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We begin this issue of the Review with a brief eulogy for Karl Brunner who passed away on May 9, 1989. All of us who are concerned with monetary theory and policy have lost an inspired teacher, an enjoyable colleague and a good friend. In his memory, we have reprinted his article on "The Role of Money and Monetary Policy," which was originally published in this Review in 1968.

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The wave of leveraged buyouts over the past decade has led many to question the social value of this type of activity in the market for corporate control. Some observers, arguing that leveraged buyouts merely redistribute wealth with a possible negative net effect or deteriorate the stability of the financial system, have proposed that they be restricted. In the second article of this Review, "The Causes and Consequences of Leveraged Buyouts," Michelle R. Garfinkel argues that the expressed skepticism about leveraged buyouts is implicitly premised on the notion that these transactions have no real impact on the target firms' productive capacity. In discussing the theory and existing empirical evidence that suggests leveraged buyouts are productive, at least in an expected sense, she points out that arguments to restrict this activity are less compelling; if leveraged buyouts actually enhance the target firms' performance, then legal restrictions could prove to be harmful.

* * *

During the 1980s, several changes in the Federal Reserve System's reserve requirements have altered the relationship between the money stock, M1, and the monetary base. The Monetary Control Act of 1980 brought all depository institutions under a uniform set of reserve requirements and removed reserve requirements on a broad category of time and savings deposits. In 1984, the Federal Reserve switched to contemporaneous reserve accounting. In the third article of this Review, "The Link Between M1 and the Monetary Base in the 1980s," Michelle R. Garfinkel and Daniel L. Thornton show that, under fairly general conditions, these changes should have made the link between M1 and the monetary base tighter in this decade, by eliminating or, at least, diminishing the importance of some sources of variability in that link. Garfinkel and Thornton present evidence that is consistent with their arguments.

* * *
Coordinating economic policies among countries, particularly to control exchange rate movements, has been advocated by an increasing number of analysts in the 1980s. While such coordination seems desirable in theory, however, its goals can often be at odds with an individual nation's domestic monetary policies.

In the final article in this Review, “Monetary Targeting with Exchange Rate Constraints: The Bundesbank in the 1980s,” Jurgen von Hagen examines the German central bank's experience with international exchange rate policies and domestic monetary control. The author reviews recent research, which finds that the Bundesbank's ability to achieve its monetary targets has been unhindered by its coordinated exchange rate policies. Von Hagen's analysis, however, shows that the Bundesbank's participation in coordinated interventions since 1985 have contributed significantly to the growth of the German money supply in excess of its monetary targets in the second half of the 1980s.
In Memoriam

Karl Brunner
1916—1989

When Karl Brunner died on May 9, 1989, the Federal Reserve Bank of St. Louis lost a teacher, a supporter, a critic, and above all, a very dear friend.

His association with this Bank began in 1967, when he began policy discussions with the staff. During this span of 22 years, he read the articles in our Review, both criticizing and complimenting them, never allowing us to forget that improving monetary policy was our first and foremost task. His participation at our annual economic policy conferences provoked the kind of heated discussions that make such meetings worthwhile.

Karl was born on February 16, 1916, in Zurich, Switzerland. He completed his formal education in 1942 and came to the United States in 1950. Over the years, he was a member of the faculties of the University of California, Los Angeles, Ohio State University and the Universities of Konstanz and Bern in Switzerland. He joined the University of Rochester in 1971, where he remained until his death.

Throughout his career, Karl was one of those rare individuals who neither stopped learning nor stopped teaching. He is best known as one of the major advocates of monetarist theory—indeed, I believe he coined the word “monetarism” in our Review—but he never merely passed on what he had learned from others. Like most students of his generation, he had a thorough grounding of Keynesian economics; unlike most others, he questioned its logical and empirical implications, which led him to abandon the doctrine in favor of the monetarist approach to which he added so much.

Despite his prodigious contributions to the body of economic knowledge, advanced in more than 200 books and articles, his chief concern was always with the passing on of his discoveries to others. I think that he was happiest either in a classroom, giving advice to young economists, or at the various central banks, giving advice to old institutions. The conferences that he helped to establish made an enormous contribution to the education of a couple of generations of American and European economists.

His impact on policy was substantial as well. His teachings directly or indirectly touched two central banks in particular: the Swiss National Bank and the German Bundesbank. Not surprisingly, these two institutions today have the most stable price levels among the developed countries. Even the Federal Reserve System, which steadfastly downplayed the usefulness of monetary discipline, has become more sensitive to the causes and effects of fluctuations in the nation’s money stock than it was 20 years ago. This heightened sensitivity is due, in large measure, to Karl’s research and teachings.

Karl Brunner was a totally honest individual: he didn’t boast about his own achievements, nor did he suffer fools lightly. This straightforwardness, though it made some uncomfortable, gave his words credibility. It was this credibility that made him influential among monetary policymakers.

He has left an indelible imprint on monetary economics and monetary policy; his influence will continue in the future through the work of his students and colleagues who learned so much from him. Like all of them, we shall miss him.

—A. B. Balbach
Director of Research
The Role of Money and Monetary Policy

The development of monetary analysis in the past decade has intensified the debate concerning the role of money and monetary policy. Extensive research fostered critical examinations of the Federal Reserve's traditional descriptions of policy and of the arrangements governing policymaking. Some academic economists and others attribute the cyclical fluctuations of monetary growth and the persistent problem concerning the proper interpretation of monetary policy to the established procedures of monetary policy and the conceptions traditionally guiding policymakers.

The critique of established policy procedures, which evolved from this research into questions concerning the monetary mechanism, is derived from a body of monetary theory referred to in this paper as the Monetarist position. Three major conclusions have emerged from the hypotheses put forth. First, monetary impulses are a major factor accounting for variations in output, employment and prices. Second, movements in the money stock are the most reliable measure of the thrust of monetary impulses. Third, the behavior of the monetary authorities dominates movements in the money stock over business cycles.

A response to the criticisms of existing monetary policy methods was naturally to be expected and is welcomed. Four articles which defend present policy procedures have appeared during the past few years in various Federal Reserve publications. These articles comprise a countercritique which argues that monetary impulses are neither properly measured nor actually transmitted by the money stock. The authors reject the Monetarist thesis that monetary impulses are a chief factor determining variations in economic activity, and they contend that cyclical fluctuations of monetary growth cannot be attributed to the behavior of the Federal Reserve authorities. These fluctuations are claimed to result primarily from the behavior of commercial banks and the public.

The ideas and arguments put forth in these articles deserve close attention. The controversy defined by the critique of policy in professional studies and the countercritique appearing in Federal Reserve publications bears on issues of fundamental importance to public policy. Underlying all the fashionable words and phrases is the fundamental question: What is the role of monetary policy and what are the requirements of rational policymaking?

The following sections discuss the major aspects of the countercritique. These rejoinders may contribute to a better understanding of the issues, and the resulting clarification may remove some unnecessary disputes. Even though the central contentions of the controversy will remain, the continuous articulation of opposing points of view plays a vital role in the search for greater understanding of the monetary process.

**A SUMMARY OF THE COUNTERCRITIQUE**

The four articles relied on two radically different groups of arguments. Gramley-Chase, Kareken and Cacy exploit the juxtaposition “New View versus Traditional View” as the central idea guiding their countercritique. The analytical framework developed by the critique is naturally subsumed for this purpose under the “Traditional View” label. On the other hand, Davis uses the analytical framework developed by the critique in order to organize his arguments.

Gramley-Chase describe their general argument in the following words:

“(New) developments have reaffirmed the bankers’ point of view that deposits are attracted, not created, as textbooks suggest. In this new environment, growth rates of deposits have become more suspect than ever as indicators of the conduct of monetary policy. . . . A framework of analysis [is required] from which the significance of time deposits and of changing time deposits can be deduced. Traditional methods of monetary analysis are not well suited to this task. The ‘New View’ in monetary economics provides a more useful analytical framework. In the new view, banks—like other financial institutions—are considered as suppliers of financial claims for the public to hold, and the public is given a significant role in determining the total amount of bank liabilities. . . . Traditional analysis. . . fails to recognize that substitution between time deposits and securities may be an important source of pro-cyclical variations in the stock of money even in the face of countercyclical central bank policy.”

This general argument guided the construction of an explicit model designed to emphasize the role of the public’s and the banks’ behavior in the determination of the money stock, bank credit and interest rates.

Kareken’s paper supplements the Gramley-Chase arguments. He finds “the received money supply theory” quite inadequate. His paper is designed to improve monetary analysis by constructing a theory of an individual bank as a firm. This theory is offered as an explanation of a bank’s desired balance sheet position. It also appears to form the basis of a model describing the interaction of the public’s and the banks’ behavior in the joint determination of the money stock, bank credit and interest rates. The whole development emphasizes somewhat suggestively the importance of the public’s and banks’ behavior in explanations of monetary growth. It is also designed to undermine the empirical hypotheses advanced by the Monetarist position. This is achieved by means of explicit references to specific and “obviously desirable” features of the model presented.

Cacy’s article develops neither an explicit framework nor a direct critique of the basic propositions advanced by the Monetarist thesis. However, he provides a useful summary of the general position of the countercritique. The Monetarist analysis is conveniently subsumed by Cacy under a “Traditional View” which is juxtaposed to a “New View” of monetary mechanisms: “The new approach argues. . . that there is no essential difference between the manner in which the liabilities of banks and nonbank financial institutions are determined. Both types of institutions are subject in the same way to the portfolio decisions of the public.” The new approach is contrasted with the Traditional View, which “obscures the important role played by the public and overstates the role played by the central bank in the determination of the volume of money balances.” The general comparison developed by Cacy suggests quite clearly to the reader that the Traditional View allegedly espoused by the Monetarist position cannot match the “realistic sense” of the New View advocated by the countercritique.

In the context of the framework developed by the critique, Davis questions some basic propositions of the Monetarist position:

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2Gramley-Chase, pp. 1380, 1381, 1393.

3Ibid., p. 7.

4Cacy, pp. 5 & 7.
“In the past five to ten years, however, there has come into increasing prominence a group of economists who would like to go considerably beyond the simple assertion that the behavior of money is a significant factor influencing the behavior of the economy. . . . In order to bring a few of the issues into sharper focus, this article will take a look at some evidence for the ‘money supply’ view. . . .

It confines itself to examining the historical relationship between monetary cycles and cycles in general business. The article concludes that the relationship between these two kinds of cycles does not, in fact, provide any real support for the view that the behavior of money is the predominant determinant of fluctuations in business activity. Moreover, the historical relationship between cycles in money and in business cannot be used to demonstrate that monetary policy is, in its effects, so long delayed and so uncertain as to be an unsatisfactory countercyclical weapon.”

AN EXAMINATION OF THE ISSUES

A careful survey of the countercritique yielded the following results. The Gramley-Chase, Kareken, and Cacy papers parade the New View in order to question the status of empirical theories used by the Monetarist critique in its examination of monetary policy. The Davis paper questions quite directly, on the other hand, the existence and relevance of the evidence in support of the Monetarist position, and constitutes a direct assault on the Monetarist critique. The others constitute an indirect assault which attempts to devalue the critique’s analysis, and thus to destroy its central propositions concerning the role of money and monetary policy.

The indirect assault on the Monetarist position by Gramley-Chase, Kareken and Cacy requires a clarification concerning the nature of the New View. A program of analysis must be clearly distinguished from a research strategy and an array of specific conjectures. All three aspects are usually mixed together in a general description. It is important to understand, however, that neither research strategy nor specific empirical conjectures are logical implications of the general program. The explicit separation of the three aspects is crucial for a proper assessment of the New View.

Section A examines some general characteristics of the countercritique’s reliance on the New View. It shows the New View to consist of a program acceptable to all economists, a research strategy rejected by the Monetarist position, and an array of specific conjectures advanced without analytical or empirical substantiation. Also, not a single paper of the counter-critique developed a relevant assessment of the Monetarist’s empirical theories or central propositions.

In sections B and C detailed examinations of specific conjectures centered on rival explanations of cyclical fluctuations of monetary growth are presented. The direct assault on the Monetarist position by Davis is discussed in some detail in section D. This section also states the crucial propositions of the Monetarist thesis in order to clarify some aspects of this position. This reformulation reveals that the reservations assembled by Davis are quite innocuous. They provide no analytical or empirical case against the Monetarist thesis. Conjectures associated with the interpretation of monetary policy (the “indicator problem”) are presented in section E.

A. The New View

The countercritique has apparently been decisively influenced by programmatic elaborations originally published by Gurley-Shaw and James Tobin. The program is most faithfully reproduced by Cacy, and it also shaped the arguments guiding the model construction by Kareken and Gramley-Chase. The New View, as a program, is a sensible response to a highly unsatisfactory state of monetary analysis inherited in the late 1950’s. A money and banking syndrome perpetuated by textbooks obstructed the application of economic analysis to the financial sector. At most, this inherited literature contained only suggestive pieces of analysis. It lacked a meaningful theory capable of

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6Davis, pp. 63-64.

6These three aspects of the New View will subsequently be elaborated more fully. Their program of analysis refers to the application of relative price theory to analysis of financial markets and financial institutions. Their research strategy refers to a decision to initiate analysis in the context of a most general framework. Their specific conjectures refer to propositions concerning the causes of fluctuation of monetary growth and propositions about proper interpretation of policy.

explaining the responses of the monetary system to policy actions or to influences emanating from the real sector. The New View proposed a systematic application of economic analysis, in particular an application of relative price theory, to the array of financial intermediaries, their assets and liabilities.

This program is most admirable and incontestable, but it cannot explain the conflict revealed by critique and countercritique. The Monetarist approach accepted the general principle of applying relative price theory to the analysis of monetary processes. In addition, this approach used the suggestions and analytical pieces inherited from past efforts in order to develop some specific hypotheses which do explain portions of our observable environment. The most impressive statements propagated by the New View were crucially influenced by the sheer formalism of its exposition. In the context of the New View's almost empty form, little remains to differentiate one object from another. For instance, in case one only admits the occurrence of marginal costs and marginal yields associated with the actions of every household, firm, and financial intermediary, one will necessarily conclude that banks and non-bank financial intermediaries are restricted in size by the same economic forces and circumstances. In such a context there is truly no essential difference between the determination of bank and non-bank intermediary liabilities, or between banks and non-bank intermediaries, or between money and other financial assets.

The strong impressions conveyed by the New View thus result from the relative emptiness of the formulation which has been used to elaborate their position. In the context of the formal world of the New View, "almost everything is almost like everything else." This undifferentiated state of affairs is not, however, a property of our observable world. It is only a property of the highly formal discussion designed by the New View to overcome the unsatisfactory state of monetary analysis still prevailing in the late 1950's or early 1960's.8

Two sources of the conflict have been recognized thus far. The Monetarists' research strategy was concerned quite directly with the construction of empirical theories about the monetary system, whereas the New View indulged, for a lengthy interval, in very general programmatic excursions. Moreover, the New Viewers apparently misconstrued their program as being a meaningful theory about our observable environment. This logical error contributed to a third source of the persistent conflict.

The latter source arises from the criticism addressed by the New Viewers to the Monetarists' theories of money supply processes. Three of the papers exploit the logically dubious but psychologically effective juxtaposition between a "New View" and a "Traditional View." In doing this they fail to distinguish between the inherited state of monetary system analysis typically reflected by the money and banking textbook syndrome and the research output of economists advocating the Monetarist thesis. This distinction is quite fundamental. Some formal analogies misled the New Viewers and they did not recognize the logical difference between detailed formulations of empirical theories on

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8 Adequate analysis of the medium of exchange function of money, or of the conditions under which inside money becomes a component of wealth, was obstructed by the programmatic state of the New View. The useful analysis of the medium-of-exchange function depends on a decisive rejection of the assertion that "everything is almost like everything else." This analysis requires proper recognition that the marginal cost of information concerning qualities and properties of assets differs substantially between assets, and that the marginal cost of readjusting asset positions depends on the assets involved. The analysis of the wealth position of inside money requires recognition of the marginal productivity of inside money to the holder. Adequate attention to the relevant differences between various cost or yield functions associated with different assets or positions is required by both problems. The blandness of the New View's standard program cannot cope with these issues. The reader may consult a preliminary approach to the analysis of the medium of exchange function in the paper by Karl Brunner and Allan H. Meltzer, in the Journal of Finance, 1964, listed in footnote 9. He should also consult for both issues the important book by Boris Pesek and Thomas Saving, Money, Wealth and Economic Theory, The Macmillan Company, New York, 1967, or the paper by Harry Johnson, "Inside Money, Outside Money, Income, Wealth and Welfare in Monetary Theory," to be published in the Journal of Money, Credit and Banking, December 1968.
the one side and haphazard pieces of unfinished analysis on the other side.9

A related failure accompanies this logical error. There is not the slightest attempt to assess alternative hypotheses or theories by systematic exposure to observations from the real world. It follows, therefore, that the countercritique scarcely analyzed the empirical theories advanced by the Monetarist critique and consequently failed to understand the major implications of these theories.

For instance, they failed to recognize the role assigned by the Monetarist view to banks’ behavior and the public’s preferences in the monetary process. The objection raised by the New View that “the formula [expressing a basic framework used to formulate the hypothesis] obscures the important role played by the public” has neither analytical basis nor meaning. In fact, the place of the public’s behavior was discussed in the Monetarist hypotheses in some detail. Moreover, the same analysis discussed the conditions under which the public’s behavior dominates movements of the money stock and bank credit.10 It also yielded information about the response of bank credit, money stock and time deposits to changes in ceiling rates, or to changes in the speed with which banks adjust their deposit-supply conditions to evolving market situations. Every single aspect of the banks’ or the public’s behavior emphasized by the countercritique has been analyzed by the Monetarist’s hypotheses in terms which render the results empirically assessable. Little remains, consequently, of the suggestive countercritique assembled in the papers by Gramley-Chase, Kareken and Cacy.11

B. A Monetarist Examination of the New View’s Money Supply Theory

Three sources of the conflict have been discussed thus far. Two sources were revealed as logical misconstruals, involving inadequate construction and assessment of empirical theories. A third source pertains to legitimate differences in research strategy. These three sources do not explain all major aspects of the conflict. Beyond the differences in research strategy and logical misconceptions, genuinely substantive issues remain. Some comments of protagonists advocating exposure to observations, I would have to withdraw my statements. A detailed analysis of the banks’ and the public’s role in the money supply, based on two different hypotheses previously reported in our papers will be developed in our forthcoming books. This analysis, by its very existence, falsifies some major objections made by Cacy or Gramley-Chase. Much of their criticism is either innocuous or fatuous. Gramley-Chase indulge, for instance, in modality statements, i.e. statements obtained from other statements by prefixing a modality qualifier like “maybe” or “possibly.” The result of qualifying an empirical statement always yields a statement which is necessarily true but also quite uninformative. The modality game thus yields logically pointless but psychologically effective sentences. Cacy manages, on the other hand, some astonishing assertions. The New View is credited with the discovery that excess reserves vary over time. He totally disregards the major contributions to the analysis of excess reserves emanating from the Monetarists’ research. A detailed analysis of excess reserves was developed by Milton Friedman and Anna Schwartz in the book mentioned in footnote 9. The reader should also note the work by George Morrison, *Liquidity Preferences of Commercial Banks*, (Chicago: University of Chicago Press, 1966), and the study by Peter Frost, “Banks’ Demand for Excess Reserves,” an unpublished dissertation submitted to the University of California at Los Angeles, 1966. The classic example of an innocuous achievement was supplied by Cacy with the assertion: “. . . the actual volume of money balances determined by competitive market forces may or may not be equal to the upper limit established by the central bank” (p. 8). Indeed, we knew this before the New View or Any View, just as we always knew that “it may or may not rain tomorrow.” The reader should note that similar statements were produced by other authors with all the appearances of meaningful elaborations.

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11 The reader is, of course, aware that these assertions require analytic substantiation. Such substantiation cannot be supplied within the confines of this article. But the reader could check for himself. If he finds, in the context of the countercritique, an analysis of the monetarists’ major hypotheses, an examination of implication, and elaborations.
the New View should probably be interpreted as conjectures about hypotheses to be expected from their research strategy. It should be clearly understood that such conjectures are not logical implications of the guiding framework. Instead, they are pragmatic responses to the general emphasis associated with this approach.

A first conjecture suggests that the money stock and bank credit are dominated by the public's and the Banks' behavior. It is suggested, therefore, that cyclical fluctuations of monetary growth result primarily from the responses of banks and the public to changing business conditions. A second conjecture naturally supplements the above assertions. It is contended that the money stock is a thoroughly "untrustworthy guide to monetary policy."

Articles by Gramley-Chase and Kareken attempt to support these conjectures with the aid of more explicit analytical formulations allegedly expressing the general program of the New View. The paper contributed by Gramley-Chase has been critically examined in detail on another occasion, and only some crucial aspects relevant for our present purposes will be considered at this point. Various aspects of the first conjecture are examined in this and the next section. The second conjecture is examined in sections D and E.

A detailed analysis of the Gramley-Chase model demonstrates that it implies the following reduced form equations:

\[ M = g(B', Y, c) \quad g_1 > 0 < g_2, \]
\[ E = h(B', Y, c) \quad h_1 > 0 > h_2, \text{ and } h_1 > g_1, \]

explaining the money stock (M) and bank credit (E) in terms of the extended monetary base (B'), the level of economic activity expressed by national income at current prices (Y), and the ceiling rate on time deposits (c).

The Gramley-Chase model implies that monetary policy does affect the money stock and bank credit. It also implies that the money stock responds *positively* and bank credit *negatively* to economic activity. The model thus differs from the Monetarist hypotheses which imply that both bank credit and the money stock respond *positively* to economic activity. The Gramley-Chase model also implies that the responses of both the money stock and bank credit to monetary actions are independent of the general scale of the public's and the banks' interest elasticities. Uniformly large or small interest elasticities yield the same response in the money stock or bank credit to a change in the monetary base.

A detailed discussion of the implications derivable from a meaningfully supplemented Gramley-Chase model is not necessary at this point. We are foremost interested in the relation between this model and the propositions mentioned in the previous paragraph. The first proposition can be interpreted in two different ways. According to one interpretation, it could mean that the marginal multipliers \(g_i\) and \(h_i\) \((i = 1, 2)\) are functions of the banks' and the public's response patterns expressing various types of substitution relationships between different assets. This interpretation is, however, quite innocuous and yields no differentiation relative to the questioned hypotheses of the Monetarist position.

A second interpretation suggests that the growth rate of the money stock is dominated by the second component (changes in income) of the differential expression:

\[ \Delta M = g_1 \Delta B' + g_2 \Delta Y \]

This result is not actually implied by the Gramley-Chase model, but it is certainly consistent with the model. However, in order to derive the desired result, their model must be supplemented with special assumptions about the relative magnitude of \(g_1\) and \(g_2\), and also about the comparative cyclical variability of \(\Delta B'\) and \(\Delta Y\). This information has not been provided by the authors.

Most interesting is another aspect of the model which was not clarified by the authors. Their model implies that policymakers could easily avoid procyclical movements in \(\Delta M\). This model exemplifying the New View thus yields

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12The reader may consult my chapter "Federal Reserve Policy and Monetary Analysis" in Indicators and Targets of Monetary Policy, ed., by Karl Brunner, to be published by Chandler House Publishing Co., San Francisco. This book also contains the original article by Gramley-Chase. Further contributions by Patric H. Hendershott and Robert Weintraub survey critically the issues raised by the Gramley-Chase paper.

13In the Gramley-Chase model, \(g_3\) and \(h_3\) are indeterminant.

14This implication was demonstrated in my paper listed in footnote 12. The monetary base is adjusted for the accumulated sum of reserves liberated from or impounded in required reserves by changes in requirement ratios.
little justification for the conjectures of its proponents.

A central property of the Gramley-Chase model must be considered in the light of the programmatic statements characterizing the New View. Gramley-Chase do not differentiate between the public's asset supply to banks and the public's demand for money. This procedure violates the basic program of the New View, namely, to apply economic analysis to an array of financial assets and financial institutions. Economic analysis implies that the public's asset supply and money demand are distinct, and not identical behavior patterns. This difference in behavior patterns is clearly revealed by different responses of desired money balances and desired asset supply to specific stimuli in the environment. For instance, an increase in the expected real yield on real capital raises the public's asset supply but lowers the public's money demand. It follows thus that a central analytical feature of the Gramley-Chase model violates the basic and quite relevant program of the New View.

Karenken's construction shares this fundamental analytical flaw with the Gramley-Chase model, but this is not the only problem faced by his analysis. The Karenken analysis proceeds on two levels. First, he derives a representative bank's desired balance sheet position. For this purpose he postulates wealth maximization subject to the bank's balance sheet relation between assets and liabilities, and subject to reserve requirements on deposits. On closer examination, this analysis is only applicable to a monopoly bank with no conversion of deposits into currency or reserve flows to other banks. In order to render the analysis relevant for a representative bank in the world of reality, additional constraints would have to be introduced which modify the results quite substantially. It is also noteworthy that the structural properties assigned by Karenken to the system of market relations are logically inconsistent with the implications one can derive from the author's analysis of firm behavior developed on the first level of his investigation.

This disregard for the construction of an economic theory relevant for the real world is carried into the second level of analysis where the author formulates a system of relations describing the joint determination of interest rates, bank credit, and money stock. A remarkable feature of the Karenken model is that it yields no implications whatsoever about the response of the monetary system to actions of the Federal Reserve. It can say nothing, as it stands, about either open market operations or about discount rate and reserve requirement actions. This model literally implies, for instance, that the money stock and the banking system's deposit liabilities do not change as a result of any change in reserve requirements ratios.

None of the conjectures advanced by the countercritique concerning the behavior of the money stock and the role of monetary policy find analytical support in Karenken's analysis. To the extent that anything is implied, it would imply that monetary policy operating directly on bank reserves or a mysterious rate of return on reserves dominates the volume of deposits—a practically subversive position for a follower of the New View.15

C. Alternative Explanations of Cyclical Fluctuations in Monetary Growth

The examination thus far in this article has shown that even the most explicit formulation (Gramley-Chase) of the countercritique, allegedly representing the New View with respect to monetary system analysis, does assign a significant role to monetary policy. This examination also argued that the general emphasis given by the New View to the public's and the banks' behavior in determination of the money stock and bank credit does not differentiate its product from analytical developments arising from the Monetarist approach. It was also shown that

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15 Two direct objections made to the Brunner-Meltzer analysis by Karenken should be noted. He finds that the questioned hypotheses do not contain "a genuine supply function" of deposits. Accepting Karenken's terminology, this is true, but neither does the Gramley-Chase model contain such a supply function. But the objection has no evidential value anyway. If a hypothesis were judged unsatisfactory because some aspects are omitted, all hypotheses are "unsatisfactory." Moreover, the cognitive status of a empirical hypothesis does not improve simply because an "analytical underpinning" has been provided. Karenken also finds fault with our use of the term "money supply function." Whether or not one agrees with this terminological preferences surely does not affect the relation between observations and statements supplied by the hypothesis. And it should be clear that the status of hypothesis depends only on this relation, and not on names attached to statements.
the only explicit formulation advanced by the New Viewers does not provide a sufficient basis for their central conjectures. It is impossible to derive the proposition from the Gramley-Chase model that the behavior of the public and banks, rather than Federal Reserve actions, dominated movements in the money supply. But the declaration of innocence by the countercritique on behalf of the monetary authorities with respect to cyclical fluctuations of monetary growth still requires further assessment.

The detailed arguments advanced to explain the observed cyclical fluctuations of monetary growth differ substantially among the contributors to the countercritique. Gramley-Chase maintain that changing business conditions modify relative interest rates, and thus induce countercyclical movements in the time deposit ratio. These movements in demand and time deposits generate cyclical fluctuations in monetary growth. On the other hand, Cacy develops an argument used many years ago by Wicksell and Keynes, but attributes it to the New View. He recognizes a pronounced sensitivity of the money stock to variations in the public's money demand or asset supply. These variations induce changes in credit market conditions. Banks, in turn, respond with suitable adjustments in the reserve and borrowing ratios. The money stock and bank credit consequently change in response to this mechanism.

Davis actually advances two radically different conjectures about causes of cyclical fluctuations of monetary growth. The first conjecture attributes fluctuations of monetary growth to the public's and banks' responses. Changing business conditions modify the currency ratio, the banks' borrowing ratio, and the reserve ratio. The resulting changes generate the observed movements in money. His other conjecture attributes fluctuations in monetary growth to Federal Reserve actions: "the state of business influences decisions by the monetary authorities to supply reserves and to take other actions likely to affect the money supply."16

The various conjectures advanced by Gramley-Chase, Cacy, and Davis in regard to causes of movements in money and bank credit can be classified into two groups. One set of conjectures traces the mechanism generating cyclical fluctuations of monetary growth to the responses of banks and the public; the behavior of monetary authorities is assigned a comparatively minor role. The other group of conjectures recognizes the predominant role of the behavior of monetary authorities.

In the following analysis the framework provided by the Monetarist view will be used to assess these conflicting conjectures. The emphasis concerning the nature of the causal mechanisms may differ between the various conjectures regarding sources of variations in money, but the following examination will be applied to an aspect common to all conjectures emphasizing the role of public and bank behavior.

In the context of the Monetarist framework, the money stock (M) is exhibited as a product of a multiplier (m) and the monetary base (B), (such that \( M = mB \)). This framework, without the supplementary set of hypotheses and theories bearing on the proximate determinants of money summarized by the multiplier and the base, is completely neutral with respect to the rival conjectures; it is compatible with any set of observations. This neutrality assures us that its use does not prejudice the issue under consideration. The Monetarist framework operates in the manner of a language system, able to express the implications of the competing conjectures in a uniform manner.

The first group of conjectures advanced by the countercritique (behavior of the public and banks dominates movements in money) implies that variations in monetary growth between upswings and downswings in business activity are dominated by the variations in the monetary multiplier. The second group (behavior of monetary authorities dominates movements in

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16Davis, p. 66. One argument about monetary policy in the same paper requires clarification. Davis asserts on p. 68 that the money supply need not be the objective of policy, and "given this fact, the behavior of the rate of growth of the money supply during the period cannot be assumed to be simply and directly the result of monetary policy decisions alone." This quote asserts that the money supply is "simply and directly the result of policy alone" whenever policy uses the money supply as a target. This is in a sense correct. But the quote could easily be misinterpreted due to the ambiguity of the term "policy." This term is frequently used to designate a strategy guiding the adjustment of policy variables. Is is also frequently used to refer to the behavior of the policy variables or directly to the variables as such. The quote is quite acceptable in the first sense of "policy," but thoroughly unacceptable in the second sense.
money) implies that, in periods with unchanged reserve requirement ratios and ceiling rates on time deposits, variations in the monetary base dominate cyclical changes in monetary growth. The movements of the monetary multiplier which are strictly attributable to the changing of requirement ratios can be separated from the total contribution of the multiplier and combined with the monetary base. With this adjustment, the second group of conjectures implies that the monetary base, supplemented by the contribution of reserve requirement changes to the multiplier, dominates variations in the money stock.

In this examination of contrasting explanations of monetary fluctuations, values of the money stock (M), the multiplier (m), and the monetary base adjusted for member bank borrowing (B) are measured at the initial and terminal month of each half business cycle (i.e., expansions and contractions) located by the National Bureau of Economic Research. We form the ratios of these values and write:

\[ \frac{M_1}{M_0} = \frac{m_1 B_1}{m_0 B_0} \text{ for } \mu = \alpha \beta \]

The subscript 1 refers to values of the terminal month and the subscript 0 to values of the initial month. These ratios were measured for each half cycle in the period March 1919 to December 1966. They were computed for two definitions of the money stock, inclusive and exclusive of time deposits, with corresponding monetary multipliers.

Kendall’s rank correlation coefficients between the money stock ratios (μ) and the multiplier ratios (α), and between (μ) and the monetary base ratio (β) were computed. We denote these correlation coefficients with \( q(\mu, \alpha) \) and \( q(\mu, \beta) \). The implications of the two rival conjectures can now be restated in terms of the two coefficients. The first group of conjectures implies that \( q(\mu, \alpha) > q(\mu, \beta) \); while the second group implies that in periods of unchanged reserve requirement ratios and ceiling rates on time deposits, the coefficient \( q(\mu, \beta) \) exceeds the coefficient \( q(\mu, \alpha) \). The second group implies nothing about the relation of the two coefficients in periods of changing reserve requirements and ceiling rates on time deposits. It follows, therefore, that observations yielding the inequality \( q(\mu, \beta) > q(\mu, \alpha) \) disconfirm the first group and confirm the second group.

The correlations obtained are quite unambiguous. The value of \( q(\mu, \beta) \) is .537 for the whole sample period, whereas \( q(\mu, \alpha) \) is only .084. The half-cycle from 1929 to 1933 was omitted in the computations, because movements in the money stock and the multiplier were dominated by forces which do not discriminate between the rival conjectures under consideration. The sample period, including 1929 to 1933, still yields a substantially larger value for \( q(\mu, \beta) \). The same pattern also holds for subperiods. In particular, computations based on observations for 1949 to 1966 confirm the pattern observed for the whole sample period. The results thus support the second group of conjectures but not the first group. These results also suggest, however, that forces operating through the multiplier are not quite negligible. The surprisingly small correlation \( q(\mu, \alpha) \) does not adequately reveal the operation of these forces. Their effective operation is revealed by the correlation \( q(\mu, \beta) \), which is far from perfect, even in subperiods with constant reserve requirement ratios. This circumstance suggests that the behavior of the public and banks contributes to the cyclical movements of monetary growth. The main result at this stage, however, the clear discrimination between the two groups of conjectures. The results are quite unambiguous on this score.

Additional information is supplied by table I. For each postwar cycle beginning with the downswing of 1948-49, the average annual growth rate of the money stock was computed. The expression \( M = mb \) was then used to compute the contribution to the average growth

<table>
<thead>
<tr>
<th>Table I</th>
<th>A Comparison of Alternative Contributions to the Average Annual Growth Rate of the Money Stock and Bank Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rank Correlations</strong></td>
<td><strong>Money</strong></td>
</tr>
<tr>
<td>Public’s currency and authorities’ behavior</td>
<td>.905</td>
</tr>
<tr>
<td>Time deposit substitution mechanism</td>
<td>.048</td>
</tr>
<tr>
<td>Wicksell-Keynes mechanism</td>
<td>.143</td>
</tr>
</tbody>
</table>

Remarks: The figures listed state the rank correlation between the average growth rate of the money stock and bank credit with three different contributing sources.
Table II

Regressions of the Money Supply On the Monetary Base and Gross National Product*

<table>
<thead>
<tr>
<th>Cycle</th>
<th>Monetary Base</th>
<th>Gross National Product</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Differences</td>
<td>Log First Differences</td>
</tr>
<tr>
<td>IV/48</td>
<td>2.03</td>
<td>.77</td>
</tr>
<tr>
<td></td>
<td>(9.80)</td>
<td>(10.02)</td>
</tr>
<tr>
<td>II/53</td>
<td>.92</td>
<td>.93</td>
</tr>
<tr>
<td>II/53</td>
<td>1.75</td>
<td>.63</td>
</tr>
<tr>
<td></td>
<td>(1.89)</td>
<td>(1.96)</td>
</tr>
<tr>
<td>III/57</td>
<td>.44</td>
<td>.45</td>
</tr>
<tr>
<td>III/57</td>
<td>4.59</td>
<td>1.66</td>
</tr>
<tr>
<td></td>
<td>(11.76)</td>
<td>(11.81)</td>
</tr>
<tr>
<td>II/60</td>
<td>.97</td>
<td>.97</td>
</tr>
<tr>
<td>II/60</td>
<td>2.76</td>
<td>1.08</td>
</tr>
<tr>
<td></td>
<td>(7.56)</td>
<td>(8.54)</td>
</tr>
<tr>
<td>III/65</td>
<td>.87</td>
<td>.89</td>
</tr>
</tbody>
</table>

*The monetary base was adjusted for reserve requirement changes and shifts in deposits. All data are quarterly averages of seasonally adjusted figures. The first entry in a column for each cycle is the regression coefficient, t-statistics are in parentheses, and partial correlation coefficients are below the t-statistics.

The rank correlations between each contribution, and the average growth rate of the money stock over all postwar half-cycles clearly support the conclusion of the previous analysis that cyclical movements in the money stock are dominated by Federal Reserve actions.

Table I also presents the results of a similar examination bearing on causes of movements in bank credit. The reader should note the radical difference in the observed patterns of correlation coefficients. The behavior of monetary authorities, supplemented by the public's currency behavior, does not appear to dominate the behavior of bank credit. The three sources contributing to the growth rate of money all exerted influences of similar order on bank credit.

It appears that bank credit is comparatively less exposed to the push of Federal Reserve actions than was the money stock. On the other hand, the money stock is less sensitive than bank credit to the time-deposit substitution mechanism emphasized by Gramley-Chase, and the Wicksell-Keynes mechanism suggested by Cacy. Most astonishing, however, is the negative association between the average growth rate of bank credit and the Wicksell-Keynes mechanism emphasized by Cacy.

It should also be noted that the average growth rate of money conforms very clearly to the business cycle. Such conformity does not hold for bank credit over the postwar half-cycles. This blurring occurred particularly in periods when the ceiling rate on time deposits was increased. These periods exhibit relatively large contributions to the growth rate of bank credit emanating from the time deposit substitution mechanism.

A regression analysis (table II) of the reduced form equations derived from the Gramley-Chase model confirms the central role of the monetary...
base in the money supply process. Estimates of the regression coefficient relating money to income are highly unstable among different sample periods, relative to the coefficient relating money to the monetary base. Furthermore, estimates of regression coefficients relating money to income occur in some periods with signs which contradict the proposition of Gramley-Chase and Cacy, or exhibit a very small statistical significance. These diverse patterns of coefficients do not occur for the estimates of coefficients relating money and the monetary base. It is also noteworthy that the average growth rate of the monetary base (adjusted for changes in reserve requirement ratios), over the upswings, exceeds without exception the average growth rate of adjacent downswings. This observation is not compatible with the contention made by Gramley-Chase that policy is countercyclical.

Additional information is supplied by table III, which presents some results of a spectral analysis bearing on the monetary base and its sources. Spectral analysis is a statistical procedure for decomposing a time series into seasonal, cyclical, and trend movements. After such an analysis was conducted on the monetary base and its sources, a form of correlation analysis was run between movements in the monetary base and movements in its various sources. The results of this procedure (table III) indicate that movements in Federal Reserve credit dominate seasonal and cyclical movements in the monetary base.

In summary, preliminary investigations yield no support for the contention that the behavior of banks and the public dominates cyclical movements in the money stock. The conjectures advanced by Gramley-Chase or Cacy are thus disconfirmed, whereas Davis' second conjecture that fluctuations in monetary growth may be attributed to Federal Reserve actions seems substantially more appropriate. However, further investigations are certainly useful.

D. Relevance of Money and Monetary Actions with Respect to Economic Activity

At present, a broad consensus accepts the relevance of money and monetary policy with respect to economic activity. But this consensus concerning the relevance of money emerges from two substantially different views about the nature of the transmission mechanism. One view is the Keynesian conception (not to be confused with Keynes' view), enshrined in standard formulations of the income-expenditure framework. In the view, the interest rate is the main link between money and economic activity. The other view rejects the traditional separation of economic theory into parts: national income analysis (macro economics) and price theory (micro economics). According to this other view, output and employment are explained by a suitable application of relative price theory. With regard to discussions of the impact of money and monetary actions on economic activity, this latter view has been termed the Monetarist position. This position may be divided into the weak Monetarist thesis and the strong Monetarist thesis. In a sense, both the New View and the Monetarist extension of the "traditional view" are represented in the weak Monetarist position.

The following discussions develop the weak and the strong Monetarist thesis. The weak thesis is compared with some aspects of the income-expenditure approach to the determination of national economic activity. The strong
thesis supplements the weak thesis with special assumptions about our environment, in order to establish the role of monetary forces in the business cycle.

1. The Weak Monetarist Thesis

According to the weak Monetarist thesis, monetary impulses are transmitted to the economy by a relative price process which operates on money, financial assets (and liabilities), real assets, yields on assets and the production of new assets, liabilities and consumables. The general nature of this process has been described on numerous occasions and may be interpreted as evolving from ideas developed by Knut, Wicksell, Irving Fisher and John Maynard Keynes.17

The operation of relative prices between money, financial assets and real assets may be equivalently interpreted as the working of an interest rate mechanism (prices and yields of assets are inversely related). Monetary impulses are thus transmitted by the play of interest rates over a vast array of assets. Variations in interest rates change relative prices of existing assets, relative to both yields and the supply prices of new production. Acceleration or deceleration of monetary impulses are thus converted by the variation of relative prices, or interest rates, into increased or reduced production, and subsequent revisions in the supply prices of current output.

This general conception of the transmission mechanism has important implications which conflict sharply with the Keynesian interpretation of monetary mechanisms expressed by standard income-expenditure formulations.18 In the context of standard income-expenditure analysis, fiscal actions are considered to have a "direct effect" on economic activity, whereas monetary actions are considered to have only "indirect effect." Furthermore, a constant budget deficit has no effect on interest rates in a Keynesian framework, in spite of substantial accumulation of outstanding government debt when a budget deficit continually occurs. And lastly, the operation of interest rates on investment decisions has usually been rationalized with the aid of considerations based on the effects of borrowing costs.

These aspects of the income-expenditure approach may be evaluated within the framework of the weak Monetarist thesis. The effects of fiscal actions are also transmitted by the relative price mechanism. Fiscal impulses, i.e., government spending, taxing, and borrowing, operate just as "indirectly" as monetary impulses, and there is no a priori reason for believing that their speed of transmission is substantially greater than that of monetary impulses. The relative price conception of the transmission mechanism also implies that a constant budget deficit exerts a continuous influences on economic activity through persistent modifications in relative prices of financial and real assets. Lastly, the transmission of monetary impulses is not dominated by the relative importance of borrowing costs. In the process, marginal costs of liability extension interact with marginal returns from acquisitions of financial and real assets. But interest rates on financial assets not only affect the marginal cost of liability extension, but also influence the substitution between financial and real assets. This substitution modifies prices of real assets relative to their supply prices and forms a crucial linkage of the monetary mechanisms; this linkage is usually omitted in standard income-expenditure analysis.

The description of monetary mechanisms in Davis' article approaches quite closely the notion developed by the weak Monetarist thesis. This approximation permits a useful clarification of pending issues. However, the criticisms and objections advanced by Davis do not apply to the


18 The paper on "The Effect of Monetary Policy on Expenditures in Specific Sectors of the Economy," presented by Dr. Sherman Maisel at the meetings organized by the American Bankers Association in September 1967, exemplifies very clearly the inherited Keynesian position. The paper will be published in a special issue of the Journal of Political Economy.
2. The Strong Monetarist Thesis

If the theoretical framework of the weak Monetarist thesis is supplemented with additional and special hypotheses, the strong Monetarist thesis is obtained. An outline of the strong thesis may be formulated in terms of three sets of forces operating simultaneously on the pace of economic activity. For convenience, they may be grouped into monetary forces, fiscal forces and other forces. The latter include technological and organizational innovation, revisions in supply prices induced by accruing information and expectation adjustments, capital accumulation, population changes and other related factors or processes.

All three sets of forces are acknowledged by the strong thesis to affect the pace of economic activity via the relative price process previously outlined. Moreover, the strong Monetarist point of view advances the crucial thesis that the variability of monetary forces (properly weighted with respect to their effect on economic activity) exceeds the variability of fiscal forces and other forces (properly weighted). It is argued further that major variabilities occurring in a subset of the other forces (e.g., expectations and revisions of supply prices induced by information arrival) are conditioned by the observed variability of monetary forces. The conjecture thus involves a comparison of monetary variability with the variability of fiscal forces and independent “other forces.” According to the thesis under consideration, the variability of monetary impulses is also large relative to the speed at which the economy absorbs the impact of environmental changes. This predominance of variability in monetary impulses implies that pronounced accelerations in monetary forces are followed subsequently by accelerations in the pace of economic activity, and that pronounced decelerations in monetary forces are followed later by retardations in economic activity.

The analysis of the monetary dynamics, using the relative price process, is accepted by both the weak and the strong Monetarist theses. This analysis implies that the regularity of the observed association between accelerations and decelerations of monetary forces and economic activity depends on the relative magnitude of monetary accelerations (or decelerations). The same analysis also reveals the crucial role of changes in the rate of change (second differences) of the money stock in explanations of fluctuations in output and employment. It implies that any pronounced deceleration, occurring at any rate of monetary growth, retards total spending. It is thus impossible to state whether any particular monetary growth, say a 10 percent annual rate, is expansionary with respect to economic activity, until one knows the previous growth rate. The monetary dynamics of the Monetarist thesis also explains the simultaneous occurrence of permanent price-inflation and fluctuations in output and employment observable in some countries.

The nature and the variability of the “Friedman lag” may also be analyzed within the framework of the Monetarist thesis. This lag measures the interval between a change in sign of the second difference in the money stock and the subsequent turning point located by the National Bureau. In general, the lag at an upper turning point will be shorter, the greater the absorption speed of the economy, and the sharper the deceleration of monetary impulses relative to the movement of fiscal forces and other forces. Variability in the relative acceleration or deceleration of monetary forces necessarily generates the variability observed in the Friedman lag.

What evidence may be cited on behalf of the strong Monetarist thesis? Every major inflation provides support for the thesis, particularly in cases of substantial variations of monetary growth. The attempt at stabilization in the Confederacy during the Civil War forms an impressive piece of evidence in this respect. The association between monetary and economic accelerations or decelerations has also been observed by the Federal Reserve Bank of St. Louis. Observations from periods with divergent movements of monetary and fiscal forces provide further evidence. For instance, such periods occurred immediately after termination of World War II, from the end of 1947 to the fall of 1948, and again in the second half of 1966. In all three cases, monetary forces pre-

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vailed over fiscal forces. The evidence adduced here and on other occasions does not "prove" the strong Monetarist thesis, but does establish its merit for serious consideration.

Davis' examination is therefore welcomed. His objections are summarized by the following points: (a) observations of the persistent association between money and income do not permit an inference of causal direction from money to income; (b) the timing relation between money and economic activity expressed by the Friedman lag yields no evidence in support of the contention that variations in monetary growth cause fluctuations in economic activity; (c) the correlation found in cycles of moderate amplitude between magnitudes of monetary and economic changes was quite unimpressive; (d) the length of the Friedman lag does not measure the interval between emission of monetary impulse and its ultimate impact on economic activity. Furthermore, the variability of this lag is due to the simultaneous operation and interaction of monetary and non-monetary forces.

Davis' first comment (a) is of course quite true and well known in the logic of science. It is impossible to derive (logically) causal statements or any general hypotheses from observations. But we can use such observations to confirm or disconfirm such statements and hypotheses. Davis particularly emphasizes that the persistent association between money and income could be attributed to a causal influence running from economic activity to money.

Indeed it could, but our present state of knowledge rejects the notion that the observed association is essentially due to a causal influence from income on money. Evidence refuting such a notion was presented in section C. The existence of a mutual interaction over the shorter run between money and economic activity, however, must be fully acknowledged. Yet, this interaction results from the conception guiding policymakers which induces them to accelerate the monetary base whenever pressures on interest rates mount, and to decelerate the monetary base when these pressures wane. Admission of a mutual interaction does not dispose of the strong Monetarist thesis. This interaction, inherent in the weak thesis, is quite consistent with the strong position and has no disconfirming value. To the contrary, it offers an explanation for the occurrence of the predominant variability of monetary forces.

The same logical property applies to Davis' second argument (b). The timing relation expressed by the Friedman lag, in particular the chronological precedence of turning points in monetary growth over turning points in economic activity, can probably be explained by the influence of business conditions on the money supply. Studies in money supply theory strongly suggest this thesis and yield evidence on its behalf. The cyclical pattern of the currency ratio, and the strategy typically pursued by monetary policymakers explain this lead of monetary growth. And again, such explanation of the timing relation does not bear negatively on the strong conjecture.

The objection noted under Davis' point (c) is similarly irrelevant. His observations actually confirm the strong thesis. The latter implies that the correlation between amplitudes of monetary and income changes is itself correlated with the magnitude of monetary accelerations or decelerations. A poor correlation in cycles of moderate amplitude, therefore, yields no discriminating evidence on the validity discriminating evidence on the validity of the strong thesis. Moreover, observations describing occurrences are more appropriate relative to the formulated thesis than correlation measures. For instance, observations tending to disconfirm the strong Monetarist thesis would consist of occurrences of pronounced monetary accelerations or decelerations which are *not followed* by accelerated or retarded movements of economic activity.

Point (d) still remains to be considered. Once again, his observation does not bear on the strong Monetarist thesis. Davis properly cautions readers about the interpretation of the Friedman lag. The variability of this lag is probably due to the interaction of monetary and non-monetary forces, or to changes from cycle to cycle in the relative variability of monetary growth. But again, this does not affect the strong thesis. The proper interpretation of the Friedman lag, as the interval between reversals in the rate of monetary impulses and their prevalence over all other factors simultaneously operating on economic activity, usefully clarifies a concept introduced into our discussions. This clarification provides, however, no relevant evidence bearing on the questioned hypotheses.

In summary, the arguments developed by Davis do not yield any substantive evidence against the strong Monetarist thesis. Moreover,
the discussion omits major portions of the evidence assembled in support of this position.\textsuperscript{20}

\textbf{E. Countercyclical Policy and the Interpretation of Monetary Policy}

The usual assertion of the New View, attributing fluctuations of monetary growth to the public's and the banks' behavior, assumed a strategic role in the countercritique. The countercritique denied, furthermore, that monetary actions have a major impact on economic activity. With the crumbling of these two bastions, the monetary policymakers' interpretation of their own behavior becomes quite vulnerable. In a previous section, the substantial contributions of monetary policy have been largely countercyclical, suggesting the existence of a pronounced discrepancy between actual behavior of the monetary authorities and their interpretation of this behavior.

A crucial question bearing on this issue pertains to the proper measure summarizing actual behavior of the monetary authorities. Two major facts should be clearly recognized. First, the monetary base consists of "money" directly issued by the authorities, and every issue of base money involves an action of the monetary authorities. This holds irrespective of their knowledge about it, or their motivation and aims. Second, variations in the base, extended by suitable adjustments to incorporate changing reserve requirement ratios, are the single most important factor influencing the behavior of the money stock. And this second point applies irrespective of whether Federal Reserve authorities are aware of it or wish it to be, or whatever their motivations or aims are. Their actual behavior, and not their motivations or aims, influences the monetary system and the pace of economic activity. Thus, actual changes in the monetary base are quite meaningful and appropriate measures of actual behavior of monetary authorities.\textsuperscript{21}

The information presented in table IV supports the conjecture that monetary policymakers' interpretation of their own behavior has no systematic positive association with their actual behavior. Table IV was constructed on the basis of the scores assigned to changes in policies, according to the interpretation of the Federal Open Market Committee.\textsuperscript{22} Positive scores were associated with each session of the FOMC which decided to make policy easier, more expansionary, less restrictive, less tight, etc., and negative scores indicate decisions to follow a tighter, less expansionary, more restrictive course. The scores varied between plus one and minus one, and expressed some broad ordering of the revealed magnitude of the changes.

An examination of the sequences of scores easily shows that the period covered can be naturally partitioned into subperiods exhibiting an overwhelming occurrence of scores with a uniform sign. These subperiods are listed in the first column of table IV. The second column cumulated the scores over the subperiods listed in order to yield a very rough ranking of the policymakers' posture according to their own interpretation.

Table IV reveals that the FOMC interpreted the subperiods from August 1957 to July 1958, and from July 1959 to December 1960 as among the most expansionary policy periods. The period from November 1949 to May 1953 appears in this account as a phase of persistently tight or restrictive policy. The next two columns list the changes of two important variables during each subperiod. The third column

\textsuperscript{20}Milton Friedman's summary of the evidence in the \textit{Forty-Fourth Annual Report of the National Bureau of Economic Research} is important in the respect. Davis overlooks in particular the evidence accumulated in studies of the money supply mechanism which bears on the issue raised by point (a) in the text. A persistent and uniform association between money and economic activity, in spite of large changes in the structure of money supply processes, yields evidence in support of the Monetarist theses.


\textsuperscript{21}The reader may also be assured by the following statement: "... monetary policy refers particularly to determination of the supply of (the government's) demand debt . . . ." This demand debt coincides with the monetary base. The quote is by James Tobin, a leading architect of the New View, on p. 148 of his contribution to the Commission on Money and Credit, "An Essay on Principles of Debt Management," in \textit{Fiscal and Debt Management Policies}, Prentice Hall, Englewood Cliffs, 1963.

\textsuperscript{22}The scores were published as Appendix II to "An Alternative Approach to the Monetary Mechanism." See footnote 9.
Table IV

The Association between Policymakers' Interpretation of Policy, Changes in the Monetary Base and Changes in Free Reserves

<table>
<thead>
<tr>
<th>Periods</th>
<th>Cumulative Scores of Policymakers' Interpretation over the Period</th>
<th>Changes in Free Reserves over the Period in $ Million</th>
<th>Changes in the Monetary Base over the Period in $ Million</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/49 - 5/53</td>
<td>-4.75</td>
<td>-1030</td>
<td>+5216</td>
</tr>
<tr>
<td>6/53 - 11/54</td>
<td>2.63</td>
<td>-186</td>
<td>+1321</td>
</tr>
<tr>
<td>12/54 - 10/55</td>
<td>-3.37</td>
<td>-818</td>
<td>+345</td>
</tr>
<tr>
<td>11/55 - 7/56</td>
<td>1.12</td>
<td>+352</td>
<td>+399</td>
</tr>
<tr>
<td>8/56 - 7/57</td>
<td>-1.00</td>
<td>-44</td>
<td>+657</td>
</tr>
<tr>
<td>8/57 - 7/58</td>
<td>3.50</td>
<td>+1017</td>
<td>+1203</td>
</tr>
<tr>
<td>7/58 - 6/59</td>
<td>2.12</td>
<td>-1059</td>
<td>+531</td>
</tr>
<tr>
<td>7/59 - 12/60</td>
<td>2.62</td>
<td>+1239</td>
<td>-53</td>
</tr>
<tr>
<td>1/61 - 12/62</td>
<td>-0.63</td>
<td>-428</td>
<td>+3288</td>
</tr>
</tbody>
</table>

describes changes in free reserves, and the fourth column notes changes in the monetary base. A cursory examination of the columns immediately shows substantial differences in their broad association. The rank correlation between the various columns is most informative for our purposes.

These rank correlations are listed in table V. The results expose the absence of any positive association between the policymakers' own interpretation or judgment of their stance and their actual behavior, as indicated by movements in the monetary base. The correlation coefficient between the monetary base and cumulated scores has a negative value, suggesting that a systematic divergence between stated and actual policy (as measured by the monetary base) is probable. On the other hand, the correlation between the policymakers' descriptions of their posture, and the movement of free reserves, is impressively close. This correlation confirms once again that the Federal Reserve authorities have traditionally used the volume of free reserves as an indicator to gauge and interpret prevailing monetary policies. Yet little evidence has been developed which establishes a causal chain leading from changes in free reserves to the pace of economic activity.

Another observation contained in table IV bears on the issue of policymakers interpretation of their own behavior. Changes in the cumulated scores and free reserves between the periods listed always move together and are perfect in terms of direction. By comparison, the co-movement between cumulated scores and changes in the monetary base is quite haphazard; only three out of eight changes between periods move together. This degree of co-movement between cumulated scores and the monetary base could have occurred by pure chance with a probability greater than .2, whereas the probability of the perfect co-movement between cumulated scores and free reserves occurring as a matter of pure chance is less than .004. The traditional selection of free reserves or money market conditions as an indicator to interpret prevailing monetary policy and to gauge the relative thrust applied by policy, forms the major reason for the negative association (or at least random association) between stated and actual policy.
Attempts at rebuttal to the above analysis often emphasize that policymakers are neither interested in the monetary base, nor do they attach any significance to it. This argument is advanced to support the claim that the behavior of the monetary base is irrelevant for a proper examination of policymakers’ intended behavior. This argument disregards, however, the facts stated earlier, namely, movements in the monetary base are under the direct control and are the sole responsibility of the monetary authorities. It also disregards the fact that actions may yield consequences which are independent of motivations shaping the actions.

These considerations are sufficient to acknowledge the relevance of the monetary base as a measure summarizing the actual behavior of monetary authorities. However, they alone are not sufficient to determine whether the base is the most reliable indicator of monetary policy. Other magnitudes such as interest rates, bank credit and free reserves have been advanced with plausible arguments to serve as indicators. A rational procedure must be designed to determine which of the possible entities frequently used for scaling policy yields the most reliable results.

This indicator problem is still very poorly understood, mainly because of ambiguous use of economic language in most discussions of monetary policy. The term “indicator” occurs with a variety of meanings in discussions, and so do the terms “target” and “guide.” The indicator problem, understood in its technical sense, is the determination of an optimal scale justifying interpretations of the authorities’ actual behavior by means of comparative statements. A typical statement is that policy X is more expansionary than policy Y, or that current policy has become more (or less) expansionary. Whenever we use a comparative concept, we implicitly rely on an ordering scale.

The indicator problem has not been given adequate treatment in the literature, and the recognition of its logical structure is often obstructed by inadequate analysis. It is, for instance, not sufficient to emphasize the proposition that the money supply can be a “misleading guide to the proper interpretation of monetary policy.” This proposition can be easily demonstrated for a wide variety of models and hypotheses. However, it establishes very little. The same theories usually demonstrate that the rate of interest, free reserves, or bank credit can also be very misleading guides to monetary policy. Thus, we can obtain a series of propositions about a vast array of entities, asserting that each one can be a very misleading guide to the interpretation of policy. We only reach a useless stalemate in this situation.

The usual solution to the indicator problem at the present time is a decision based on mystical insight supplemented by some impressionistic arguments. The most frequently advanced arguments emphasize that central banks operate directly on credit markets where interest rates are formed, or that the interest mechanism forms the centerpiece of the transmission process. Accordingly, in both cases market interest rates should “obviously” emerge as the relevant indicator of monetary policy.

These arguments on behalf of market interest rates are mostly supplied by economists. The monetary authorities’ choice of money market conditions as an indicator evolved from a different background. But in recent years a subtle change has occurred. One frequently encounters arguments which essentially deny either the existence of the indicator problem or its rational solution. A favorite line asserts that “the world is very complex” and consequently it is impossible or inadmissible to use a single scale to interpret policy. According to this view, one has to consider and weigh many things in order to obtain a “realistic” assessment in a complicated world.

This position has little merit. The objection to a “single scale” misconstrues the very nature of the problem. Once we decide to discuss monetary policy in term of comparative statements, an ordinal scale is required in order to provide a logical basis for such statements. A multiplicity of scales effectively eliminates the use of comparative statements. Of course, a single scale may be a function of multiple arguments, but such multiplicity of arguments should not be confused with a multiplicity of scales. Policymakers and economists should therefore realize that one either provides a rational procedure which justifies interpretations of monetary policy by means of comparative statements, or that one abandons any pretense of meaningful or intellectually honest discussion of such policy.

Solution of the indicator problem in the technical sense appears obstructed on occasion by a prevalent confusion with an entirely different problem confronting the central banker—
the target problem. This problem results from the prevailing uncertainty concerning the nature of the transmission mechanism and the substantial lags in the dynamics of monetary processes.

In the context of perfect information, the indicator problem becomes trivial and the target problem vanishes. But perfect information is the privilege of economists’ discourse on policy: central bankers cannot afford this luxury. The impact of their actions are both delayed and uncertain. Moreover, the ultimate goals of monetary policy (targets in the Tinbergen-Theil sense) appear remote to the manager executing general policy directives. Policymakers will be inclined under these circumstances to insert a more immediate target between their ultimate goals and their actions. These targets should be reliably observable with a minimal lag.

It is quite understandable that central bankers traditionally use various measures of money market conditions, with somewhat shifting weights, as a target guiding the continuous adjustment of their policy variables. This response to the uncertainties and lags in the dynamics of the monetary mechanism is very rational indeed. However, once we recognize the rationality of such behavior, we should also consider the rationality of using a particular target. The choice of a target still remains a problem, and the very nature of this problem is inadequately understood at this state.

This is not the place to examine the indicator and target problem in detail. A possible solution to both problems has been developed on another occasion. The solutions apply decision theoretic procedures and concepts from control theory to the determination of an optimal choice of both indicator and target. Both problems are in principle solvable, in spite of the complexity of the world. Consequently, there is little excuse for failing to develop rational monetary policy procedures.

CONCLUSION

A program for applying economic analysis to financial markets and financial institutions is certainly acceptable and worth pursuing. This program suggests that the public and banks interact in the determination of bank credit, interest rates, and the money stock, in response to the behavior of monetary authorities. But the recognition of such interaction implies nothing with respect to the relative importance of the causal forces generating cyclical fluctuations of monetary growth. Neither does it bear on the quality of alternative empirical hypotheses, or the relative usefulness of various magnitudes or conditions which might be proposed as an indicator to judge the actual thrust applied by monetary policy to the pace of economic activity.

The Monetarist thesis has been put forth in the form of well structured hypotheses which are supported by empirical evidence. This extensive research in the area of monetary policy has established that: (i) Federal Reserve actions dominate the movement of the monetary base over time; (ii) movements of the monetary base dominate movements of the money supply over the business cycle; and, (iii) accelerations or decelerations of the money supply are closely followed by accelerations or decelerations in economic activity. Therefore, the Monetarist thesis puts forth the proposition that actions of the Federal Reserve are transmitted to economic activity via the resulting movements in the monetary base and money supply, which initiate the adjustments in relative prices of assets, liabilities, and the production of new assets.

The New View, as put forth by the counter-critique, has offered thus far neither analysis nor evidence pertaining relevantly to an explanation of variations in monetary growth. Moreover, the counter-critique has not developed, on acceptable logical grounds, a systematic justification for the abundant supply of statements characterizing policy in terms of its effects on the economy. Nor has it developed a systematic justification for the choice of money market conditions as an optimal target guiding the execution of open market operations.

But rational policy procedures require both a reliable interpretation and an adequate determination of the course of policy. The necessary conditions for rational policy are certainly not satisfied if policies actually retarding economic activity are viewed to be expansionary, as in the
case of the 1960-61 recession, or, if inflationary actions are viewed as being restrictive, as in the first half of 1966.

The major questions addressed to our monetary policymakers, their advisors and consultants remain: How do you justify your interpretation of policy, and how do you actually explain the fluctuations of monetary growth? The major contentions of the academic critics of the past performance of monetary authorities could possibly be quite false, but this should be demonstrated by appropriate analysis and relevant evidence.
The Causes and Consequences of Leveraged Buyouts

In the market for corporate control during the past decade, leveraged buyouts have become increasingly popular. Many observers, speculating about the causes of this recent trend, have expressed concern about the potential problems arising from such activity. Implicit in many casual discussions is the assumption that leveraged buyouts—hereafter LBOs—are merely some type of cosmetic surgery. That is, an LBO has no impact on the productive capacity of the target firm, while unjustifiably inflating the value of the stock.

Under this assumption, any observed gains to the existing shareholders of the target firm are likely to be matched, if not dominated, by losses to others; since there is no net gain and possibly a loss to society, LBO activity should be restricted. Some analysts also argue that LBOs have contributed to the unprecedented growth of outstanding debt in recent years. If, as many contend, the large growth in debt is associated with increased instability in the financial system, public policy might aim to reverse or at least curb debt growth. In addition, tax reform might be an appropriate way to reduce this
debt growth, if it stems chiefly from tax incentives.

This article examines whether LBOs have had a productive impact on the target firm. If economic theory and evidence suggest that LBOs generally are productive, then arguments for legal restrictions on LBO activity are less persuasive. Alternatively, if there are few, if any, gains from LBOs, the idea that LBOs pose a problem for the economy might be valid.

What are LBOs?

Despite the ever-expanding literature on LBOs, there does not appear to be a single, clear definition of what an LBO really is. Loosely speaking, an LBO is simply the purchase of a firm by an outside individual, another firm or the incumbent management with the purchase being financed by large amounts of debt; the resulting firm is said to be "highly leveraged." The target firm can be a free-standing entity or a division of a public corporation. Although the target of the LBO can be a private firm, recent discussions about LBO activity have focused primarily

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1For example, see Lowenstein (1986), "When Industry Borrows Itself" (1988), Friedman (1989) and Kaufman (1989).
2When the target of an LBO is a division of a public company, the transaction is typically called a "management buyout." Stancill (1988), p. 18, who points out that LBO activity targeting smaller (private) firms is not a new phenomenon, provides a very general definition of an LBO: "whenever a buyer lacks the requisite cash and borrows part of the purchase price against the target company's assets (receivables, equipment, inventory, real estate) or cash flow (future cash), that's an LBO."
on instances in which a public firm is taken private. Upon this type of transaction, the target firm's stock shares are no longer traded publicly in equity markets.

The greatest ambiguity about what constitutes an LBO concerns the degree to which the purchase is financed with debt. Typically, debt finance provides about 80 percent to 90 percent of the funds for the purchase. Equity finance, in which the resulting shares are held by the purchasers of the target firm and, often, an outside investment group, provides the remaining funds.

**Debt Finance in an LBO**

Two types of debt are usually employed in an LBO transaction: senior debt and subordinated debt. Senior debt typically accounts for the greatest proportion, usually 50 percent to 60 percent, of financing for the LBO. Sometimes called secured debt, senior debt specifies a lien on a particular piece of property. In the case that the firm's earnings are insufficient to service the firm's debt obligations fully, the holders of senior debt can have the pledged property sold to recover the unpaid interest and principal. Funds through senior debt are often provided by commercial banks, insurance companies, leasing companies and limited partnerships specializing in LBOs and venture capital investments.

Subordinated debt, or "mezzanine" debt, is considered to be more speculative than senior debt because it is issued without a lien against specified property. Although the holders of subordinated debt are protected in the case of default, only assets not pledged explicitly and any cash remaining after paying other creditors are available to satisfy these unsecured claims. Accounting for about 30 percent of the financing for the transaction, subordinated debt is usually provided by pension funds, insurance companies and limited partnerships.

In many LBOs, after the purchase, the new owners sell some of the firm's assets and use the proceeds to retire some of the debt. Cash flows from continued operations are used to service the remaining debt obligations.

**Key Features of Recent LBOs**

The typical LBO in recent years has two interesting characteristics that distinguish it from other takeover and merger activities. First, the equity of the target firm usually is held by fewer individuals following the financial reorganization. This increased concentration of ownership is especially typical of a "going-private" transaction in which the stock is no longer publicly traded.

Second, although alternative sources of funds are available to obtain corporate ownership, going-private transactions usually are financed heavily with debt, leaving the target firm in a highly leveraged position. In essence, the transaction involves a substitution of debt for equity. For example, in a sample of 58 LBOs between 1980 to 1984, the average debt-to-equity ratio rose from 0.457 to 5.524, a percentage change exceeding 1100 percent.

The higher degree of leveraging means that a larger proportion of claims against the target firm's assets and operations are fixed obligations. Because holders of these claims can push the firm into bankruptcy if these obligations are not met fully, the greater leveraging, holding all else constant, erodes the target firm's insulation from unexpected declines in earnings and, hence, increases the firm's risk of bankruptcy.

**RECENT TRENDS IN LBO ACTIVITY**

The following discussion defines an LBO as a highly leveraged, going-private transaction. This
Table 1
LBO Activity, 1979-88: Going Private Transactions (dollar amounts in millions)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of transactions</th>
<th>Median purchase price</th>
<th>Total dollar value paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>16</td>
<td>$7.9</td>
<td>$636.0</td>
</tr>
<tr>
<td>1980</td>
<td>13</td>
<td>25.3</td>
<td>967.4</td>
</tr>
<tr>
<td>1981</td>
<td>17</td>
<td>41.1</td>
<td>2,338.5</td>
</tr>
<tr>
<td>1982</td>
<td>31</td>
<td>29.6</td>
<td>2,836.7</td>
</tr>
<tr>
<td>1983</td>
<td>36</td>
<td>77.8</td>
<td>7,145.4</td>
</tr>
<tr>
<td>1984</td>
<td>57</td>
<td>66.9</td>
<td>10,805.9</td>
</tr>
<tr>
<td>1985</td>
<td>76</td>
<td>72.6</td>
<td>24,139.8</td>
</tr>
<tr>
<td>1986</td>
<td>76</td>
<td>84.5</td>
<td>20,232.4</td>
</tr>
<tr>
<td>1987</td>
<td>47</td>
<td>123.3</td>
<td>22,057.1</td>
</tr>
<tr>
<td>1988</td>
<td>125</td>
<td>79.8</td>
<td>60,920.6</td>
</tr>
</tbody>
</table>


NOTE: These numbers do not include management buyouts. See Merrill Lynch Business Brokerage and Valuation, Inc. (1988), p. 82.

Table 2
Premium Paid Over Market Price in LBOs

<table>
<thead>
<tr>
<th>Year</th>
<th>Average</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>106.4%</td>
<td>65.6%</td>
</tr>
<tr>
<td>1980</td>
<td>49.2</td>
<td>36.2</td>
</tr>
<tr>
<td>1981</td>
<td>31.3</td>
<td>26.7</td>
</tr>
<tr>
<td>1982</td>
<td>41.4</td>
<td>38.6</td>
</tr>
<tr>
<td>1983</td>
<td>36.7</td>
<td>31.3</td>
</tr>
<tr>
<td>1984</td>
<td>36.3</td>
<td>33.7</td>
</tr>
<tr>
<td>1985</td>
<td>30.9</td>
<td>25.7</td>
</tr>
<tr>
<td>1986</td>
<td>31.9</td>
<td>26.1</td>
</tr>
<tr>
<td>1987</td>
<td>34.8</td>
<td>30.9</td>
</tr>
<tr>
<td>1988</td>
<td>33.8</td>
<td>26.3</td>
</tr>
</tbody>
</table>


NOTE: Premiums over the market price were calculated on the basis of the market value of the firm’s closing stock price five days before the initial announcement. These data are for going-private transactions only.

A narrow focus permits the discussion to address recent concerns about LBO activity that appear to revolve around those transactions in which public firms are taken private primarily through debt financing.

As shown in table 1, the number of going-private transactions in 1988 was nearly eight times that in 1979. Just in the past year, the incidence of these transactions has more than doubled. Furthermore, the table indicates that the average as well as the median purchase price rose dramatically over the same period. In 1979, the average purchase price was $39.8 million, whereas in 1988 it was $487.4 million. The average purchase price rose at an annual rate of 32.1 percent, nearly three times the 11.1 percent annual rate of increase in the value of firms included in the New York Stock Exchange. Even accounting for inflation, the increase in the average purchase price was substantial—from $50.6 million to $400.5 million in 1982 prices, a real annual growth rate of 25.8 percent.

While the average purchase price generally rose during the 1980s, the "premium" or the price paid for these firms above their initial market value (the value of their stock shares before the initial announcement) as a percentage of the market value has been relatively stable. As table 2 shows, average and median premiums paid over the prior market price of the target firms from 1979 to 1988 have been quite large. Even excluding the extremely large 1979 values, the average and median premiums averaged about 36.3 percent and 30.6 percent, respectively. These large premiums indicate...
that the target firm's stockholders have captured significant capital gains upon the LBO transaction.\textsuperscript{12}

\textbf{ARE LBOs PRODUCTIVE?—SOME FINANCE THEORY AND EVIDENCE}

The growing incidence of LBO activity in the market for corporate control has sparked many to question the social value of this activity. Many expressed concerns are predicated implicitly on the notion that the changes in the firm's financial structure associated with the LBO transaction have no positive real effects on that firm's output. If the transaction were merely a device to realize some short-term gain, at the expense of long-term growth and a reduction in social wealth, then these concerns would be justified.

Finance theory, however, suggests that LBOs \textit{can} be productive. The gains derive from two key features of LBOs in recent years—namely, going private and highly leveraged financing. These related features permit a reorganization of the firm to alter its incentive structure and produce an increase in its earnings potential.

\textbf{The Advantages of Going Private}

The theory of corporate finance shows how the distinction between ownership and control, or equivalently the differences between the incentives and constraints of the firm's stockholders and those of the firm's managers, can have important implications for the performance of the firm. Specifically, this distinction can create a situation in which the firm does not achieve its maximum earnings potential—

\textsuperscript{12}Also, see DeAngelo, DeAngelo and Rice (1984), Torabzadeh and Bertin (1987) and Lehn and Poulsen (1988, 1989), who find that announcements of LBOs have significant positive effects on the target firm's stock price. For example, Lehn and Poulsen (1989, p. 776) calculate the average daily return from holding the stock of the target firm of the LBO for various holding periods, abstracting from movements in the firm's stock price due to economy-wide factors. They find that the "cumulative average daily abnormal return" (CAR) from 20 days before to 20 days after the LBO announcement averaged 20.54 percent across the firms included in the sample during the period 1980-87. This means that an individual buying a stock of an LBO target 20 days before the announcement and then selling it 20 days after the announcement could have made a 20.5 percent return on average above a normal (the market) return over the same period. Even holding the stock from one day before the announcement until the end of the announcement day yielded, on average, a CAR of 16.3 percent, a return too high to be attributed solely to chance. Similarly, for the period 1973-80, DeAngelo, DeAngelo and Rice (1984), pp. 394-95, estimate a significant CAR of 16.99 percent for the same holding period.

\textsuperscript{13}For example, see Manne (1965) and Jensen and Meckling (1976).

\textsuperscript{14}Another gain from going private, which is more obvious, involves circumventing the explicit costs that are otherwise incurred with outside ownership, such as registration and listing fees and other stockholder service costs. Relative to the market value of the public firm, these explicit costs can be significant. For example, in the early 1980s, estimates of the costs of public ownership incurred annually ranged from $30,000 to $200,000. The value of the stream of this annual cost (for an indefinite time) discounted at a rate of 10 percent, ranges from $300,000 to $2,000,000, whereas the median value of a sample of 72 firms attempting to go private between 1973 and 1980 was $2,838,000. See DeAngelo, DeAngelo and Rice (1984) and references cited therein.
nger's incentives with those of the owners cannot be enforced completely.

To see why the distinction between ownership and managerial control can be important when monitoring incentives are weaker, consider the following extreme example in which a firm has such a large number of owners that no individual finds it worthwhile to monitor the manager at all. As is typical in any publicly owned firm, the owners have voting rights, but do not participate directly in the daily operations and decision-making of the firm. Suppose that the firm's manager, who exercises full control over these operations, has the opportunity to undertake a new project whereby the present value of cash flows (that is, revenues net of operating costs) can increase by $100. If the manager had a fixed salary and no ownership claims in the firm, he would be completely indifferent between exploiting this opportunity and not doing so, as long as the expansion required no additional time by the manager. If the expansion actually required any additional time, however, he might well choose to forgo the opportunity; after all, what's in it for him?

In this example, the distinction between ownership and control is meaningful because the manager does not fully bear the wealth consequences of his actions. In the absence of effective monitoring by the owners, the decisions of the manager, acting on his own behalf, are not likely to maximize the owners' wealth; instead, they will maximize the manager's utility.

As the distinction between ownership and control becomes less clear, the conflict of interests between owners and managers becomes less severe. In the example above, if the manager owned a fraction of the firm's stock, say 5 percent, he would be less reluctant to initiate the new project; the additional cash flow created by the new project would increase the total value of his stock and wealth by $5. Nevertheless, the manager would not act entirely on behalf of all the owners unless the marginal gain from doing so, $5 in this example, exceeded the marginal value of his time used in other ways, including leisure.

The problems that potentially arise from the distinction between ownership and control, called "agency problems," explain why we observe managerial contracts that are more complicated than those that simply specify a fixed income. The problem of "incomplete monitoring" explains why the observed managerial contracts are less complicated than those that could perfectly remove the conflict of interests between owners and managers. A contract that partially links the manager's income to the firm's characteristics observed easily by stockholders—for example, sales, profits or the firm's stock performance—could help alleviate the conflict. A change in the organizational structure of the firm, such as that engendered by an LBO, however, is another and potentially more effective method to circumvent the firm's organizational inefficiencies attributable to the meaningful separation of control and ownership.

In a going-private transaction, the interests of owners and the manager generally are closely, if not fully, reconciled. Once the manager becomes the owner, there is no conflict; the wealth consequences of the manager's actions are entirely internalized by the firm's reorganization. Even when a third party (another company or an individual) finances the purchase, monitoring possibilities improve, simply because the transaction decreases the number of owners—or, equivalently, concentrates the ownership of the firm—thereby raising the level of monitoring and the possibility that enforceable contracts can be designed to resolve the conflict of interests more effectively. By improving the organizational efficiency of the firm through a change of ownership, the LBO can increase the firm's earnings.16

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15Note that a manager who dislikes risk would not willingly enter into a wage contract specifying that his compensation be a function only of the market value of the firm's stock. Doing so would involve taking on a large amount of risk—i.e., possible, large fluctuations in income that are not entirely under his control. Provided that there is competition in the market for managers, owners of the firm must bear some of the risks and offer a compensation schedule such that risks are shared by owners and managers. Bennett (1989), however, reports that executives increasingly are taking on some of the risks, in the sense that the link between their salaries and the market value of the firm, through long-term incentive schemes (such as stock options and restricted stock), has become substantial over the past decade. In the absence of complete monitoring, the problems that typically arise from the distinction between ownership and control are being partly mitigated by tying executive compensation to the performance of the firm.

16An inefficient organization of a firm provides a motivation for others to take over that firm. Note that such a takeover need not involve taking that firm private. Rather, the takeover is necessary to reorganize the firm to effect a higher concentration of ownership.
The Advantages of Highly Leveraged Financing

That most going-private transactions are financed with a large proportion of debt suggests that leveraging itself must augment the potential gains from the buyout. That is, the high degree of leveraging in the buyout need not indicate that the buyers do not have the requisite cash for the transaction.

One widely mentioned source of gain from extensive leveraging is based on the incentive structure of the tax system. Because interest payments on debt are tax deductible, debt financing is relatively more attractive (ceteris paribus) than other methods of finance. The double taxation of dividends, first as corporate income and then as shareholder income, further increases the incentive to issue or sell debt to finance the purchase of the firm.

The gain from leveraged financing, however, need not be restricted to reducing the tax liability of the target firm. Another motive for the use of debt finance stems from the misalignment of the manager's incentives with those of the owners in cases where the firm faces low growth prospects and a large "free cash flow." When the firm's cash flow exceeds what is necessary to finance its own projects that are expected to yield positive (discounted) net revenues, the firm is said to have a positive free cash flow. That is, the firm has reached its optimal size; additional projects to expand its operations would not maximize its profits.

There are cases, however, in which the manager of a firm that has reached its optimal size might choose not to maximize the shareholders' wealth by paying out the free cash flow in the form of dividends. For example, if the manager's compensation were linked to the firm's growth in sales, he would have a greater incentive to invest the free cash in any project that increases the firm's sales, even if the project's net return would be insufficient to maintain the firm's value. The incentive to use the free cash inefficiently (from the stockholders' and society's perspective) to increase the firm's size is greater if the manager values his power as measured by the amount of resources under his control.

The problem of free cash flow, a particular type of agency problem, can be mitigated in a buyout that is financed with debt. Issuing debt and using the entire proceeds to purchase equity in an LBO enables the stockholders to capture the present value of the future free cash flow that otherwise would be used inefficiently. The firm's increased leveraged position after the transaction, in effect, imposes a binding commitment on the manager to not waste future cash flow; specifically, the manager cannot repudiate the firm's debt obligation to pay out the future free cash flow as interest payments because the bondholders could then push the firm into bankruptcy. By circumventing or reducing the agency problem associated with free cash flow, the use of debt essentially improves the productive efficiency of the firm.

Evidence

The empirical observation that the purchase price in an LBO is, on average, considerably higher than the market price before the LBO announcement suggests that these transactions have increased the value of the target firm and, hence, the wealth of the shareholders. The observed gain to shareholders is consistent with the notion that market participants at least expect the changes brought about by the LBO activity to be productive.

The basic idea here is that by increasing the efficiency with which the firm's resources are used, the LBO transaction is expected to in-

\[ \text{footnote reference: } 17 \text{Jensen (1986, 1988). Also see "Management Brief: The Way the Money Goes" (1989) for a brief discussion of this hypothesis as well as others to explain the increasing degree of leveraging by corporations in recent years and Laderman (1989a) for a discussion of the concept of free cash flow and its relation to cash flow and operating cash flow.} \]

\[ \text{footnote reference: } 18 \text{Of course, free cash flow could also explain the growing acquisition activity that has generated losses to stockholders. See Jensen (1986, 1988) for details.} \]

\[ \text{footnote reference: } 19 \text{See the evidence cited in footnotes 11 and 12.} \]

\[ \text{footnote reference: } 20 \text{The issue of whether merger and acquisition activity in general is productive has also received attention by researchers in finance as well as the news media. See Jarrell, Brickley and Netter (1988) and Jensen and Ruback (1983) for recent reviews of the empirical studies on the effects of merger and takeover activity. These studies generally indicate that stockholders gain, on average, from this activity in the market for corporate control. Also, see Ott and Santoni (1985) who present a useful theoretical discussion of the productiveness of mergers and acquisitions and place this activity into an historical perspective.} \]
crease economic earnings, which would eventually be paid out as dividends. Because the price of a firm's stock is equal, in theory, to the expected present discounted value of future dividends, the transaction also raises the price of the stock. In equilibrium, the gains to stockholders or the premium paid over the market price before the transaction should be identical to the expected increase in the present discounted value of economic earnings to the target firm.21

In an attempt to identify the sources of the increase in value from LBOs, one recent study found that the increase in the market price of the target firm's stock is largely explained by its cash flow as a fraction of the market value of its equity before the transaction.22 This evidence suggests that, with greater cash flow and the greater agency costs potentially associated with that flow, there is more room to improve the firm's productive efficiency and, accordingly, to increase the firm's value. Indeed, although differences in the firm's tax liabilities are associated with significant differences in the observed magnitudes of the premiums, measures of the firm's tax liability do not add statistically significant information for predicting the market-valued premium above the information provided by the cash flow measure.23 Hence, the expected gains from the LBO transactions appear to be over-and-above the tax advantages of debt finance.

**SKEPTICISM ABOUT THE SOCIAL VALUE OF LBOs**

Despite the gains typically realized by a target firm's shareholders, some observers have expressed doubt about the benefits of LBOs. These doubts stem from two types of potential "bad" effects of LBOs: wealth redistributions and increased instability of the economy.

**LBOs and Wealth Redistributions**

One version of the redistribution criticism is the claim that LBOs generate gains for the stockholders at the expense of those holding the target firm's original bonds; the redistribution presumably results from a reduction in the

21For example, in the simple case where expected future dividends, \(d_t\), for \(t > 0\), grow at a constant rate, \(g\), the price of the firm's stock can be written as \(\frac{d_1}{r - g}\). \(r\) is the constant discount rate appropriately adjusted for risk, and \(d_1\) is next period's dividend payment. Hence, by increasing expected dividends (\(d_t\) or \(g\))—or, equivalently, expected economic earnings—the transaction can increase the market value of the firm's stock.

Assuming that market participants correctly value the firm's stock, the observed increases in the stock price cast some doubt on the general criticism of activity in the market for corporate control, that managers are exploiting opportunities for short-term gains at the expense of long-term performance. Rather, this activity effectively removes myopic incentives so as to increase long-term economic earnings. Of course, the claim that observed unusual increases in the stock price supports the hypothesis that mergers and acquisitions are productive presumes that capital markets are efficient. In particular, firms are not systematically undervalued (given public information) and daily changes in the price of the firm's stock reflect new information that is made available to the public and is relevant for determining the firm's value. Otherwise, the observed increase in the stock price could merely reflect a re-evaluation of the firm's productiveness, without any fundamental change expected to arise from this activity in the market for corporate control.

22Lehn and Poulsen (1988), table 6, p. 54. The measure of cash flow used in their empirical analysis, however, does not control for the firm's growth prospects and so only crudely captures the firm's "free cash flow." But in a subsequent analysis, Lehn and Poulsen (1989), using undistributed cash flow (that is, the firm's after-tax cash flow net of interest and dividend payments) and attempting to control for the firm's growth prospects, get similar results for LBOs between 1984 and 1987 (table V, p. 782). Also, Lehn and Poulsen (1989), table III, p. 778, find that firms going private have a significantly higher flow of undistributed cash flow as a fraction of their equity value and possibly lower growth prospects than a control group of firms.

Recently, Mitchell and Lehn (1988), who attempt to identify the source of gains to shareholders in takeover activity, present some preliminary evidence to support the hypothesis that the growth in productive takeover activity is partly an attempt to prevent the target firm from using free cash flow in an unprofitable way or to reverse the earlier unprofitable takeover activity due to the free cash flow problems.

23Lehn and Poulsen (1988, 1989). Lehn and Poulsen (1988), table 9, p. 60, divide their sample into two equal sub-samples according to the magnitude of the firm's tax liability as a fraction of the market value of the firm's outstanding equity before the transaction. They find that the mean market-valued premium for those firms with the higher tax liability measure was 47.7 percent, whereas that for firms with the lower measure of tax liability was 32.1 percent. The difference in the premiums for the two sub-samples cannot be due to chance alone. (See footnote 11 for their definition of the market-valued premium.) However, the firm's tax liability does not explain variation in the premium not already explained by variation in the firm's undistributed cash flow. See Lehn and Poulsen (1989), table V, p. 782. Also, they do not find a significant difference between the mean tax liability for firms that went private and that for a control group of firms (table III, p. 778).
The value of debt allegedly falls because the target firm's increased leveraged position, typically in the form of low-quality, high-yielding (junk) bonds, increases the probability that its future revenues will be insufficient to cover its higher interest payments. That is, the value of the firm's bonds outstanding before the announcement of the LBO drops because market participants believe that the probability of default has increased as a result of the LBO transaction.25

Even if LBOs were to redistribute wealth in this way, however, whether or not public policy should aim to discourage LBO activity is not obvious.26 Economics has nothing meaningful to say about the “fairness” of wealth redistributions that leave social wealth unchanged. The key economic issue is whether LBOs reduce the market value of the firm’s outstanding debt by more or less than the increase in the value of its outstanding stock. If the net change in the value of stockholders’ and bondholders’ claims on the firm is negative, then LBOs reduce social wealth. In this case, LBOs would be socially inefficient and public policy to limit such activity could be justified.

The evidence discussed above, however, casts some doubt on the validity of the claim that LBOs merely redistribute wealth among those having claims in the firm with no net gain to society. Specifically, the alleged positive effect of the increase in leveraging on the firm’s default probability should not emerge. If such an effect were to emerge, it would first be reflected in the price of the stock. Because the new owners of the firm will be the residual claimants of the firm’s earnings, they take on the greatest amount of risk in the transaction. The bidders must expect that, while future debt-servicing increases, the LBO will improve the firm’s productivity so as to augment the future cash flow available for servicing that increased debt obligation; otherwise, they would not be willing to pay such a premium to purchase the firm.

Confirming this line of reasoning, empirical studies indicate that LBO announcements have an insignificant effect on the market value of the firm’s outstanding debt. One study found that, for a sample of 13 target firms between 1980 and 1984, the average percentage change in the bond price from 10 days before to 10 days after the announcement was -1.42 percent, much smaller than the average 7.21 percent decline in the Wall Street Journal’s 20-bond index over the same period.27 Another study of 20 LBOs between 1984 to 1988 found that the likelihood of the bond price falling was virtually equal to the likelihood of the price increasing upon the LBO announcement.28 However, a recent study found that, for 33 successful buyouts between 1974 and 1985, the default risk of the target firms’ bonds (as measured by Moody’s) typically increased.29

Another version of the redistribution hypothesis is based on the widely cited reason for the recent growth of LBOs—that is, the tax system produces a bias for debt finance. By reducing the firm’s tax liability, the LBO increases the firm’s after-tax earnings and, consequently, the market value of the firm’s stock. According to some observers, the observed increase in stock value takes place at the expense of taxpayers. Because these transactions permit the target firms to reduce their tax liability, tax gains to the target firms realized by the shareholders are said to be offset indirectly by increasing the tax liabilities of all taxpayers.30

Regardless of the issues related to the fairness of the tax system, the critical economic issue for public policy toward LBOs is whether the

25The value of preferred stock is also said to fall. Specified payments or dividends, distributed to holders of these stock shares unless earnings are insufficient to cover interest payments on outstanding debt, are fixed like interest payments on debt.
26The forms of protection, offered in financial markets, against such losses weakens the role for public intervention. See, for example, “The Debt Deduction” (1988) and Lehn and Poulsen (1988).
27Lehn and Poulsen (1988), table 8, p. 57. Also, see Marais, Schipper and Smith (1989) who similarly find that bond values did not significantly decline following 200 proposed management buyouts between 1974 and 1985. Furthermore, preferred stock values do not appear to be significantly affected by the announcement.
28Fortier (1989). Out of a sample of 20 LBOs, the bond prices of only eight target firms fell. The average change in price as a percentage of the bond’s face value, abstracting from general market interest rate movements was only -0.50 percent, too small to be attributed to the LBO announcement. However, she finds that after January 1987, when the elimination of preferential tax treatment of capital gains made debt finance even more attractive, bondholders, on average, experienced significant losses (5.1 percent).
30For example, see Lowenstein (1986).
Table 3
Growth of GNP and Debt

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal GNP</td>
<td>6.89%</td>
<td>10.24%</td>
<td>7.57%</td>
</tr>
<tr>
<td>Total credit market debt owed by domestic non-financial sectors</td>
<td>6.80%</td>
<td>10.34%</td>
<td>10.85%</td>
</tr>
<tr>
<td>U.S. government</td>
<td>1.95%</td>
<td>8.67%</td>
<td>13.76%</td>
</tr>
<tr>
<td>State and local governments</td>
<td>7.56%</td>
<td>7.27%</td>
<td>8.69%</td>
</tr>
<tr>
<td>Households</td>
<td>8.54%</td>
<td>11.31%</td>
<td>9.96%</td>
</tr>
<tr>
<td>Corporate</td>
<td>8.47%</td>
<td>9.09%</td>
<td>10.41%</td>
</tr>
<tr>
<td>Farm corporate</td>
<td>8.95%</td>
<td>12.56%</td>
<td>-0.31%</td>
</tr>
<tr>
<td>Nonfarm, noncorporate</td>
<td>13.51%</td>
<td>16.07%</td>
<td>13.13%</td>
</tr>
</tbody>
</table>

SOURCE: Federal Reserve Board, "Flow of Funds."
NOTE: All data are annual percentage changes.

Table 3 indicates that all borrowers contributed to this recent trend except for the farm, and nonfarm, noncorporate sectors. But the primary contributors appear to be the U.S. government and the corporate sector.33

Net effect on social wealth is negative. But, for example, even if LBOs had no effect on the firm's performance, the net effect of LBO activity on tax revenues is unlikely to be negative. While the tax liability of the target firm falls with increased leveraging, that of the shareholders realizing capital gains and new bondholders increases. Moreover, the evidence that the tax benefits do not fully explain the observed gains to shareholders suggests that the gains to shareholders do not simply come at the expense of taxpayers31. Thus, the argument that the gains to shareholders are offset by losses to taxpayers ignores the future increased tax base resulting from the LBO's predicted effect on the firm's productivity. If LBOs enhance the firm's performance, then income subject to taxation would increase later; increased future tax revenues would offset partially, if not fully, the loss in tax revenues now due to the use of debt finance in the LBO transaction.

Macroeconomic Instability

Some individuals have argued that the recent activity in the market for corporate control has contributed to an excessive growth of debt by nonfinancial borrowers in this decade.32 As table 3 shows, the growth of nominal GNP exceeded that of total debt of nonfinancial borrowers slightly during the 1960s and was marginally smaller in the 1970s. In the 1980s, however, the growth of total outstanding debt for nonfinancial borrowers exceeded that of nominal GNP by more than 3 percentage points. Table 3 indicates that all borrowers contributed to this recent trend except for the farm, and nonfarm, noncorporate sectors. But the primary contributors appear to be the U.S. government and the corporate sector.33

Some observers have suggested that the growth rates of corporate and public debt, which appear high relative to GNP growth in the 1980s, especially by post-World War II standards, reflect a greater instability in financial markets and, hence, the economy. According to this view, for any given slowdown in economic activity, the higher degree of leveraging by firms implies a greater likelihood that these firms will be forced to default on their debt obligations; if the affected creditors who suffer from deficient cash flows, in turn, are unable to service their own debt, then the severity of a slowdown in economic activity will be aggravated as the incidence of default is transmitted throughout the financial system.34

Despite the fact that the recent growth in corporate debt and LBO activity appear to be striking, whether or not these new trends indicate a threat to the stability of the financial system or

31See evidence cited in footnote 23.
32See Friedman (1989) and Kaufman (1989), for example. Gilbert and Ott (1985) found that the increase in corporate merger activity financed with debt (including LBOs) accounted for a substantial amount of the unusually large growth of business loans in the first half of 1984.
33During the 1980s, corporate debt growth has exceeded nominal GNP growth in all but two years and by as much as 9.96 percentage points. See also Bernanke and Campbell (1988), who provide a detailed analysis of the recent trends in corporate debt. They look at disaggregated data in an attempt to determine the financial stability or solvency of those firms most likely to default on their debt obligations.
34See, for example, "Taking the Strain of America's Leverage" (1988) and Ferguson (1989), Kaufman (1986, 1989), Friedman (1986, 1989) and Greenspan (1989, especially p. 269). Friedman (1989) also argues that "because of the increased likelihood of debtors' distress in the event of an economic downturn, the Federal Reserve system is likely to be less willing either to seek or to permit a business recession in the United States." According to Friedman, a consequence of the higher degree of leveraging is the prospect for greater inflation.
the economy is not obvious. If LBOs or, more generally, merger and acquisition activity had no other benefit than providing a channel through which tax advantages of debt finance could be realized, then the growth of debt that only recently has significantly exceeded the growth of nominal output might seem alarming.

The existing empirical evidence briefly discussed above, however, suggests that LBOs provide anticipated gains over and above the tax gains to the target firm. Since these anticipated benefits include enhancing the earnings potential of the firm, simply comparing debt growth with nominal GNP growth does not provide a complete picture from which to identify the effects of debt growth on the stability of financial markets. Specifically, the increased debt as a fraction of nominal output could reflect an increase in expected future cash flows relative to the prior post-World War II trends. In this case, the increased debt would be associated with a rise in the market value of firms' assets. Indeed, aggregate debt-to-asset ratios, which more accurately indicate financial stability, hardly changed on net from 1969 to 1986. For example, one measure of this ratio using "flow of funds" data, rose from 34 percent in 1969 to 42 percent in 1986, peaking in 1974 at 51 percent.

Aggregate debt-to-asset ratios, however, can be misleading, because they mask the financial condition of those firms with especially high debt-to-asset ratios. In fact, such firms have exhibited only a slightly higher increase in debt-to-asset ratios than would be suggested by the aggregate data. Specifically, a recent study found that while, for a full sample of firms, the debt-to-asset ratio fell from 31 percent in 1969 to 27 percent in 1986, for those firms in the 99th percentile (that is, having a higher debt-to-asset ratio than 99 percent of the sample), debt-to-asset ratios rose from about 74 percent to 82 percent.

SOME UNANSWERED QUESTIONS AND POLICY IMPLICATIONS

The existing evidence cannot rule out the validity of all critical concerns about LBOs. In particular, most research on LBOs has examined the impact of the transaction on pre-buyout stockholders and bondholders of the firm. As such, these studies provide evidence on financial market participants' expectations about the impact of LBOs on the target firms performance. Although these studies generally indicate that these transactions on average are expected to generate gains beyond tax liability reductions, we will have to wait to see if these gains are actually realized. Several recent studies on post-buyout performance of LBO firms provide evidence suggesting that those transactions, on average, have actually improved the firm's performance; however, evidence is preliminary and particularly subject to many methodological problems due to data limitations.

Nevertheless, without evidence that LBOs are harmful or are likely to be harmful to the economy, policy actions to restrict LBO activity seem to be premature; indeed, such restrictions could themselves be harmful, especially if LBO activity actually enhances the productiveness of the target firms.

36Ibid., table 5, p. 104. As predicted by the "free cash flow" theory, the study found a dramatic increase in real and nominal interest expenses as a percentage of cash flows over this same period (see tables 6 and 7, pp. 106-07). Because expectations about increased future cash flows (as reflected in the increased market value of the firms' outstanding assets that has left debt-to-asset ratios virtually unchanged on net from 1969 to 1986) might not be fulfilled, however, concerns about recent trends in debt growth are not entirely unwarranted. Another recent study found that the default rate on junk bonds, commonly used to finance transactions in the market for corporate control, could be as high as 34 percent, much higher than the average 2.5 percent reported by an earlier study. See Laderman (1989b) for a brief discussion of these two studies and Mitchell (1989) and Fidler and Cohen (1989) for discussions of a more recent study by Moody's Investors Services, Inc. Also see Passell (1989) who summarizes two other studies' findings that the greater risk of default has been compensated by higher realized returns on average.

37For example, see Deveny (1989), who discusses a recent study indicating that companies involved in the market for corporate control have not, on average, exhibited a decrease in expenditures on research and development, as predicted by some critics. Also, see Yago (1989), who reports one study's finding that target firms of management buyouts are less likely to close plants than are other firms. Francis (1989) discusses evidence from another study indicating that, upon a change in ownership of a firm, the ratio of the administrative employees to plant employees fell 11 percent on average. Indeed, one study found that for LBO firms between 1984 and 1986, average annual growth of the firm's productivity (measured by sales per employee) increased from an average of 3.6 percent before the transaction to 17.4 percent after the transaction. See Yago (1989). Also, Palmeri (1989) recently found that the stocks of 70 LBO target firms that subsequently went public performed significantly better than the market since going public. But see Long and Ravenscraft (1989) for a brief summary of a few other existing studies providing mixed evidence on post-LBO performance and a critical assessment of the validity of these studies.
Although the recent behavior of various debt-to-asset ratios does not indicate a drastic deterioration of corporate solvency, the higher debt-to-income ratios do suggest some increased risk of financial stress. That is, the recent behavior of these latter ratios indicate a higher degree of pressure on cash flows exerted by interest expenses (a reduction in liquidity), which could exacerbate the severity of any given slowdown in economic activity. To the extent the tax advantages of debt finance are not necessary to realize the gains from LBO activity, as well as from other highly leveraged transactions in the market for corporate control, a change in public policy might be warranted.

A widely discussed policy recommendation intended to slow the growth of all corporate debt involves eliminating the tax advantages of debt finance, in particular, by eliminating the tax deductibility of interest payments on debt.38 Another policy recommendation would involve removing the double-taxation of dividends by relieving the tax burden on dividends at the corporate level or stockholder level. Whether the latter approach to curb debt growth is politically feasible, given the wide concern about the unprecedented growth in public debt along with explicit commitments made by the administration to reduce the budget deficit, remains unclear. In any case, if, as suggested by the empirical evidence, LBO activity has benefits in addition to the tax advantages, these tax reforms should be considered on their own merits, not chiefly as a way to reduce LBO activity.

REFERENCES


38For example, see "The Debt Deduction" (1988) and Friedman (1986, 1989) and Dowd (1989). Also see U.S. Congress, Joint Committee on Taxation (1989) for a more detailed and exhaustive list of policy proposals.


The Link Between M1 and the Monetary Base in the 1980s

Since 1980, there have been several changes in the Federal Reserve System's reserve requirements that have altered the relationship between the money stock, M1, and the monetary base. The Monetary Control Act of 1980 (henceforth, MCA) brought all depository institutions—member and nonmember commercial banks, saving and loan associations, mutual savings banks and credit unions—under a uniform set of reserve requirements and removed reserve requirements on a broad category of savings time deposits that are close substitutes for checkable deposits. In February 1984, the Federal Reserve switched from lagged reserve accounting to contemporaneous reserve accounting.1

This article shows how these changes affected the relationship between the money stock and the monetary base, arguing that, under fairly general conditions, the relationship should have become less variable since 1980. Evidence consistent with this argument is then presented.

Changes in the Money Supply Process Since 1980

A simple model of the money supply process provides a useful framework to illustrate how the link between M1 and the monetary base has changed in the 1980s. This model is summarized by the following equation:

(1) \[ M1 = m \cdot MB, \]

where \( M1 \) denotes the stock of money consisting of checkable deposits and currency held by the non-bank public; \( MB \) denotes the stock of the monetary base consisting of total reserves and currency; and \( m \) represents the money multiplier.

The money multiplier, which translates fluctuations in the monetary base into fluctuations in \( M1 \), depends on the reserve requirements that the Federal Reserve imposes on depository institutions and a number of ratios that reflect portfolio decisions of both depository institu-

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1The Fed moved from contemporaneous to lagged reserve accounting in 1968.
tions and the public (see the appendix for details and verification of the claims made in the text). For a given set of portfolio preferences and reserve requirements, equation 1 shows what level of M1 will result from any given level of the monetary base.

The ratios that reflect portfolio preferences of depository institutions and the public generally are not constant. As a result, even if reserve requirements were unchanged, variation in these ratios would produce variability in the money multiplier. The MCA was intended to strengthen the link between Federal Reserve actions and changes in the money stock by reducing or eliminating specific sources of variability in the multiplier.

**Uniform Reserve Requirements for Member and State-Chartered Nonmember Banks**

The MCA imposed uniform reserve requirements on all depository institutions. Before 1980, reserve requirements on deposits of state-chartered nonmember banks were established by the state in which they were domiciled. These requirements were generally lower than those imposed by the Federal Reserve. More importantly, while only vault cash held by these institutions was part of the monetary base, checkable deposits held by these institutions were included in M1.²

Without uniform reserve requirements on checkable deposits, the multiplier would change as deposits shifted between member and nonmember banks. For example, as checkable deposits flowed from member to nonmember banks, reserves would be released so that a larger money stock could be supported by the same level of the monetary base. That is, the multiplier would increase. The opposite would occur when deposits flowed from nonmember to member banks. With uniform reserve requirements, such shifts in checkable deposits are no longer a source of variation in the multiplier.

The same reasoning applies to shifts of time and savings deposits between nonmember and member banks. Before the MCA, as these deposits flowed from member to nonmember banks, reserves were released that could support a larger volume of checkable deposits. Other things the same, the multiplier would fluctuate as time and savings deposits shifted between member and nonmember banks. Again, uniform reserve requirements established by the MCA removed this source of variation.

**Extending Reserve Requirements to Thrifts**

The MCA also extended the same set of reserve requirements to deposits at thrift institutions, thereby removing another source of variation from the multiplier. Before 1980, these institutions were not subject to the Fed's reserve requirements and checkable deposits held at these institutions, called NOW accounts, were not included in M1. In February 1980, however, M1 statistics were revised to include interest-bearing checking accounts held at thrifts and the historical data were revised to reflect this change.³ Consequently, shifts of checkable deposits between thrifts and banks influenced the money multiplier prior to the adoption of the MCA. Now, deposit shifts between thrifts and banks can no longer be a source of variation in the money multiplier.

Before the nationwide introduction of interest-bearing checking accounts on January 1, 1981, however, thrifts did not hold a large amount of NOW accounts.⁴ Accordingly, deposit shifts be-

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²For a discussion of state reserve requirements, see Gilbert and Lovati (1978) and Gilbert (1978).

³See Hafer (1980) for a detailed discussion of the redefinition of the monetary aggregates. While the redefinition did not change the aggregate level of the monetary base, vault cash holdings of thrifts were moved from currency to total reserves.

There were two other important definitional changes in the aggregates in the 1980s. Starting in February 1980, demand deposits of foreign commercial banks and official institutions were excluded from M1. In July 1981, nonbank traveler's checks were included in M1. In both cases, the M1 series was revised historically. The latter revision introduces an additional source of variability in the M1-base relationship because non-bank traveler's checks are not reservable. Further, since foreign deposits are still subject to reserve requirements, they absorb the base even though they are no longer included in M1.

⁴For example, as of December 31, 1979, the non-bank depository institutions held only $4.2 billion in NOW accounts.
tween thrifts and banks may not have been an important source of variation in the multiplier prior to 1981.5

Elimination of Reserve Requirements on Savings and Time Deposits

Before the MCA, the Federal Reserve imposed reserve requirements of 3 percent on commercial bank savings and time deposits.6 The MCA eliminated reserve requirements on a broad class of savings and time deposits (hereafter, S&Ts).7 As a consequence, shifts between formerly reservable deposits and non-reservable time deposits no longer affect the multiplier. Of course, shifts between currently reservable time deposits and checkable deposits or non-reservable time deposits remain a source of variability in the multiplier. Hence, the elimination of reserve requirements on a broad class of S&Ts does not guarantee that the variability of the multiplier will be reduced.

The Gradual Implementation of the MCA

Reserve requirement changes under the MCA were phased in over several years. The adjustments for most nonmember banks and thrifts occurred gradually over an eight-year period. Beginning November 1980, these institutions had to maintain only one-eighth of the required reserves they would eventually hold when the act was fully implemented. Each successive September until 1987 (when the phase-in was completed), these institutions had to hold an additional one-eighth of the target level of required reserves.

Member bank reserve requirements generally were reduced by the MCA.8 Starting November 1980, a seven-step phase-down began, with one-fourth of the new reserve requirements being implemented in November 1980 and one-sixth of the remainder being implemented in six steps. The full phase-down was completed on March 1, 1984. For member banks whose reserve requirements were raised, the phase-in was implemented in four steps, with one-fourth of the increase being required in November 1980 and one-fourth being met in each of the next three Septembers.

Although member banks had completely adjusted to the new reserve requirements by March 1, 1984, the full impact of the MCA on the multiplier could not have emerged until the phase-in was completed for all depository institutions—unless the effect of extending reserve

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5Conversations with Board staff suggest that thrifts may have held vault cash in excess of what would have been required on NOW accounts. If, in effect, thrifts were holding vault cash in the form of reserves against these accounts as if they were member banks, a shift from demand deposits in a member bank to a NOW account at a thrift would have no effect on the multiplier using current data. Prior to the revision of the monetary aggregates, however, such a shift would have caused the money supply to decline with no corresponding change in the monetary base. Consequently, it would have affected the multiplier. Furthermore, prior to January 1, 1981, member banks in Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont also issued interest-bearing NOW accounts that were not included in the money stock at that time. Member banks, however, were required to hold reserves against these deposits. Nevertheless, a shift from a member bank NOW account to a thrift NOW account would have left both the money stock and the monetary base unchanged if thrifts were holding vault cash as reserves against these deposits.

6It should be noted, however, that in both cases above, the measured ratio of currency to either M1 or checkable deposits would have changed before the redefinition of money and the adoption of MCA. Nonetheless, the variation in the currency ratio would have been reflected in the measured multiplier only in the first case.

7Specifically, the MCA imposed reserve requirements on time deposits except some of those that have an original maturity shorter than 3½ years; shorter-maturity time deposits that are transferable, or that are non-transferable and owned by anybody excluding an individual person or a sole proprietorship, are still subject to a 3 percent reserve requirement.

8Prior to the MCA, a system of marginal reserve requirements on transaction deposits varied with the deposit size of the institution. For example, just before the implementation of the MCA, the marginal reserve requirement on demand deposits more than $400 million was 16½ percent, while that on deposits less than $2 million was 7 percent. Hence, the money supply could change relative to the base as transaction deposits shifted between institutions of different size. By reducing the number of tiers in the marginal system from five to two,—that is, by partially removing the marginal reserve requirement system—the MCA reduced the importance of this source of variability in the multiplier. Moreover, the new system generally lowered reserve requirements to be maintained against transaction accounts. Starting in November 1980, the marginal reserve requirement was only 3 percent for accounts less than $25 million and was 12 percent for accounts in excess of $25 million. With the exception of member banks holding balances of checkable deposits between $25 million and $100 million, member banks were subject to lower marginal reserve requirements on checkable deposits.
requirements to thrifts is quantitatively unimportant. Because of the nature of the phase-in, the variability of the multiplier might not have dropped sharply at any particular time during the 1980s. Instead, MCA’s impact on the variability of the multiplier could have occurred gradually throughout the transition period.

**The Impact of the MCA on the Level of the Multiplier**

In addition to reducing the variability of the multiplier, the MCA’s changes in reserve requirements had divergent effects on the level of the multiplier.\(^9\) While higher reserve requirements for nonmember banks, thrifts and some member banks reduced the multiplier, the elimination of reserve requirements on a broad class of S&Ts for member banks and lower reserve requirements for most member banks increased it. The net effect of the MCA on the size of the multiplier depends on the relative magnitude of these effects.\(^{10}\)

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\(^9\)For a given level of the monetary base, an expected increase (decrease) in the money multiplier would imply an increase (decrease) in the money supply. If the Fed removes reserves from (injects reserves into) the system, however, the money supply need not be affected by the expected increase in the multiplier. Typically, changes in the money supply produced by changes in the multiplier as a result of reserve-requirement changes are largely offset through open market operations. See Burger (1979).

\(^{10}\)See footnote 8. As of September 30, 1978, large banks held more than 48 percent of the total demand deposits outstanding. The net effect of the MCA on reserve requirements for all depository institutions on the phase-in dates is shown in table 2 which lists all reserve-requirement changes from 1973 to 1988.

\(^{11}\)Strictly speaking, reserve requirements under CRA are not completely contemporaneous. There is a two-day lag on reserve requirements on transaction accounts and a 14-day lag on liabilities other than transaction deposits. See Gilbert and Trebing (1982) for details.

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\(^{12}\)One of the main concerns about the effect of LRA on monetary control was that LRA encouraged the Fed to validate deposit creation of depository institutions. Specifically, some observers argued that under LRA depository institutions were free to create any desired amount of the checkable deposits. The Fed would be forced to supply the necessary reserves two weeks later; otherwise, there would be a sharp increase in the federal funds rate.

At one level, this argument reflects a view that the Fed might be more concerned with movements in the federal funds rate than with its money supply objective. At another level, however, it was frequently suggested,—e.g., Laufenberg (1976)—that LRA severed the contemporaneous link between the money stock and the monetary base. Thornton (1983), however, has shown that the link need not be affected by the accounting procedure for reserve requirements; a contemporaneous link between the money stock and the monetary base could be maintained either through depository institutions’ holdings of excess reserves or through the currency-deposit ratio under LRA. von Hagen (1987) arrives at a similar conclusion, but emphasizes the role of interest rate expectations under LRA. Thornton (1984) provides some early evidence on the effect of the move to CRA on the variability of money and interest rates. Also, see Thornton (1982) for an analysis of money stock control under LRA and CRA.

\(^{13}\)While the contribution of the variance of the currency-deposit ratio and the ratio of excess reserves to checkable deposits to the variability of the multiplier both decline with the adoption of CRA, the contribution of the variance of the other ratios could get larger. The net effect on the variance of the multiplier depends on the relative magnitude of these effects. Given the importance of the currency-deposit ratio, in particular, the variance of the multiplier should decline with the adoption of CRA. This conjecture depends on modeling depository institutions’ holdings of excess reserves as a proportion of their checkable and time deposits. If this specification is inappropriate, the only link between M1 and the base would be through the currency-deposit ratio. In this instance, the variance of the multiplier would increase with the move to CRA.

Also, if depository institutions hold excess reserves as a buffer stock under CRA, there might be no change in the variability of the multiplier. See Thornton (1983) for details. Although it is not immediately obvious why depository institutions would behave that way, Tarhan and Spindt (1983) provide some evidence that banks maintain excess reserves as a buffer stock.
otherwise, it would have no effect on the level of the multiplier.

**EMPIRICAL EVIDENCE**

The multiplier is measured as the ratio of M1 to the monetary base. The effects of reserve requirement changes are reflected in the adjusted monetary base, so that they are not reflected in its multiplier. The effect of such changes are not reflected in the source base, so they are reflected in the multiplier obtained using it. Because the above analysis abstracts from reserve requirement changes, normally it would be preferable to use the adjusted monetary base to construct the multiplier. The adjusted monetary base can also yield misleading results, however, because the ratio of reservable time deposits to total checkable deposits appears in the adjusted monetary base and not its multiplier after November 1980. Removing this component from the multiplier only after November 1980 biases the results toward finding a reduction in the multiplier's variance.

Although the multiplier derived from the source base does not suffer from this limitation, it reflects reserve-requirement changes. The effect of such changes on the variability of the multiplier before and after the MCA depends on the frequency and magnitude of reserve-requirement changes during the two periods. If reserve-requirement changes were more frequent or larger before the MCA, failure to abstract from such changes produces results that are biased in favor of seeing a reduction in variability after the MCA. If they are less frequent or smaller, the bias would be in the opposite direction.

The analysis presented here is carried out for multipliers based on the adjusted monetary base (mₐ) and the source base (mₛ) to see if the results are affected by these factors. The data are monthly and cover the period from January 1973 through December 1988.

**The Level of the Multiplier**

As noted previously, the net effect of the MCA on the level of the multiplier is analytically indeterminate. On one hand, extending reserve requirements to nonmember banks and nonbank depository institutions and increasing reserve requirements for some member banks cause the multiplier to fall. On the other hand, the elimination of reserve requirements on a broad class of S&Ts and the reduction in reserve requirements for most member banks cause the multiplier to rise. The effect of the move to CRA is somewhat less indeterminate analytically. If it had any affect at all, the multiplier would decline.

Figure 1 shows the levels of the two multipliers over the period. The vertical lines correspond to the initiation of the MCA and the adoption of CRA. Both multipliers generally decline from January 1973 through early 1980. Following a sharp decline in early 1980 and a sharp rise in mid-1980, the multipliers generally rose until mid-1986 and declined thereafter. Although both multipliers declined slightly during 1984, the beginning of the decline, especially for the adjusted monetary base multiplier, predates the adoption of CRA by several months. Relating the behavior of the level of the multipliers to the adoption of the MCA and CRA by direct inspection is complicated by the fact that the multipliers are influenced greatly by the "k-ratio," the ratio of currency to checkable deposits, which changed markedly during this period.

**The Effect of the MCA and the Adoption of CRA on the Non-Currency Ratio Components of the Multiplier**

One can abstract from movements in the k-ratio by obtaining a joint representation for the other components. Each multiplier can be written in the general form,

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14See Gilbert (1987), especially the appendix, for a discussion of the revised adjusted monetary base.

15The strength of this conclusion is based on an implicit assumption that the covariance between this and other multiplier components is zero. If the covariance is nonzero, the direction of the bias could be the opposite of that stated in the text.

16For a discussion of the importance of the k-ratio and its behavior during the 1980s, see Burger (1988).
Figure 1
Adjusted Monetary Base and Source Base Multipliers

(2) \[ m = \frac{1 + k}{z + k}, \]

where \( k \) is the k-ratio and \( z \) is a composite of the required reserve ratios and the other ratios that reflect the portfolio preferences of depository institutions and the public. Equation 2 can be solved for \( z \) to yield

(3) \[ z = \frac{1 + k - mk}{m}. \]

This calculation of \( z \) is done for both \( m_A \) and \( m_S \); the results are denoted respectively as \( z_A \) and \( z_S \).

Figures 2 and 3 show the behavior of the multiplier, the k-ratio and \( z \) for the adjusted monetary base and source base, respectively, over the full sample period. In both cases, \( z \) declines following the adoption of the MCA, although the timing of this descent does not match precisely the implementation of the MCA. The behavior of \( z_S \) in the early to mid-1980s was influenced greatly by the Federal Reserve's imposition and subsequent elimination of credit controls.\(^{17}\) Nonetheless, its decline through February 1984 suggests that the elimination of reserve requirements on many savings and time deposits and/or the lowering of reserve requirements for most member banks are the dominant factors influencing the level of the multiplier.\(^{18}\) \( z_S \) declines markedly through February 1984 and increases slightly thereafter. The increase following the move to CRA is consistent with the hypothesized effect of CRA, but is so small that the move to CRA might not have had an important impact on the level of the multiplier. \( z_A \) behaves similarly, except that

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\(^{17}\)The credit controls imposed new reserve requirements on increases in credit card lending, on large-denomination time deposits and on money market mutual funds. The credit controls were imposed in March 1980 and removed in July 1980.

\(^{18}\)Actually, this observation is not too surprising. The removal of reserve requirements on a large class of time and savings deposits should have caused the multiplier to increase significantly. Moreover, the Board's estimates indicate that the largest effect of reserve-requirement changes for member and nonmember institutions on reserves was through institutions that had their reserve requirements decreased (see table 2).
it continues to fall following the move to CRA.

Figures 2 and 3 reveal that much of the movement in the multipliers is associated with movements in the k-ratio. The dominant effect of the k-ratio on the multipliers is particularly evident for the source base multiplier after 1984, when \( z_s \) hardly changed. Indeed, the decline in both multipliers since mid-1986 is associated with a rise in the k-ratio; it appears to be unrelated to movements in \( z \).

The effect of reserve-requirement changes on the level of \( z_s \) is seen more clearly when the data are differenced. The differences of \( z_A \) and \( z_s \), denoted \( \Delta z_A \) and \( \Delta z_s \), respectively, are presented in figure 4. Beginning in 1980, there are several pronounced spikes in \( \Delta z_s \). The first two are the large positive and negative spikes associated with the introduction and subsequent elimination of the credit controls. The next seven large negative spikes are associated with the important phase-in dates for the MCA for member banks.

The presence of spikes in \( \Delta z_s \) related to reserve-requirement changes and their absence in \( \Delta z_A \) attests both to the importance of the ef-

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\(^{19}\)The divergent behavior of \( z_A \) and \( z_s \), especially after the move to CRA, is difficult to explain. With the exception of the ratio of reservable time deposits to checkable deposits, changes in all other ratios should be reflected in the same way in both measures of \( z \). An increase in the ratio of reservable time deposits to checkable deposits would cause \( z_s \) to rise; because of the way that the adjusted monetary base has been calculated since November 1980, however, such an increase would have no effect on \( z_A \). In any event, the disparate movements in the \( z \)'s had a very small effect on the multipliers; both multipliers have moved together after February 1984.

It should be noted, that because \( z_s \) reflects the actual level of reserve requirements while \( z_A \) reflects the average level over some base period before November 1980 and the marginal reserve requirement on transaction deposits (12 percent) thereafter, \( z_s \) is larger than \( z_A \) until mid-1982 and is smaller thereafter. The level of \( z_s \) in recent years is somewhat puzzling, however, because it is substantially less than the marginal reserve requirement on transaction deposits. Moreover, both measures suggest that the proportion of the \( z \)'s not accounted for by reserve requirements is very small. Indeed, the excess reserve ratio and the ratios of government and foreign deposits to total checkable deposits averaged 0.018, 0.0397 and 0.0231, respectively, from February 1984 through December 1988.
Figure 3
Source Base Multiplier and Its Components

Figure 4
Changes in the Non-k Components of the Multipliers
The Variability of the Multiplier

Because the levels of the multipliers, the corresponding z's and the k-ratio have definite trends, the variances of the levels are not very useful as measures of variation. More appropriate measures are the variances of the first differences (Δ) of these variables.20

The variances of the first differences of the multipliers, the z's and the k-ratio for various periods are presented in the upper part of Table 1. This table also presents the F-statistic for a test of the null hypothesis that the variances of each series for the periods 1973.1-1980.11 and 1980.12-1988.12 are equal against the alternative that the variance is larger during the earlier period. These data show that the variance of both ΔmA and ΔmS declined following the adoption of the MCA; however, only the decline for ΔmS is statistically significant at the 5 percent level. There is also a decrease in the variances of ΔzA and ΔzS following the adoption of the MCA. Caution must be exercised in interpreting the decline in the variance of ΔzA; it is biased downward because of the elimination of the ratio of reservable time deposits to checkable...

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20 Diagnostic tests indicate that mA, mS, zA, zS and k are non-stationary in levels but stationary in first differences. Moreover, in most cases, the hypothesis that, in levels, these series follow a random walk cannot be rejected at the 5 percent level.
### Table 2

**Reserve Requirement Changes, 1973-88**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Reserve requirement change</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 21, 1973</td>
<td>The Board amended its Regulation D to establish a marginal reserve requirement of 8 percent against certain time deposits and to subject to the 8 percent reserve requirement certain deposits exempt from the rate limitations of the Board's Regulation Q. In addition, reserves against certain foreign branch deposits were reduced from 10 percent to 8 percent. These changes had little effect on required reserves.</td>
</tr>
<tr>
<td>July 12, 1973</td>
<td>Reserve requirements were imposed against finance bills. This action increased required reserves approximately $90 million.</td>
</tr>
<tr>
<td>July 19, 1973</td>
<td>The reserve requirement against all net demand deposits, except the first $2 million was increased 1/2 percentage point. This action increased required reserves approximately $760 million.</td>
</tr>
<tr>
<td>October 4, 1973</td>
<td>The marginal reserve requirement against certain time deposits was increased from 8 percent to 11 percent. This action increased required reserves approximately $465 million.</td>
</tr>
<tr>
<td>December 27, 1973</td>
<td>The marginal reserve requirement against certain time deposits was reduced from 11 percent to 8 percent. This action reduced required reserves approximately $360 million.</td>
</tr>
<tr>
<td>September 19, 1974</td>
<td>The marginal reserve requirement against time deposits in denomination greater than $100,000 and more than four-month maturity was eliminated. This action reduced required reserves approximately $510 million.</td>
</tr>
<tr>
<td>December 12, 1974</td>
<td>The reserve requirement against all time deposits with an original maturity of six months or longer was reduced from 5 percent to 3 percent; the reserve requirement against all time deposits with an original maturity of less than six months was increased from 5 percent to 6 percent; and the reserve requirement against net demand deposits more than $400 million was reduced from 18 percent to 17-1/2 percent. In addition, the 3 percent marginal reserve requirement on large certificates of deposit with an initial maturity of less than four months was removed. These actions reduced required reserves approximately $710 million.</td>
</tr>
<tr>
<td>February 13, 1975</td>
<td>The reserve requirements against all categories of net demand deposits up to $400 million were reduced by one-half of 1 percentage point, and the reserve requirement against net demand deposits of more than $400 million was reduced 1 percentage point. This action reduced required reserves approximately $1,065 million.</td>
</tr>
<tr>
<td>May 22, 1975</td>
<td>The reserve requirement against foreign borrowings of member banks, primarily Eurodollars, was reduced from 8 percent to 4 percent. This action reduced required reserves approximately $80 million.</td>
</tr>
<tr>
<td>October 30, 1975</td>
<td>The reserve requirement against member bank time deposits with an original maturity of four years or more was reduced from 3 percent to 1 percent. This action reduced required reserves approximately $360 million.</td>
</tr>
<tr>
<td>January 8, 1976</td>
<td>The reserve requirement on time deposits maturing in 180 days to 4 years was reduced from 3 percent to 2-1/2 percent. This action reduced required reserves by approximately $500 million.</td>
</tr>
<tr>
<td>December 30, 1976</td>
<td>The reserve requirement against net demand deposits up to $10 million was reduced by 1/2 percentage point, and the reserve requirement against net demand deposits more than $10 million was reduced by 1/4 percentage point. This action reduced required reserves by approximately $550 million.</td>
</tr>
<tr>
<td>November 2, 1978</td>
<td>A supplementary reserve requirement of 2 percentage points was imposed on time deposits of $100,000 or more. This action increased required reserves approximately $3.0 billion.</td>
</tr>
</tbody>
</table>
### Table 2 (Continued)
#### Reserve Requirement Changes, 1973-88

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Reserve requirement change</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 11, 1979</td>
<td>A marginal reserve requirement of 8 percent was imposed on &quot;managed liabilities&quot; of member banks, Edge Act corporations, and U.S. agencies and branches of foreign banks above a base average for the two weeks ending September 26, 1979. Managed liabilities included large time deposits ($100,000 and more with maturities of less than one year), repurchase agreements against U.S. government and federal agency securities, Eurodollar borrowings, and federal funds borrowings from a nonmember institution. On October 25, required reserves and reserves held by Edge Act corporations were included in member bank reserves. (Previously reserves held by these institutions were recorded as &quot;other deposits&quot; by Federal Reserve Banks.) These actions raised required reserves approximately $355 million and $320 million, respectively.</td>
</tr>
<tr>
<td>March 12, 1980</td>
<td>The 8 percentage point marginal reserve requirement was raised to 10 percent. In addition, the base upon which the marginal reserve requirement was calculated was reduced. This action increased required reserves about $1.7 billion.</td>
</tr>
<tr>
<td>May 29, 1980</td>
<td>The marginal reserve requirement was reduced from 10 percentage points to 5 percentage points and the base upon which the marginal reserve requirement was calculated was raised. This action reduced required reserves about $980 million.</td>
</tr>
<tr>
<td>July 24, 1980</td>
<td>The 5 percent marginal reserve requirement on managed liabilities and the 2 percent supplementary reserve requirement against large time deposits were removed. These actions reduced required reserves about $3.2 billion.</td>
</tr>
<tr>
<td>November 13, 1980</td>
<td>Required reserves of member banks and Edge Act corporations were reduced about $4.3 billion and required reserves of other depository institutions were increased about $1.4 billion due to the implementation of the Monetary Control Act of 1980.</td>
</tr>
<tr>
<td>February 12, 1981</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember banks and foreign-related institutions increased by approximately $245 million.</td>
</tr>
<tr>
<td>March 12, 1981</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of small nonmember &quot;quarterly reporters&quot; increased about $75 million.</td>
</tr>
<tr>
<td>May 14, 1981</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember banks and foreign-related institutions increased by approximately $245 million.</td>
</tr>
<tr>
<td>August 13, 1981</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember banks and foreign-related institutions increased approximately $230 million.</td>
</tr>
<tr>
<td>September 3, 1981</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of member banks were reduced about $2.0 billion, and required reserves of other depository institutions were increased about $0.9 billion.</td>
</tr>
<tr>
<td>November 12, 1981</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember banks and foreign-related institutions increased about $210 million.</td>
</tr>
<tr>
<td>January 14, 1982</td>
<td>The low reserve tranche for transaction accounts at depository institutions was raised from $25 million to $26 million. This action reduced required reserves approximately $60 million.</td>
</tr>
<tr>
<td>February 11, 1982</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember banks and foreign-related institutions increased about $170 million.</td>
</tr>
</tbody>
</table>
## Table 2 (Continued)
### Reserve Requirement Changes, 1973-88

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Reserve requirement change</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 4, 1982</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of member banks decreased by about $2.0 billion.</td>
</tr>
<tr>
<td>May 13, 1982</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember banks and foreign-related institutions increased about $150 million.</td>
</tr>
<tr>
<td>August 12, 1982</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember banks and foreign-related institutions increased about $140 million.</td>
</tr>
<tr>
<td>September 2, 1982</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of member banks were reduced about $2.1 billion, and required reserves of other depository institutions were increased about $0.9 billion.</td>
</tr>
<tr>
<td>October 28, 1982</td>
<td>In accordance with provisions of the Depository Institutions Act of 1982, required reserves of certain former member banks were reduced by approximately $100 million.</td>
</tr>
<tr>
<td>December 23, 1982</td>
<td>In accordance with provisions of the Depository Institutions Act of 1982 that exempted the first $2.1 million of reservable liabilities at all depository institutions from reserve requirements, required reserves were reduced by an estimated $800 million.</td>
</tr>
<tr>
<td>March 3, 1983</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of member banks were reduced by approximately $1.9 billion.</td>
</tr>
<tr>
<td>April 14, 1983</td>
<td>Required reserves were reduced an estimated $80 million as a result of the elimination of reserve requirements on nonpersonal time deposits with maturities of 2-1/2 to 3-1/2 years.</td>
</tr>
<tr>
<td>September 1, 1983</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of member banks were reduced about $2.0 billion, and required reserves of other depository institutions were increased about $0.9 billion.</td>
</tr>
<tr>
<td>October 20, 1983</td>
<td>Required reserves were reduced an estimated $100 million as a result of the elimination of reserve requirements on nonpersonal time deposits with maturities of 1-1/2 to 2-1/2 years.</td>
</tr>
<tr>
<td>January 12, 1984</td>
<td>The low reserve tranche for transaction accounts at depository institutions was raised from $26.3 million to $28.9 million. Also, in accordance with the provisions of the Depository Institutions Act of 1982, the reserve requirement exemption applied to total reservable liabilities was raised from $2.1 million to $2.2 million. These actions reduced required reserves by about $350 million.</td>
</tr>
<tr>
<td>February 2, 1984</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of member banks were reduced about $2.0 billion.</td>
</tr>
<tr>
<td>September 13, 1984</td>
<td>In conjunction with the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember depository institutions increased about $1.08 billion.</td>
</tr>
<tr>
<td>January 3, 1985</td>
<td>The low-reserve tranche for transaction accounts was raised from $28.9 million to $29.8 million. The exemption applied to reservable liabilities was also raised from $2.2 million to $2.4 million. These actions reduced required reserves by about $190 million.</td>
</tr>
<tr>
<td>September 12, 1985</td>
<td>According to the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember depository institutions were increased about $1.23 billion.</td>
</tr>
<tr>
<td>January 2, 1986</td>
<td>The low-reserve tranche for transaction accounts was raised from $29.8 million to $31.7 million. The exemption applied to reservable liabilities was also raised from $2.4 million to $2.6 million. These actions reduced required reserves by about $340 million.</td>
</tr>
</tbody>
</table>
Reserve Requirement Changes, 1973-88

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Reserve requirement change</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 24, 1986</td>
<td>Money market deposit accounts (MMDA), which had previously been subject to full reserve requirements, were made subject to the transitional phase-in program of the Monetary Control Act. In addition, the order of application of the exemption applied to reservable liabilities was changed. These actions reduced required reserves by about $260 million.</td>
</tr>
<tr>
<td>September 11, 1986</td>
<td>According to the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember depository institutions were increased about $1.58 billion.</td>
</tr>
<tr>
<td>January 1, 1987</td>
<td>The low-reserve tranche for transaction accounts was raised from $31.7 million to $36.7 million. The exemption applied to reservable liabilities was also raised from $2.6 million to $2.9 million. These actions reduced required reserves by about $970 million.</td>
</tr>
<tr>
<td>September 10, 1987</td>
<td>According to the transitional phase-in program under the Monetary Control Act, required reserves of certain nonmember depository institutions were increased about $1.70 billion.</td>
</tr>
<tr>
<td>December 31, 1987</td>
<td>The low-reserve tranche for transaction accounts was raised from $36.7 million to $40.5 million. The exemption applied to reservable liabilities was also raised from $2.9 million to $3.2 million. The actions reduced required reserves by about $740 million.</td>
</tr>
<tr>
<td>December 29, 1988</td>
<td>The low-reserve tranche for transaction accounts was raised from $40.5 million to $41.5 million. The exemption applied to reservable liabilities was also raised from $3.2 million to $3.4 million. The actions reduced required reserves by an estimated $210 million.</td>
</tr>
</tbody>
</table>

deposits from \( m_A \). Care must also be taken in interpreting the decline in the variance of \( \Delta z_s \) because reserve-requirement changes affect that variance in an indeterminate way. To remove the effect of reserve-requirement changes, the variances of \( \Delta m_s \), \( \Delta z_s \), and \( \Delta k \) were recalculated from smaller samples in which observations for months affected by the reserve-requirement changes were deleted. These variances are presented in the bottom portion of table 1. The list of reserve requirement changes from January 1973 through December 1988 is presented in table 2. The results show a large, though not statistically significant, decline in the variance of \( \Delta m_s \) and a large and statistically significant decline in the variance of \( \Delta z_s \). Hence, while it is clear that reserve-requirement changes had a substantial effect on the variances of \( \Delta m_s \) and \( \Delta z_s \), these changes do not seem to qualitatively affect the observed impact of the MCA.

The variance of \( \Delta k \) increased slightly, but not significantly so over these periods. Hence, it would appear that the observed reduction in the variances of \( \Delta m_s \) and \( \Delta m_s \) can be attributed to the predicted reduction in the variances of \( \Delta z_s \) and \( \Delta z_s \). This is not necessarily the case, however. The variance of \( \Delta m \) is given by an expression like

\[
\text{Var}(\Delta m) = a^2 \text{Var}(\Delta k) + b^2 \text{Var}(\Delta z) - 2ab \text{Cov}(\Delta k, \Delta z),
\]

where Var and Cov denote the variance and covariance of the variables in parentheses, respectively. Because the coefficients, \( a \) and \( b \), change with the MCA and the adoption of CRA, it is impossible to say that the observed decline in the variance of \( \Delta m \) is due solely to the decline in the variance of \( \Delta z \). A clearer picture of the effects of the MCA and the adoption of CRA on the variance of \( \Delta m \) can be obtained by calculating the proportion of the variance of \( \Delta m \) ac-

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21 Reserve-requirement changes from 1960 to 1973 can be found in Burger (1979), pp. 6-7.

22 As expected, the variance of \( \Delta z_s \) from the sample in which observations affected by reserve-requirement changes were deleted is substantially smaller than that from the full sample. The same is generally true for the variance of \( \Delta m_s \).
Table 3
Relative Contributions of the Components to the Variance of $\Delta m$

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$a^2Var(\Delta k)/Var(\Delta m)$</td>
<td>.389</td>
<td>.599</td>
<td>.496</td>
<td>.683</td>
</tr>
<tr>
<td>$b^2Var(\Delta z)/Var(\Delta m)$</td>
<td>.339</td>
<td>.272</td>
<td>.298</td>
<td>.248</td>
</tr>
<tr>
<td>$2abCov(\Delta z, \Delta k)/Var(\Delta m)$</td>
<td>.272</td>
<td>.129</td>
<td>.206</td>
<td>.068</td>
</tr>
<tr>
<td>$a^2Var(\Delta k)/Var(\Delta m)$</td>
<td>.170</td>
<td>.591</td>
<td>.431</td>
<td>.797</td>
</tr>
<tr>
<td>$b^2Var(\Delta z)/Var(\Delta m)$</td>
<td>.516</td>
<td>.400</td>
<td>.406</td>
<td>.300</td>
</tr>
<tr>
<td>$2abCov(\Delta z, \Delta k)/Var(\Delta m)$</td>
<td>.315</td>
<td>.009</td>
<td>.162</td>
<td>.097</td>
</tr>
</tbody>
</table>

Observations Deleted$^2$

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$a^2Var(\Delta k)/Var(\Delta m)$</td>
<td>.215</td>
<td>.854</td>
<td>.733</td>
<td>.875</td>
</tr>
<tr>
<td>$b^2Var(\Delta z)/Var(\Delta m)$</td>
<td>.490</td>
<td>.249</td>
<td>.187</td>
<td>.192</td>
</tr>
<tr>
<td>$2abCov(\Delta z, \Delta k)/Var(\Delta m)$</td>
<td>.296</td>
<td>.094</td>
<td>.080</td>
<td>.067</td>
</tr>
</tbody>
</table>

$^1$The coefficients $a$ and $b$ are $(z - 1)/(z + k)^2$ and $(1 + k)/(z + k)^2$, respectively. These coefficients are evaluated at the means of $z$ and $k$ during the periods, and the proportions are based on the $Var(\Delta m)$ calculated from the approximations rather than the actual sample variance for $\Delta m$.

$^2$See footnote 3 from table 1.

counted for by each component on the right-hand side of equation 4.

These proportions for the relevant periods are presented in table 3. For both multipliers, the proportion of the variance of $\Delta m$ explained by the $\Delta z$ component declines after November 1980, while the proportion of the variance explained by the $\Delta k$ component rises. Furthermore, the decline in the proportion of the variance of the change in the multiplier explained by the $\Delta z$ component continues after the adoption of CRA. This latter observation is not necessarily evidence that the move to CRA reduced the variability of the multiplier; however, the completion of the MCA phase-in for member banks coincides closely with the adoption of CRA.

**CONCLUSION**

The changes in reserve requirements specified by the Monetary Control Act of 1980 and the switch to contemporaneous reserve accounting in February 1984 imply that the link between M1 and the monetary base should have become tighter in the 1980s. The empirical evidence presented in this article suggests that, in fact, the money-base relationship has strengthened in the sense that, for a given k-ratio, the multiplier has become less variable.

By eliminating or, at least, diminishing the importance of some sources of variability in the multiplier, these changes have potentially enhanced the Federal Reserve's control over M1. The degree to which control over M1 has improved, however, hinges on how these changes, among others, have affected the predictability of the multiplier.$^{23}$ The slight reduction in the variance of the change in the multiplier in the 1980s does not necessarily imply that the multiplier itself is easier to predict. The evidence presented in this article suggests that the predictability of the multiplier, especial-
ly that for the source base, depends crucially on the predictability of the k-ratio in the 1980s. In any case, further research is necessary to determine whether predicting the multiplier has become more or less difficult.

REFERENCES

________. "Effectiveness of State Reserve Requirements," this Review (September 1978).

Appendix

The following equations form a simple static model of the money supply process. This model is intended solely to illustrate the main effects of the passage of the Monetary Control Act on the money supply process. It is not intended to represent completely the money supply process.1

(1) $M_1_t = CD_t + C_t$
(2) $SB_t = RR_t + ER_t + C_t$
(3) $RR_t = r_C [CD^M_t \gamma + CD_t (1-\gamma)] + r_T TR^R_t + r_C GD_t$
(4) $ER_t = a[CD^M_t + d_1 CD_t + GD_t + \beta CD^N_t + \xi (TD_t - d_1 CD_t)] \gamma$
+ $a[CD_t + d_2 CD_t + GD_t] (1-\gamma)$
(5) $TD^R_t = d_1 CD_t \gamma + d_2 CD_t (1-\gamma), \ d_1 > d_2$
(6) $TD_t = TD^R_t + TD^NR_t$
(7) $CD_t = CD^M_t + CD^N_t$
(8) $CD^M_t = \theta CD_t$
(9) $C_t = kCD_t$
(10) $TD_t = \lambda CD_t$
(11) $GD_t = \sigma CD_t$

The superscripts, M and N, distinguish deposits held at member depository institutions from those held at nonmember institutions. (Nonmember institutions include both banks and thrifts). The superscripts R and NR distinguish reservable from nonreservable time and savings deposits. The variable names are:

$C = $ the currency component of the money stock
$CD = $ checkable deposits
$TD = $ time and savings deposits

1For example, the model does not account explicitly for the fact that required reserves under both LRA and CRA consist of deposits at the Federal Reserve plus vault cash held during the two weeks prior to the current reserve maintenance period. Since the impact of the variability of changes in vault cash is the same under all regimes, accounting for this fact would merely add another random component to all of the reduced-form expressions; so it does not qualitatively affect the conclusions. The same conclusion holds for Eurodollar deposits and traveler's checks, which are also not explicitly treated in the model.
GD = government deposits
SB = source base, currency plus total reserves
RR = required reserves
ER = excess reserves
M1 = the M1 definition of the money stock
rc = reserve requirement ratio on reservable checkable deposits
rT = reserve requirement ratio on reservable savings and time deposits
γ is a shift parameter with the characteristic,
γ = { 1 before November 1980
       0 after November 1980

The reserve requirement ratios, rc and rT, and the coefficients, β and ζ, are assumed to be fixed parameters, whereas the ratios, θ, k, λ, δ₁, δ₂, g and α, are treated as independent random variables with time-invariant (stationary) distributions.

These equations establish the relationship between the monetary base and M1 and the features of the MCA that have altered that relationship. In the context of this static model, there are two distinct regimes: before the MCA, γ = 1; and, after the MCA, γ = 0. Equation 1 is simply the current definition of M1, currency plus checkable deposits, including demand deposits and NOW accounts. Equation 2 defines the uses of source base as the sum of required and excess reserves and currency held by the nonbank public.

Equation 3 specifies required reserves in the pre-MCA period (γ = 1) and under MCA (γ = 0). Before the MCA, reserves were required to be held against checkable deposits and savings and time deposits at member banks, as well as total government deposits. Equation 5 says that, prior to the MCA, reservable time and savings deposits were a fraction, δ₁, of checkable deposits. Equation 5 defines that class, under the MCA, to be a smaller fraction of checkable deposits, δ₂, where δ₁ > δ₂. Equation 4 describes excess reserve holdings by all depository institutions under both regimes and is general enough to capture the possibility that nonmember banks acted as if they were subject to reserve requirements. Specifically, if
\[ β = \frac{α + r_c}{α} \and ζ = \frac{α + r_T}{α}, \]
then member and nonmember banks acted identically before and after the MCA.

Equation 6 is an identity for total time and savings deposits. Similarly, equation 7 is an identity for total checkable deposits. Equations 8 through 11 establish proportional links of checkable deposits at member banks, currency, total time and savings deposits and government deposits, respectively, to total checkable deposits.

Equations 1 through 11 are general enough to show the potential impact of the MCA on the multiplier. A dynamic specification, however, is necessary to illustrate the possible effects of the switch from LRA to CRA. Introducing a dynamic element into the model can be accomplished easily by substituting the following equations for equations 3 and 5:

\begin{align*}
3') \ RR_t &= r_c CD_{M1} \gamma + r_c CD_{T1-1} (1-\gamma)(1-\psi)
                  + r_c CD_t \psi + r_T TD^*_t \\
        &+ r_c GD_{T1-1} (1-\psi) + r_c GD \psi \\
5') \ TD^*_t &= δ_1 CD_{T1-1} \gamma + δ_2 CD_{T1-1} (1-\gamma)(1-\psi)
                     + δ_2 CD_t \psi
\end{align*}

where \( \psi = 0 \) under LRA and \( \psi = 1 \) under CRA.

**The Effects of the MCA**

The multipliers (denoted by m), linking M1 to the source base in the static framework for the pre- and post-MCA regimes, are given respectively by:

\begin{align*}
12a) \ m &= 1 + k \frac{A}{A} \\
\text{where} \ A &= α(θ + δ_1 + g + β(1-θ) + ζ(λ - δ_1)) \\
           &+ r_c(θ + g) + r_T δ_1 + k \\
12b) \ m &= 1 + k \frac{B}{B} \\
\text{where} \ B &= α(1 + δ_2 + g) + r_c(1 + g) \\
           &+ r_T δ_2 + k
\end{align*}

The impact of the MCA on the multiplier can be seen partly by comparing the expressions in 12. First, notice that the ratio of checkable deposits at member banks to total checkable deposits, \( δ_1 \), does not influence the multiplier under the MCA. Second, the parameters that capture the nonmember banks' preferences for holding excess reserves disappear from the
multiplier under the MCA. If, however, non-member banks held reserves as if they were member banks, deposit shifts between member and nonmember banks would not have been a source of variability in the multiplier. Nevertheless, even in this case, the MCA would have affected the multiplier because of the MCA’s reclassification of reservable time deposits. This new classification means that \( \delta_1 \) replaces \( \delta \) and \( \lambda \) in the multiplier under the MCA regime.

To see how the MCA affected the variability of the multiplier, we can compare the variances of \( m \) expressed in equations 12a and 12b. By using a Taylor’s series expansion to approximate the variances of \( m \) before the MCA, one can verify the following:

\[
\text{(13) Var} \ (m) = \left( \frac{\partial m}{\partial k} \right)^2 \sigma_k^2 + \left( \frac{\partial m}{\partial \theta} \right)^2 \sigma_\theta^2 + \left( \frac{\partial m}{\partial \alpha} \right)^2 \sigma_\alpha^2 + \left( \frac{\partial m}{\partial \delta_1} \right)^2 \sigma_{\delta_1}^2 + \left( \frac{\partial m}{\partial \lambda} \right)^2 \sigma_{\lambda}^2,
\]

where

\[
\frac{\partial m}{\partial k} = \frac{A - (1 + k)}{A^2} \\
\frac{\partial m}{\partial \theta} = \frac{\alpha \beta - (r_C + \alpha)}{A^2} (1 + k) \\
\frac{\partial m}{\partial g} = \frac{r_C + \alpha}{A^2} (1 + k) \\
\frac{\partial m}{\partial \alpha} = \frac{\theta + g + \delta_1 + \beta (1 - \theta) + \xi (\lambda - \delta_1)}{A^2} (1 + k) \\
\frac{\partial m}{\partial \delta_1} = \frac{\alpha \xi - (r_T + \alpha)}{A^2} (1 + k) \\
\frac{\partial m}{\partial \lambda} = \frac{\alpha \xi}{A^2} (1 + k)
\]

and \( \sigma_j^2 \) denotes the constant variance of the random variable \( j \). This approximation assumes that the covariances between the random variables is 0.

Similarly, we can approximate the variance of the multiplier under MCA:

\[
\text{(14) Var} \ (m) = \left( \frac{\partial m}{\partial k} \right)^2 \sigma_k^2 + \left( \frac{\partial m}{\partial \theta} \right)^2 \sigma_\theta^2 + \left( \frac{\partial m}{\partial \alpha} \right)^2 \sigma_\alpha^2 + \left( \frac{\partial m}{\partial \delta_2} \right)^2 \sigma_{\delta_2}^2,
\]

where

\[
\frac{\partial m}{\partial k} = \frac{B - (1 + k)}{B^2} \\
\frac{\partial m}{\partial \theta} = \frac{r_C + \alpha}{B^2} (1 + k) \\
\frac{\partial m}{\partial g} = \frac{1 + g + \delta_2}{B^2} (1 + k) \\
\frac{\partial m}{\partial \alpha} = \frac{r_T + \alpha}{B^2} (1 + k)
\]

Comparing equations 13 and 14 reveals that some sources of variation present before the MCA are no longer relevant—namely, \( \sigma_k^2, \sigma_{\delta_1}^2 \), and \( \sigma_\lambda^2 \). Variability of the ratios of time deposits at member banks to total checkable deposits and total time deposits to total checkable deposits does not contribute to the variance of the multiplier under the MCA. The MCA, however, does maintain reserve requirements on some time deposits, represented here by \( \delta_2 CD_t \). Accordingly, variability in the ratio of these deposits to total checkable deposits essentially represents a new source of variation in the multiplier under MCA.

The MCA had another important effect on the variance of the multiplier. In particular, by changing the level of the multiplier, it changed the coefficients on each of the individual variances. The multiplier in the MCA regime will be unambiguously larger than in the pre-MCA regime if, before the adoption of the MCA, non-member banks acted identically to member banks—that is, if \( \beta = \alpha + r_C \) and \( \xi = \alpha + r_T \).

As \( \beta \) and \( \xi \) approach 0, the difference in the multipliers for the two regimes gets smaller. But, provided that \( (\delta_1 - \delta_2) (r_T + \alpha) > (1 - \theta) (r_C + \alpha) \), \( B < A \) and the multiplier is larger under MCA. That is, if the impact of eliminating reserve requirements on a large class of time and savings deposits is greater than the effect of extending reserve requirements to all depository institutions, then the multiplier is
larger in the current regime than in the pre-MCA regime.²

That the multiplier can be larger under MCA implies that the sources of variability remaining under MCA can make a greater contribution to the variability of the multiplier. Even under the simplifying assumption that the magnitudes of the remaining sources of variability do not change across regimes, the variance of the multiplier could be larger under the current regime. Although it is highly unlikely that the variance would increase, the variability in k is likely to have a greater impact on the variance of the multiplier under MCA than in the pre-MCA regime.

**The Effects of the Move to CRA from LRA**

To investigate the possible effects of the switch to CRA from LRA, we employ the dynamic version of the model. In the dynamic model, there are three regimes of interest: pre-MCA, LRA (γ = 1, ψ = 0); MCA, LRA (γ = 0, ψ = 0); and, MCA, CRA (γ = 0, ψ = 1). The contemporaneous multipliers in the dynamic model for these three regimes are given, respectively, by:

\[(15a)\quad m = \frac{1 + k}{A'},\]

where \(A' = a(\theta + \delta_1 + g + \beta(1 - \theta) + \xi(k - \delta_1) + k\)

\[(15b)\quad m = \frac{1 + k}{B'},\]

where \(B' = a(1 + \delta_2 + g) + k\)

\[(15c)\quad m = \frac{1 + k}{C'},\]

where \(C' = a(1 + \delta_2 + g) + r_c(1 + g) + r_f\delta_2 + k\)

Before discussing the effects of the move to CRA, we can see how the MCA influenced the multiplier under LRA by comparing 15a with 15b. As in the static model, the random ratio of checkable deposits at member banks to total checkable deposits and the fixed parameters, describing the behavior of nonmember banks' holdings of excess reserves prior to MCA, are no longer relevant for the multiplier in the MCA/LRA regime. Also, the MCA influences the level of the multiplier in an analytically indeterminant way.

The move to CRA unambiguously decreased the average level of the multiplier, however, as can be seen by inspecting equations 15b and 15c. Nevertheless, the net effect from the first to the third regimes predicted by the dynamic model is identical to that predicted by the static model. That is, holding all else constant, the level of the multiplier is most likely higher now than before the MCA if the net effect of the MCA was to decrease average reserve requirements.

In fact, the dynamic version of the model of the money supply process has similar predictions about the impact of the MCA on the variability of the multiplier to those from the static model. The similarities of the predictions of both models can be verified by approximating the variance of the multipliers expressed in 15 with a Taylor's series expansion. Since the multiplier declines from the second to the third regimes, variation in k and \(\gamma\) provide smaller contributions to the variability of the multiplier upon the move to CRA. The change in the importance of the variability of \(\delta_2\) and g for the variability of the multiplier could be smaller, but is likely to be larger. Nonetheless, the predicted effect of the MCA on the variability of the multipliers and its components from the first to the third regimes in the dynamic model is qualitatively identical to the effect predicted by the static model.³ Specifically, the variance of the multiplier should fall with the implementation of the MCA and the switch to CRA.

²As discussed in the main text but not captured in this simple model, if the effect of reducing reserve requirements on checkable deposits held at many member banks is large, the adoption of the MCA would tend to increase the multiplier.

³As Thornton (1983) shows, the isolated impact of the move to CRA on the multiplier is diminished if depository institutions hold excess reserves as a buffer stock to absorb changes in required reserves under CRA, a possibility not captured by the dynamic model. To the extent that these institutions hold excess reserves as a buffer stock, the switch from LRA to CRA has a smaller effect on the dynamic structure of the money supply process. Further, one can verify, by setting \(\gamma = 0\), that the move to CRA could have increased the variability of the multiplier if, under LRA, the only contemporaneous link between the monetary base and M1 were through currency holdings.
Monetary Targeting with Exchange Rate Constraints: The Bundesbank in the 1980s

Recent programs for international coordination of economic policies have focused on the control of exchange rate movements among the major industrial countries. Such efforts gained visibility in the 1985 Plaza Agreement among the G5 nations (the United States, Canada, France, Germany and the United Kingdom) to curb the rising dollar, and in the subsequent joint efforts to prevent it from falling too low. Discussion of exchange rate coordination often neglects the potential conflict between exchange rate targets and domestic monetary policy objectives. Exchange rate policies may be costly, because a central bank may lose the ability to control domestic money growth and, hence, the domestic rate of inflation, in the effort to control exchange rates.

The purpose of this paper is to explore the impact of exchange rate policies on domestic monetary control during the 1980s for one of the main players in the international arena, the German Bundesbank. The Bundesbank presents a particularly interesting case. On the one hand, it maintains a formal, explicit commitment to monetary targeting. On the other hand, it engages in exchange rate stabilization policies both inside the European Monetary System (EMS) and vis-à-vis the U.S. dollar. Recently, a number of authors have concluded that these joint commitments do not lead to significant conflict among the Bundesbank’s policy objectives. Specifically, they argue that its participation in the EMS and in coordinated exchange rate policies in the G5 does not affect the Bundesbank’s ability to achieve its monetary targets.

The analysis in this paper suggests that this conclusion is too optimistic for two reasons. First, it neglects important institutional aspects of the Bank’s operating procedure; second, it neglects the fact that its exchange rate policies are geared to two different markets, the EMS and the dollar. When these aspects are taken into account, the evidence shows that German domestic money growth has been significantly affected by the Bundesbank’s exchange rate policies in at least five years over the decade from 1979 to 1988.

1See Funabashi (1988).
MONETARY TARGETING IN GERMANY

Shortly after the 1973 breakdown of the Bretton Woods system of fixed exchange rates, which freed the Bundesbank from the obligation to intervene in the deutsche mark-U.S. dollar market to maintain the fixed dollar parity, the Bundesbank established monetary targeting as its monetary policy regime. A monetary target was first announced in late 1974. Monetary targeting has remained the basic policy regime in Germany, although, occasionally, changes have occurred in implementation procedures.

The Bundesbank announces annual monetary targets for a broad monetary aggregate. During 1975 to 1987, the targeted aggregate was the "central bank money stock," a weighted M3 monetary aggregate, where M3 is the sum of currency in the non-bank sector, demand deposits and reserveable time and savings deposits. This aggregate is similar to the Federal Reserve's money stock definition for M2. In 1988, the Bank adopted the simple sum M3 as its target aggregate. Between 1979 and 1987, the targets were expressed as ranges of growth rates from the fourth quarter to the fourth quarter; only in 1989, the Bundesbank returned to its pre-1979 practice of announcing a precise fourth-quarter-to-fourth-quarter target growth rate.

Reasons for Monetary Targeting

Annual monetary targets impose limits on monetary policy activism and discretion. They imply that, over a year's time horizon, the central bank's actions have to be reconciled with its targeted growth rate of the money supply. The Bundesbank adopted monetary targeting to influence the public's expectations of future inflation and to provide the public with a standard of monetary policy that can be easily monitored to assess the credibility of the Bank's commitment to price stability. Targeting a monetary aggregate helps to reduce the economic cost of expectation errors about inflation that cause fluctuations in output and employment, and allows the central bank to establish a reputation for commitment to price stability. This reputation helps to further reduce inflation expectations.

Monetary targeting also permits the Bundesbank to deny responsibility for labor and output market disequilibria, and to signal that monetary policy will not be available as an instrument of discretionary aggregate demand management. Both arguments arise from the basic view—laid down in the Bank's legal constitution—that the principal goal of German monetary policy is price stability.\(^3\)

Reasons for Exchange Rate Management

Exchange rate management has been the second important determinant of Bundesbank monetary policy during the 1980s. Exchange rate considerations arise from two grounds. First, Germany's membership in the EMS obligates the Bundesbank to intervene in foreign exchange markets to maintain stable parities of the DM with the other participating currencies; these currencies are the French franc, the Belgian franc, the Dutch guilder, the Italian lira, the Irish punt, and the Danish korner.\(^4\) Under the EMS arrangement, member central banks are required to intervene without limits if necessary, to keep exchange rates within target zones of ±2.25 percent (±6 percent for the lira) around predetermined central parities.

Second, the Bundesbank has often argued that intervention in the DM-dollar market is necessary at times to maintain "orderly" market conditions; that is, to dampen exchange rate fluctuations perceived to be unwarranted by the prevailing basic economic conditions or "fundamentals." While the Bundesbank has repeatedly denied having specific dollar targets for such interventions, the concept of unwarranted exchange rate movements implies that some fundamental value of the exchange rate is being considered and serves as a target for interventions.


\(^4\)For a recent review of the European Monetary System, see Fratianni and von Hagen (1990). German law places the authority to participate in international exchange rate arrangements with the Ministry of Finance, not the Bundesbank. One may, therefore, argue that the obligations implied by the EMS were imposed on the Bank. Indeed, the Bundesbank strongly opposed the formation of the EMS.
The Relationship Between Monetary Control and Exchange Rate Management

The link between exchange rate policies and monetary control arises from the central bank's balance sheet. Domestic monetary control is achieved primarily by controlling the growth rate of the monetary base—total bank reserves plus currency in circulation—at an appropriate rate. The monetary base, from the sources' side, consists of various domestic assets and the central bank's stock of international reserves. Exchange rate control requires intervention in foreign exchange markets: purchases and sales of foreign assets which change the international reserves component of the base. Consequently, to assess the extent to which exchange rate policies affect domestic monetary control, one must answer the question of how much foreign exchange interventions affect the growth of the monetary base. This is called the "sterilization" issue. Only if foreign exchange interventions are "sterilized" completely, that is, have no effect on monetary base growth, will exchange rate policies not impede domestic monetary control. Otherwise, foreign exchange market interventions have some impact on the growth of the monetary base, and, consequently, on domestic monetary control. Sterilization of foreign exchange market interventions requires offsetting sales or purchases of domestic assets, such that the total base remains unchanged.

Monetary Targeting with Exchange Rate Constraints

The monetary policy regime prevailing in Germany in the 1980s can best be characterized as one of monetary targeting with EMS and U.S. dollar exchange rate constraints. Did these constraints prevent the Bundesbank from reaching its monetary targets? Table 1, which reports the monetary targets and realized growth rates in Germany since 1979, provides a preliminary look at the answer to this question. During these years, the Bundesbank met its target on five occasions, and missed its target on five occasions. Money growth was too slow in 1980 and 1981, and too fast in 1986 to 1988. The table also presents some qualitative information about the performance of the mark vis-a-vis the dollar and in the EMS during the previous years. Here, a "strong" position of the mark is typified by an appreciation of the mark and sales of DM reserves against foreign currency in the relevant market; the opposite is true for a "weak" position. A "mixed" position indicates that the mark switched between "strong" and "weak" during the year.

Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Monetary target (percent)</th>
<th>Realized money growth (percent)</th>
<th>Relative position of the DM in the previous year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>6-9</td>
<td>6.3</td>
<td>Against US$ In EMS</td>
</tr>
<tr>
<td>1980</td>
<td>5-8</td>
<td>4.9*</td>
<td>mixed mixed</td>
</tr>
<tr>
<td>1981</td>
<td>4-7</td>
<td>3.5*</td>
<td>weak weak</td>
</tr>
<tr>
<td>1982</td>
<td>4-7</td>
<td>6.0</td>
<td>weak mixed</td>
</tr>
<tr>
<td>1983</td>
<td>4-7</td>
<td>7.0</td>
<td>weak strong</td>
</tr>
<tr>
<td>1984</td>
<td>4-6</td>
<td>4.6</td>
<td>weak mixed</td>
</tr>
<tr>
<td>1985</td>
<td>3-5</td>
<td>4.5</td>
<td>weak mixed</td>
</tr>
<tr>
<td>1986</td>
<td>3.5-5.5</td>
<td>7.7*</td>
<td>strong strong</td>
</tr>
<tr>
<td>1987</td>
<td>3-6</td>
<td>8.1*</td>
<td>strong strong</td>
</tr>
<tr>
<td>1988</td>
<td>3-6</td>
<td>6.7*</td>
<td>strong strong</td>
</tr>
</tbody>
</table>

*Indicates violation of monetary target.

Figure 1 illustrates these qualitative characterizations. The upper part of the figure shows an index of the DM-dollar exchange rate (red-line) and a weighted index of the DM exchange rates in the EMS (black-line). The lower part of figure 1 shows an index of the Bundesbank's net foreign asset position (red line) excluding net claims on the European Monetary Cooperation Fund (EMCF), and an index of its net claims on the EMCF (black line). Changes in these two foreign asset positions reflect the Bank's interventions in the dollar market and in EMS currencies, respectively. During 1980 and most of 1981, the dollar was rising and net foreign assets fell due to intervention supporting the mark.

The mark's exchange rate in the EMS remained flat, but net claims on the EMCF fell, too. From 1982 to the end of 1984, the dollar kept rising, while the mark appreciated steadily in the EMS. The two net foreign asset positions oscillated with little apparent trend. With the dollar's decline from early 1985 to the end of 1987, a period of intervention to support the dollar began, reflected in the increase in net foreign assets during that period. As the mark remained strong in the EMS, net claims on the EMCF fell. Again, the dollar appreciated steadily in the EMS. The two net foreign asset positions oscillated with little apparent trend. With the dollar's decline from January 1985 to the end of 1987, a period of intervention to support the dollar began, reflected in the increase in net foreign assets during that period. As the mark remained strong in the EMS, net claims on the EMCF fell.
Figure 1
Indexes of DM Exchange Rates and Bundesbank Net Foreign Assets
Monthly Data, April 1979 = 100

1Total international reserves less net claims on the EMCF
Vertical lines indicate realignments in the EMS.
Table 2
Main Sources of the Monetary Base (end of year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Base (DMbill)</th>
<th>International</th>
<th>Domestic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IR$ (%)</td>
<td>IRE (%)</td>
</tr>
<tr>
<td>1978</td>
<td>140.7</td>
<td>68.2</td>
<td>—</td>
</tr>
<tr>
<td>1979</td>
<td>151.2</td>
<td>46.0</td>
<td>12.8</td>
</tr>
<tr>
<td>1980</td>
<td>145.0</td>
<td>37.4</td>
<td>6.3</td>
</tr>
<tr>
<td>1981</td>
<td>142.2</td>
<td>34.3</td>
<td>11.7</td>
</tr>
<tr>
<td>1982</td>
<td>148.6</td>
<td>33.3</td>
<td>13.2</td>
</tr>
<tr>
<td>1983</td>
<td>157.4</td>
<td>33.0</td>
<td>9.8</td>
</tr>
<tr>
<td>1984</td>
<td>163.8</td>
<td>31.8</td>
<td>8.8</td>
</tr>
<tr>
<td>1985</td>
<td>170.5</td>
<td>36.2</td>
<td>14.7</td>
</tr>
<tr>
<td>1986</td>
<td>179.6</td>
<td>28.6</td>
<td>9.1</td>
</tr>
<tr>
<td>1987</td>
<td>196.4</td>
<td>36.2</td>
<td>14.7</td>
</tr>
<tr>
<td>1988</td>
<td>216.1</td>
<td>21.2</td>
<td>10.0</td>
</tr>
</tbody>
</table>

NOTE: Base - currency in circulation plus central bank deposits of commercial banks; IR$ - net monetary reserves less net claims on the European Monetary Cooperation Fund, IRE; DISC - discount window borrowing (domestic and foreign bills); LOMB - Lombard borrowing; REPO - loans to domestic commercial banks through repurchase agreements; MOB - net stock of money market paper (Mobilisierungs-und Liquiditätspapiere); SEC - stock of government securities.

SOURCE: Bundesbank, Monthly Reports.

accounted for nearly two thirds of the base. That share declined to about 45 percent at the end of 1981. It climbed again from 38 to 51 percent during 1987 and fell sharply in 1988.

Table 2 distinguishes the three most important types of loan operations in the domestic component: discount credit (DISC), Lombard credit (LOMB) and repurchase agreements (REPOS). In Germany, discount credit is rationed and the discount rate is kept consistently below money market rates, and commercial banks have additional incentives to fully utilize their discount quota. Consequently, the Bundesbank can tightly control the quantity of discount credit. Discount credit is collateralized with trade bills and has a fixed maturity of up to 90 days.

Lombard credit, in contrast, is freely accessible to banks under normal circumstances at a rate that is kept higher than money market rates. The Bundesbank may, however, impose quantitative restrictions on Lombard credit also. Lombard credit, which is collateralized with trade bills, securities and Treasury bills and can be repaid at any time, is a more flexible refinancing instrument than discount credit for commercial banks.

Repurchase agreements are loans to commercial banks collateralized with securities, trade-bills or foreign assets. Typically, they have fixed maturities between three and 30 days and are available only at the Bundesbank's discretion. The table shows that REPOS gained importance during the 1980s.

The two remaining components of the domestic sources of the German monetary base shown in table 2 are the Bundesbank's stock of open market paper, securities issued by the Federal or State Governments, the Federal Railroad

\[6\] For example, an individual bank's quota may be reduced if it has not been exhausted for some time. This practice implies that variations in the discount rate have no direct impact on the money supply. The important variable determining the quantity of discount credit is the total size of discount quota.

\[7\] The official terms for these operations, "open market operations with repurchase agreements," is misleading in that their economic nature is a loan to a commercial bank, using a bank's asset as collateral. That is, the Bundesbank does not purchase or sell securities or trade bills in these operations. See Bundesbank (1985).
or the Federal Post Office (SEC), and the net Treasury bill position (MOB). The Bank can issue Treasury bills, “Mobilisierungs-und-Liquiditätspapiere” on its own initiative, but only up to the amount of DM 16.5 billion. During the period under consideration, the combined share of MOB and SEC never exceeded 7 percent of the base.

An important consequence of the Bundesbank’s asset structure is that the domestic component, D, is controlled mainly via loans to domestic banks. For this purpose, the Bundesbank has developed a two-stage strategy. It is based on the decomposition of the domestic component into a permanent part (P) and a transitory part (T):

\[
D = P + T. 
\]

The permanent part (P) is used to achieve the desired trend growth of the domestic component over a time horizon of several months. The main policy instruments for its control are purchases and sales of securities (SEC), reserve requirements, the discount rate and discount quota.

The transitory component (T) is used to control the short-term growth of the monetary base with regard to current money market conditions. Here, the main policy instruments are the issue and redemption of Treasury bills (MOB), repurchase agreements, including loans collateralized with foreign assets (REPO) and Lombard credit (LOMB).

Variations in T are geared primarily at reducing short-run fluctuations in the interbank rate for overnight central bank funds, the Bundesbank’s principal operating target for monetary control. The Bundesbank stresses the short-run character of these operations by calling them “reversible money market operations.” Reversible money market operations have typical maturities between two and thirty days; only recently has the Bundesbank introduced repurchase agreements that extend over two months. Under the current two-stage strategy, increases or decreases of the transitory component are generally reversed after some time. That is, they are neither intended nor permitted to have a lasting impact on the total domestic component or on the base. The notable exception to this policy design was the increase in REPO during 1984/85, when the Bundesbank decided to increase the stock of REPO to gain more flexibility in its use to control money market conditions.

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**STERILIZING FOREIGN EXCHANGE INTERVENTIONS: THE CASE OF THE BUNDESBANK**

In view of equations 1 and 2, we can now write the change in the monetary base during a period t as:

\[
\Delta B_t = \Delta IR_t + \Delta P_t + \Delta T_t, 
\]

where \(\Delta IR_t = (\Delta IR_S + \Delta IR_E)\) is the change in the total international reserves component. Consider now the impact of an exchange market intervention, say, to support the dollar. This requires an increase in foreign assets, \(\Delta IR_t > 0\). Under the two-stage control procedure described above, the Bundesbank may simultaneously reduce the transitory component if it wants to neutralize the immediate effect of the intervention on the monetary base. Thus, we may assume:

\[
\Delta T_t = \xi \Delta IR_t + v_t, 
\]

where \(v_t\) is a random variable that represents all other changes in the transitory component. Inserting (4) into (3) yields:

\[
\Delta B_t = (1 + \xi) \Delta IR_t + \Delta P_t + v_t. 
\]
If $\xi = -1$, the intervention is fully sterilized in the current period: There is no current effect on the base.

The two-stage monetary control strategy implies, however, that things do not end here. The initial decrease in the transitory component is reversed during subsequent periods. As this happens, the effect of the initial intervention on the growth of the monetary base is gradually realized. Therefore, even if foreign exchange interventions are sterilized completely in the current period, the growth of the base need not be independent of foreign exchange interventions in the longer run. Independence of base growth from foreign exchange interventions in the longer run can only be achieved by counteracting their effects with appropriate changes in the permanent component.

As a consequence of its control strategy for the monetary base, the Bundesbank has developed a two-stage sterilization procedure. The essential point is to distinguish between short-run and long-run sterilization. The former is brought about by variations of the transitory component as discussed above; the latter requires changes in the permanent component. To illustrate the two-stage procedure, let the change in the permanent component be:

$$\Delta P_t = u_t + \sum_{j=1}^{m} d_j \Delta R_{t-j}$$

where $u_t$ denotes changes in the permanent component, independent of exchange rate policies. Here, the sum $\sum_{j=1}^{m} d_j$ determines the degree of sterilization in the long run, and the individual $d_j$ parameters show how the sterilization with the permanent component is distributed over time. The effect of a one-time intervention in period $t$ on base money growth in the current period can be represented as:

$$B_t - B_{t-1} = u_t + (1 + \xi) \Delta R_t + v_t,$$

while the long-run effect is apparent from:

$$B_{t+m} - B_{t-1} = \sum_{j=0}^{m} (u_{t+j} + v_{t+j}) + (1 + \sum_{j=1}^{m} d_j \Delta R_t).$$

Equations (7) and (8) highlight the different roles of short-run and long-run sterilization in influencing the growth of the monetary base. Short-run sterilization reduces the immediate impact of an intervention on the monetary base and serves to distribute its effect more smoothly over time. Only long-run sterilization, however, can make monetary base growth independent of the consequences of exchange rate policies. This requires $\sum_{j=1}^{m} d_j = -1$, and is independent of the degree of short-run sterilization. For the conflict between monetary targeting and exchange rate targeting, the degree of long-run sterilization is the relevant issue because it determines the consequences of exchange market interventions on money growth over time.

Two conclusions can be drawn at this point. First, the strong negative correlations between contemporaneous or short-lagged changes in the domestic component and the international reserves component of the base pointed out by Camen (1986), Obstfeld (1983), Roubini (1988), Mastropasqua et al. (1988) and Bofinger (1988) only tell us about a high degree of short-run sterilization. Given the control strategy of the Bundesbank, these results per se have no implications for the independence of the Bundesbank's domestic monetary policy goals from its exchange rate policies in the EMS or in the coordination efforts of the G5.

Second, even if the degree of short-run sterilization is high, foreign exchange interventions can produce accelerations or decelerations in base and money over time simply because changes in the transitory component are reversed only gradually and with a lag of several periods. Therefore, the lag pattern found in table 1 is consistent with this distinction between short-run and long-run sterilization.

**Offsetting Interventions**

In practice interventions may not seriously endanger monetary control even if they are not sterilized in the long run. For example, different interventions can offset each other and thus neutralize their individual effects on monetary base growth. Such “offsetting” interventions can occur either over time or across markets.

Offsetting interventions that occur over time are possible if, in the absence of interventions, the exchange rate is subject to purely transitory, random fluctuations of mean zero, while the underlying “fundamental” exchange rate is constant. If the central bank decides to dampen exchange rate movements by intervening in the...
foreign exchange market, the resulting interventions would produce purely transitory fluctuations in the international reserves component. Since these fluctuations average out to zero over time, they contribute nothing to the growth of the monetary base over time, even without sterilization.¹⁵

Unfortunately, the fundamental exchange rate is not constant, as illustrated by the large swings in the DM-dollar rate and the persistent appreciation of the mark in the EMS since 1981 shown in figure 1. Worse than that, the fundamental rate is not known. Therefore, every change in the exchange rate can represent a fundamental change, a transitory change, or the sum of both. Thus, interventions to smooth only transitory fluctuations require knowledge of what is transitory and what is not, knowledge which is not available to policymakers. Misinterpreting fundamental for transitory movements will lead to interventions that do not average out over time, and therefore cannot be sterilized by the transitory base component alone.¹⁶

The dual exchange rate constraints in the EMS and the dollar market create an opportunity for the second kind of offsetting interventions. This could occur if, for example, intervention in the EMS is required to bring the mark's value in other EMS currencies down, while the mark is weak against the dollar at the same time. Intervention in the EMS then requires purchases of reserves, ΔIRE > 0, while stabilizing the mark against the dollar requires sales of dollar assets, ΔIR$ < 0. Such offsetting operations across the two markets seem to have occurred frequently between 1982 and 1985. For example, the Bundesbank reports that “the considerable inflows of foreign exchange from the EMS area did not pose any problem for Germany on balance because the Bundesbank simultaneously sold heavily in the dollar market in the form of smoothing interventions in favor of the Deutsche Mark.”¹⁷ In the figure, this is most clearly visible during 1982. Since the monetary base is affected only by the net change of the total international reserves component, the sterilization problem is considerably alleviated in this situation.

Thus, with two exchange rate constraints, the consequences of exchange rate policies for monetary targeting depend on the relative movement of the mark in the two markets. Specifically, the Bundesbank's exchange rate constraints are more likely to jeopardize monetary control if the mark is moving in the same direction in both markets, because this limits the possibility of offsetting interventions across markets. This suggests that empirical studies of the degree of sterilization by the Bundesbank should distinguish between periods of equal or opposite movements of the mark against the dollar and the EMS.

EMPIRICAL ESTIMATES OF SHORT-RUN AND LONG-RUN STERILIZATION

In this section I estimate the degree of sterilization of foreign exchange interventions for the Bundesbank over the period of 1979-88. In contrast to earlier studies, I distinguish between short- and long-run sterilization and look at subperiods according to the mark's relative strength.

The Data

The analysis is based on monthly data for changes in the monetary base and its sources from the Bundesbank's Monthly Reports. The data are calculated from averages of daily figures and are not seasonally adjusted. Changes in the international reserves component, ΔIR, are measured as “foreign exchange inflows to or outflows from the Bundesbank.” These foreign exchange flows are reported in actual, effective transaction values and measure precisely their effect on the base. This is the

¹⁵They do, however, increase the variability of base growth. Statements by the Bundesbank indicate that this is indeed its paradigm for exchange rate policies with regard to the dollar: Interventions are geared to dampen “erratic” fluctuations of the DM-dollar rate around the fundamental rate. See e.g. Dudler (1988), p. 69, Scholl (1983), p. 120.

¹⁶The Bundesbank has admitted that such interpretation errors have led to undesirable monetary developments on numerous occasions. See Bundesbank, “Vierzig Jahre Deutsche Mark,” Monthly Report, May 1988.

main advantage of using these data rather than balance sheet data, where, in accordance with German accounting laws, international reserves are reported at constant exchange rates throughout each year. One problem arising with these data—as well as with balance sheet data—is that they do not distinguish between changes in international reserves due to intervention and changes due to other sources. Even without intervention, the net foreign asset position of the Bundesbank would change over time as interest income on foreign assets is collected and exchanges of DM for dollars takes place in regular business with U.S. armed forces stationed in Germany. However, in the present context of testing for short-run and long-run sterilization, this does not pose a serious problem.

For interventions in EMS currencies, balance sheet data must be used. IRE is measured by the Bundesbank's net claims on the EMCF in connection with the EMS. Dollar market interventions are then obtained from ΔIR - ΔIRE = ΔIR$. Finally, to obtain an empirical counterpart of the transitory base component (T), we use the bank's "balance of short-term assistance measures on the money market" and add Lombard loans outstanding. The monthly changes in these variables are normalized by the lagged monetary base to obtain scale-free variables.

Regression Equations

I estimate the following regression model for the transitory component:

\[ \Delta T_t = \pi_t + \sum_{j=1}^{K} \alpha_{1,j} \Delta T_{t-j} + \alpha_{1,12} \Delta T_{t-12} + \sum_{j=1}^{N} \beta_{1,j} \Delta IR$, \, + \sum_{j=1}^{M} \gamma_{1,j} \Delta IRE_{t-1-j} + \nu_t. \]

The model has an autoregressive part and two sets of regressors, the two intervention variables ΔIR$ and ΔIRE. In equation 9, the parameter sums \( \sum_{j=1}^{n} \beta_{1,j} \) and \( \sum_{j=1}^{m} \gamma_{1,j} \) estimate the total degree of short-run sterilization achieved with the transitory component, while the individual coefficients \( \beta_{1,j} \) and \( \gamma_{1,j} \) show how this is distributed over the current and the following months.

The model for the monetary base is:

\[ \Delta B_t = \pi_t + \sum_{j=1}^{K} \alpha_{2,j} \Delta B_{t-j} + \alpha_{2,12} \Delta B_{t-12} + \sum_{j=1}^{N} \beta_{2,j} \Delta IR$, \, + \sum_{j=1}^{M} \gamma_{2,j} \Delta IRE_{t-1-j} + \nu_t. \]

Here, the sums of parameters \( \sum_{j=1}^{N} \beta_{2,j} \) and \( \sum_{j=1}^{M} \gamma_{2,j} \) measure the total impact of a given intervention on the base; \( \beta_{2,j} \) and \( \gamma_{2,j} \) reflect its distribution over time.

I estimate equations (9) and (10) over the total period, 1979 to 1988, and three subperiods. These subperiods, while necessarily somewhat arbitrary, were chosen in accordance with the characterizations shown in table 1: 1980-81 was a period in which the mark was generally weak against both the dollar and the EMS currencies, 1985-87 was a period in which the mark was mostly strong against both currency groups; 1982 to 1984 was a period in which the mark was generally weak against the dollar and strong against the EMS currencies.

Preliminary estimates of the two equations were run to select the appropriate lag lengths for the regressors. The preferred specifications have \( k = K = 3 \) lags for the autoregressive part.


19See e.g. Monthly Report, November 1988, p. 32.

20We may interpret ΔIR as the sum of the true effect of interventions plus a measurement error from other changes in international reserves. It is well-known that such errors-in-variables bias regression coefficients toward zero, unless the covariance of the measurement error and the equation error is positive and large relative to the magnitude of the coefficient being estimated. In tests of a short-run sterilization coefficient of negative one, and of no long-run effect of ΔIR on the base, the test is biased against full short-run and in favor of full long-run sterilization. Since the test results accept the former and reject the latter, they are actually stronger than indicated by the nominal significance levels used.

21All data except IRE are obtained from the Bundesbank's table III.3. IRE is taken from the Bank's table IX.6a.

22We estimate equations 6 and 8 together with an auxiliary equation for total interventions, ΔIR, or dollar market interventions, ΔIR$, using a three-stage least-squares (3SLS) estimator. The equation for ΔIR$ is a regression of these interventions on a set of instruments, namely lagged interventions, lagged changes in the DM-dollar rate and lagged German-U.S. interest rate differentials for call money and government securities. The use of these instruments allows us to solve the simultaneity problem that arises in equations 7 and 9, as exchange rates and hence interventions may be contemporaneously affected by changes in the base. Furthermore, the use of the 3SLS estimator is appropriate to account for the likely correlation of the error terms u, and w, for the EMS interventions, an instrumental estimator was not used because there were no appropriate instruments.
### Table 3

**Results for Transitory Sterilization (dependent variable $\Delta T$)**

<table>
<thead>
<tr>
<th>Sample</th>
<th>$\Delta\text{IRS}$</th>
<th>$\Delta\text{IRE}$</th>
<th>$\text{SE}$(%)</th>
<th>$F$</th>
<th>$R^2$</th>
<th>AR(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$F_\pi$ $\Sigma \tilde{a}_{1j}$</td>
<td>$F_\pi$ $\Sigma \tilde{b}_{1j}$</td>
<td>$F_\pi$ $\Sigma \tilde{y}_{1j}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/79-12/88</td>
<td>4.3**</td>
<td>-0.21</td>
<td>12.1**</td>
<td>10.9**</td>
<td>-0.82</td>
<td>2.70</td>
</tr>
<tr>
<td>1/80-12/81</td>
<td>6.0**</td>
<td>-1.33</td>
<td>6.1**</td>
<td>8.9**</td>
<td>-1.87</td>
<td>4.72</td>
</tr>
<tr>
<td>1/82-12/84</td>
<td>2.8*</td>
<td>0.32</td>
<td>10.4**</td>
<td>6.2**</td>
<td>-1.37</td>
<td>2.35</td>
</tr>
<tr>
<td>1/85-12/87</td>
<td>4.6**</td>
<td>-0.31</td>
<td>11.4**</td>
<td>6.5**</td>
<td>-0.30</td>
<td>2.72</td>
</tr>
</tbody>
</table>

**F-Tests for Short-Run Sterilization**

(degrees of freedom in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>$\Sigma \beta_{1j} = -1$</th>
<th>$\Sigma \gamma_{1j} = -1$</th>
<th>joint test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/79-12/88</td>
<td>2.3</td>
<td>0.8</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>(1,325)</td>
<td>(1,325)</td>
<td>(2,325)</td>
</tr>
<tr>
<td>1/80-12/81</td>
<td>0.3</td>
<td>3.6+</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>(1,40)</td>
<td>(1,40)</td>
<td>(2,40)</td>
</tr>
<tr>
<td>1/82-12/84</td>
<td>0.8</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>(1,76)</td>
<td>(1,76)</td>
<td>(2,76)</td>
</tr>
<tr>
<td>1/85-12/87</td>
<td>0.6</td>
<td>5.1*</td>
<td>2.5+</td>
</tr>
<tr>
<td></td>
<td>(1,76)</td>
<td>(1,76)</td>
<td>(2,76)</td>
</tr>
</tbody>
</table>

**NOTE:** SE is the regression standard error. $F_\pi$, $F_\pi$, $F_\pi$ are F-tests for the joint significance of the sets of parameters involved. Numerator degrees of freedom are: $F_\pi$ 3, $F_\pi$ 2, $F_\pi$ 2. Denominator degrees of freedom are: total period, 325; 1980-81, 40; 82-84, 76; 85-87, 76. $R^2$ is the multiple correlation coefficient. $F$ is the F-test for model significance. $R^2$ and $F$ are taken from the second stage estimates and apply to each equation individually. AR(6) is the test statistic of a Lagrange Multiplier test for residual autocorrelation up to lag six. AR(6) has a chi-square distribution with six degrees of freedom under the null of no autocorrelation. $+$, * and ** denote significance at the 10 percent, 5 percent and 1 percent levels.

and $m = n = 1$ lag for the intervention variables in the transitory component model, and $N=6$ and $M=4$ lags for dollar and EMS interventions in the base equation. These specifications were chosen because the inclusion of more lags did not improve the model's explanatory power, while further restrictions reduced it.

**Short-Run Sterilization**

Table 3 summarizes the result for the transitory component equation. The upper panel indicates that the regressions are highly significant for all samples and explain monthly changes in the transitory component fairly well. The AR(6) statistic shows no signs of residual autocorrelation. The significant negative sum of the AR coefficients agrees with the reversibility of the short-run operations involved. The only exception in the subsample 1982-84 where the own lags are not significant, presumably reflects the Bundesbank's attempt to build up a larger portfolio of loans to banks with repurchase agreements during this period. Both sets of intervention variables appear highly significant. In all subsamples and the total sample, the sums of the short-run sterilization coefficients $\beta_{1j}$ and $\gamma_{1j}$ have the expected negative signs.

Based on equation 9, the hypothesis of full short-run sterilization is given by:

$$
\sum_{j=1}^{m} \beta_{1j} = -1, \sum_{j=1}^{m} \gamma_{1j} = -1.
$$

The lower panel of table 3 reports the results of the tests for short-run sterilization. We test the hypothesis of full short-run sterilization separately for each type of intervention, and jointly. The hypothesis is not rejected for the total sample. Only for interventions in the EMS is full short-run sterilization rejected in the two
Table 4

Results for Long-Run Sterilization (dependent variable ΔB)

<table>
<thead>
<tr>
<th>Sample</th>
<th>own lags</th>
<th>Summary of Estimates</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>∆IR$\xi$</td>
<td>∆IRE</td>
<td>SE(%)</td>
<td>F</td>
<td>R$^2$</td>
<td>AR(6)</td>
<td></td>
</tr>
<tr>
<td>1/79-12/88</td>
<td>2.3+</td>
<td>-0.32</td>
<td>1.6</td>
<td>0.22</td>
<td>2.0+</td>
<td>0.24</td>
<td>1.08</td>
<td>13.3**</td>
</tr>
<tr>
<td>1/80-12/81</td>
<td>5.4**</td>
<td>-0.86</td>
<td>1.6</td>
<td>0.74</td>
<td>1.9</td>
<td>0.66</td>
<td>1.55</td>
<td>5.3**</td>
</tr>
<tr>
<td>1/82-12/84</td>
<td>0.4</td>
<td>0.23</td>
<td>0.6</td>
<td>-0.20</td>
<td>1.3</td>
<td>-0.30</td>
<td>1.41</td>
<td>7.8**</td>
</tr>
<tr>
<td>1/85-12/87</td>
<td>1.3</td>
<td>-0.30</td>
<td>4.0**</td>
<td>0.59</td>
<td>7.7**</td>
<td>0.30</td>
<td>0.72</td>
<td>7.1**</td>
</tr>
</tbody>
</table>

F-Tests for Long-Run Sterilization (degrees of freedom in parentheses)

$\Sigma\beta_{2i} = 0$  $\Sigma\gamma_{2j} = 0$  joint test

<table>
<thead>
<tr>
<th>Sample</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1/79-12/88</td>
<td>5.6*</td>
<td>4.8*</td>
<td>3.9*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1,325)</td>
<td>(1,325)</td>
<td>(2,325)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/80-12/81</td>
<td>5.3*</td>
<td>6.1*</td>
<td>5.6**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1,40)</td>
<td>(1,40)</td>
<td>(2,40)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/82-12/84</td>
<td>0.4</td>
<td>2.3</td>
<td>1.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1,76)</td>
<td>(1,76)</td>
<td>(2,76)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/85-12/87</td>
<td>9.4**</td>
<td>2.9+</td>
<td>6.7**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1,76)</td>
<td>(1,76)</td>
<td>(2,76)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: SE is the regression standard error. $F_\xi$, $F_p$, $F_r$ are F-tests for the joint significance of the sets of parameters involved. Numerator degrees of freedom are: $F_\xi$ 3, $F_p$ 6, $F_r$ 4. Denominator degrees of freedom are: total period, 325; 1980-81, 40; 82-84, 76; 85-87, 76. $R^2$ is the multiple correlation coefficient. F is the F-test for model significance. $R^2$ and F are taken from the second stage estimates and apply to each equation individually. AR(6) is the test statistic of a Lagrange Multiplier test for residual autocorrelation up to lag six. AR(6) has a chi-square distribution with six degrees of freedom under the null of no autocorrelation. +, * and ** denote significance at the 10 percent, 5 percent and 1 percent levels.

subsamples with equal relative stances of the mark, 1980-81 and 1985-87. The hypothesis of full short-run sterilization of dollar market interventions is never rejected.

Long-Run Sterilization

Table 4 presents a similar summary of the results for the monetary base. Again, all regressions are found highly significant and without residual autocorrelation. When tested separately, the two sets of intervention variables enter these equations significantly only in the 1985-87 subsample. However, if we test the significance of the dollar and the EMS interventions jointly, we find that the interventions together had significant consequences for German monetary base growth in 1980-81 and 1985-87.23 The sum of coefficients $\beta_{2i}$ and $\gamma_{2j}$ have the anticipated, positive signs in the total sample and these two subsamples.

The lower panel of this table reports the results of testing for full long-run sterilization:

$\sum_{j=1}^{N} \beta_{2j} = 0, \sum_{j=1}^{M} \gamma_{2j} = 0.$

We reject full long-run sterilization for both types of interventions in the total sample and the two subsamples when the mark's move-

23The joint tests yield the following F-ratios (degrees of freedom in parentheses): 1.5 (10,325) for the total sample, 2.1* (10,40) for 1980-81, 1.3 (10,76) for 1982-84, and 4.8** (10,76) for 1985-87.
Estimates With Switching Parameters

Table 4 indicates that the Bundesbank's long-run sterilization of foreign exchange interventions varied substantially between the subperiods considered here. But the estimates in these tables may suffer from small sample problems, as each subperiod is fairly short. To reduce this problem, I re-estimate the system using the total sample, 1979 to 1988, and modify the base equation to allow for regime shifts over time. For this purpose, I define a dummy variable with the value one for 1980, 1981, and 1985 to 1987, and zero elsewhere, and multiply it by the lagged intervention variables \( \Delta IRS_{-1} \) and \( \Delta IRE_{-1} \). The resulting variables are added as additional regressors to the base equations. The coefficients on these new regressors estimate the difference between the impact of interventions on monetary base growth in 1979, 1982-84, and 1988 vs. the remaining years.¹

The results of this step are reported in the table below. The first line of this table confirms the significance of the new regressors and, hence, of the change in regression parameters between the subperiods. Foreign exchange market interventions had a significant long-run impact on base money growth in the years of 1980 to 1981 and 1985 to 1987. The second part of the table reports the estimates \( \Sigma \beta_{2i} \) and \( \Sigma \gamma_{2i} \) and the results of the tests for long-run sterilization. Long-run sterilization prevailed in 1979, 1982-84 and 1988. However, long-run sterilization is strongly rejected for the remaining years, when the mark had similar relative positions in the EMS and the dollar market. Thus, the table corroborates the results of the earlier tables.

¹Treating the two periods 1980-81 and 1985-87 equally is justified by the result in table 4 that the sums \( \Sigma \beta_{2i} \) and \( \Sigma \gamma_{2i} \) in the base equation are similar for these periods. A similar modification for the transitory component seems unnecessary, as we find full short-run sterilization uniformly for all subperiods.

<table>
<thead>
<tr>
<th>Estimates of Base Equation with Shifting Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable: ( \Delta B ); Sample 1979 to 1988</td>
</tr>
<tr>
<td>( F_1 )</td>
</tr>
<tr>
<td>0.4</td>
</tr>
<tr>
<td>(6)</td>
</tr>
</tbody>
</table>

Tests for Long-Run Sterilization

\[
\begin{align*}
\Sigma \beta_{2i} & = 0.07 \\
\Sigma \gamma_{2i} & = 0.05 \\
\Sigma \beta_{2i} & = 0.61 \\
\Sigma \gamma_{2i} & = 0.49 \\
0.4 & = 10.7** \\
0.5 & = 5.4*
\end{align*}
\]

NOTE: \( F_1, F_x \) and \( F_1^d \) are F-tests for joint significance of the intervention variables, \( x = \Delta IRS, z = \Delta IRE \). Numbers in parentheses are numerator degrees of freedom. Denominator degrees of freedom are 315 (94 for F). "d" denotes tests and parameter estimates for the subperiods 1980-81 and 1985-87 for which the dummies are one. Numbers below the sum-of-parameter estimates are F-values for the null of full long-run sterilization, with one numerator degree of freedom. See previous tables for further symbols.
ments against the dollar and the EMS were in the same direction. Thus, the impact of foreign exchange interventions on monetary base growth was significant in times when the two exchange rate constraints required intervention in the same direction.24

The empirical results for short-run and long-run sterilization are thus very different. In contrast to short-run sterilization, long-run sterilization, which is the more relevant issue for monetary policy, did not generally hold throughout the 1980s. The shaded insert on the opposite page illustrates how this important conclusion is missed if the analysis fails to recognize the Bundesbank's distinction between short-run and long-run sterilization.

**Do EMS Interventions and Dollar Interventions Have the Same Effects?**

Did the Bundesbank's sterilization procedures treat interventions in the EMS significantly different from interventions in the dollar market? To answer this question, we test the hypotheses:

\[
\sum_{j=1}^{n} \beta_{1,j} = \sum_{j=1}^{m} \gamma_{1,j} \quad \text{and} \quad \sum_{j=1}^{N} \beta_{2,j} = \sum_{j=1}^{M} \gamma_{2,j},
\]

meaning that the extent of short- and long-run sterilization is the same for both types of interventions. The F-statistics pertaining to these tests for the total sample and the three sub-samples are all well below the 10 percent significance levels.25 Thus, we do not reject the hypothesis that, apart from differences in timing, sterilization is the same on both markets.

Even though the extent of sterilization was the same in the dollar market and the EMS, dollar market and EMS intervention had different implications for monetary growth in Germany during the 1980s. This result is due to the marked differences in the time profiles of these interventions. EMS interventions have occurred on a large scale mostly around realignments of the central parities. As the realignments involved revaluations of the mark, the Bundesbank generally experienced large inflows of international reserves before realignments, due to interventions supporting weak currencies. But the new central parities were usually chosen such that the mark would be temporarily in a relatively weak position in the EMS after the re-alignment. The realignments triggered outflows of reserves, which offset the initial expansionary effect.26 This general pattern is clearly demonstrated in figure 1.

Similar, self-reverting tendencies did not, in general, occur for interventions in the dollar market. The long-lasting changes in dollar reserves shown in figure 1 suggest that interventions in the dollar market, especially in the two critical periods of 1980-81 and 1985-87, had more permanent effects. These observations indicate that the monetary control implications of EMS and dollar market interventions have been very different: non-sterilized EMS interventions cause temporary deviations of monetary base growth from what is warranted by the monetary target. In contrast, dollar market interventions cause more permanent deviations and, particularly in the two critical periods, have contributed significantly to the over- and under-shooting of the monetary target.27

**IMPLICATIONS FOR MONETARY POLICY**

The fact that the Bundesbank fully sterilizes foreign exchange interventions in the short run but does not generally do so in the long run can be interpreted in two ways. Incomplete long-run sterilization may reflect the lack of suf-

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24 Finding a significant impact of interventions on monetary base growth does not necessarily imply that interventions became an obstacle to monetary targeting. For example, if the Bundesbank wanted to hold a constant share of its total assets in international reserves, the latter would have to grow in line with the monetary base [e.g. Scholl (1983), p. 120]. In this case, such reversed causality between base growth and growth of international reserves could lead to similar regression results as those above. However, we know from figure 1 that the net international reserves positions of the Bundesbank were subject to large swings, particularly during the years when long-run sterilization did not occur, which makes this interpretation implausible.

25 The following F-values are computed for this test (degrees of freedom in parentheses). Equal short-run sterilization: 0.2 (1,325), 2.8 (1,40), 0.1 (1,76), 2.2 (1,76) for 1979-88, 1980-81, 1982-84, 1985-87, respectively. Equal long-run sterilization: 0.0 (1,325), 0.0 (1,40), 0.1 (1,76), and 1.1 (1,76). For the base equation with shifting parameters, the F-value for equal long-run sterilization is 0.2 (1,315) for the interactive dummy terms.

26 See Bundesbank, Monthly Report, November 1988, p. 34.

27 This accords well with Dudley's (1988) assessment of the EMS and dollar market constraints. The result for the EMS also accords well with the findings about German dominance in the EMS in Fratianni and von Hagen (1990).
A Pitfall: Testing for Sterilization Using the Total Domestic Component

The distinction between short- and long-run sterilization, derived from the Bundesbank’s operating principles, is crucial to assess the impact of its exchange rate policies on monetary control in Germany. Had we looked only at the transitory component, we would have concluded that the Bank fully sterilized all interventions; this conclusion, which has been reached by most studies of the Bundesbank, would then suggest that exchange rate constraints have not interfered with Germany’s monetary targeting. The tests for long-run sterilization, however, show that this conclusion is erroneous.

To further demonstrate this point, I replace the base equation in the regressions cited in the text by an equation for the total domestic component, $\Delta D = \Delta B - \Delta IR$. Following the procedure used in the previous studies, I allow for a contemporaneous effect and two lags of the intervention variable. This yields the following estimates of $\sum \beta_{2j}$, the total impact of dollar market interventions: -1.06 for the total sample, -0.86 for 1980-81, -1.64 for 1982-84, and -1.25 for 1985-87. For the EMS interventions, the total impact of interventions is estimated as $\sum \gamma_{2j} = -1.02$ for the total sample, -1.11 for 1980-81, -0.99 for 1982-84, and -1.18 for 1985-87. In no case do I reject the hypotheses of complete sterilization. These results, similar to those for the transitory component, indicate that short-run fluctuations in the total domestic component and its short-run co-movements with the intervention variable are dominated by changes in the transitory component.

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market would imply that such interventions are ineffective, since the degree of capital mobility between Germany and the U.S. is high and it seems plausible to assume that short-term, interest-bearing assets in the two countries are very close substitutes.

However, the Bundesbank does find sterilized interventions in the dollar market effective, and recent empirical research confirms its claim. The distinction between perfect short-run and imperfect long-run sterilization becomes crucial in resolving this puzzle. If market participants understand that full sterilization holds only in the short run, while long-run sterilization is—or may be—imperfect, interventions would change market participants' expectations about the future growth of the money supply, and this change in expectations would lead to exchange rate movements even if the interventions were fully sterilized initially. That is, sterilized interventions act as a signal about future central bank behavior. This is the essence of Mussa's (1981) expectations argument of sterilized interventions. As Dominguez (1989) points out, market participants generally seem to be aware of central bank activities in the dollar market, so that they are able to read the intended signal. This lends some further plausibility to the expectations argument.

**The Bundesbank and the EMS**

The results provide some insights into the functioning of the EMS during the 1980s. They reject the popular hypothesis that sterilization of EMS interventions makes German monetary policy independent from policies in the EMS and puts the burden of adjustment to balance of payments problems on weak currency countries. The evidence suggests that the long-run independence of German money supply growth from influences in the EMS, shown in Fratianni and von Hagen (1990), should be rather attributed to the way realignments have been engineered in most cases. Our results suggest that, with its dual exchange rate constraint, the Bundesbank may be more likely to accept or even pressure for realignments to revalue the strong mark in the EMS when the dollar is weak than when it is high, since the mark's strength in both markets reduces the scope for offsetting interventions. This may explain why realignments have indeed been preceded by periods of dollar weakness in most cases.

**CONCLUSIONS**

Our results can be summarized as follows: Over the entire period under consideration, I cannot reject the hypothesis that the Bundesbank sterilizes foreign exchange interventions completely in the short run. However, complete intervention sterilization does not generally occur in the long run. Foreign exchange market interventions affect German monetary base growth significantly when the mark's movements against the dollar and the EMS currencies are in the same direction, that is, when the mark is relatively strong or relatively weak in both markets at the same time. This was the case in five out of the 10 years from 1979 to 1988. In contrast, exchange rate policies have no significant effect on German monetary control when the mark has unequal relative positions on the two markets. This suggests that, generally, persistent net intervention affects monetary control.

The results indicate that the Bundesbank's dollar policies and participation in coordinated interventions since 1985 have contributed significantly to the excess growth of the German money supply, relative to the Bank's monetary targets in the second half of the 1980s. The present revival of inflation in Germany—-in the spring of 1989, inflation in terms of the cost of living index was at an annual rate of 2.7 percent, up from zero in 1987—marks one cost of this monetary overexpansion and, consequently, of the policies leading to it. This result suggests that international policy coordination schemes that focus on exchange rates are more costly than they were previously believed to be.
REFERENCES


______. Monthly Reports, various issues, Frankfurt.


