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MONEY, CREDIT AND INTEREST RATES IN THE BUSINESS CYCLE

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ABSTRACT

Fluctuations of business activity in the United States clearly have their monetary and financial side, but these aspects of U.S. economic fluctuations exhibit few quantitative regularities that have persisted unchanged across spans of time over which the nation's financial markets have themselves undergone significant change.

The evidence on monetary and financial aspects of U.S. business cycles assembled in this paper shows major differences among the pre World War I, inter-war, and post World War II periods, and between the first and second halves of the post-war period. Evidence suggesting changes from one period to another repeatedly emerges, regardless of whether the method of analysis is simple or sophisticated, regardless of whether the underlying data are annual or quarterly, and regardless of whether the relationships under study are bivariate or multivariate. Moreover, the differences between one period and another are significant not just statistically but also economically, in the sense of major differences in the magnitude and timing of cyclical movements.

The paper's main message, therefore, is a warning against accepting too readily — either as a matter of positive economics or for policy purposes — the appearance of simple and eternal verities in much of the existing literature of monetary and financial aspects of business fluctuations. More complicated models involving many variables and/or nonlinear relationships may have remained stable, but the evidence clearly shows that simple linear relationships among only a few such variables have not.

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The monetary and financial aspects of fluctuations in economic activity have attracted the attention of economists and other observers of the business cycle for a long time. Throughout the nineteenth century and into the early years of the twentieth, business downturns in the United States were typically associated in a quite obvious way with "panics" or other sharp discontinuities in the financial markets. Such readily visible events have all but vanished since the establishment of the Federal Reserve System in 1914 and especially the Federal Deposit Insurance Corporation in 1934, but the pace of activity in the financial markets has continued to vary closely with that in many of the economy's nonfinancial markets. Much of this covariation is by now highly familiar, if not necessarily well understood. The regularities on which macroeconomists have focused most intensively in this context are those involving money (including either high-powered money or deposit money), credit (including public debt, private debt, or the sum of the two), and interest rates.[1] In large part because of the availability of data extending back to the early years of this century, and in some cases still earlier, the documentation of these regularities over fairly long time periods is now broadly familiar.

One factor motivating the long history of interest in this subject is, of course, simply the desire to understand more fully the underlying causes and internal dynamics of business fluctuations. Implications for public policy have also been important in this regard, however. A common thread running through decades of literature on the monetary and financial aspects of business cycles has been the actual or potential role of monetary

policy in affecting either real economic outcomes or price stability, or both. Indeed, even those strands of literature which have argued vigorously against the existence of any possibility for monetary policy to improve real outcomes have heavily emphasized the negative results to follow, typically via the speed or variability of price inflation, from an ill chosen (according to that view) policy regime.

The basic theme of this paper, in contrast to much of the extensive literature of the subject to date, is that the quantitative relationships connecting monetary and financial variables to the business cycle exhibit few if any strongly persistent regularities which have remained even approximately invariant in the context of the widespread and, in some instances, dramatic changes undergone by the U.S. financial markets over familiar time periods both long and short. At a qualitative level, of course, broadly familiar regularities have characterized many monetary and financial aspects of U.S. business fluctuations. The procyclical behavior of money, credit and interest rates is well known, as is the tendency of money and credit growth to "lead" real economic growth at major business cycle turning points. Nevertheless, these characteristic qualitative features of most business fluctuations have not corresponded to persistent regularities in the quantitative relationships that constitute the main focus of modern business cycle analysis.

The finding that stable quantitative relationships to monetary and financial variables have been absent from the U.S. business cycle experience does not mean that monetary and financial phenomena are unimportant elements of business fluctuations, nor that there is no consistent basis for seeking to understand or explain these phenomena. The basic monetary and financial elements of economic behavior have no

doubt persisted in some fundamental sense. The problem is instead that these basic elements of economic behavior do not correspond straightforwardly in theory or closely in practice to the specific quantities that economists can typically measure. In addition, the relevant behavior is probably far too complex to be readily represented in simple linear relationships limited to very few variables.

From the perspective of positive economics based on familiar and available data, therefore, the main message of this paper is that simple relationships usually taken to be central to monetary and financial aspects of business cycles have in the past changed often and much. From the perspective of inferences about monetary policy, the chief implication is a warning against proceeding as if any one, or a few, of these simple relationships will reliably remain immutable.

Changes in the working of the U.S. financial markets that are potentially important for monetary and financial aspects of business fluctuations are not difficult to identify. Within the twentieth century the entire apparatus and orientation of U.S. monetary policy have undergone several dramatic shifts. In addition to monetary policy, major changes in government regulation and the expansion of government intermediation have been further potentially important and often shifting influences. Moreover, the nation's private financial institutions and practices have also undergone profound and far reaching changes over these years, in part in response to changing patterns of government regulation and monetary policy but as a result, too, of private institutions' taking advantage of new developments elsewhere in the economy.

Any attempt to see whether the monetary and financial aspects of U.S. economic fluctuations have remained invariant, or nearly so, in

the face of these financial market changes must at the outset confront the methodological choice between structural and reduced-form approaches to this question. A structural framework imposes potentially valuable restrictions on the way in which the corresponding empirically estimated model summarizes the quantitative relationships exhibited by the prior experience in question. Whatever analysis is grounded in a specific structural model is therefore conditional on those restrictions. Restrictions that are valid reflections of actual economic behavior will enable the model to extract the relevant behavioral relationships more efficiently from the available data, but incorrect or arbitrary restrictions will distort the representation of those relationships. Either kind of error can introduce the appearance of change where in fact there has been continuity, or of continuity where there has been change.

The subject of monetary and financial influences on economic fluctuations is not lacking for suggested structural frameworks. One long-familiar strand of thinking along these lines, which has emphasized interest rate, asset price, and credit rationing effects on specific kinds of spending, is the expanded IS-LM aggregate demand model typical of the post-Keynesian neoclassical synthesis, perhaps best exemplified empirically by the MPS model.[2] A closely related line of structural analysis, which has placed more emphasis on portfolio substitutions and asset valuations, is the disaggregated asset market approach of Tobin (1961, 1969) and Brunner and Meltzer (1972, 1976). A third line of analysis, which in its structural components is also related to these two, but which has more narrowly emphasized the role of monetary assets in affecting aggregate demand, is the monetarist model of Friedman (1956, 1971), as exemplified empirically by the St. Louis model.[3] A more different line of structural

analysis is the rational expectations model of aggregate supply developed by Lucas (1972, 1973), and exemplified empirically by Sargent (1976). A still more recent line of analysis has been the explicit banking sector model of Fama (1980a, 1980b).[4] Moreover, each of these different structural approaches essentially refers to a closed economy. To the extent that the U.S. economy's increasing openness may also be important for monetary and financial aspects of economic fluctuations, the range of choice — and, consequently, of potential disagreement — is only greater.

The approach taken in this paper is to sidestep the choice among, or synthesis of, these disparate structural models, and to employ instead only a reduced-form empirical approach that in principal is compatible with any of them. The basic advantage in this approach is to avoid making the analysis conditional on explicit structural restrictions that would attract sharp disagreement from the outset, and that could indeed be incorrect. The key disadvantages are the loss of efficiency in the extraction of the relevant quantitative relationships from the data and, correspondingly, the loss of explicit connection between the estimated relationships and more specific elements of monetary and financial behavior.

Section I sets the stage for the empirical analysis by briefly reviewing the major twentieth century changes in the U.S. financial markets that would make it surprising if there had been no significant changes in the monetary and financial aspects of U.S. economic fluctuations during this period — at least under the view that the prevailing institutions, including government structures as well as private business practices, importantly affect economic behavior. Section II documents at a qualitative level the familiar interrelatedness of money, credit, interest rates and nonfinancial economic activity in a business cycle context, but

then goes on to point out some changes in these relationships over time that are apparent even at a very simple level of analysis. Section III digresses to consider the relationships connecting money, credit and their respective "velocities" to the flucutations of both nominal and real income during the economy's seven and one-half recognized business cycles since World War II. Section IV applies formal time-series and frequency-domain methods to examine at a quantitative level, and in an explicitly dynamic context, the familiar relationships introduced in Section II. Section V pursues this line of analysis further, to determine whether differences in these familiar relationships from one time period to another are signficant not just in a statistical sense but economically as well. Section VI digresses again to consider the post-war evidence on the economy's "credit cycle." Section VII concludes by summarizing the principal empirical findings presented throughout the paper.

I. Changes in the U.S. Economy's Financial Structure

Whether or not the monetary and financial aspects of economic fluctuations in the United States have changed their character over any specific period of time — within the twentieth century, for example, or since World War II, or since October 1979 — is an empirical issue. Before examining the evidence on this question, however, it is appropriate to ask whether during the relevant time period there have been changes in the economy's underlying financial structure that, at least in principle, could have effected changes in the cyclical relationships between monetary and financial variables and nonfinancial economy activity. Three broad categories of changes in the U.S. economy's financial structure stand out in this regard.

First, within the time period spanned by available data (and studied in this paper), the entire apparatus and orientation of U.S. monetary policy have undergone dramatic shifts. Before 1914 the United States had no central bank as such, but relied instead on a largely unregulated national banking system anchored by a gold standard. Prompted by a recurrent series of financial crises and panics, especially in 1901, 1907 and 1913, Congress created a new Federal Reserve System charged with the basic task of preserving stability in the financial markets — more specifically, instructed "to furnish an elastic currency." The macroeconomic objectives almost universally associated with monetary policy in the post World War II era, including especially the objective of price stability, received no mention in the original Federal Reserve Act.

Between 1914 and World War II, monetary policy evolved in a variety of ways, as Federal Reserve decision makers gradually came to understand what effects the System's open market purchases and sales of government

securities had in the new world of fractional reserve banking directly based on central bank liabilities. The establishment in 1923 of what subsequently evolved into today's Federal Open Market Committee led temporarily to an increasing emphasis on open market operations in a monetary policy context, but in the 1930s the confusions of the depression and the associated international monetary crisis, including the abandonment of the gold standard in 1934, arrested the development of the monetary policy mechanism. Then, during World War II and thereafter until 1951, this evolution effectively ceased as the Federal Reserve assumed an obligation to support the open market price of the government's outstanding debt (which was then almost entirely a war loan).

In 1951 the Treasury-Federal Reserve Accord relieved the central bank of this obligation, and monetary policy assumed the quasi-independent macroeconomic role it has played ever since. Even so, there have been several major changes in monetary policy orientation and procedures since then. In the early post-Accord years, the Federal Reserve keyed its operations to the net free reserve position of the commercial banking system. By the late 1960s, the principal policy focus had changed to setting interest rates on short-term debt instruments, sometimes Treasury bills and later on federal funds. From 1970 onward, quantity targets for the growth of various aggregative measures of money and credit, including especially the narrowly defined money stock (M1), played a generally increasing albeit sporadic role in the formulation and implementation of monetary policy. In 1979 the Federal Reserve announced a renewed emphasis on these quantity growth targets and adopted new operating procedures, based on the growth rate of nonborrowed bank reserves, for achieving them. In 1982 the M1 target was publicly suspended, however, and the weight placed on even the broader money and credit targets in 1982 and 1983 was uncertain. As of the time of writing,

the role of quantity growth targets in U.S. monetary policy may be central, irrelevant or, more likely, somewhere in between.

Second, the often shifting evolution of monetary policy has hardly been the only way in which actions of the federal government (not to mention those of state governments) have effected structural changes that may well have altered, perhaps importantly, how the economy's financial and nonfinancial markets interact in a business cycle context.[6] Government regulatory actions have also been a potentially important and often changing influence. The three most dramatic such changes — the insurance of private bank deposits, the prohibition of interest on demand deposits, and the separation of the commercial banking and securities industries — all took effect in the 1930s. Further potentially important changes in bank regulation and supervision have occurred since then from time to time, including most prominently the key legislation governing bank holding companies in the late 1960s and the deregulation of banks and other depository institutions in the early 1980s. Moreover, in several further complete turns of the wheel, the prohibition of interest on demand deposits has become effectively inoperative within the past decade, while long-standing prohibitions on interstate banking and on banking firms engaging in the securities business (and vice versa) are even now becoming fictional. Perhaps most importantly, in recent years the entire distinction between transactions balances and savings balances has become blurred to the point of meaninglessness.

Changes in government financial regulation have also extended well beyond the banking system and other depository institutions. The securities legislation of the 1930s created a whole new separate industry, and subsequent regulation has continued to affect how it works. Key regulatory changes effected by the Securities and Exchange Commission have ranged

from requiring competitive bidding in most public utility company underwritings beginning in the 1950s, to allowing the spread of open-end mutual funds beginning in the 1960s, to prohibiting fixed minimum commissions on stock exchange brokerage beginning in the 1970s, to permitting "shelf" offerings of corporate securities beginning in the 1980s. As a result of these and many other regulatory actions over the years, the securities markets in the United States function differently today than they did in earlier times.

The National Banking Act of 1933 introduced deposit interest rate ceilings, in part as a response to banks' alleged overly aggressive bidding for interbank demand deposits during the 1920s. The ceilings have also applied to time and saving deposits, however, and in this context they have at times had enormous impacts on the workings of the financial markets and on the financing of economic activity. Specific episodes of disintermediation during the 1960s and 1970s, due to Regulation Q ceiling rates that remained low in comparison to sharply rising market interest rates, led to the rise of whole new patterns of portfolio behavior and to periodic depression in the homebuilding industry. The Federal Reserve System first moved to eliminate these adverse effects in 1970 by suspending the ceiling on interest paid on most large bank certificates of deposit. As of the time of writing, these ceilings appear to be on the way out altogether as a result of the Depository Institutions Deregulation and Monetary Control Act of 1980.

A related development in the government's role in the credit market, which came about in part in response to the distortions caused by deposit interest ceilings, has been the great increase in government intermediation. The Federal Home Loan Bank System and the Federal Intermediate Credit Bank

began operations before World War II, but the scale of their activity was small at first and their initial focus was on agricultural credit. The Federal National Mortgage Association began its lending operations in 1955. Only in the 1960s and 1970s, however, as periodic disintermediation became severe, did the scope and size of government financial intermediation expand greatly. In recent years, the government sponsored credit agencies have been joined by pools issuing mortgage-backed securities that are not only government sponsored but, in some cases, formally guaranteed. As of the late 1960s, and as recently as 1982, it was not atypical for these quasi-government institutions to account for half or more of all home mortgage lending in the United States in high disintermediation years. Moreover, in recent years the federal government has extended its direct loan and loan guarantee operations far beyond housing- and agriculture-related credits, to the benefit of such diverse borrowers as college students, New York City, and the Lockheed and Chrysler corporations.

Third, the nation's private financial institutions and practices have undergone profound and far reaching changes over these years, in part in response to changing patterns of government regulation and monetary policy but also in large part as a result of private initiatives taking advantage of new developments elsewhere in the economy, including especially the rapidly changing technology of communications and data processing. New forms of deposits (for example, negotiable time certificates, Eurodollar credits, and money market deposit accounts) and new securities (for example, variable-rate mortgages, floating-rate notes, interest rate futures, and listed stock options) have come, and in some cases gone. So have new kinds of financial institutions (for example, money market mutual funds and mortgage pass-through pools).

Other forms of change in private financial practices have been more gradual, but potentially just as important. The nation's financial markets have steadily become less segmented, and presumably more efficient in the classic sense. Diverse regional markets have become more integrated, though still far from entirely so, and barriers separating different kinds of borrowers from different kinds of depositors or lenders have steadily eroded. Meanwhile, some institutions like pension funds and credit unions have grown rapidly in relative terms, while others like insurance companies and mutual savings banks have done the opposite. In a further series of developments of potentially very great importance for the questions at issue here, the U.S. financial markets as a whole have at times become less open to foreign participation, and more recently more so, as capital controls have come and gone, while most (though not all) foreign markets have become more accessible from here. Indeed, during large parts of the period under study here, many key foreign currencies simply were not convertible.

Although adequately summarizing the elements of these private financial market changes that are of greatest potential importance in a business cycle context is probably impossible, given the space available here, several basic trends that are relevant in this context stand out. One is that transactions costs have fallen, irregularly but persistently nonetheless, over the period under study in this paper. Another is that financial assets have increasingly become negotiable, and those which have always been negotiable have become more liquid. A third is that, despite the potentially very important episodes of retrogression, financial markets around the world have in fact become more closely integrated.

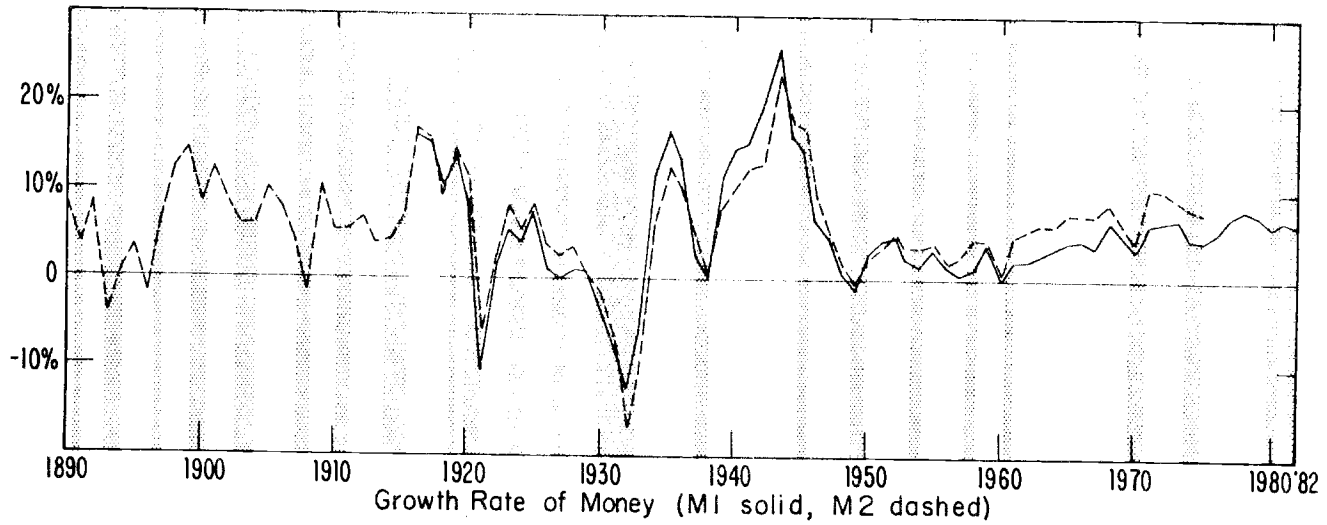
In light of these changes in the role of monetary policy, in government regulations and intermediation, and in private financial institutions and practices, it would be astonishing if there had been no changes at all

in the relationships connecting money, credit and interest rates to U.S. economic fluctuations. In the context of business cycles, however, as opposed to a study of financial markets per se, what matters is whether these (or still other) changes have brought about significant, and economically important, changes in such relationships at the macroeconomic level.

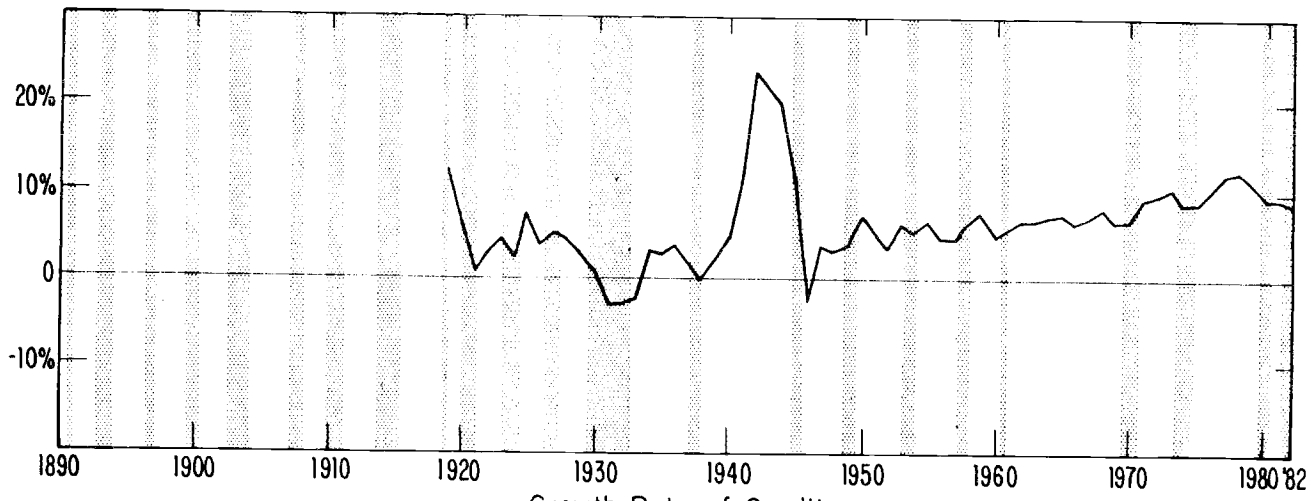
II. Basic Cyclical Relationships in Monetary and Financial Data

The four panels of Figure 1 give an overview of the basic relationships of four key monetary and financial variables to U.S. economic fluctuations by showing these variables' annual variation from either 1891 or 1919 to the present. The figure does not explicitly include any measure of nonfinancial economic activity, but the conventional shadings indicate business contractions as designated by the National Bureau.

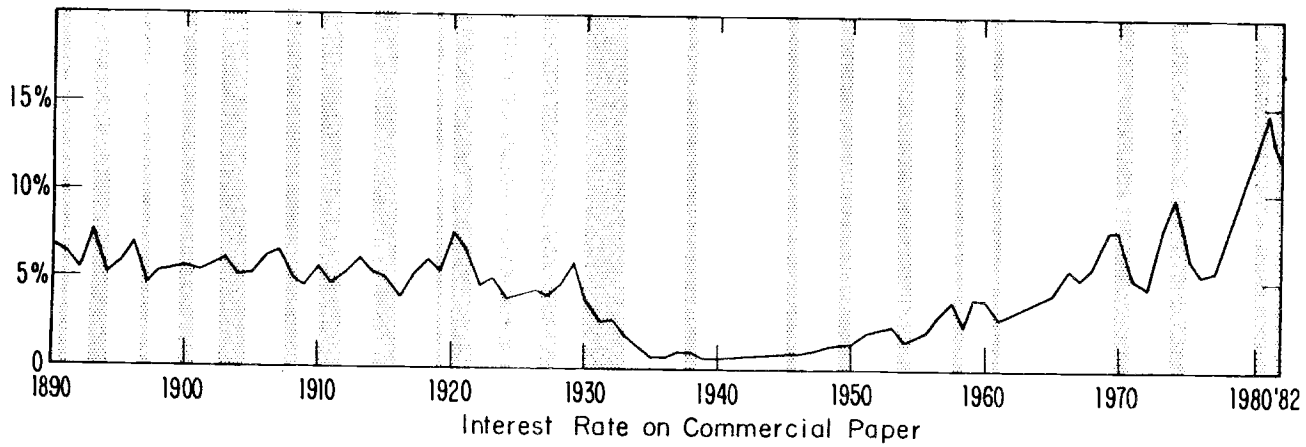
The top panel of the figure shows the annual percentage change in the money stock, measured both by the Friedman-Schwartz "old M2" concept for 1891-1975 and by the "new M1" concept for 1919-82. The "old M2" measure includes currency held by the public plus "adjusted" total deposits at commercial banks but not at nonbank depository institutions (and also, since 1961, excluding large certificates of deposit).[7] The "new M1" measure is that adopted in 1980 (as "M1-B") by the Federal Reserve System, including currency held by the public plus all checkable deposits other than those held by foreign commercial banks and official institutions, and as amended in 1982 to include travellers' checks.[8] As is well known from the work of Friedman and Schwartz (1963, 1970, 1983) and others, the major historical fluctuations in U.S. nonfinancial economic activity have been accompanied by often sharp fluctuations in the rate of money growth. Prominent examples that stand out in the figure include the episodes of negative money growth in 1921, 1931 and 1949, and the sharp slowing of money growth in 1938. Especially during the post World War II period, however, fluctuations in economic activity and variations in money growth have both been more modest. The comovement of money growth and real economic growth has been less pronounced also, although it is still readily visible.



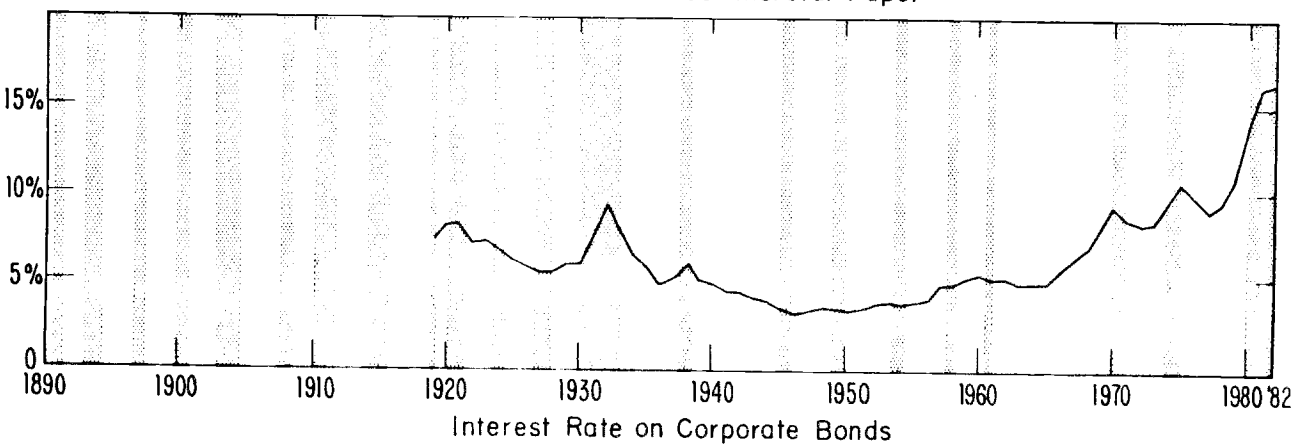
Growth Rate of Money (M1 solid, M2 dashed)



Growth Rate of Credit



Interest Rate on Commercial Paper



Interest Rate on Corporate Bonds

FIGURE 1

MONEY, CREDIT AND INTEREST RATES IN THE BUSINESS CYCLE

The second panel of Figure 1 shows the annual percentage change in domestic nonfinancial credit, including the total outstanding credit market indebtedness of all U.S. public and private sector borrowers other than financial intermediaries.[9] As is documented in Friedman (1981, 1983a), domestic nonfinancial credit has also borne a close relationship to U.S. nonfinancial economic activity, especially in the post-war period. Even before World War II, however, several major episodes of negative credit growth, including those in 1921, 1931 and 1938, stand out as having occurred in conjunction with recognized economic fluctuations.

The bottom two panels of Figure 1 show the annual average levels of interest rates on prime 4-6 month commercial paper offered in New York, and on Baa-rated corporate bonds, respectively.[10] The main features that stand out immediately in the interest rate data are the great volatility of both short- and long-term rates before 1930 and after 1970, the extraordinarily low level of both rates during the late 1930s and early 1940s, and the persistent upward trend since World War II. As is thoroughly familiar, however, interest rates also fluctuate cyclically, and many of the recognized business cycle episodes during this period also coincide with readily visible interest rate movements.

Table 1 focuses more closely on the comovements of both the M1 money stock and domestic nonfinancial credit with economic activity by arranging seasonally adjusted quarterly data in the context of the seven and one-half complete episodes since World War II designated as contractions and expansions by the National Bureau.[11] For each designated contraction or expansion, the table shows the average per annum growth rate of money and credit, respectively.[12] Despite the secular post-war trend toward faster growth of money and credit,

TABLE 1

POST-WAR CYCLICAL MOVEMENTS OF MONEY AND CREDIT

Business Cycles		Average Growth Rate of Money (M1)		Average Growth Rate of Credit	
Peaks	Troughs	Contractions	Expansions	Contractions	Expansions
1948:IV					
		-.75%		—	
	1949:IV				
			3.90%		—
1953:II					
		1.16		5.28%	
	1954:II				
			1.69		5.67%
1957:III					
		.64		5.42	
	1958:II				
			2.30		6.77
1960:II					
		1.43		4.65	
	1961:I				
			4.14		6.89
1969:IV					
		4.53		6.71	
	1970:IV				
			6.72		9.61
1973:IV					
		4.38		8.48	
	1975:I				
			6.65		10.90
1980:I					
		6.60		8.81	
	1980:III				
			7.89		9.44
1981:III					
		6.69		8.71	
	1982:IV				
Mean for All Contractions		3.08%		6.86%	
Mean for All Expansions			4.76%		8.21%

Note: Values shown are in percent per annum.

the strongly cyclical aspect of both money growth and credit growth stands out clearly in these summary data. Money growth in expansions has exceeded money growth in contractions by nearly 1 3/4% per annum on average, while credit growth in expansions has exceeded credit growth in contractions by nearly 1 1/2% per annum on average. The basic cyclical regularity is much more striking than these average differences suggest, however. Money growth in each expansion was faster than in the preceding contraction, and money growth was slower in each contraction than in the preceding expansion. Similarly, credit growth in each expansion was faster than credit growth in the preceding contraction, and credit growth in each contraction was slower than in the preceding expansion.

Table 2 presents analogous data (not seasonally adjusted) for the post-war cyclical levels and movements of short- and long-term interest rates. Once again a secular post-war trend, toward higher interest rates and larger (absolute) interest rate changes, stands out immediately. Interest rates have also exhibited strong cyclical regularities, but they are not so striking as in the case of money and credit growth. Interest rate levels have been lower in expansions than in contractions by about 3/4% on average, but there has hardly been uniformity in this respect. In only two expansions were short-term interest rates lower than in the previous contraction, and in only one expansion was the long-term rate lower (by more than a single basis point).[13]

By contrast, the chief cyclical regularity that does stand out in Table 2 is the rise of the short-term interest rate in every expansion and the corresponding decline in every contraction. The 6 3/4% (algebraic) difference between the average short-term rate change in expansions and in

TABLE 2

POST-WAR CYCLICAL MOVEMENTS OF INTEREST RATES

Business Cycles		Average Level of Short Rate		Average Level of Long Rate		Change in Short Rate		Change in Long Rate	
Peaks	Troughs	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions
1948:IV									
		1.50%		3.43%		-.20%		-.19%	
	1949:IV								
			2.00%		3.42%		1.25%		.47%
1953:II									
		2.28		3.69		-.99		-.31	
	1954:II								
			2.68		3.87		2.32		1.38
1957:III									
		3.12		4.79		-2.24		-.28	
	1958:II								
			3.52		5.00		2.36		.65
1960:II									
		3.43		5.12		-1.06		-.19	
	1961:I								
			4.72		5.72		5.61		3.44
1969:IV									
		7.89		8.97		-2.32		.65	
	1970:IV								
			6.02		8.38		2.69		.70
1973:IV									
		9.15		9.58		-2.42		2.18	
	1975:I								
			7.57		10.10		7.69		3.04
1980:I									
		11.55		13.42		-4.61		-.23	
	1980:III								
			14.05		15.20		6.57		3.20
1981:III									
		12.78		16.22		-7.40		-2.36	
	1982:IV								
Mean for All Contractions		6.46%		8.15%		-2.65%		-.09%	
Mean for All Expansions			5.79%		7.38%		4.07%		1.64%

contractions, respectively, dwarfs the small difference in the corresponding average levels. The long-term interest rate has also risen in all seven post-war expansions and declined in six of the eight contractions, although here the (algebraic) difference for the respective average changes has been much smaller, as most familiar theories of the pricing of long- versus short-term assets imply.

In summary, both the annual data plotted in Figure 1 and the cycle-specific averages of quarterly data shown in Tables 1 and 2 give the impression of strong and persistent regularities in the monetary and financial aspects of U.S. economic fluctuations. On closer inspection, however, many of these regularities turn out not to be so regular or so persistent after all. Although the investigation of these relationships in a dynamic context is the subject of Sections IV and V below, Table 3 provides a quick overview by showing simple correlation coefficients relating the annual movements of the monetary and financial variables plotted in Figure 1 to the annual percentage change in real gross national product.[14] For the monetary and credit aggregates, the table also shows analogous correlations for the corresponding aggregates deflated by the gross national product price deflation.

In order to highlight changes in these relationships over time, Table 3 presents correlation coefficients separately for the pre World War I (1891-1916), inter-war (1919-40), and post World War II (1947-82) periods, and also for two sub-periods (1947-65 and 1966-82) within the post-war period. Especially from the perspective of changes in monetary policy, other possible breaks in the post-war period would also be logical, including 1951 when the Treasury-Federal Reserve Accord took effect, 1970 when the Federal

TABLE 3

SIMPLE ANNUAL CORRELATIONS WITH REAL ECONOMIC GROWTH

	1891-1916	1919-40	1947-82	1947-65	1965-82
Money (M1)	—	.20	-.22	-.02	-.18
	—	.69***	.17	.46**	.43*
	—	.43*	.05	.19	.13
Real Balances (M1)	—	.28	-.04	.11	-.06
	—	.77***	.42***	.56**	.36
	—	.19	.12	.13	.05
Money (M2)	-.02	.09	—	.04	—
	.65***	.64***	—	.22	—
	-.18	.56**	—	.12	—
Real Balances (M2)	-.08	.22	—	.13	—
	.58***	.85***	—	.44**	—
	-.29	.34	—	.10	—
Credit	—	.25	-.17	.01	.04
	—	.69***	.13	.54**	.31
	—	.50**	-.20	-.54**	.12
Real Credit	—	-.00	-.07	-.01	.01
	—	.34	.49***	.52**	.67***
	—	-.31	.15	-.38	.56**
Short Rate	-.21	.22	-.34**	-.03	-.48**
	-.39*	-.24	-.65***	-.49**	-.79***
	.56***	.19	.26	.55**	.20
Long Rate	—	-.59***	-.52***	-.74***	-.52**
	—	-.65***	-.38**	-.05	-.52**
	—	.03	-.02	-.04	-.01

Notes: ***significant at .01 level
**significant at .05 level
*significant at .10 level

Reserve System first began to employ explicit monetary aggregate targets and also first began to suspend Regulation Q ceilings, and 1979 when the Federal Reserve (temporarily) adopted new operating procedures. The break at 1966 roughly separates the early post-war years of low price inflation, stable real economic growth and few apparent "supply shocks" from the subsequent years of rapid and accelerating price inflation, less stable and on average slower real growth, and occasional large supply-side disturbances.

For each monetary or financial variable among the eight considered, and for each separate time period, Table 3 reports the simple correlation of the variable's annual percentage change (for interest rates, the absolute change) with the annual percentage change of real gross national product for three lead-lag relationships: first with the monetary or financial variable leading real growth by one year, next contemporaneously, and last with that variable lagging real growth by one year.

In contrast to the appearance of strong regularities in Figure 1 and in Tables 1 and 2, the dominant impression given by these correlations is the absence of systematic relationships that have persisted across the different time periods under consideration.[15] The only two consistently significant relationships are the tendency of real M2 growth to be rapid (slow) contemporaneously with rapid (slow) real growth, and of long-term interest rates to fall (rise) in the year before a year of rapid (slow) real growth. Nominal M1 growth was strongly positively correlated with contemporaneous real growth during the inter-war period, but less so during either half of the post-war period considered separately and not at all for the post-war period overall. Real M1 growth was strongly correlated with contemporaneous real economic growth earlier on, but not during the

later post-war period. Neither nominal nor real M1 growth has shown a significant lead or lag relationship to real economic growth on an annual basis. Nominal M2 growth was strongly positively correlated with contemporaneous real growth during the pre-war and inter-war periods, but not since World War II.

Nominal credit growth resembles nominal M1 growth in being strongly postively correlated with contemporaneous real economic growth during the inter-war period and the early post-war period, but not for the later post-war period or for the post-war period as a whole. For the inter-war and early post-war periods, lagged credit growth has been significantly correlated with real economic growth, although positively in the former years and negatively in the latter. Real credit growth has been positively correlated with real economic growth on a contemporaneous basis throughout the post-war period, but it was not so earlier on.

Finally, both short- and long-term interest rate changes have been negatively correlated with contemporaneous real economic growth, and (except for short-term rates in the inter-war period) with the following year's real growth, throughout the period under study here. Many of these correlations are not significant, however. The contemporaneous relationship for short-term rates is significant except for the inter-war years, and for long-term rates it is so except for the early post-war period. The change in short-term rates has been positively correlated with the prior year's real growth, but significantly so only during the pre-war and early post-war periods.

Simple correlations based on annual data are a crude way of summarizing economic relationships, of course, even when they allow for

modest leads or lags. Nevertheless, if the regularities connecting monetary and financial variables to business cycles were sufficiently powerful and persistent, they would be likely to show up more strongly even in these simple correlations. That they do not is hardly the end of the story, but the fact that it is necessary to look harder in order to find them is itself suggestive.

III. Money, Credit and "Velocity" in Post-War Business Cycles

A subject that has run throughout the long standing literature of monetary and financial aspects of economic fluctuations is the respective roles in this context of money (or credit) and the associated "velocity" defined simply as the ratio of nominal income to money (or, again, to credit). Before examining the U.S. experience in this regard, it is useful to point out the absence of any economic meaning of "velocity" as so defined — other than, by definition, the income-to-money ratio. Because the "velocity" label may seem to connote deposit or currency turn-over rates, there is often a tendency to infer that "velocity" defined in this way does in fact correspond to some physical aspect of economic behavior. When the numerator of the ratio is income rather than transactions or bank debits, however, "velocity" is simply a ratio.[16]

As Table 1 shows for the post-war period, both money and credit grow faster on average during economic expansions than during contractions. The issue of money or credit movements versus their respective "velocities," in a business cycle context, is simply the distinction between movements of nominal income that match movements of money or credit and movements of income that do not, and hence that imply movements in the income-to-money or income-to-credit ratio.

Table 4, using quarterly data for post-war cyclical episodes exactly analogues to the money and credit growth averages in Table 1, shows that the "velocity" associated with each aggregate has also exhibited strong cyclical properties. Monetary velocity, which has had an upward secular trend since World War II, has risen on average in each expansion

and has declined on average in six of eight contractions. The average growth of monetary velocity in expansions has exceeded that in contractions by about 4 3/4% per annum, a much greater difference than the 1 3/4% per annum shown in Table 1 for money growth itself. Credit velocity, which has been trendless on average since World War II, has risen on average in four of six expansions and declined on average in each contraction. The average growth of credit velocity in expansions has exceeded that in contractions by about 4 1/4% per annum, again a much larger difference than the 1 1/4% per annum difference shown in Table 1 for credit growth.

Because the numerator of the "velocity" ratio is nominal income, while business cycle expansions and contractions typically refer to fluctuations of real economic activity, it is difficult to go much further in considering money, credit and their respective "velocities" in a business cycle context without allowing for cyclical variation in price inflation. As Table 5 shows, however, during the post-war period price inflation has apparently followed the business cycle with a sufficient lag that the movements of real and nominal gross national product during expansions and contractions have almost exactly corresponded on average. Real income, of course, has grown on average in each expansion and declined on average in each contraction, with an (algebraic) difference of nearly 6% per annum between the mean for all expansions and the mean for all contractions. By contrast, because of the upward secular trend in price inflation, nominal income declined in the first three post-war contractions but increased in the subsequent five. Even so, the difference between the average growth of nominal income in expansions and contractions, respectively, has been about 6 1/2% per annum — almost identical to the corresponding difference

TABLE 4

POST-WAR CYCLICAL MOVEMENTS OF MONEY AND CREDIT "VELOCITIES"

Business Cycles		Average Growth Rate of Money "Velocity"		Average Growth Rate of Credit "Velocity"	
Peaks	Troughs	Contractions	Expansions	Contractions	Expansions
1948:IV					
		-1.61%		—	
	1949:IV				
			5.57%		—
1953:II					
		-2.00		-6.12%	
	1954:II				
			4.46		.47%
1957:III					
		-1.00		-5.78	
	1958:II				
			4.26		-.21
1960:II					
		-1.17		-4.39	
	1961:I				
			3.03		.27
1969:IV					
		-.16		-2.34	
	1970:IV				
			3.01		.12
1973:IV					
		2.35		-1.75	
	1975:I				
			3.95		-.29
1980:I					
		.47		-1.74	
	1980:III				
			4.34		2.79
1981:III					
		-2.33		-4.35	
	1982:IV				
Mean for All Contractions		-.68%		-3.78%	
Mean for All Expansions			4.08%		.53%

Note: Values shown are in percent per annum.

TABLE 5

POST-WAR CYCLICAL MOVEMENTS OF REAL AND NOMINAL INCOME

Business Cycles		Average Growth Rate of Real Income		Average Growth Rate of Nominal Income	
Peaks	Troughs	Contractions	Expansions	Contractions	Expansions
1948:IV					
		-.37%		-2.36%	
	1949:IV				
			6.36%		9.47%
1953:II					
		-1.94		-.84	
	1954:II				
			3.43		6.15
1957:IV					
		-2.11		-.36	
	1958:II				
			4.62		6.56
1960:II					
		-.38		.26	
	1961:I				
			4.38		7.17
1969:IV					
		-.54		4.37	
	1970:IV				
			4.51		9.73
1973:IV					
		-2.79		6.73	
	1975:I				
			3.73		10.60
1980:I					
		-2.27		7.07	
	1980:III				
			3.45		12.23
1981:III					
		-1.42		4.36	
	1982:IV				
Mean for All Contractions		-1.48%		2.40%	
Mean for All Expansions			4.35%		8.84%

Note: Values shown are in percent per annum.

for real income. At least for averages across business cycle expansions and contractions, therefore, relationships to nominal income (like those based on "velocity" ratios) approximately carry over to relationships to real income, and hence to economic fluctuations in the ordinary business cycle sense. Table 6 summarizes these relationships by collecting the means from Tables 1, 4 and 5 and the corresponding implied means of price inflation.[17]

Table 7 pursues further the distinction of money and credit growth versus "velocity" growth by showing an analysis of variance for the respective real and nominal income identities summarized in terms of means in Table 6. The upper half of the table first decomposes the variation of real income growth into components representing nominal growth, price inflation and their covariance, and then decomposes the variation of nominal income growth into components representing money growth, "velocity" growth (that is, nominal income growth which does not correspond to money growth) and the associated covariance term.

The first column of the table applies this decomposition only to contractions, treating each one as a simple observation — in other words, asking what role money growth, "velocity" growth and price inflation have played in accounting for differences between one business contraction and another. The average (negative) real growth rate has varied little among successive contraction episodes, so that the differences here are almost entirely differences among respective contractions' rates of price inflation and hence of nominal growth. The results show that money growth variations have dominated velocity growth variations in accounting for these differences. Analogous results presented in the second column show an even greater

TABLE 6

CYCLICAL MEANS FOR INCOME, MONEY, CREDIT AND "VELOCITY"

1948:IV-1982:IV

	8 Contractions	7 Expansions	Difference
Mean X	-1.48%	4.35%	5.83%
Mean Y	2.40	8.84	5.44
-Mean P	-3.89	-4.51	-.62
Mean Y	2.40%	8.84%	6.44%
Mean M	3.08	4.76	1.68
Mean Vm	-.68	4.08	4.76

1953:II-1982:IV

	7 Contractions	6 Expansions	Difference
Mean X	-1.64%	4.02%	5.66%
Mean Y	3.08	8.74	5.66
-Mean P	-4.72	-4.72	.00
Mean Y	3.08%	8.74%	5.66%
Mean C	6.86	8.21	1.35
Mean Vc	-3.78	.53	4.31

Notes: Values are in percent per annum.
Detail may not add to totals because of rounding.
Definitions of variable symbols:

X = growth rate of real GNP
Y = growth rate of nominal GNP
P = growth rate of GNP price deflator
M = growth rate of M1 money stock
Vm = growth rate of Y/M
C = growth rate of domestic nonfinancial credit
Vc = growth rate of Y/C

TABLE 7

CYCLICAL VARIANCE DECOMPOSITIONS FOR MONEY, CREDIT AND "VELOCITY"

1948:IV-1982:IV

	8 Contractions	7 Expansions	15 Periods
Var (X)	.89	1.03	9.96
Var (Y)	13.38	5.17	19.96
Var (P)	17.66	6.56	11.74
-2 Cov (Y,P)	-30.15	-10.70	-21.76
Var (Y)	13.38	5.17	19.96
Var (M)	8.04	5.64	7.18
Var (Vm)	2.30	.79	7.52
+2 Cov (M, Vm)	3.04	-1.26	5.25

1953:II-1982:IV

	7 Contractions	6 Expansions	13 Periods
Var (X)	.81	.30	9.14
Var (Y)	11.28	6.11	16.80
Var (P)	14.04	7.42	10.11
-2 Cov (Y,P)	-24.51	-13.23	-17.77
Var (Y)	11.28	6.11	16.80
Var (C)	3.22	4.20	3.85
Var (Vc)	3.42	1.31	7.25
+2 Cov (C,Vc)	4.64	.60	5.70

Note: Values are in percent per annum squared.
See Table 6 for definitions of variable symbols.

predominance of money growth variations over velocity growth variations in accounting for nominal income growth differences across expansions. The final column of the table presents the results of an analogous decomposition applied to all contractions and all expansions, again treating each as a single observation — in other words, asking what role money growth, velocity growth and price inflation have played in accounting for differences not just among contractions or among expansions but also between contractions and expansions. In this context the respective variations of money growth and velocity growth have been more nearly coequal, and also importantly correlated.

The lower half of Table 7 presents the analogous three sets of decompositions including credit and credit "velocity." The results are similar to those for money and money velocity shown above, but in each case with a smaller role for the aggregate, and consequently a greater role for velocity. Variations in credit growth have predominated over velocity growth variations only in accounting for differences among expansions. For differences among contractions, the two have been approximately coequal, and importantly correlated. Variations in credit velocity, and its correlation with credit growth variations, have been more important than variations in credit growth per se in the broader cyclical context of accounting also for differences between expansions and contractions.

IV. Dynamic Relationships

Simple annual correlations like those shown in Table 3 fail to convey that it is important to know about the comovement of economic time series in a business cycle context for at least three reasons. First, the relevant lead-lag relationships may be distributed over either more or less than one year. The work of Friedman and Schwartz (1963), for example, concluded that variations in money growth typically lead variations in income growth by less than a year. Second, even highly significant lead correlations may merely reflect the interaction of contemporaneous (or even lagged) relationships among time series that are individually autocorrelated. In contrast to the propositions that characterized much of the earlier literature of monetary and financial aspects of economic fluctuations, which typically referred simply to the comovement among two or more variables, the modern analysis of business cycles focuses instead on whether movements in one variable are systematically related to those parts of the movements in another that are not purely autoregressive. Third, the relationship of one variable to another may depend on what further variables the analysis includes. The proposition that two variables exhibit a stable relationship to one another without allowance for further variables implies either that other variables are unimportant to that relationship or that whatever other variables are relevant have not varied (will not vary) significantly during the period under study. The results presented in this section of the paper extend the simple overview provided in Table 3 so as to take account of each of these potentially important considerations.

Table 8 presents F-statistics for conventional exogeneity ("causality") tests of bivariate annual relationships connecting nominal income growth respectively to the growth of M1, M2 and credit, and the change in short-

TABLE 8

SUMMARY OF BIVARIATE ANNUAL RELATIONSHIPS: FINANCIAL VARIABLES AND NOMINAL INCOME

	1891-1916	1919-40	1947-82	1947-65	1966-82
Equation for Y					
F(Y)	—	.21	1.97	1.21	1.20
F(M1)	—	1.39	6.87***	6.38**	.32
Equation for M1					
F(Y)	—	1.13	1.64	.93	.17
F(M1)	—	4.77**	13.77***	2.83*	4.10**
Equation for Y					
F(Y)	4.01**	.08	—	1.68	—
F(M2)	4.07**	1.01	—	.19	—
Equation for M2					
F(Y)	2.11	.54	—	1.11	—
F(M2)	3.29*	2.20	—	1.38	—
Equation for Y					
F(Y)	—	.16	2.12	.64	5.82**
F(C)	—	3.14*	9.83***	.40	11.18***
Equation for C					
F(Y)	—	.03	18.21***	18.17***	1.98
F(C)	—	1.08	64.11***	2.59	11.89***
Equation for Y					
F(Y)	.34	2.92*	.28	1.01	5.75**
F(Rs)	4.09**	1.42	1.03	.67	8.82***
Equation for Rs					
F(Y)	1.70	.88	.51	.21	.77
F(Rs)	9.86***	.95	4.29**	3.38*	1.88

Table 8 continued on next page

Equation for Y					
F(Y)	—	.15	.09	1.12	.37
F(Rl)	—	6.23**	.31	4.32**	1.91
Equation for Rl					
F(Y)	—	.18	1.48	.06	1.48
F(Rl)	—	1.27	8.49***	.23	1.71

Notes: Values shown are F-statistics

Definitions of variable symbols:

Y = growth rate of nominal GNP
M = growth rate of money stock (M1 or M2)
C = growth rate of domestic nonfinancial credit
Rs = change in prime commercial paper rate
Rl = change in Baa bond rate

Significance levels:

***significant at .01 level
**significant at .05 level
*significant at .10 level

TABLE 9

SUMMARY OF BIVARIATE ANNUAL RELATIONSHIPS: FINANCIAL VARIABLES AND REAL INCOME

	1891-1916	1919-40	1947-82	1947-65	1966-82
Equation for X					
F(X)	—	.14	.85	1.69	.17
F(M1)	—	.19	7.73***	5.57**	2.42
Equation for M1					
F(X)	—	.19	2.39	4.20**	.74
F(M1)	—	2.53	22.57***	4.40**	1.10
Equation for X					
F(X)	2.56	.78	—	.47	—
F(M2)	.70	.06	—	2.40	—
Equation for M2					
F(X)	5.12**	.64	—	3.48*	—
F(M2)	5.53**	1.91	—	4.98**	—
Equation for X					
F(X)	—	.13	.42	.73	.02
F(C)	—	.79	2.42	.81	1.82
Equation for C					
F(X)	—	.58	7.94***	8.08***	2.20
F(C)	—	.78	42.64***	3.92**	14.23***
Equation for X					
F(X)	.71	1.98	2.74*	1.68	2.83*
F(Rs)	3.65**	1.51	14.91***	3.52*	25.11***
Equation for Rs					
F(X)	2.48	.58	.50	.02	1.15
F(Rs)	10.90***	1.22	3.69**	3.35*	.48

Table 9 continued on next page

Equation for X					
F(X)	—	.07	.35	2.64	1.21
F(Rl)	—	3.57*	4.84**	8.32***	3.13*
Equation for Rl					
F(X)	—	.04	.83	.13	1.99
F(Rl)	—	.94	9.89***	.37	2.75

Notes: X = growth rate of real GNP.
See also Table 8.

and long-term interest rates, for the same time periods used in Table 1, and Table 9 presents analogous results for bivariate relationships to real economic growth.[18] Such exogeneity tests constitute the modern formal analog to the investigation of leads and lags that has been central to the more traditional business cycle literature. Once again, however, the chief impression given by these results is the absence of persistence over time in familiar simple quantitative relstionships.

The often assumed relationship by which M1 growth helps explain either nominal or real economic growth, but not vice versa, appears in the results in Tables 8 and 9 only since World War II, and only when the first half of the post-war period is included. Growth in M2 helps explain nominal economic growth only before World War I, and does not help explain real economic growth in this sense in any of the three periods studied. Credit growth helps explain nominal income growth both in the inter-war period and in the post-war period as long as the more recent post-war years are included, but for the post-war period as a whole nominal income growth also helps explain credit growth. Credit growth does not help explain real income growth in this sense in any period. The change in short-term interest rates helps explain both nominal and real income growth, but not vice versa, in the pre-war period and in the second half of the post-war period. The change in long-term interest rates helps explain both nominal and real income growth, but not vice versa, in the inter-war period and the first half of the post-war period.

It is important to distinguish these generally negative findings from the more traditional propositions, noted and in some cases documented above, about the comovement in a simple sense, including lead and lag

relationships, connecting income with familiar monetary and financial variables. As Figure 1 and Tables 1-3 show, each of the five monetary and financial variables considered here has exhibited distinctly cyclical movements, at least during some time periods. What the tests in Tables 8 and 9 seek to establish, however, is not just whether a variable has fluctuated in conjunction with movements in income but whether it has shown a relationship to that part of the movement in income which is not explainable in purely autoregressive terms. Even a readily visible simple relationship to income fluctuations need not — indeed, evidently often does not — imply a corresponding relationship to the elements of income fluctuations that are not purely autoregressive.

More importantly, the basic theme of this paper focuses less on what helps explain what than on which if any quantitative relationships have persisted across spans of time during which the U.S. financial markets have undergone changes like those reviewed in Section I, which at least in principle could have importantly affected the monetary and financial aspects of economic fluctuations. Table 10 presents further F-statistics testing the null hypothesis of absence of structural change in the bivariate relationships summarized in Tables 8 and 9, against the alternative hypothesis of breaks at World War II and at the mid-point of the post-war period to date (and also, for relationships involving M2 and the short-term interest rate, at World War I). In all but two isolated cases, the data indicate significant structural change. What is especially striking in the results of these stability tests is that even sets of coefficients which Tables 8 and 9 report to be not significantly different from zero are nonetheless significantly different from one another.

TABLE 10

TEST STATISTICS FOR STABILITY IN BIVARIATE ANNUAL RELATIONSHIPS

	Break at 1916	Break at 1940	Break at 1965
Equation for Y	—	6.15***	9.34***
Equation for M1	—	6.80***	8.07***
Equation for Y	22.92***	5.01***	—
Equation for M2	12.45***	24.24***	—
Equation for Y	—	2.12**	34.49***
Equation for C	—	15.45***	5.59***
Equation for Y	13.90***	2.56**	5.23***
Equation for Rs	4.26***	24.16***	52.23***
Equation for Y	—	5.12***	10.93***
Equation for Rl	—	4.68***	52.91***
Equation for X	—	8.23***	7.92***
Equation for M1	—	6.64***	13.26***
Equation for X	20.24***	4.26***	—
Equation for M2	24.58***	15.49***	—
Equation for X	—	1.72	9.42***
Equation for C	—	18.97***	10.79***
Equation for X	10.76***	2.49**	2.16
Equation for Rs	6.43***	22.66***	50.77***
Equation for X	—	3.87***	10.91***
Equation for Rl	—	4.79***	55.82***

Note: See Tables 8 and 9.

Annual data, of course, may simply be too coarse to capture the relevant behavior connecting these aspects of aggregative economic activity. Tables 11 and 12 therefore present F-statistics for analogous bivariate exogeneity tests for the respective relationships of nominal and real income growth to the growth of money (M1) and credit, and the change in short- and long-term interest rates, based on quarterly data for the post World War II period.[19] Money growth consistently helps explain both nominal and real economic growth, as is familiar from previous work, but these results show that either nominal or real income growth also typically helps explain money growth (so that money does not "cause" income in the Granger sense). Credit growth helps explain nominal income, but not vice versa, in the second half of the post-war period. For the post-war period as a whole, credit growth again helps explain nominal income growth, while the reverse effect is only marginally significant. Changes in short-term interest rates consistently help explain nominal income growth, but not vice versa, and the same is true with respect to real income growth in the later post-war years. Changes in long-term interest rates never help explain income at all in this context. Finally, Table 13 shows that most of these quarterly results also fail to exhibit stability across the earlier and later halves of the post-war period. Further results (not shown) are also broadly similar for other logical break-points like those suggested in Section II.

One reason why relationships like these may appear to be unstable, of course, is that they are misspecified — for example, by the omission of other relevant variables. Given the results for the bivariate relationships in Tables 8 and 9 and Tables 11 and 12, in which several monetary and financial variables each appear to be related to either nominal or

TABLE 11

SUMMARY OF BIVARIATE QUARTERLY RELATIONSHIPS: FINANCIAL VARIABLES AND NOMINAL INCOME

	1952:I-1982:IV	1952:I-1965:IV	1965:I-1982:IV
Equation for Y			
F(Y)	3.84***	2.23*	.28
F(M)	10.28***	2.13*	2.80**
Equation for M			
F(Y)	4.09***	2.30*	1.01
F(M)	14.42***	8.31***	1.69
Equation for Y			
F(Y)	2.95**	2.61**	2.23*
F(C)	13.52***	1.69	9.04***
Equation for C			
F(Y)	2.17*	1.21	1.69
F(C)	45.41***	2.50*	28.22***
Equation for Y			
F(Y)	3.93***	2.94**	.30
F(Rs)	5.43***	5.75***	4.03***
Equation for Rs			
F(Y)	.68	1.42	1.02
F(Rs)	5.99***	6.71***	2.65**
Equation for Y			
F(Y)	6.33***	8.39***	.32
F(Rl)	.94	1.42	.69
Equation for Rl			
F(Y)	.88	1.36	.81
F(Rl)	2.04*	1.10	3.39**

Notes: Values shown are F-statistics.

Definitions of variable symbols:

Y = growth rate of nominal GNP
M = growth rate of M1 money stock
C = growth rate of domestic nonfinancial credit
Rs = change in prime commercial paper rate
Rl = change in Baa bond rate

Significance Levels:

*** significant at .01 level
** significant at .05 level
* significant at .10 level

TABLE 12

SUMMARY OF BIVARIATE QUARTERLY RELATIONSHIPS: FINANCIAL VARIABLES AND REAL INCOME

	1952:I-1982:IV	1952:I-1965:IV	1966:I-1982:IV
Equation for X			
F(X)	3.91***	3.43**	1.35
F(M)	3.81***	3.72**	3.32**
Equation for M			
F(X)	2.71**	2.30*	.97
F(M)	21.02***	7.24***	2.05*
Equation for X			
F(X)	3.16**	6.83***	.89
F(C)	.69	3.12**	.54
Equation for C			
F(X)	4.94***	4.39***	.84
F(C)	58.09***	1.49	24.15***
Equation for X			
F(X)	4.61***	3.57**	2.63**
F(Rs)	5.44***	1.20	5.81***
Equation for Rs			
F(X)	3.70***	3.46**	1.95
F(Rs)	7.40***	4.30***	3.90***
Equation for X			
F(X)	5.47***	4.90***	1.91
F(Rl)	1.00	.88	.75
Equation for Rl			
F(X)	1.31	2.18*	1.73
F(Rl)	2.35*	1.39	3.10**

Notes: X = growth rate of real GNP.
See Table 11.

TABLE 13

TEST STATISTICS FOR STABILITY IN BIVARIATE QUARTERLY RELATIONSHIPS

	Break at 1965:IV
Equation for Y	1.24
Equation for M	1.70*
Equation for Y	2.29**
Equation for C	2.94***
Equation for Y	5.58***
Equation for Rs	.79
Equation for Y	3.90***
Equation for Rl	1.77*
Equation for X	2.12**
Equation for M	2.30**
Equation for X	1.81*
Equation for C	2.76***
Equation for X	1.63
Equation for Rs	.31
Equation for X	.83
Equation for Rl	2.51***

Note: See Tables 11 and 12.

real income growth at least in some periods, it is difficult to justify the use of only bivariate relationships. Table 14 presents F-statistics for analogous exogeneity tests based on a five-variable annual system including real income growth, price inflation, money (M1) growth, credit growth and the change in the short-term interest rate, for the same inter-war and post-war periods studied earlier.

Even with only three monetary and financial variables in the system, however, it is difficult to draw any solid conclusions from this expanded analysis. Among the three, only money growth significantly helps explain real income growth — given the presence of the other included variables — in any period examined, and even this effect is evident only for samples including the first half of the post-war period.[20] At the same time, real income growth helps explain both money growth and credit growth during the full post-war period, and also helps explain money growth during the later post-war years. Real income growth only marginally helps explain the short-term interest rate change. Once again, what significant regularities do appear have not been regular enough to persist across different time periods.

The same generalization also characterizes analogous results for multivariate systems estimated for the post World War II period using quarterly data. There is little point in displaying vast quantities of empirical results along these lines, since the basic lack of consistency is readily apparent just from a summary of what does and does not help explain real income growth in quarterly systems based on different sub-periods. For the quarterly version of the same <u>five</u>-variable system shown in Table 14, neither money growth nor credit growth nor the short-term interest rate change significantly helps explain real income growth, even

at the .10 level — again, given the presence of one another — for 1952:I-1982:IV, 1952:I-1965:IV or 1966:I-1982:IV. By contrast, for the four-variable system estimated for 1953:I-1978:IV in Friedman (1983a), including all of the same variables as in Table 14 except the interest rate change, money growth and credit growth each significantly help explain real income growth at the .05 level.[21] Similarly, for the six-variable system estimated for 1962:III-1979:III in Clarida and Friedman (1984), including all of the same variables as in Table 14 plus the change in the federal government budget deficit, credit growth significantly helps explain real income growth at the .01 level, money growth does so at the .05 level, and the short-term interest rate change does so at the .10 level.[22]

Moreover, these multivariate relationships too show significant evidence of instability from one time period to another, thereby revealing that the instability of the bivariate systems documented in Table 10 is not due to anything so simple as merely omitting a small number of familiar variables. Table 15 presents F-statistics testing the null hypothesis of absence of structural change in the five-variable annual relationships summarized in Table 14, and in the corresponding quarterly relationships, against the alternative hypothesis of a break between the inter-war and post-war periods or between the first and second halves of the post-war period. The annual data indicate significant structural change in each relationship at World War II, though only for the interest rate equation at 1965. The appearance of stability between the first and second halves of the post-war period is probably just due to lack of degrees of freedom, however, since the corresponding quarterly data indicate highly significant structural change in each relationship at 1965:IV. In

TABLE 14

SUMMARY OF ANNUAL RELATIONSHIPS: FIVE-VARIABLE SYSTEM

	1919-40	1947-82	1947-65	1966-82
Equation for X				
F(X)	.40	3.95**	1.50	1.42
F(P)	.82	1.13	1.46	1.51
F(M)	.59	5.17**	4.11*	2.44
F(C)	.44	.85	.40	3.18
F(Rs)	2.43	2.49	.09	3.43
Equation for P				
F(X)	4.51**	4.46**	3.67*	1.64
F(P)	5.61***	3.50**	.67	.83
F(M)	8.59***	.52	1.07	1.10
F(C)	2.86	2.75*	.01	1.74
F(Rs)	2.59	6.57***	.40	3.08
Equation for M				
F(X)	1.06	6.15***	2.04	5.04***
F(P)	.82	1.04	.22	9.35***
F(M)	2.18	.38	1.19	1.95
F(C)	1.64	4.58**	.85	10.41**
F(Rs)	2.56	2.74*	.29	10.66**
Equation for C				
F(X)	1.11	11.57***	3.69*	.88
F(P)	.68	3.25*	.28	1.00
F(M)	1.69	.34	.89	1.29
F(C)	1.66	11.62***	.94	4.87*
F(Rs)	3.81*	3.44**	.46	1.39
Equation for Rs				
F(X)	.99	2.74*	.64	3.70*
F(P)	.54	1.62	.07	.35
F(M)	.41	1.12	.07	2.15
F(C)	2.15	2.38	.12	1.51
F(Rs)	.27	2.24	.29	2.16

Notes: Variables shown are F-statistics.
Definitions of variable symbols:
X = growth rate of real GNP
P = growth rate of GNP price deflator
M = growth rate of M1 money stock
C = growth rate of domestic nonfinancial credit
Rs = change in prime commercial paper rate

*** significant at .01 level
** significant at .05 level
* significant at .10 level

TABLE 15

TEST STATISTICS FOR STABILITY IN FIVE-VARIABLE SYSTEM

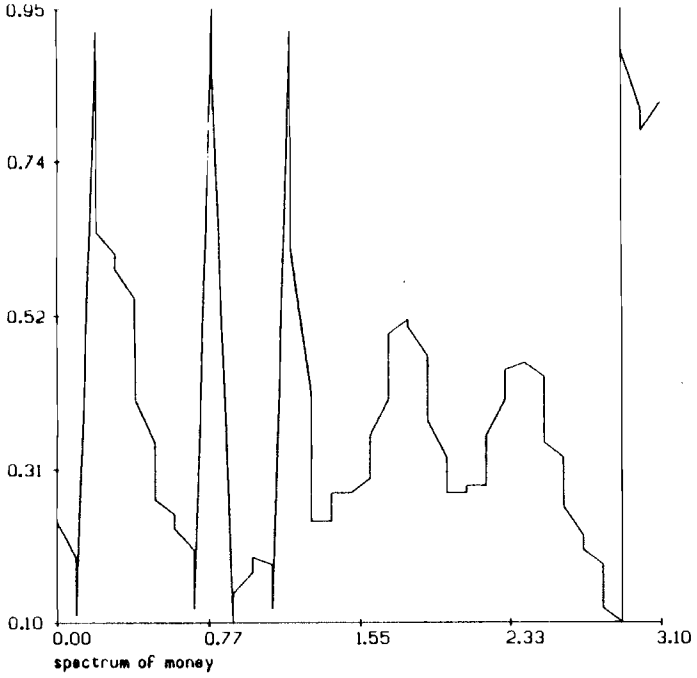
	Annual Relationships		Quarterly Relationships
	Break at 1940	Break at 1965	Break at 1965:IV
Equation for X	2.42**	2.15	10.82***
Equation for P	17.35***	1.15	11.00***
Equation for M	6.34***	2.18	14.67***
Equation for C	39.82***	2.05	8.32***
Equation for Rs	44.09***	7.13***	121.79***

Note: See Table 14.

sum, neither using quarterly data in place of annual, nor using multivariate systems in place of bivariate, nor doing both at once, overturns the general finding of heterogeneity from one period to another in the monetary and financial aspects of economic fluctuations.

Finally, because the very notion of business "cycles" suggests the possibility of comovements that recur at possibly regular intervals, it is interesting to see whether the frequency-domain properties of the comovements studied here can provide further information to supplement the time-domain properties reported above. In particular, what light can the associated frequency-domain properties of these data shed on familiar questions like the "leads and lags" of monetary and financial aspects of economic fluctuations?

As would be expected, frequency-domain methods immediately confirm the presence of strong cyclical comovements along the lines reported in Section II. The top two panels of Figure 2 show the respective power spectra of money growth and credit growth, estimated using the full sets of available post-war quarterly data spanning 1947:I-1982:IV for money and 1952:I-1982:IV for credit.[23] Both spectra display substantial "noise" at high frequencies — say, 1.5 radians and above. More importantly from the perspective of the questions addressed here, both also display significant power at or near frequencies plausibly related to recognized business cycles. The record of seven complete cycles from the peak in 1948:IV to that in 1981:III implies a mean cycle length of just under 19 calendar quarters, equivalent to a frequency of almost exactly 1/3 radian. The spectra of both money growth and credit growth display sharp spikes at just that point.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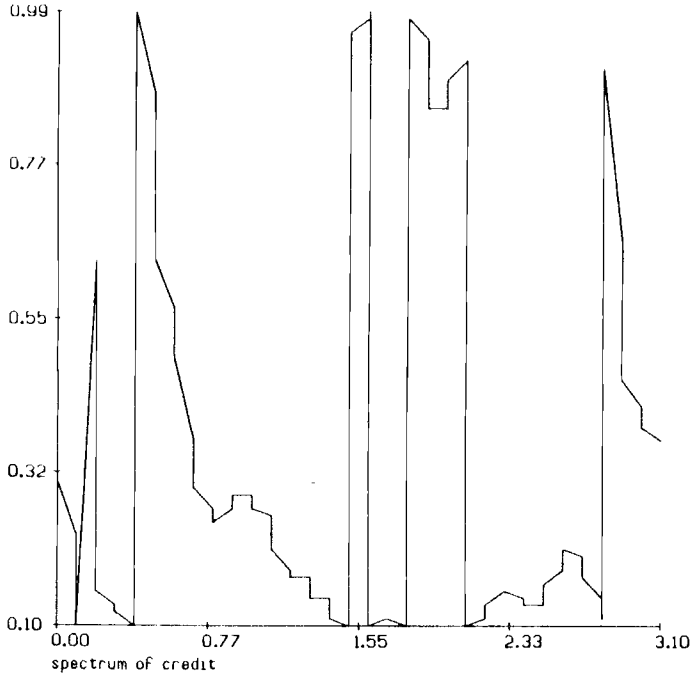
0.52
0.31
0.10
0.00
0.77
1.55
2.33
3.10
spectrum of money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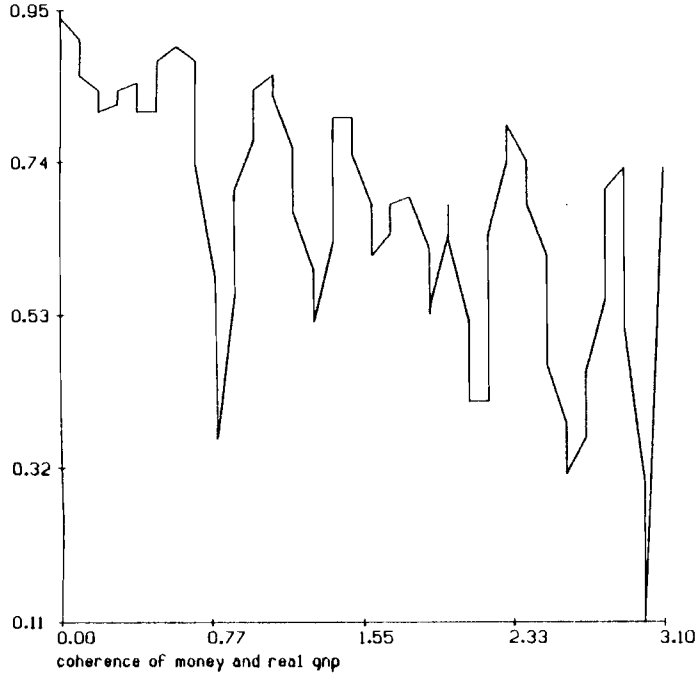
0.77
0.55
0.32
0.10
0.00
0.77
1.55
2.33
3.10
spectrum of credit


0.95
0.74
0.53
0.32
0.11
0.00
0.77
1.55
2.33
3.10
coherence of money and real gnp

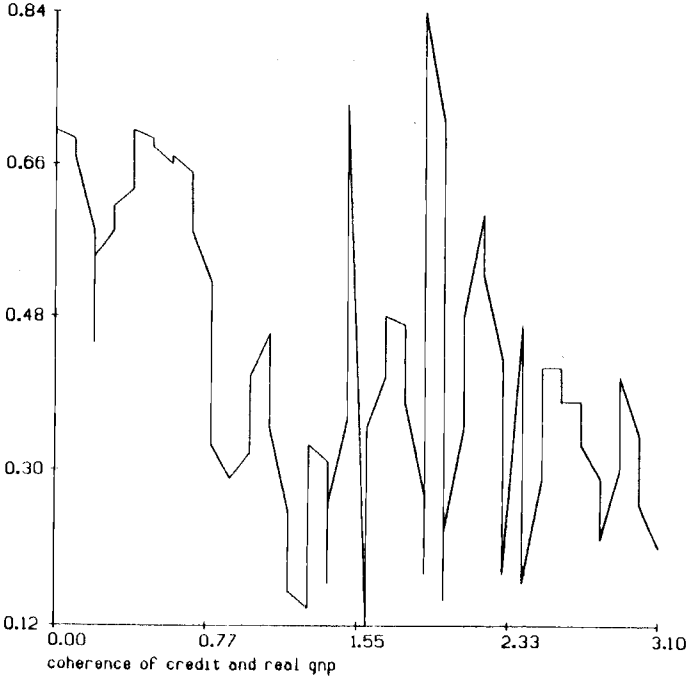

0.84
0.66
0.48
0.30
0.12
0.00
0.77
1.55
2.33
3.10
coherence of credit and real gnp

FIGURE 2

Closer analysis of these two power spectra indicates, however, that the respective frequency-domain properties of money and credit growth are not identical. In the range of .20-.79 radian, corresponding to a period of 2-8 years, the value of the test statistic for the null hypothesis of no difference between the two spectra is 3.90 (distributed normally with 22 degrees of freedom), indicating that the two spectra do differ significantly at the .01 level.[24] One way to explore further the nature of this difference in the frequency-domain properties of money and credit growth is to examine their respective coherences with real income growth, shown in the bottom two panels of Figure 2. Not surprisingly, both coherences display increases at about 1/3 radian. In the same range of .20-.79 radian, the coherence of real income growth with money growth is .98 with standard error .01, while the coherence of real income growth with credit growth is .96 with standard error .02.[25]

In the same vein as the analysis of lead and lag relationships via the bivariate exogeneity tests reported above, a plausible question to ask in this context is whether these respective coherences indicate that either money growth or credit growth, or both, tend to lead real income growth. In fact, both do so, and credit somewhat more so, although the indicated leads are both surprisingly short in comparison to those usually suggested in the time-domain literature. Money growth leads real income growth by a phase angle of only .11 radian (or .35 quarter, based on the 20 quarter midpoint of the 2-8 year range) with standard error .05, while credit growth leads real income growth by .32 radian (or 1.02 quarters) with standard error .06. Even so, the difference between these two leads is not statistically significant. The value of the test statistic for the null

hypothesis of no difference between the two coherences in the same .20-.79 radian range is only .39 (distributed as a t-statistic with 22 degrees of freedom), not significant at any reasonable level.

In addition, in the same vein as the analysis of partial relationships via the multivariate exogeneity tests reported above, a further plausible question to ask in this context is whether the partial coherence of either money growth or credit growth with real income growth is significantly different from zero — in other words, whether either adds significantly to explaining the frequency-domain properties of real income growth — given the presence of the other. As is largely consistent with the time-domain results, the answer is no in both cases. For the same range of .20-.79 radian, the values of the relevant test statistic (distributed as an F-statistic with 2 and 20 degrees of freedom) are .04 for the additional role of money growth and .42 for the additional role of credit growth. Neither value is significant at any reasonable level.

V. Statistical Significance and Economic Significance

The results of the stability tests reported in Tables 10 and 15 indicate strong evidence of statistically significant differences, between one time period and another, in both bivariate and multivariate relationships summarizing the monetary and financial aspects of U.S. economic fluctuations. For many purposes, however, the statistical significance of such differences does not necessarily mean that they are significant in a broader economic sense. After all, two corresponding coefficients, estimated for different time periods, can differ by an amount that is statistically significant but economically trivial if each is individually measured with sufficient precision. In addition, in dynamic relationships involving several coefficients, offsetting shifts in different coefficients can leave important properties of the resulting overall relationship unaffected.

The structural shifts in the monetary and financial aspects of the U.S. business cycle experience reported above are signficiant not just statistically but economically as well. Table 16 shows the full sets of estimation results for the bivariate annual relationship between real income growth and money growth summarized in the top panel of Table 9, for 1919-40, 1947-65 and 1966-82, respectively. As Table 10 shows, the data indicate statistically signficant shifts in these two estimated relationships. Comparison of the three full sets of results shown in Table 16 confirms that these significant differences are typically due not to small changes in a few precisely measured coefficients but to one or even several quite large changes, sometimes even involving switches of sign.

Figure 3 shows the implications of the differences among these respective sets of estimated coefficients for the overall relationship

TABLE 16

BIVARIATE RELATIONSHIPS BETWEEN REAL INCOME AND MONEY

1919 - 1940

$$X_t = \underset{(.9)}{.019} + \underset{(.5)}{.190}X_{t-1} - \underset{(-.3)}{.106}X_{t-2} + \underset{(.6)}{.277}M_{t-1} - \underset{(-.4)}{.157}M_{t-2}$$

$\bar{R}^2 = .00$ SE = .089 DW = 2.02

$$M_t = \underset{(1.3)}{.022} + \underset{(.1)}{.024}X_{t-1} + \underset{(.6)}{.156}X_{t-2} + \underset{(1.9)}{.702}M_{t-1} - \underset{(-1.9)}{.581}M_{t-2}$$

$\bar{R}^2 = .28$ SE = .071 DW = 1.66

1947-1965

$$X_t = \underset{(4.1)}{.060} - \underset{(-.5)}{.156}X_{t-1} + \underset{(1.5)}{.351}X_{t-2} + \underset{(.3)}{.142}M_{t-1} - \underset{(-3.3)}{1.21}M_{t-2}$$

$\bar{R}^2 = .32$ SE = .023 DW = 1.46

$$M_t = \underset{(2.6)}{.020} + \underset{(.1)}{.018}X_{t-1} + \underset{(2.8)}{.365}X_{t-2} + \underset{(.8)}{.216}M_{t-1} - \underset{(-2.9)}{.596}M_{t-2}$$

$\bar{R}^2 = .38$ SE = .013 DW = 2.13

1966-1982

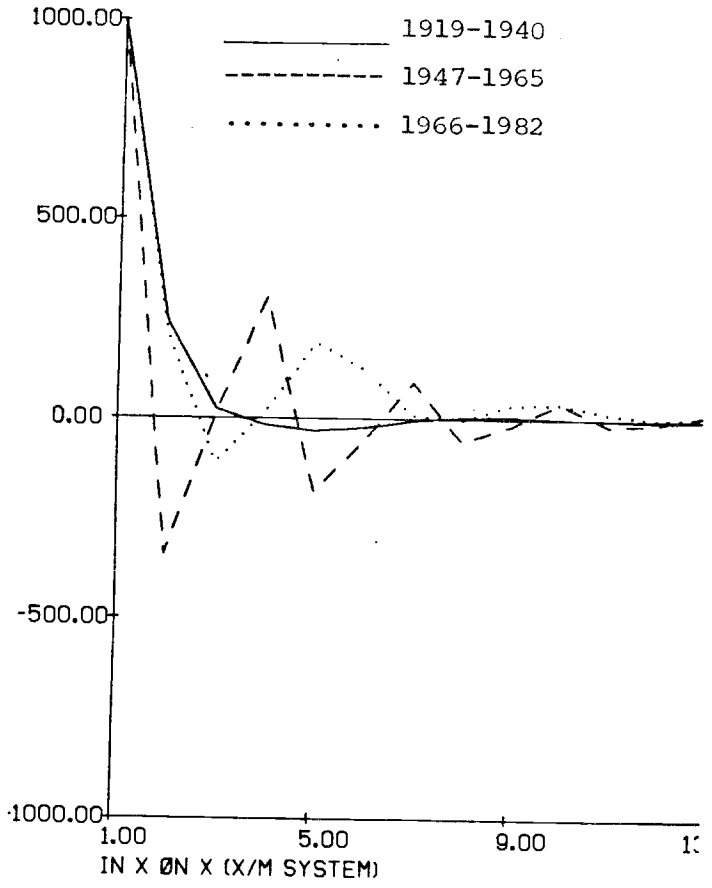
$$X_t = \underset{(3.0)}{.089} + \underset{(.5)}{.211}X_{t-1} - \underset{(-.5)}{.164}X_{t-2} + \underset{(-.4)}{.269}M_{t-1} - \underset{(-1.2)}{.837}M_{t-2}$$

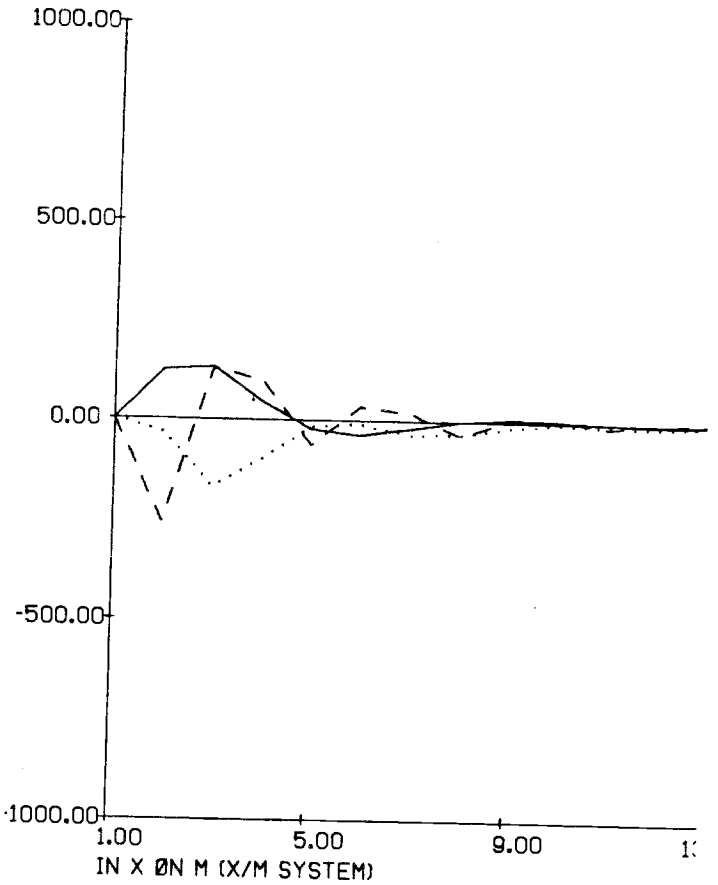
$\bar{R}^2 = .19$ SE = .024 DW = 2.01

$$M_t = \underset{(2.8)}{.045} - \underset{(-.2)}{.034}X_{t-1} - \underset{(-.9)}{.147}X_{t-2} + \underset{(1.1)}{.429}M_{t-1} - \underset{(-.2)}{.071}M_{t-2}$$

$\bar{R}^2 = .02$ SE = .013 DW = 2.17

Notes: X = growth rate of real GNP
M = growth rate of M1 money stock
$\bar{R}^2$ = adjusted coefficient of determination
SE = standard error of estimate
DW = Durbin-Watson statistic
Numbers in parentheses are t-statistics.


1919-1940
1947-1965
1966-1982
1000.00
500.00
0.00
-500.00
-1000.00
1.00
5.00
9.00
IN X ØN X (X/M SYSTEM)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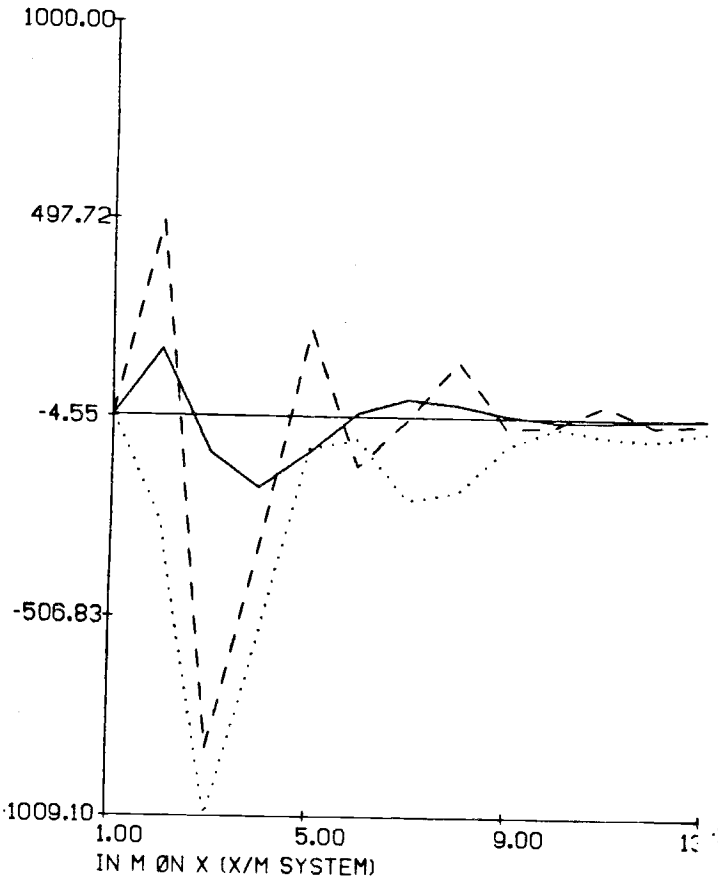
1.00
5.00
9.00
IN X ØN M (X/M SYSTEM)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5.00
9.00
IN M ØN X (X/M SYSTEM)

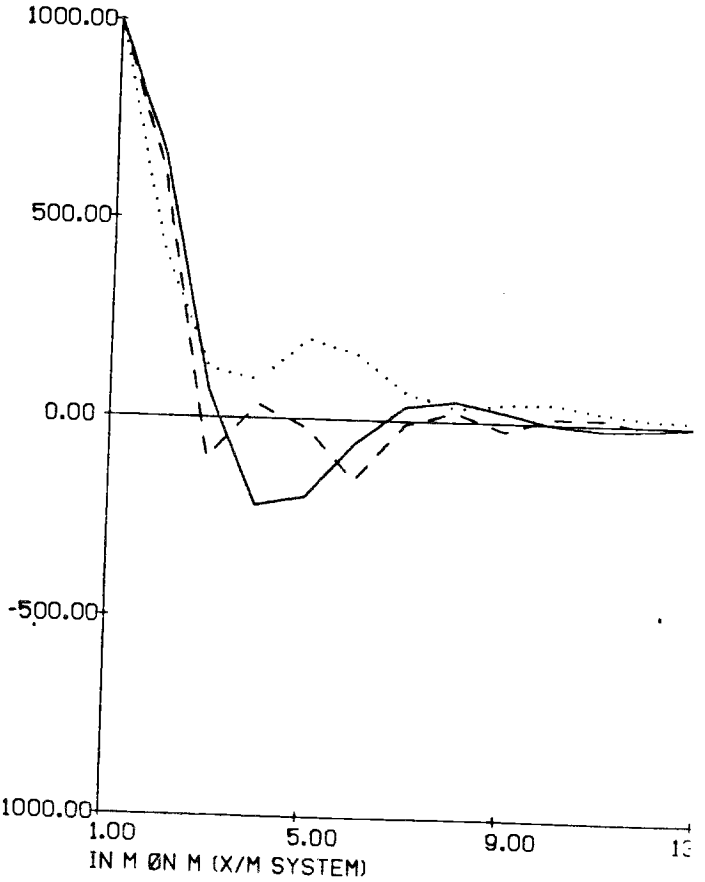

1000.00
500.00
0.00
-500.00
-1000.00
1.00
5.00
9.00
IN M ØN M (X/M SYSTEM)

FIGURE 3

between real income growth and money growth by tracing out the first ten years of the dynamic response pattern exhibited by the solved-out (but not orthogonalized) moving-average representation of each of the three estimated bivariate autoregressions. The implied own-disturbance responses shown in the upper left and lower right panels of the figure are roughly similar among the three systems, but the implied cross-disturbance responses shown in the upper right and lower left panels diverge sharply and even include differences in the direction of the initial responses.

Table 17 and Figure 4 present analogous sets of estimation results and associated dynamic response patterns for the bivariate annual relationship between real income growth and credit growth summarized in the middle panel of Table 9. Here again large differences appear among corresponding coefficients estimated for different time periods, as do readily visible differences among the implied response patterns, especially for the respective cross-responses. In addition, further results (not shown) indicate similar large differences for systems relating the growth of either money or credit to nominal income growth, as well as for systems relating either real or nominal income growth to the change in short-term interest rates. Finally, still further results (also not shown) indicate large differences in the results for analogous systems based on quarterly data, estimated for 1947:I-1965:IV and 1966:I-1982:IV.

In sum, the differences between one time period and another that characterize the monetary and financial aspects of U.S. economic fluctuations have been significant both statistically and economically, reflecting major differences in the magnitude as well as the timing of the comovements between income and money, credit and interest rates.

TABLE 17

BIVARIATE RELATIONSHIPS BETWEEN REAL INCOME AND CREDIT

1919-1940

$$X_t = \underset{(1.1)}{.027} + \underset{(.5)}{.161}X_{t-1} - \underset{(-.2)}{.063}X_{t-2} + \underset{(.8)}{.959}C_{t-1} - \underset{(-1.3)}{.962}C_{t-2}$$

$\bar{R}^2 = .00$ SE = .086 DW = 2.00

$$C_t = \underset{(1.5)}{.012} + \underset{(1.1)}{.109}X_{t-1} - \underset{(-.3)}{.027}X_{t-2} + \underset{(1.0)}{.350}C_{t-1} - \underset{(-.1)}{.117}C_{t-2}$$

$\bar{R}^2 = .16$ SE = .026 DW = 1.30

1947-1965

$$X_t = \underset{(.4)}{.015} - \underset{(-.8)}{.235}X_{t-1} + \underset{(1.0)}{.355}X_{t-2} + \underset{(1.3)}{.896}C_{t-1} - \underset{(-.8)}{.563}C_{t-2}$$

$\bar{R}^2 = -.16$ SE = .029 DW = 1.95

$$C_t = \underset{(3.7)}{.045} - \underset{(-3.9)}{.389}X_{t-1} + \underset{(1.2)}{.135}X_{t-2} + \underset{(2.8)}{.647}C_{t-1} - \underset{(-1.1)}{.242}C_{t-2}$$

$\bar{R}^2 = .45$ SE = .009 DW = 2.05

1966-1982

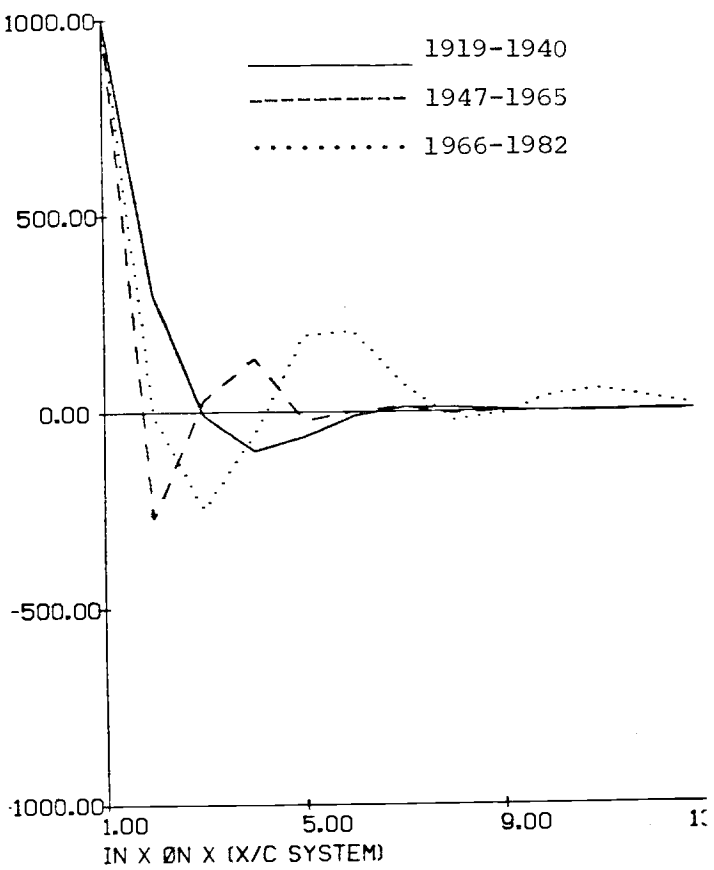
$$X_t = \underset{(1.7)}{.055} - \underset{(-.03)}{.009}X_{t-1} - \underset{(-.17)}{.052}X_{t-2} + \underset{(1.4)}{1.01}C_{t-1} - \underset{(-1.8)}{1.32}C_{t-2}$$

$\bar{R}^2 = .13$ SE = .025 DW = 2.08

$$C_t = \underset{(2.5)}{.035} - \underset{(-1.4)}{.195}X_{t-1} - \underset{(-.7)}{.086}X_{t-2} + \underset{(3.7)}{1.16}C_{t-1} - \underset{(-1.5)}{.439}C_{t-2}$$

$\bar{R}^2 = .65$ SE = .010 DW = 2.27

Notes: C = growth rate of domestic nonfinancial credit.
See also Table 16.


1919-1940
1947-1965
1966-1982
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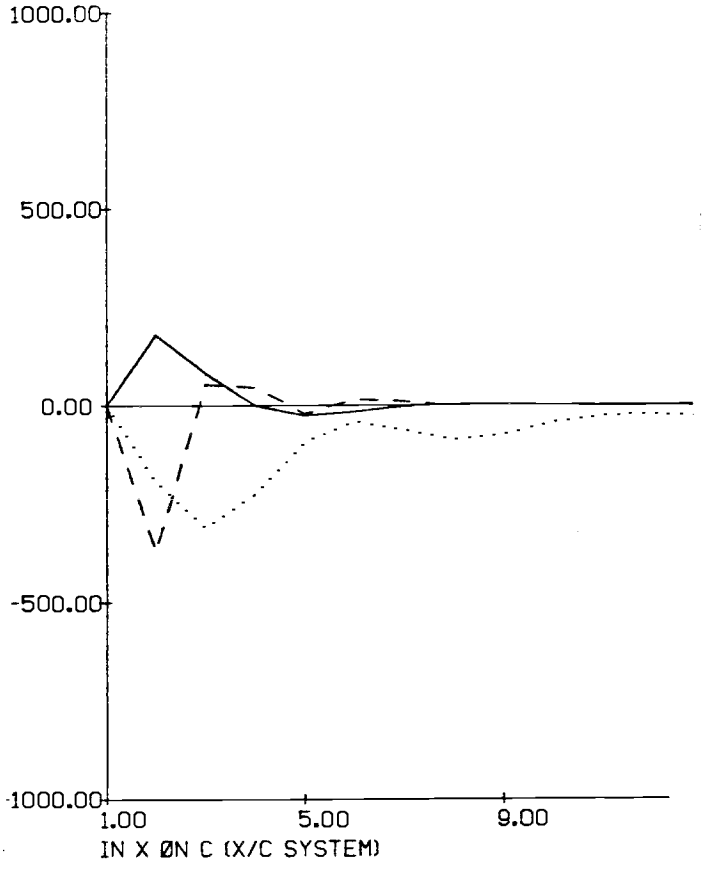
500.00
0.00
-500.00
-1000.00
1.00
5.00
9.00
IN X ØN X (X/C SYSTEM)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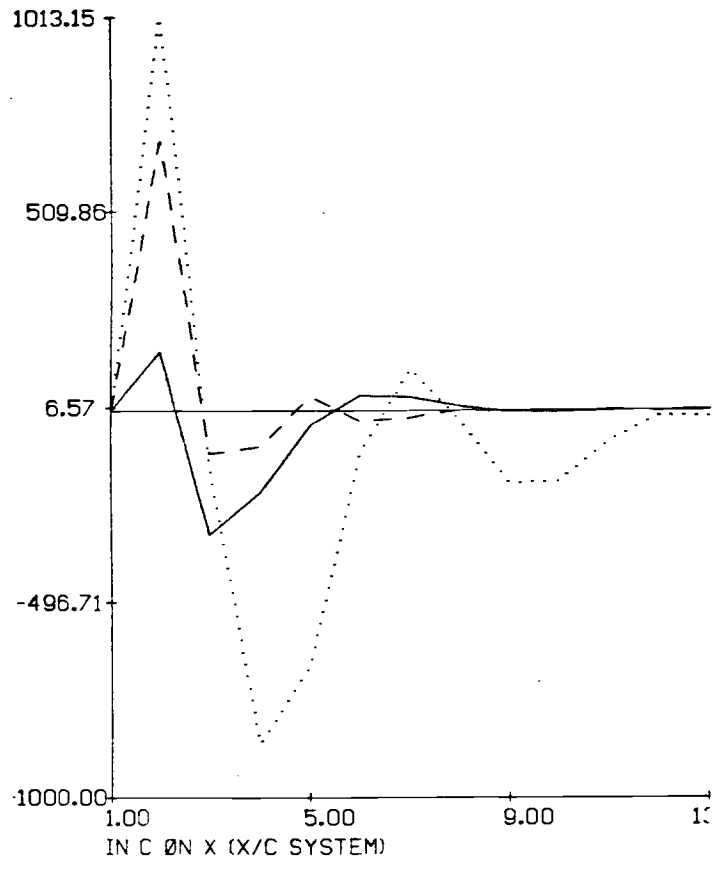
5.00
9.00
IN X ØN C (X/C SYSTEM)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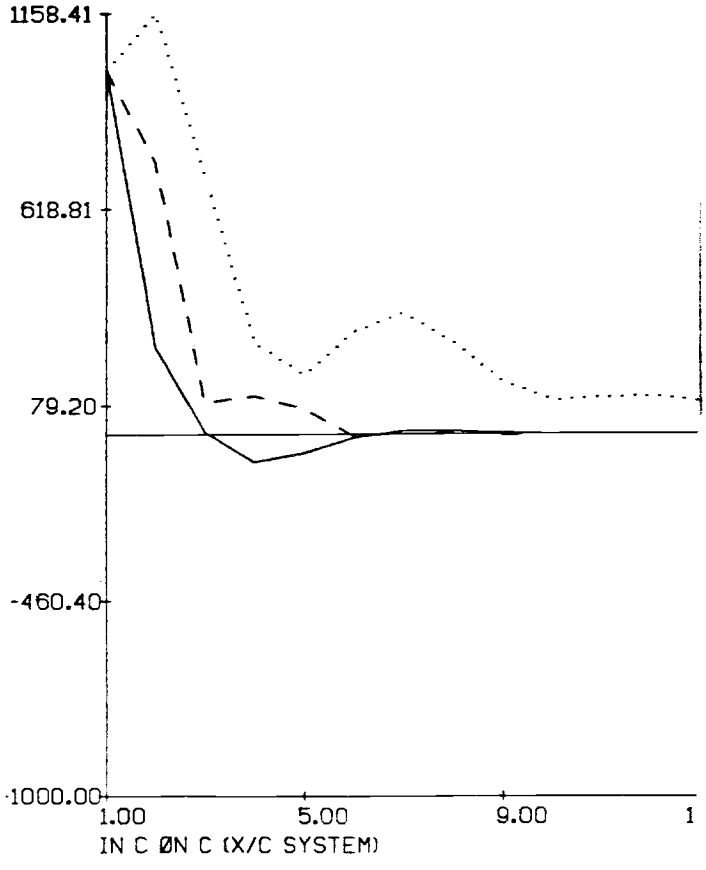
5.00
9.00
IN C ØN X (X/C SYSTEM)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618.81
79.20
-460.40
-1000.00
1.00
5.00
9.00
IN C ØN C (X/C SYSTEM)

FIGURE 4

VI. The Credit Cycle

A final financial aspect of U.S. economic fluctuations that bears investigation here is the familiar "credit cycle" by which the economy's public and private sectors alternate over the business cycle in their respective volumes of credit market borrowing. In brief, the basic idea behind this familiar notion is that federal government reliance on the credit market typically bulges when weakness in the economy enlarges the government's budget deficit, while the private sector's borrowing does just the opposite as a consequence of the cyclical variation of typically debt-financed spending. As a result, federal government borrowing is greater in economic contractions than in expansions, while private sector borrowing is greater in expansions than in contractions. This cyclical regularity is broadly familiar in somewhat general terms, although to date little if any formal analysis of it has appeared.

Table 18 summarizes the main outlines of this regularity by showing the respective quarterly average growth rates of federal government debt and the remainder of domestic nonfinancial credit (including the debt of state and local governments) during the six and one-half recognized business cycles since 1953. In part because of the lag of federal tax receipts behind fluctuations in economic activity, but also in part because of the upward secular trend in the growth rate of federal debt outstanding (as budget deficits have grown, while the level of federal debt outstanding has shrunk, relative to nonfinancial economic activity), the basic regularity of the "credit cycle" is more uniformly descriptive of private than of public borrowing.[26] In four contractions out of six, average federal debt growth was faster than in the preceding expansion, but the mean difference in

TABLE 18

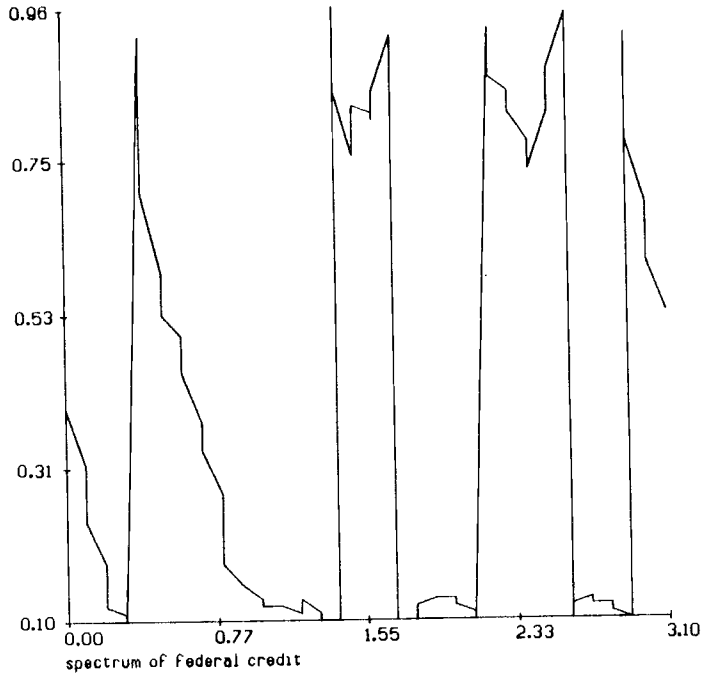
POST-WAR CYCLICAL MOVEMENTS OF GOVERNMENT AND PRIVATE SECTOR DEBT

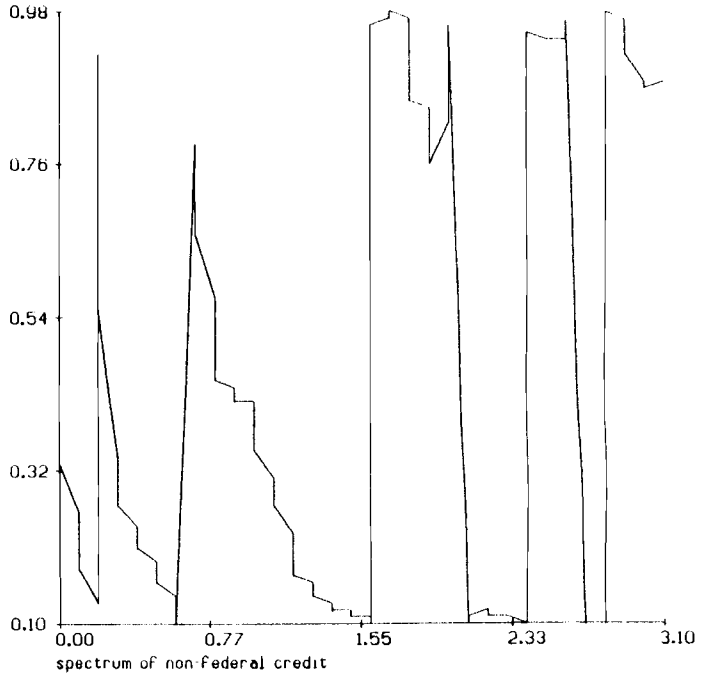
Business Cycles		Average Growth Rate of Government Debt		Average Growth Rate of Private Debt	
Peaks	Troughs	Contractions	Expansions	Contractions	Expansions
1953:II		2.50%		7.86%	
	1954:II		-.74%		10.49%
1957:III		2.71		7.08	
	1958:II		2.49		9.14
1960:II		-.41		7.21	
	1961:I		2.23		8.63
1969:IV		3.40		7.62	
	1970:IV		5.01		10.74
1973:IV		5.20		9.21	
	1975:I		11.92		10.69
1980:I		11.02		8.31	
	1980:IV		10.88		9.11
1981:III		15.42		7.03	
	1982:IV				
Mean for All Contractions		5.69%		7.76%	
Mean for All Expansions			5.30%		9.80%

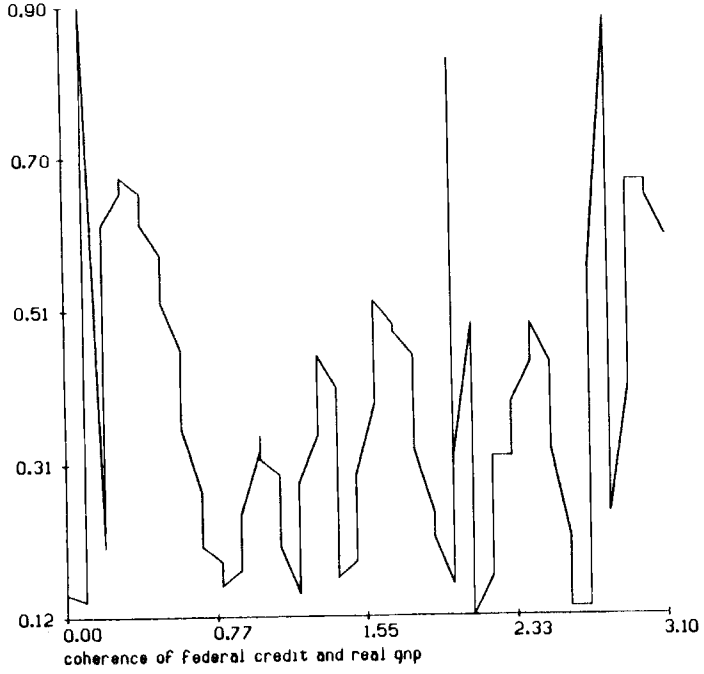
Note: Values shown are in percent per annum.

growth rates between contractions and expansions has been less than 1/2% per annum. By contrast, private debt growth in each expansion has been faster than in the preceding contraction, while private debt growth in each contraction has been slower than in the preceding expansion, resulting in a mean growth rate in expansions fully 2% per annum greater than in contractions.

Attempts to analyze the dynamic aspects of these regularities using the same time-domain results applied in Section IV yielded few interesting results, but the corresponding frequency-domain results do bear inspection. The top two panels of Figure 5 show the respective power spectra of federal and private sector debt growth, estimated using quarterly data for 1952:I-1982:IV. The spectrum for federal debt growth displays an obvious spike at almost exactly the mean cyclical frequency of 1/3 radian, while that for private debt growth exhibits a large spike at a frequency only moderately higher. In contrast to the results reported in Section IV for the growth of money and credit, the respective frequency-domain properties of federal and private debt growth do not exhibit significant differences. In the range of .20-.79 radian, the value of the test statistic for the null hypothesis of no difference between these two spectra is only .44 (distributed normally with 22 degrees of freedom), not significant at any reasonable level. The bottom two panels of Figure 5 show the respective coherences of federal debt growth and private debt growth with real income growth. Both show increases at about 1/3 radian, although the coherences are smaller than those reported above for the growth of money and credit. In the same range of .20-.79 radian, the coherence of real income growth with federal debt growth is .36 with standard error .19, while the


0.98
0.75
0.53
0.31
0.10
0.00
0.77
1.55
2.33
3.10
spectrum of federal credit


0.98
0.76
0.54
0.32
0.10
0.00
0.77
1.55
2.33
3.10
spectrum of non-federal credit


0.90
0.70
0.51
0.31
0.12
0.00
0.77
1.55
2.33
3.10
coherence of federal credit and real gnp

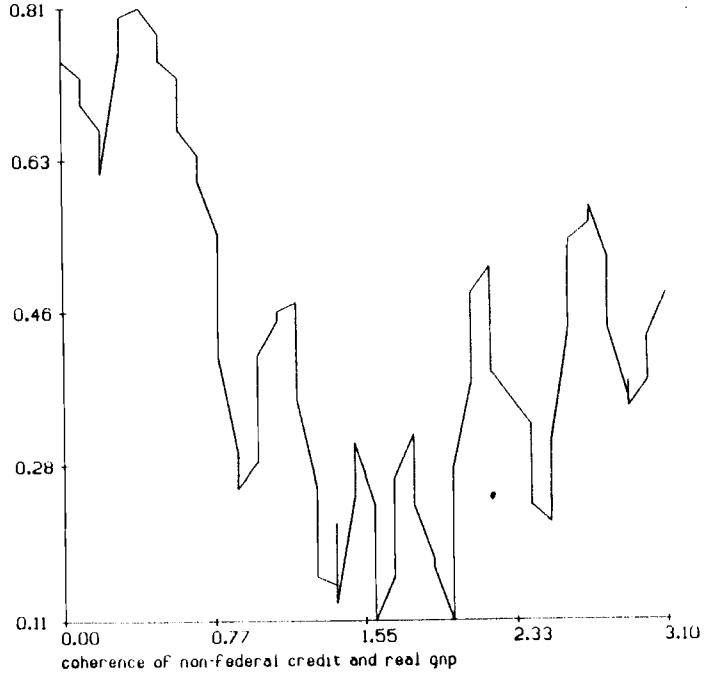

0.81
0.63
0.46
0.28
0.11
0.00
0.77
1.55
2.33
3.10
coherence of non-federal credit and real gnp

FIGURE 5

coherence between private debt growth and real income growth is .77 with standard error .09.

In addition to this evidence of regular comovements of federal and private debt growth with real income growth at cyclical frequencies, the associated phase relationships (corresponding to leads and lags in the time domain) provide some support for the idea that private borrowing activity helps in part to determine real income while the federal government's budget posture reacts passively.[27] Federal debt growth lags real income growth by a phase angle of 1.47 radians (or 4.7 quarters) with standard error .55, while private debt growth leads real income growth by a phase angle of .97 radians (or 3.1 quarters) with a standard error or .18. Despite the small standard errors, however, these apparent differences are not statistically significant. The value of the test statistic for the null hypothesis of no difference between the two coherences in the same .20-.79 radian range is only .002 (distributed as a t-statistic with 22 degrees of freedom).

Similar negative results emerge from asking whether either federal debt growth or private debt growth significantly contributes to explaining the frequency-domain properties of real income growth in the presence of the other.[28] In the range of .20-.79 radian, the values of the test statistic (distributed as an F-statistic with 2 and 20 degrees of freedom) for the partial coherence of real income growth with federal debt growth and with private debt growth — in each case taking the other as given — are respectively 1.49 and .17. Neither is significant at the .10 level.

In sum, there is evidence of a "credit cycle" in the sense of regular movements of federal and private sector debt growth, and regular comovements

of each with real income growth, at cyclical frequencies. In addition, there is some indication that private debt growth leads real income growth while federal debt growth lags, but the differences between these respective comovements are not statistically significant, nor does either federal or private debt growth contain significant information about real income growth beyond what is also in the other.

VI. Summary of Conclusions

There can be no doubt that economic fluctuations in the United States have their monetary and financial side. The comovements among money, credit, interest rates and nonfinancial economic activity are evident enough at the crudest eyeball level of inspection, as well as in the results of more sophisticated time- and frequency-domain exercises. Moreover, many of these comovements have coincided with major historical business cycle episodes.

On closer inspection, however, these monetary and financial aspects of U.S. economic fluctuations exhibit few quantitative regularities that have persisted unchanged across spans of time in which the nation's financial markets have undergone profound and far reaching changes. The evidence for the absence of such persistent quantitative regularities assembled in this paper shows major differences among the pre World War I, inter-war, and post World War II periods, and between the first and second halves of the post-war period. Evidence suggesting changes from one period to another repeatedly emerges, regardless of whether the method of analysis is simple or sophisticated, regardless of whether the underlying data are annual or quarterly, and regardless of whether the relationships under study are bivariate or multivariate. Moreover, the differences between one period and another reported here are significant not just statistically but economically as well, in the sense of major differences in the magnitude and timing of cyclical comovements.

The paper's main message, therefore, is a warning against accepting too readily — either as a matter of positive economics or for policy purposes — the appearance of simple and eternal verities in much of the

existing literature of monetary and financial aspects of business fluctuations. More complicated models involving many variables and/or nonlinear relationships may have remained stable, but the evidence clearly shows that simple linear relationships among only a few such variables have not.

Footnotes

*I am grateful to Diane Coyle and Ken Weiller for research assistance and helpful discussions; to them as well as Stephen Goldfeld, Allan Meltzer, Robert Gordon and other participants in the NBER business cycles conference for useful comments on an earlier draft; and to the National Science Foundation and the Alfred P. Sloan Foundation for research support.

1. Stock prices have also attracted substantial attention in a business cycle context, but less so than has been the case for money, credit and interest rates.
2. See, for example, de Leeuw and Gramlich (1968, 1969), Ando (1974), and Modigliani and Ando (1976).
3. See, for example, Anderson and Jordan (1968) and Anderson and Carlson (1970). These models are really reduced-form in spirit, however. See Jonson (1976) for an example of an attempt at a more structural rendering of the same ideas.
4. Empirical work to date among these lines has mostly adopted a reduced-form approach. See, for example, King and Plosser (1981).
5. Much earlier on the Bank of the United States had constituted a rudimentary form of central bank, but it passed out of existence when Andrew Jackson declined to renew its charter in 1832. From then until the passage of the National Banking Act in 1864, private commercial banks were chartered exclusively by the individual states. Thereafter, until 1914, federally chartered banks enjoyed a monopoly over the note-issuing power but continued (as they do today) to share other banking functions, like deposit taking, with state chartered banks.

6. The discussion that follows focuses narrowly on the financial markets and therefore omits such important elements of the changing role of government as taxes, government spending, bankruptcy arrangements, and so on — all of which could importantly affect the relationships between monetary and financial variables and levels of economic activity.

7. The underying data are annual averages centered on June 30. From 1890 to 1907 the annual data are averages of quarterly figures. From 1908 to 1945 they are averages of end-of-month data. From 1947 to 1975 they are averages of daily-average monthly data.

8. The underlying data, constructed for this paper, are annual averages of monthly data, including end-of-month data through 1946 and daily-average data since 1947. (The Federal Reserve has constructed the official new M1 series back only to 1959.)

9. The underlying data are end-of-year data. The domestic nonfinancial credit concept is roughly analogous to "primary securities" in the sense of Gurley and Shaw (1960).

10. The data are annual averages of daily-average monthly data.

11. The expansion ending in 1948:IV officially began in 1945:IV, but the analysis here and below excludes it so as to avoid any remaining effects due to the wartime economy.

12. The table excludes credit growth for the first contraction and expansion because quarterly credit data are available only from 1952:I onward.

13. It is at first tempting to suggest that, given the upward secular trend, the lower average levels for expansions are simply due to the

omission of the expansion that began in 1982:IV; but any such claim would, of course, be merely a forecast.

14. From 1929 to 1982 the underlying GNP data are the standard National Income and Product Accounts estimates. From 1909 to 1928 the data are U.S. Department of Commerce estimates which (in principle) are analogous to the subsequent N.I.P.A. estimates at the aggregate level. From 1890 to 1908 the data are Department of Commerce estimates based on Kendrick (1961).

15. In addition, because the underlying variables are serially correlated, the conventional statistical confidence levels indicated in Table 3 are overstated.

16. See Cramer (1983), for example, for evidence on the different respective movements of income and total transactions.

17. The reason for calculating the relationships among the nonfinancial variables a second time in the lower half of the table is that quarterly credit data are not available for the first post-war contraction and expansion. The same point applies to Table 7 below.

18. The underlying vector autoregressions include a constant term and and two lags on each variable in each equation. The results for analogous autoregressions also including a linear time trend are broadly similar. (The most interesting difference to emerge on the introduction of a time trend is that M1 no longer helps explain nominal income.) Two lags appear to be sufficient to eliminate most, if not all, of the serial correlation in the residuals of the equations based on these annual data. Because each equation includes lags on <u>both</u> variables, and therefore a rational distributed lag,

there is of course no limitation on the length of lag in the economic process represented.

19. The underlying vector autoregression systems include a constant term and four lags on each variable in each equation. (The discussion of lag length in footnote 18 applies here too.) Once again, the results for analogous autoregressions also including a linear time trend are broadly similar.

20. In this system the most interesting difference to appear on the introduction of a time trend is that the one variable which helps explain real income growth is not money growth but the change in short-term interest rates.

21. In this system real growth in turn helps explain money growth but not credit growth.

22. In this system real growth in turn helps explain money growth but not credit growth nor the interest rate change.

23. This exercise relies on data for the full post-war period, despite the time-domain evidence of structural change within that period, so as to provide enough observations to make the frequency-domain analysis sensible. Both spectra, as well as the coherences displayed below, were estimated using a triangular window with bandwidth 11.

24. I am grateful to Jim Powell for assistance in constructing the tests, and for calculating the test statistics and their distributions, reported here and in Section VI below.

25. With the estimated coherences so close to unity, the calculated standard errors are not well behaved.

26. See Friedman (1983b) for a discussion of the divergent trends in federal deficits and federal debt outstanding in relation to economic activity.

27. This idea is consistent with a cyclical role for "credit crunches." It is also consistent with the fact that only some one-fourth of the cumulative federal budget deficit incurred during the period under study here would have emerged if the economy had remained at "high employment" throughout; see again, for example, Friedman (1983b).

28. The lack of significance here parallels the results of time-domain exogeneity tests.

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