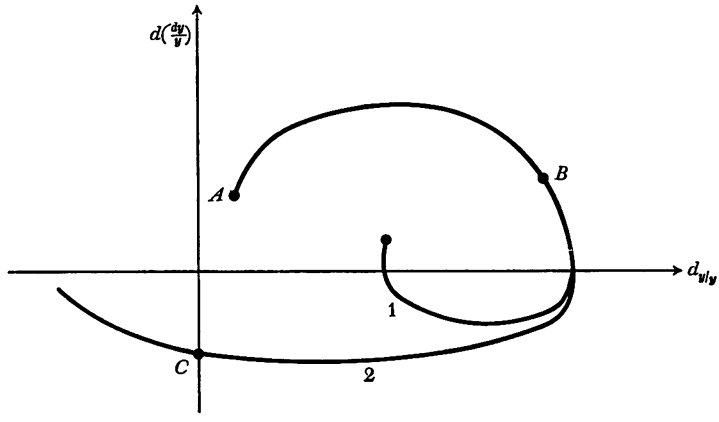
pushes the state point towards the horizontal. The point A thus moves downwards towards the intersection of the descending line with the horizontal axis. In case of point B the motion is upwards towards the axis. The intersection with the axis defines an equilibrium position of the growth rate relative to the forces defining the intercept b.

b) An accelerated monetary impulse



Suppose dM/M increases and raises the intercept b by $\triangle b$ in the diagram. The movement of the state point located initially at A is subject to distinct forces expressed by arrows in the diagram. One arrow is downward along the line reflecting the working of the system's internal dynamics. Another arrow points straight up and measures the effect of a larger dM/M, i.e. of a monetary acceleration. The net effect of the two forces is depicted by the arrow from point A to point B.

c) The motion of the state point in response to the joint operation of internal dynamics and monetary accelerations (or decelerations)



A is the initial state. B is the state reached when acceleration terminates. The line 1 describes the motion of the state point in case dM/M is held fixed, i.e. in the absence of deceleration. Line 1 thus shows the consequences of terminating acceleration without initiating decelerations. The state point moves in this case in response to the delayed responses of dK/K, $d\omega/\omega$ and π. The line 2 describes the motion in case after the point B has been reached, monetary deceleration is initiated. The time interval between B and C measures the Friedman lag. This lag is shorter whenever a large deceleration follows a large acceleration.

Appendix VI

Our explication begins with the notions of a marginal cost of deposit acquisition or maintenance and a marginal gain of asset acquisition. Both functions could be derived from a coherent theory of the firm, but we sketch at the moment a very tentative argument which uses the marginal concepts as primitive terms. The marginal cost c of deposits is a function of the volume of deposits D and the conditions characterizing the services and charges associated with the deposit accounts. These conditions are expressed by an index v. The marginal gain of assets is equal to the marginal productivity p of reserves and the marginal net yield g of earning assets. The marginal value of assets is thus decomposed into two components. Two additional functions must be introduced in order to explain p and g, and also their relation with the marginal cost c. The analysis could be developed for an explicit system of interacting banks. But the major result can be obtained at a lower price. The formulation suggested by a firm-theoretical approach is directly applied to the banking industry as a whole and we obtain thus the following set of relations:

1. $$p[X, D, rD, cm] = c(D, v)$$

$$p_1 < 0 < p_2, p_3 < 0 < p_4; \quad c_1 \geqq 0 < c_2 .$$

2. $$g[E, cm] = c(D, v)$$

$$g_1 \leqq 0 < g_2 .$$

3. $$B + E = C^p + D .$$

4. $$B = X + rD + C^p .$$

5. $$C^p = kD^p .$$

6. $$E = s(cm, \varrho, Y, W)$$

$$s_1 < 0 < s_2, s_3 > 0 < s_4$$ X denotes excess reserves.

Signs with subscripts indicate derivatives of the function denoted by the sign. The derivative is taken with respect to the argument in the position referred to by the number counted from the left. The first two equations describe the banks' equilibrium which determines a balance-sheet position equating the marginal cost of deposits with the marginal value of reserves and earning assets. It should be noted that p expresses the marginal productivity of *excess* reserves X. This marginal productivity depends on X, the deposit volume, the required reserves and market conditions cm. The requirement ratio is denoted by r. Equation 3 states the consolidated account for banks and monetary authorities; C^p designates currency held by the public and B is the monetary base. The fourth equation describes the allocation of base money among excess reserves, required reserves and the public's currency, and the fifth equation describes currency demand relative to deposits. The currency ratio k is introduced as a predetermined entity in order to simplify the analysis. The last equation describes the public's supply of assets to the banks as a function of market conditions cm, the required rate of return on real capital, ϱ, current (nominal) wealth W. In addition to k, the entities ϱ, B, Y and W are also treated as predetermined variables. The system of six equations can be usefully reduced into a smaller system explaining D, v and cm in terms of the predetermined variables.

7. $$p[B-(r+k)D, D, rD, cm] = c(D, v).$$

8. $$g[(1+k)D-B, cm] = c(D, v).$$

9. $$(1+k)D-B = s(cm, \varrho, Y, W).$$

The reduced system jointly determines the volume of deposits (or the money stock), the credit market conditions cm and the banks supply conditions v by the interaction of bank and public on the credit markets. Both the banks' optimizing behavior and the public's preferences have been explicitly incorporated into the analysis. Among the implications we are mostly interested in is the response of deposits to variations in the base. This derivative can be easily obtained

$$\frac{\partial D}{\partial B} = \frac{p_1 + g_1 + \frac{1}{s_1}(g_2 - p_4)}{p_1(r+k) - p_2 - p_3 r + g_1(1+k) + \frac{1+k}{s_1}(g_2 - p_4)}.$$

A sufficient (but not necessary) condition (relative to the specification of the signs for the derivatives) for $\partial D/\partial B$ to be positive is that $p_1 < p_3$ and $g_2 \geqq p_4$.

The first condition states that a unit increase in excess reserves lowers their marginal productivity by more than a unit increase in required reserves, and the second condition asserts that higher interest rates raise the marginal gain of earning assets by at least as much as the marginal productivity of excess reserves.

The analysis can be easily adjusted to the case without requirements. The variable r becomes zero and excess reserves X are reinterpreted as total reserves R. The derivative $\partial D/\partial B$ will still exhibit the same numerator. The denominator would be shortened to

$$\left[p_1 k - p_2 + g_1 (1+k) + \frac{1+k}{s_1}(g_2 - p_4)\right].$$

It is quite clear that the derivative remains positive even in the absence of any requirements and even with a competitive adjustment of the banks' deposit-supply condition v. But suppose this were not the case and v were subject to the constraint $v \leqq \bar{v}$, where $\bar{v}$ describes an upper bound imposed on v, by cartel agreement or regulating agencies. In this case the analysis would have to be reformulated. Let us denote the system circumscribed by equations 1 to 6 by S_1 and we write $v(S_1)$ for the value of v associated with the system S_1. The reformulation proceeds as follows:

If $\quad v(S_1) \leqq \bar{v}$, then S_1 governs the behavior of the variables D, cm and v.

If $\quad v(S_1) > \bar{v}$, then the following system

$$p = g$$

$$(1+k)D - B = s(cm, \varrho, Y, W)$$

determines the behavior of D and cm. In the latter case p and g are either larger or equal to the marginal costs of deposits. It is assumed for this purpose that the derivative c_1 is zero in a first approximation, i.e. in the context of given supply conditions v, the marginal costs c are constant relative to the volume of deposits. Some easy manipulations will convince the reader that the derivative $\partial D/\partial B$ obtained for the second regime is identical with the formula already derived. The two regimes thus exhibit identical responses of deposits to changes in the base.

The analysis outlined should be clearly recognized to offer a *partial* explanation of the money supply mechanism. The money stock is explained as a function of policy variables, the public's currency ratio k, the required rate of return ϱ on real capital, income and wealth. This solution function [money supply function] does not incorporate interaction with money demand. This

could be easily remedied by adding a demand function $D = \delta(cm, \varrho, Y, W)$ to the reduced system 7–9. The extended reduced system jointly determines deposits D, market conditions cm, the banks' supply condition v, and the required return on real capital ϱ.

Summary

A Survey of Major Issues in Monetary Theory and Monetary Policy

The Survey of Monetary Theory opens with a discussion of the micro-analytic foundations of money. It considers subsequently issues concerning the nature of the transmission mechanism and policy problems decisively influenced by the view of the transmission mechanism. The survey examines also, within a general analytic framework, major hypotheses about the dominant impulse forces operating on the economy. The nature of the monetarist hypothesis is particularly developed in order to clarify some major issues in current discussion. Another section summarizes major aspects of money supply theory, and includes an analysis of the New View. The last chapter surveys the analysis of policy problems.

Zusammenfassung

Ein Überblick über die Hauptprobleme der Geldtheorie und -politik

Der vorliegende Überblick über die Geldtheorie beginnt mit einer Diskussion der mikroökonomischen Aspekte des Geldes. In der Folge werden Probleme betreffend die Art des Transmissionsmechanismus aufgeworfen, und es wird gezeigt, wie die Probleme der Geldpolitik entscheidend von der Betrachtung des Transmissionsmechanismus beeinflusst werden. Mit Hilfe eines allgemeinen analytischen Apparates behandelt der Aufsatz anschliessend die hauptsächlichsten Hypothesen über die dominanten Impulse, die auf die Wirtschaft einwirken. Die Hypothese der Monetaristen ist detailliert dargestellt, und zwar zum Zwecke der Klarstellung einiger Hauptprobleme der aktuellen Diskussion. Ein weiterer Abschnitt fasst die hauptsächlichsten Aspekte der Geldangebotstheorie zusammen und vermittelt eine Analyse der «New View». Das letzte Kapitel schliesslich gibt einen Überblick über einige Probleme der Geldpolitik.

Résumé

Un aperçu sur les problèmes principaux de la théorie et politique monétaire

L'aperçu sur la théorie monétaire commence par une discussion des aspects micro-économiques de l'argent. Ensuite, on traite des problèmes concernant la nature du mécanisme de transmission et on montre comment les problèmes de la politique monétaire sont décisivement influencés par la considération du mécanisme de transmission. A l'aide d'un appareil d'analyse générale, l'article examine alors les hypothèses principales sur les impulsions dominantes qui influencent l'économie. L'hypothèse des monétaristes est développée en détails dans le but de clarifier quelques problèmes principaux de la discussion actuelle. Un autre paragraphe traite des aspects principaux de la théorie de l'offre monétaire et inclus une analyse du «New View». Le dernier chapitre donne un aperçu sur quelques problèmes de la politique monétaire.