This PDF is a selection from an out-of-print volume from the National Bureau of Economic Research

Volume Title: Monetary Trends in the United States and United Kingdom: Their Relation to Income, Prices, and Interest Rates, 1867-1975

Volume Author/Editor: Milton Friedman and Anna J. Schwartz

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-26409-2

Volume URL: http://www.nber.org/books/frie82-2

Publication Date: 1982

Chapter Title: Long Swings in Growth Rates

Chapter Author: Milton Friedman, Anna J. Schwartz

Chapter URL: http://www.nber.org/chapters/c11411

Chapter pages in book: (p. 588 - 620)

11 Long Swings in Growth Rates

We noted earlier that lengthening the period used to compute rates of change eliminates short, erratic movements but reduces only moderately the amplitude of the fluctuations in money and nominal income, leaving long, relatively smooth swings (sec. 9.3, especially chart 9.4). Chart 11.1 highlights this phenomenon. It gives rates of change computed from three, five, seven, and nine successive phase averages for money in panel A, nominal income in panel B, real income in panel C, and price level in panel D.

11.1 Past Work on Long Swings

For the United States, these long swings are members of the same species as those that have been studied by Kuznets, Burns, Abramovitz, and other investigators. That is clear from table 11.1, which compares three earlier chronologies for the United States with the turning points in our rate of change series for money, nominal income, and real income.[1]

1. See Simon Kuznets, "Long-Term Changes in the National Income of the United States of America since 1870," *Income and Wealth in the United States, Trends, and Structure*, Income and Wealth Series, vol. 2 (Cambridge: Bowes and Bowes, 1952), pp. 29–241; "Quantitative Aspects of the Economic Growth of Nations. I. Levels and Variability of Rates of Growth," *Economic Development and Cultural Change* 5 (October 1956): 1–94; "Long Swings in the Growth of Population and Related Economic Variables," *Proceedings of the American Philosophical Society* 102 (February 1958): 25–52; *Capital in the American Economy: Its Formation and Financing* (Princeton: Princeton University Press for the NBER, 1961), pp. 54, 316–88. The dates in table 11.1 are from the latter source, p. 352, referring to GNP, based on decadal levels in 1929 prices.

Arthur F. Burns, *Production Trends in the United States since 1870* (New York: NBER, 1934), pp. 174–252, esp. p. 196. Burns gives two sets of dates, one that regards his decade rates of growth as the slopes of secular trends at the midpoint of the decade, the second, in terms of decades of rapid and slow growth. The dates given in table 11.1 are the former,

For our series, we have entered every turning point, regardless of the size of the movement. As the average durations at the foot of the table show, the three-phase rates yield cycles roughly comparable in length to those dated by Abramovitz, though somewhat shorter; the nine-phase rates, longer cycles intermediate in length between those dated by Kuznets and by Burns. The exact dating differs somewhat for our three series, and, for each series for matching three-phase and nine-phase turns. However, there are comparably large differences among the dates assigned by the other investigators, and there is clearly more than a family resemblance among all the dates.

For the United Kingdom we have no satisfactory independent chronologies, despite a number of studies of long swings in the United Kingdom patterned after the Kuznets study for the United States. These studies examine the same phenomena but for the most part have not attempted to settle on a specific chronology.[2] Table 11.2 therefore gives only the

since the method used seems more nearly comparable with that implicit in the dating of the money series.

Moses Abramovitz, *Resource and Output Trends in the United States since 1870*, NBER Occasional Paper 52 (1956; reprinted from *American Economic Review* 46 [May 1956]: 5–23), pp. 19–23. See *Hearings on Employment, Growth and Price Levels*, Joint Economic Committee, 86th Cong., 1st Sess., part 2: "Historical and Comparative Rates of Production, Productivity, and Prices" (Washington, D.C.: Government Printing Office, 1959), 411–66, for an excellent summary and analysis of the evidence on long swings in the rate of growth. The dates in table 11.1 are from his "The Nature and Significance of Kuznets Cycles," *Economic Development and Cultural Change* 9 (April 1961): 225–48. They are designated as referring to swings in "economic activity or GNP."

See also Abramovitz, *Evidences of Long Swings in Aggregate Construction since the Civil War*, NBER Occasional Paper 90 (1964); R. A. Easterlin, *The American Baby Boom in Historical Perspective*, NBER Occasional Paper 79 (1962), and his *Population, Labor Force and Long Swings in Economic Growth* (New York: Columbia University Press for NBER, 1968); Manuel Gottlieb, *Estimates of Residential Building, United States, 1840–1939*, NBER Technical Paper 17 (1964), and his *Long Swings in Urban Development* (New York: Columbia University Press for NBER, 1976).

2. See in particular Brinley Thomas, *Migration and Economic Growth* (Cambridge: Cambridge University Press, 1954), and P. J. O'Leary and W. Arthur Lewis, "Secular Swings in Production and Trade, 1870–1913," *Manchester School* 23 (May 1955), reprinted in [American Economic Association] *Readings in Business Cycles*, ed. R. A. Gordon and L. R. Klein (Homewood, Ill.: Irwin, 1965), pp. 546–72.

The one long swing that has been identified by some United Kingdom investigators is a slowdown in United Kingdom growth rates in the 1880s and early 1890s. Others dispute this finding, in particular, S. B. Saul, *The Myth of the Great Depression* (London: Macmillan, 1969), whose main focus is fifty-year swings (so-called Kondratiev cycles) rather than the twenty-year swings that are the subject of this chapter.

Thomas does provide a more extensive chronology, by giving dates of the British building cycle in his table 52, p. 175. For our period, these show a trough in 1871, peak in 1899, trough in 1912, and peak in 1920. Thomas notes that these give cycles inverse to those in the United States but of the same average duration.

Kuznets, in *Economic Growth of Nations* (Cambridge: Harvard University Press, 1971), pp. 43–50, summarizes data on long swings in the United Kingdom, Germany, Sweden,

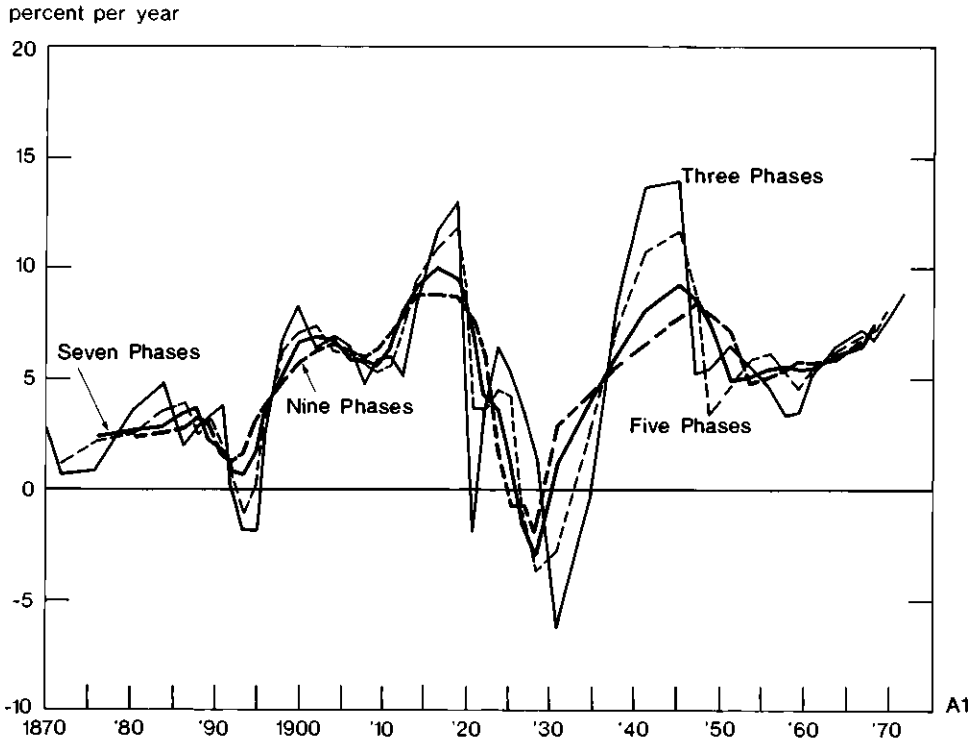
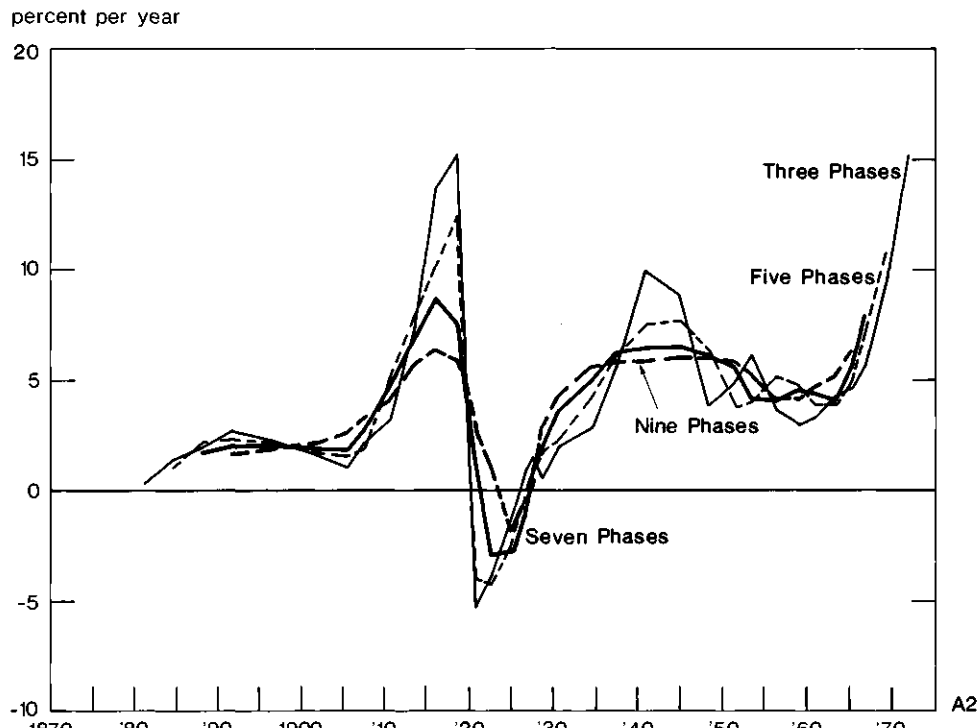
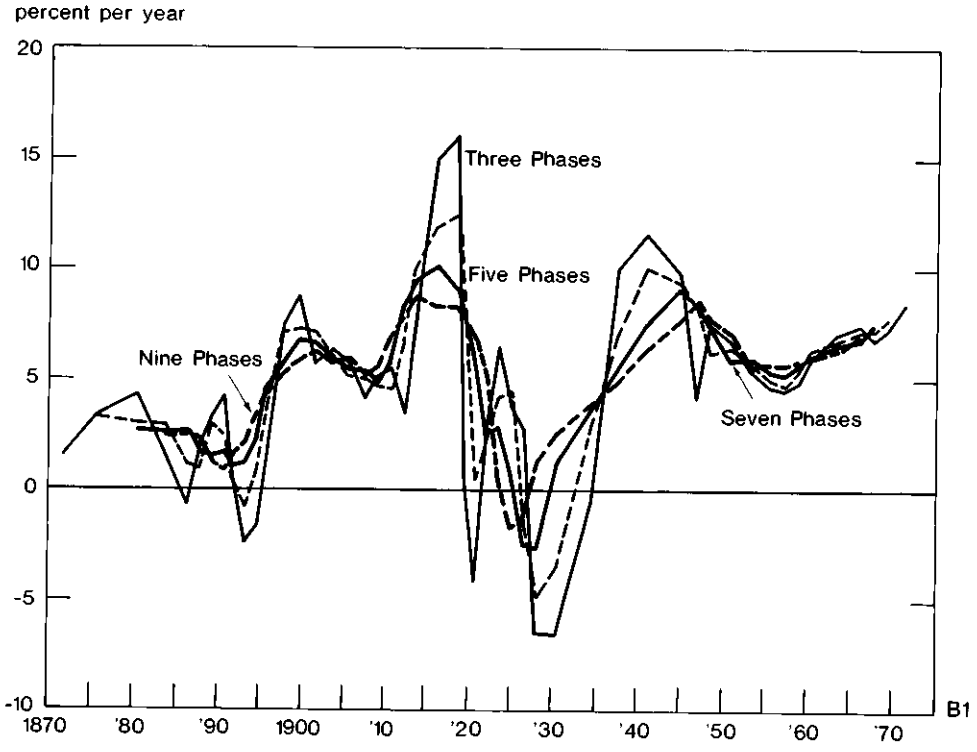


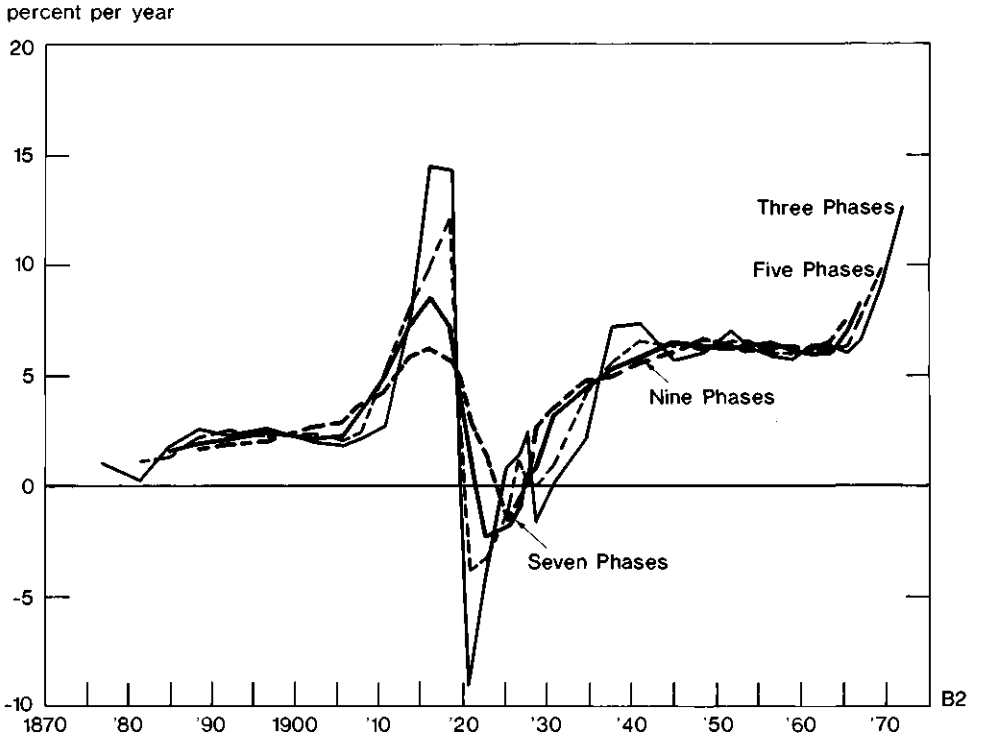
Chart 11.1 Rates of change computed from three, five, seven, and nine overlapping phase averages: money stock, nominal income, real income, United States, United Kingdom. **A1**, United States money.



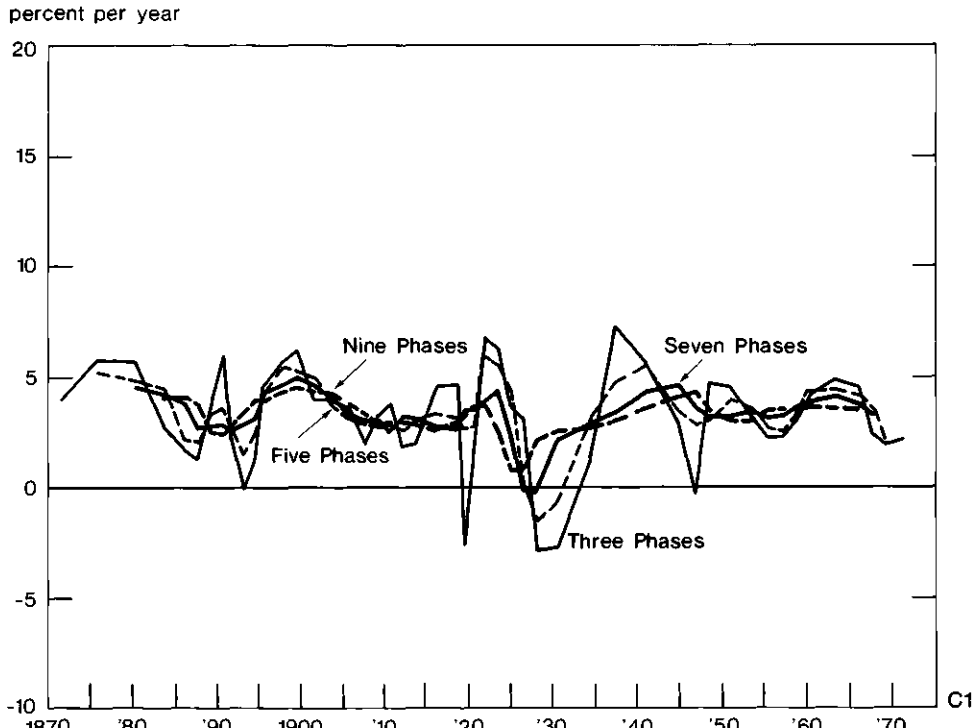
A2, United Kingdom money.



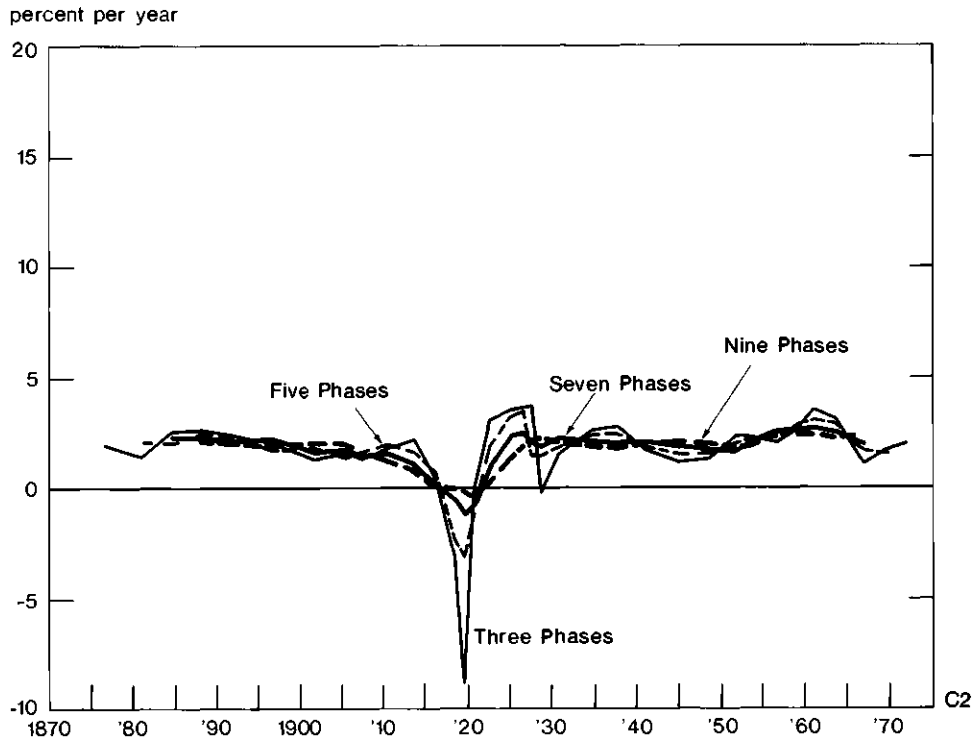
B1, United States nominal income.



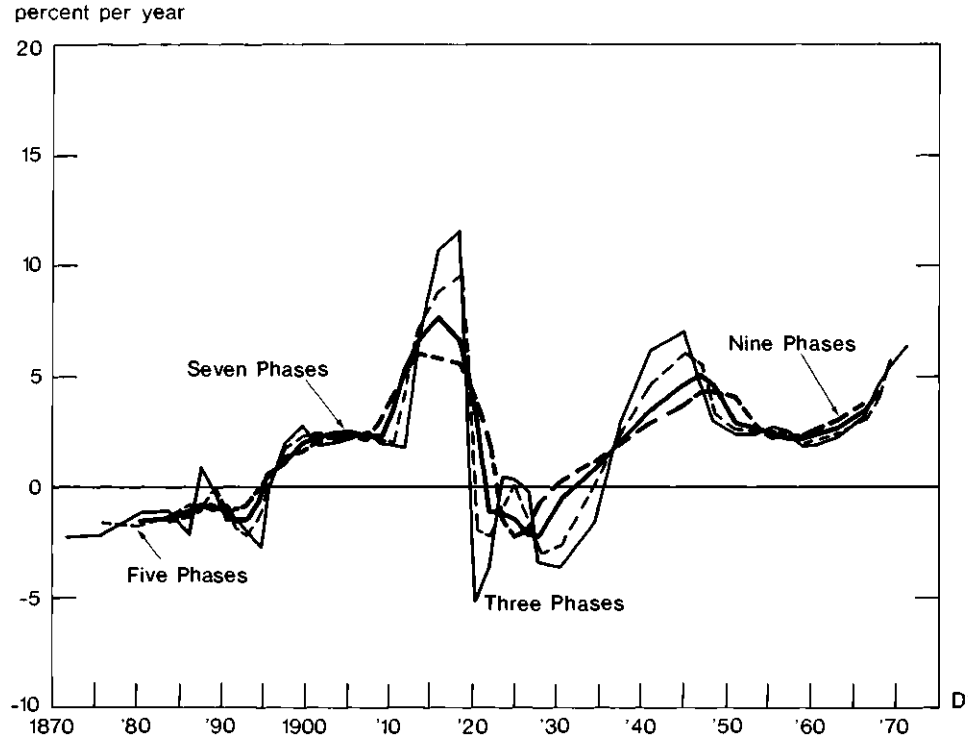
B2, United Kingdom nominal income.



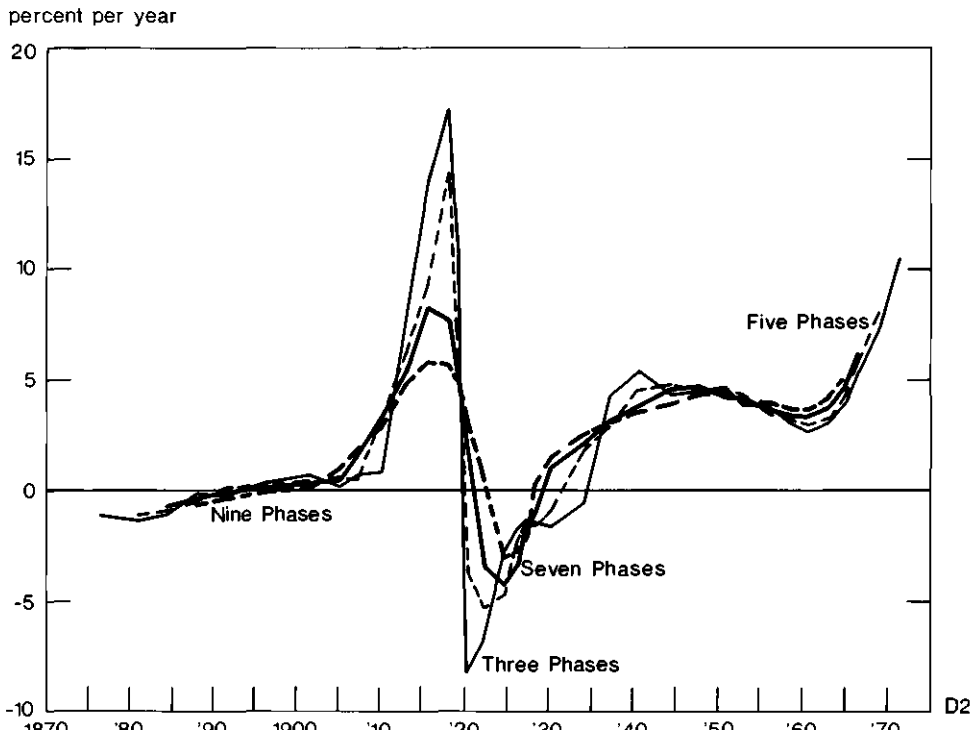
C1, United States real income.



C2, United Kingdom real income.



D1, United States price level.



D2, Unitd Kingdom price level.

Table 11.1 **Long Swings: Alternative Chronologies for the United States**

Turning Point (1)	Kuznets (2)	Burns (3)	Abramovitz (4)	Money: Three-Phase Rates (5)	Money: Nine-Phase Rates (6)	Nominal Income: Three-Phase Rates (7)	Nominal Income: Nine-Phase Rates (8)	Real Income: Three-Phase Rates (9)	Real Income: Nine-Phase Rates (10)
T	1873.5		1874.75	1872	1880.5	1872			
P	1882.5	1880	1881.5	1884		1880.5	1884	1876	1884
T			1887	1886.5		1886.5		1888	
P			1890.25	1891	1888	1891		1891	
T	1893.5	1890	1892.75	1895	1892	1893.5	1891	1893.5	1891
P		1900	1899.5	1900		1900	1902	1900	1900
T				1902		1902		1902	
P				1904	1904	1904		1904	
T				1908	1908	1908	1908	1908	1909.5
P	1908.5			1911	1914	1911		1911	1911
T		1910	1911.5	1912.5		1912.5		1912.5	1916.5
P		1915	1915	1919		1919	1914	1919	
T	1916.5	1920	1920.75	1921		1921		1920	
P	1926.5		1923.5	1924		1924		1922.5	1922.5
T	1934.5		1930.75	1931	1927	1931	1925.5	1928.5	1925.5
P			1939	1945.5	1947.5	1941.5	1947.5	1938	1947.5

T				1947.5		1947.5		1947.5	
P	1950.5			1951.5		1949		1949	
T				1958	1954	1958	1954	1956	1954
P				1967	1964	1967	1956	1964	1961
T				1968.5		1968.5	1959.5	1970	1967
P				1972	1968	1972	1967	1972	
Mean duration of swing[a]	22.0	16.0	11.7	9.5	17.5	9.5	16.6	9.6	15.1

Source, by column: 2. Kuznets, *Capital in the American Economy*, p. 352, table 66, line 1,
3. Burns, *Production Trends*, p. 196 (midpoints of decades).
4. Abramovitz, "Nature and Significance of Kuznets Cycles," p. 231, col. headed, "Economic activity or gross national product" (redated in accordance with convention used here, as described in note, below).
5, 7, 9. See table 5.9, above, cols for g_Y, g_M, and $g_{Y'}$, except for period of dummy adjustment of money figures described in chapter 8.
6, 8, 10. Based on rates of change computed from moving nine-phase averages shown in chart 9.4 above, panels A, B, and C.

Note: 1900.0 = 1 January 1900
1900.25 = 31 March 1900
1900.5 = 30 June 1900
1900.75 = 30 September 1900

[a]Calculated by dividing differences between terminal and initial date in each column by number of swings, counting a final rise or final fall not matched by a subsequent fall or rise as 0.5 swing.

Table 11.2 **Long Swings: Alternative Chronologies for the United Kingdom**

Turning Point (1)	Money: Three-Phase Rates (2)	Money: Nine-Phase Rates (3)	Nominal Income: Three-Phase Rates (4)	Nominal Income: Nine-Phase Rates (5)	Real Income: Three-Phase Rates (6)	Real Income: Nine-Phase Rates (7)
T	1881.5		1881.5		1881.5	
P			1888.5		1888.5	1888.5
T		1892	1892	1888.5	1902.5	
P	1892		1897		1906	
T	1906		1906		1908	
P	1919	1916.5	1916.5	1916.5	1914	
T	1921	1925.5	1921	1925.5	1920	1921
P					1925.5	
T					1927	
P	1928		1928		1928	1929
T	1929		1929		1931	1938
P	1941.5		1941.5		1938	1945.5
T	1949		1945.5		1945.5	
P	1954	1949	1952	1949	1952	
T	1959.5	1957	1959.5	1954	1954	1952
P		1966	1964	1959.5	1961.5	1959.5
T			1966	1961.5	1967.5	1966
P	1972.5		1972.5	1966	1972.5	
T						
Mean duration of swing[a]	16.5	29.6	12.1	22.1	10.6	22.1

Source by column: 2, 4, 6. Table 5.10 above, cols. for $g_{Y'}$ $g_{M'}$ and $g_{y'}$.
3, 5, 7. Based on rates of change computed from moving nine-phase averages shown in chart 9.4 above, panels A, B, and C.
[a]See notes to table 11.1.

turning points in the three-phase and nine-phase rates of change computed from our United Kingdom money, nominal income, and real income series.

The three-phase rates yield longer swings for the United Kingdom than for the United States. For nominal and real income this difference reflects primarily the pre–World War I period. For the period after World War I, the swings in real income are on the average slightly shorter for the United Kingdom than for the United States; in nominal income, slightly longer. For the period before World War I, we are uncertain whether the longer recorded swings in the United Kingdom than in the United States reflect a real phenomenon or simply the unsatisfactory and highly interpolated measurements for the United Kingdom. For money the situation is different. The longer United Kingdom swings reflect not only pre–World War I experience, but also the post–World War II period when it took so much longer in the United Kingdom than in the United States for velocity to recover from the war.

It is clear from chart 11.1 that the nine-phase rates for the United Kingdom retain only two major swings, one for each of the two wartime and postwar periods, plus a final upsurge in money and nominal income but not real income. (Note that, although table 11.2 identifies 1888.5—the first observation for the nine-phase rates—as a peak for real income, one can see on the chart only essential flatness in the observations before World War I; there is no cycle in real income until after World War I.) To judge from our data alone, it is doubtful that, with the exception of wartime and postwar periods, the United Kingdom experienced long swings comparable to those of the United States economy. This ambiguity is consistent with the absence of anything like a consensus on a pre–World War I chronology of United Kingdom long swings and the difficulty that investigators have had in establishing the existence of long swings in the United Kingdom. The absence of long swings in real income is also consistent with our finding in chapter 9 that, excluding wars, the rate of change of real income in the United Kingdom seems to be a random series.

Australia, and the United States for the pre–World War I period. He reports deviations from straight-line trends in the rate of growth of per capita output, population, and total output between successive decades, each pair of decades separated by five years. He gives no chronology, but the peaks and troughs for the United Kingdom in the reported deviations for per capita and total output show only one full swing with perhaps an initial half swing. The dates are: initial peak, 1867; trough 1874–75; peak, 1889–90; trough, 1904–5, implying a swing averaging twenty-five years in duration, or only slightly longer than those Kuznets identified for the United States. His final peak corresponds to the initial peak in column 7 of table 11.2.

Kuznets gets swings for Germany and Sweden roughly comparable to those for the United Kingdom but swings for Australia that are inverse to those for the European countries.

The long swings etched by the undulations in chart 11.1 for the United States clearly correspond to widely diffused movements common to an extraordinary variety of economic and quasi-economic phenomena—from gross capital expenditures by railroads to immigration, from nonfarm residential construction to fertility of different population groups, from nonagricultural prices and shares traded on the New York Stock Exchange to number of patents issued.[3] The swings are present not only in real income but also in money and nominal income: indeed, the most striking feature of the chart is the decidedly larger amplitude of the swings in money and nominal income than in real income.

The less clearly marked and milder swings in real income in the United Kingdom than in the United States correspond to less clearly marked and milder swings in money. Where this is not the case, as during the wartime years when the United Kingdom monetary swings are as wide as those in the United States, the swings in real output are also as wide as those in the United States.

Yet in all the extensive literature on long swings, there is hardly a mention of money! The only studies we know of that explore the role of money in long swings are the second edition (1973) of Brinley Thomas's book (the original study is cited in footnote 2 above) and an unpublished study by Moses Abramovitz that was stimulated by an earlier draft of this book.[4] Two survey articles on long swings deal only with series in real terms: one uses fifteen such series for Sweden and the United Kingdom, as well as four for the United States; the other uses thirty British series.[5]

3. Kuznets, *Capital in the American Economy*, pp. 321, 352; Abramovitz, *Long Swings in Aggregate Construction*, p. 35; Easterlin, *American Baby Boom*, p. 25; Burns, *Production Trends*, pp. 223–41.

4. Thomas notes that in the first edition of his book, "Monetary influences were not ignored, but they did not form an important part of the mechanism of interaction" (p. 246), which stressed real factors. In the second edition he assumes that "A monetary cobweb is superimposed on the real instability inherent in the interplay of the real magnitudes" (p. 250) in the period 1870–1913. Moses Abramovitz ("The Monetary Side of Long Swings in U.S. Economic Growth," Memorandum no. 146, Stanford University Center for Research in Economic Growth, April 1973) proposes a model of United States long swings in which nominal income growth and its handmaiden, money stock growth, are governed by the growth rate of the sum of current merchandise and net capital imports.

Saul's study of the United Kingdom, 1873–96, is another exception to the general omission of a role for money. He concedes that money is "the oldest [explanation] and is one which could have the all-pervading effects mentioned" (p. 16) and "that we may have to put money back where it used to be as a major force in the price movement" (p. 19).

5. Benjamin P. Klotz, "Oscillatory Growth in Three Nations," *Journal of the American Statistical Association* 60 (September 1973): 562–67; John C. Soper, "Myth and Reality in Economic Time Series: The Long Swing Revisited," *Southern Economic Journal* 41 (April 1975): 570–79.

Kazushi Okhawa and Henry Rosovsky in *Japanese Economic Growth: Trend Acceleration in the Twentieth Century*, Studies of Economic Growth in Industrialized Countries (Stanford, Calif.: Stanford University Press, 1973) stress long swings in Japanese economic

Kuznets in a conclusion to a 1958 article says, "long swings would probably be found in a much wider range of phenomena . . . than was indicated above. For example, they would presumably be evident in the financial aspects of economic performance and structure," to which he adds three sentences elaborating on this possibility.[6] Aside from this one reference, we have found no mention of money or monetary phenomena in any of Kuznets's writings on long swings.[7] Similarly, the leading British article on long swings, by O'Leary and Lewis, does not mention money.[8]

The omission of money from the studies of long swings doubtless reflects the prevailing Keynesian temper at the time the basic studies were undertaken—characterized as it was by the view that "money does not matter."[9] The omission of money from later studies reflects the tendency of later investigators to stay in well-worn ruts rather than to strike out for themselves. In light of our own findings about the relation between changes in the quantity of money and in nominal and real income, as well as the wider amplitude of the long swings in money than of the associated long swings in real output, it may well be that Hamlet has been left out of the long-swing drama.

This chapter does not explore in detail the relation between long swings in monetary and real magnitudes—we leave that to investigators concerned more centrally with long swings. Our aim is much more modest: (1) to call attention, as we have already done, to the existence of long swings in money and to their apparent temporal association with the long swings that have been studied so extensively in real phenomena; (2) to indicate the relevance of our data to the question whether the swings are episodic or cyclical; and (3) to make some tentative suggestions about the way monetary changes are diffused through the economy and spread out in time.

---

development related to the absorption of advanced foreign technology by the Japanese modern sector.

6. Kuznets, "Long Swings in Population Growth and Related Economic Variables." This paper is reprinted in Kuznets, *Economic Growth and Structure* (New York: Norton, 1965), pp. 328–78; quotation from p. 352.

7. For example, his book *Economic Growth of Nations* contains no entry in the index under money, or monetary.

8. O'Leary and Lewis, "Secular Swings in Production and Trade."

9. A monetary role in long swings is logically entirely consistent with Keynes's pure theory, through the effect of monetary change on interest rates and thereby on investment. However, the view that "money does not matter" led to a complete neglect of this possibility.

Somewhat paradoxically, a rigid simple quantity theory—which regards long-run output as determined independently of monetary changes—would rule out any role for money in long swings. However, no scholar immersed in the quantity theory approach of the pre- or post-Keynesian era would neglect to consider the possible role of money—as we have been led to do.

11.2 Are the Swings Episodic or Cyclical?

The widespread diffusion of the swings through the economy and their apparent smoothness over time are consistent with their being either episodic or cyclical. Let the economy, or some sector of it, be affected by a large "disturbance"—that is, an unsystematic movement, whether favorable or unfavorable—and the disturbance will affect sectors other than those in which it arose, some immediately, some after a lag. These secondary disturbances will in turn produce further effects, including a feedback to the sector in which the disturbance arose. The question is whether the appearance of smooth swings in rates of change is produced by such reactions to occasional episodic disturbances, plus the effect of the statistical devices used to smooth the series,[10] or whether they reflect an internal cyclical mechanism that converts a reasonably steady stream of disturbances into a roughly periodic and recurring pulsation.

Earlier investigators have tended to favor the cyclical interpretation, though recognizing that it is far from established, and have offered tentative hypotheses about the cycle-generating mechanism. The neglect of monetary phenomena has meant that the suggested mechanisms all rely on real phenomena. In light of our own results, these hypotheses are either wrong or, at the very least, seriously incomplete. They are wrong if the monetary phenomena play a significant role in generating the observed swings. They are incomplete even if the monetary phenomena are simply reflections of independent real swings because they do not account for the systematic monetary changes that accompany the real swings.

One technique that has been used extensively in the attempt to determine whether the swings are episodic or cyclical is spectral analysis.[11] Since spectral analysis is a purely descriptive technique, it is not contaminated by defects in the theoretical explanations that have been offered for the real swings. However, because the spectral analysis has relied solely on real series, it has failed to use all of the information available. This failure is particularly unfortunate because the results of spectral analysis have so far been inconclusive, interpreted by some investigators as rejecting the existence of long swings, except as episodic disturbances, by others as mildly favoring that hypothesis.[12]

10. This possibility has been suggested and explored by Bird, Desai, Enzler, and Taubman, "'Kuznets Cycles' in Growth Rates: Their Meaning," *International Economic Review* 6 (May 1965): 229–39.

11. See, for example, J. P. Harkness, "A Spectral-Analytic Test of the Long-Swing Hypothesis in Canada," *Review of Economics and Statistics* 50 (November 1968): 429–36; M. Hatanaka and E. P. Howrey, "Low Frequency Variation in Economic Time Series," *Kyklos* 22, no. 3 (1969): 752–63; E. P. Howrey, "A Spectrum Analysis of the Long-Swing Hypothesis," *International Economic Review* 9 (June 1968): 228–52.

12. See Soper, "Myth and Reality in Economic Time Series," for a convenient summary.

The rough temporal coincidence between the swings that earlier investigators found in real magnitudes, the swings in our real income series, and the swings in the stock of money suggests that the real and monetary swings are part of the same process and require a common explanation. In *A Monetary History* we examined in detail the sources of the large changes in the United States in rates of monetary growth. We concluded that each had a fairly straightforward specific explanation. We attributed the four successive substantial rises recorded in chart 11.1 to the reaction to successful resumption of specie payments in 1879, the development of a commercially feasible cyanide process for the extraction of gold, the financing of World War I, the reaction to the Great Contraction plus the financing of World War II. We attributed the four successive substantial declines to the worldwide price decline in the 1880s exacerbated by silver agitation and terminating in the deep depression of the early 1890s, the tapering off of the gold expansion plus the 1907 panic, the post–World War I monetary contraction, which, in the severe smoothing imposed by the nine-phase rates of change merges into the even more drastic monetary contraction from 1929 to 1932, and, finally, the cessation of the rapid monetary expansion of World War II.

We have not made a similarly exhaustive study of United Kingdom monetary history. However, the two wars and postwar periods were characterized by essentially the same pattern of monetary growth in the United Kingdom as in the United States. In the interwar period there is a substantial difference: based on midpoint dates of our three-phase rates of change, United States monetary growth declines sharply from 1924 to 1931 and only then starts to rise to a World War II peak; United Kingdom monetary growth rises sharply, though irregularly, from 1923 to 1941 with only a minor dip marking the Great Contraction. This difference can plausibly be attributed to the different foreign exchange policies: the United States retention of gold until 1933, the United Kingdom departure from gold in 1931. In the pre–World War I period, British monetary growth, as recorded, is much stabler than United States growth, rising moderately in response to the rise in the international supply of gold and then settling back along with United States monetary growth as that impact was absorbed.

These events seem mostly episodic rather than cyclical in character. They are, of course, linked. The worldwide decline in prices expressed in terms of gold before 1890 must have stimulated the search for gold and for better processes of extracting gold from low-grade ore. World War I certainly set in motion political forces that played a part in the strains leading to World War II. In the United States, the monetary panic of 1907 played a large role in producing the agitation for monetary reform that led to the enactment of the Federal Reserve Act and so to the establishment of the monetary institutions that served as the channel of wartime

inflation and that were responsible for the severe monetary contractions of 1919–21 and 1929–33. The severe post–World War I contraction in the United Kingdom plus the effects of the return to gold in 1925 certainly laid the groundwork for the early departure from gold in 1931 and the accompanying and subsequent rapid monetary growth. However, these links are of the general kind that connect all major historical events. It is hard to see in them the kind of economic self-generating long cycle mechanism that is embodied in the tentative hypotheses offered by earlier investigators.

While this evidence favors an episodic interpretation of the long swings, it is not decisive. It can be rendered consistent with the self-generating long cycle mechanism in two different ways.

1. It can be maintained that the reaction mechanism of the economy to a major episodic disturbance is cyclical in character, but damped, so that the cycle would die away unless another major disturbance occurred to keep it going. If the damping is assumed to be substantial, the explanation is indistinguishable from a simple episodic explanation, hence it must assume relatively slow damping, so that many observed swings are not episodic.

2. It can be maintained that the particular dramatic events we associate with the monetary changes took the form they did and had the monetary effects they had only because the underlying self-generating cycle mechanism produced a climate favorable to them. Had the same "disturbances" occurred at a different stage of the cycle, they might have passed off without important consequences. Plausible examples are the deep depression of the 1890s and the panic of 1907. In both cases it can be maintained that, unless there had been underlying real forces working for retardation in rates of growth of output, the silver agitation in the earlier case or the failure of a number of banks in the later would not have triggered appreciable monetary contraction. It is much more difficult, on the qualitative evidence available to us, to accept a similar interpretation for the other episodes.

The principal events that are candidates for "random disturbances," the smoothing of which might be regarded as generating the long swings are clearly, for the United States, the deep contractions that have punctuated American economic history since at least as far back as 1808, and for both the United Kingdom and the United States, the major wars. One way, therefore, to get some evidence bearing on the episodic or cyclical character of long swings is to determine the extent to which the long swings reflect these two categories of events.

In order to use phase averages for this purpose, we divided the phases into two sets: "special" phases, which correspond to the wars and deep contractions for the United States and to wars alone for the United Kingdom, and "other" phases, which correspond to the "usual" or

"normal" expansions and contractions. In doing so, we treated as deep contraction phases not only the contraction phases themselves, but also the following expansion phases, because of the finding in our other work that there is a close relation between the amplitude of contractions and of succeeding expansions (though not of preceding expansions).[13] The succeeding expansion, as it were, reflects a reaction to, or a rebound from, the deep contraction. Put differently, we treat the period from a peak to a subsequent peak as a deep contraction, containing a contraction and an expansion phase. For the same reason we include as a war phase the expansion phase following the contractions that started at the end of the wars (1918–19 and 1944–46). In all, for the period from 1873 to 1975 for the United States and 1874 to 1975 for the United Kingdom, we classified six phases as war phases and, for the United States, an additional eleven phases as deep contraction phases.[14] Since our rates of change are based on triplets of phases, the rate of change associated with a phase just preceding, or just following, a special phase is affected by the special phases. Accordingly, in the analysis of rates of change which follows, we treat ten observations as corresponding to war phases—for the six war phases proper plus the two that precede and follow each triplet of war phases—and, for the United States, twenty-five observations as corre-

13. *A Monetary History*, pp. 97, 139, 173, 241, 493; "The Monetary Studies of the National Bureau," in *The National Bureau Enters Its 45th Year*, 44th Annual Report (June 1964), pp. 14–18. Reprinted in M. Friedman, *The Optimum Quantity of Money* (Chicago: Aldine, 1969), pp. 271–75.

14. The phases classified as war phases are:

Contraction		*Expansion*	
United States	United Kingdom	United States	United Kingdom
1918–19	1918–19	1914–18	1914–18
1944–46	1944–46	1919–20	1919–20
		1938–44	1938–44
		1946–48	1946–51

The phases classified as deep contraction phases for the United States are as follows:

Deep Contraction	*Following Expansion*
1892–94	1894–95
1895–96	1896–99
1907–8	1908–10
1920–21	1921–23
1929–32	1932–37
1937–38	1938–44

We classify both 1892–94 and 1895–96 as deep contractions because the troubled situation of the period straddled two contraction phases. The 1938–44 expansion is also classified as a war phase, and hence reduces the number of deep contraction phases to eleven.

sponding to all special phases.[15] For the United Kingdom, there remain twenty-five observations corresponding to other phases, for the United States, twenty-two. In terms of years covered, the special observations for the United Kingdom cover twenty-three of the 101 years in the period as a whole; for the United States they cover about half of the 102 years in the period as a whole.

The importance of the special observations in determining the amplitude of fluctuations in our series is brought out dramatically by chart 11.2. In each panel, the first pair of curves (part 1) shows the actual rates of change—for money and nominal income in panel A for the United States, panel B for the United Kingdom; for prices and real income in panel C for the United States, panel D for the United Kingdom. The second panel (part 2) shows hypothetical rates of change in which the special observations are replaced by the average value of the other observations. Eliminating the special observations eliminates the bulk of the variability in the series. Moreover, even some of the variability that remains seems fairly clearly to be a reaction to the special observations—particularly for nominal income for the United Kingdom. It would be hard to justify a long-swing hypothesis as more than random perturbations on the basis of the nonspecial observations alone. If there is any kind of a nonepisodic long swing, wars and deep depressions must be of its essence.

Tables 11.3 and 11.4 supplement the graphs, table 11.3 for means, table 11.4 for variance. For both countries the war phases, as we have noted repeatedly, are characterized by high average rates of growth in money, nominal income, and prices. Real income grew at a higher rate during wars in the United States than during all other phases,[16] but at a somewhat lower rate in the United Kingdom. The United States nonwar deep depression observations are, as expected, at the opposite extreme from the war observations: lower rate of growth in all variables than during nonspecial phases.

Table 11.4 is more significant for the present purpose. It allocates the total variability of rates of change to various sources depending on the type of observation. Taking all special together,[17] for the United States, they account for 54 percent of the degrees of freedom, but for 81 to 95 percent of the variability, so that the variation per degree of freedom of the special observations is between three and a half and fifteen times as

15. Adding phases that precede and follow each set of deep contraction phases, listed in note 14 above, gives a total of twenty phases. Five of these are included in the ten observations corresponding to war phases. Hence, other special phases number fifteen, for a total of twenty-five.

16. The average value for the thirty-seven nonwar observations is 3.0.

17. The inclusion of the one degree of freedom "between special and other" with special rather than with other is called for by the hypothesis being tested, namely, that the "other" phases are the "norm," so that the difference in means between the special and other phases is to be attributed to the special ones.

large as per degree of freedom of the other observations.[18] The only interesting feature of the more detailed sources of variation is that for the nominal magnitudes (money, nominal income, and prices), the one degree of freedom corresponding to the difference between the war and nonwar deep depression observations accounts for 44 to 48 percent of the variance, reflecting the wide difference between the corresponding means in table 11.3. For real income, on the other hand, this degree of freedom contributes 16.5 percent.

For the United Kingdom, the war observations account for twenty-nine percent of the degrees of freedom, but for from 60 to 69 percent of the variability, so that the variation per degree of freedom of the war observations is between three and five times as large as per degree of freedom of the other observations.[19] Once again, the one degree of freedom between war and other observations is extremely important for the nominal magnitudes, much less so for real income.

These results simply confirm the tale of charts 11.1 and 11.2: wars and deep depressions are the major source of wide variability in money, nominal income, prices, and real income. Unless these events can be regarded as integral parts of a self-generating long swing, the empirically observed swings must be regarded as reflecting episodic phenomena smoothed both by the economic reaction to them and by the statistical treatment of the economic data.

The importance of deep depressions for the United States, and their apparent unimportance for the United Kingdom, seems to us further evidence against the cyclical interpretation. In *A Monetary History* we concluded the United States deep depressions reflected predominantly monetary collapse. On that interpretation, the difference between the two countries for the periods concerned is readily explained by the difference in monetary institutions and history. The United Kingdom during this period had some serious monetary disturbances—as in 1890 connected with the Baring crisis—but it had no major financial panics of the kind that were experienced in the United States.[20] On the other hand,

18. These F values would be exceeded by chance distinctly less than one-tenth of 1 percent of the time.

19. For money, nominal income, and prices, the F ratios would be exceeded by chance less than 1 percent of the time; for real income, less than one-tenth of 1 percent of the time.

20. Baring Brothers was threatened with insolvency in November 1890 as a result of imprudent investments in issues of the governments of Argentina and Uruguay. The Bank of England thereupon mobilized a guarantee fund of £17m., subscribed to by the bank and a syndicate of private and joint stock banks, to enable the Barings to discharge their obligations in an orderly way over a period of years. There was no panic on the Stock Exchange, no run on banks, no internal drain of funds, no external run on sterling. See Sir John Clapham, *The Bank of England, 1694–1914* (Cambridge: Cambridge University Press, 1945), 2:326–39; L. S. Presnell, "Gold Reserves, Banking Reserves, and the Banking Crisis of 1890," in *Essays in Money and Banking in Honour of R. S. Sayers*, ed. C. R. Whittlesey and J. S. G. Wilson (Oxford: Clarendon Press, 1968), pp. 167–68, 192–207.

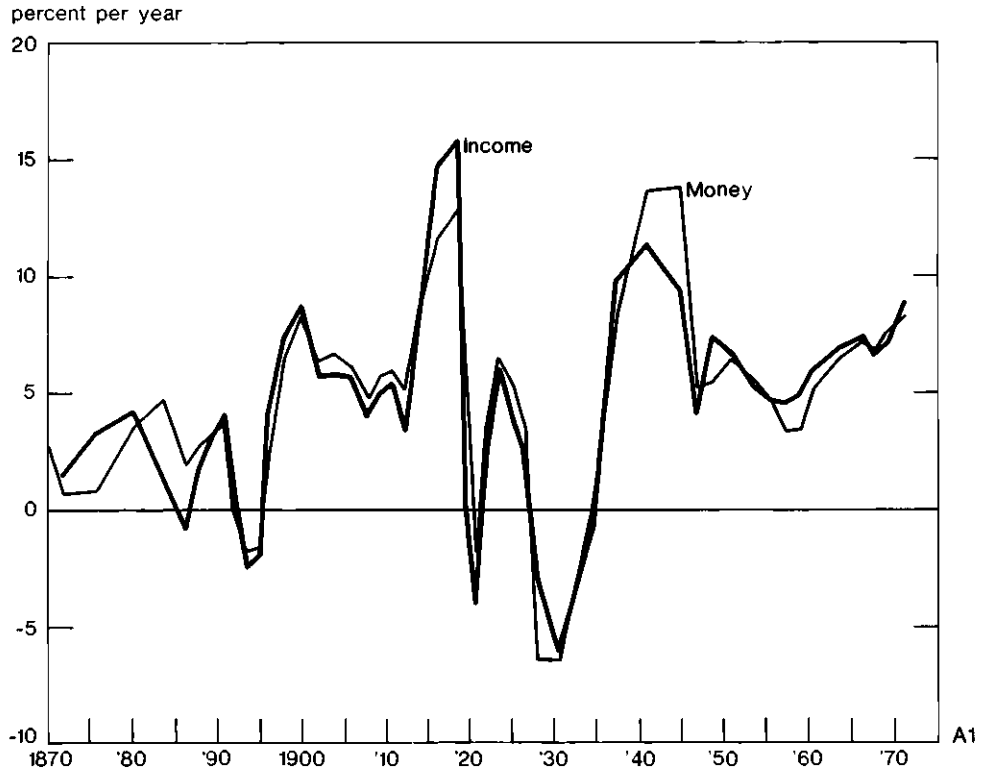
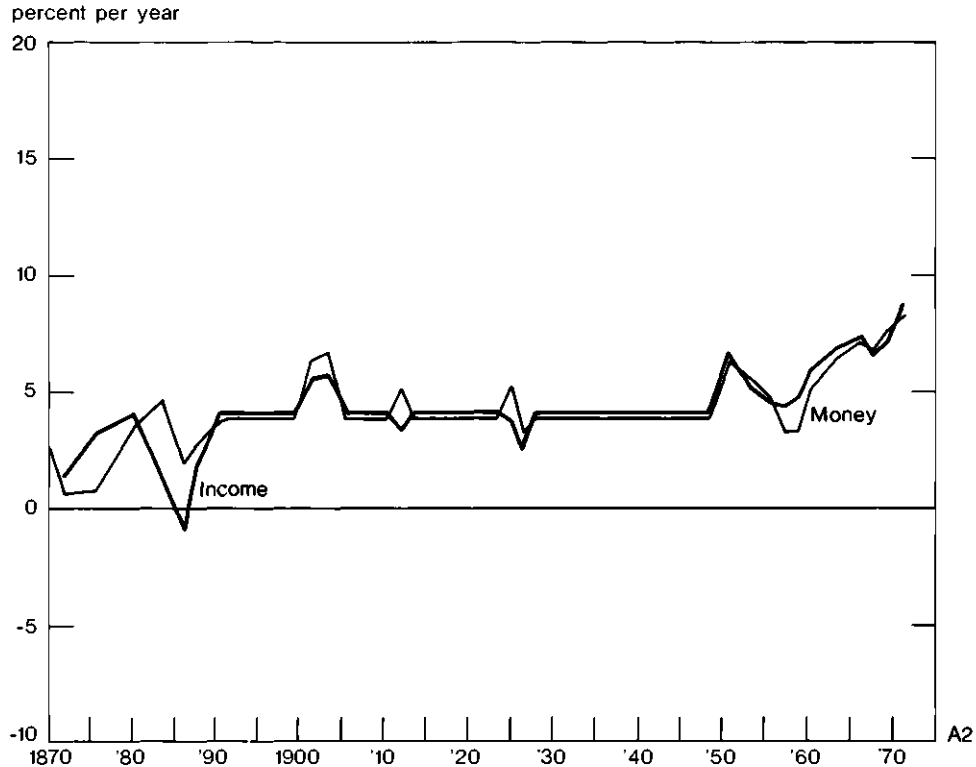
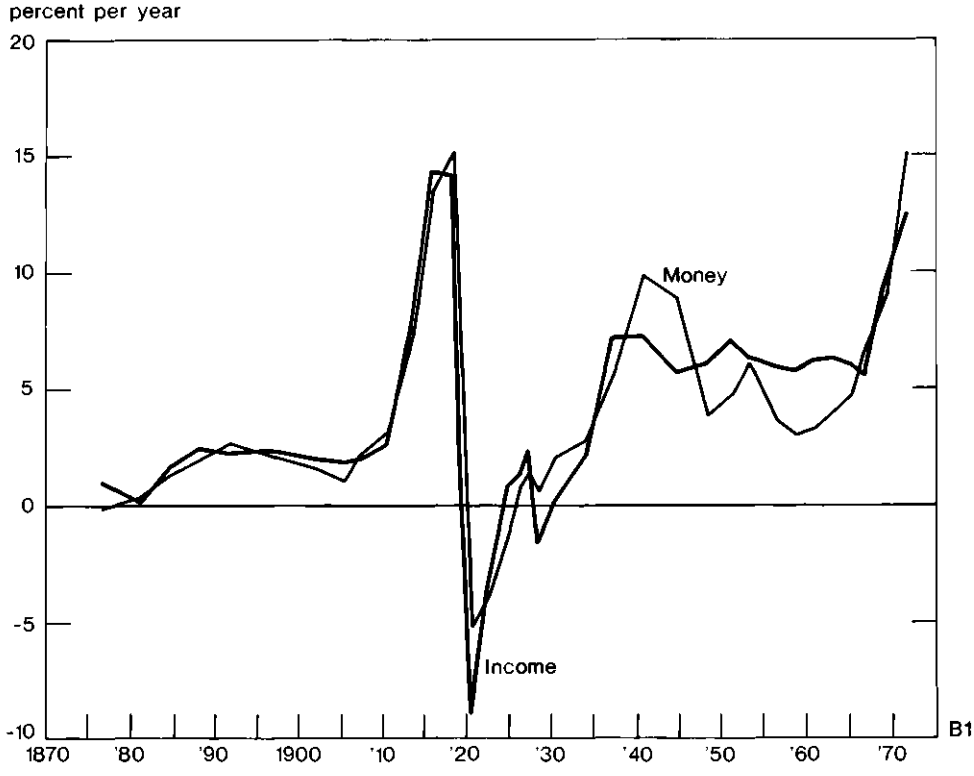


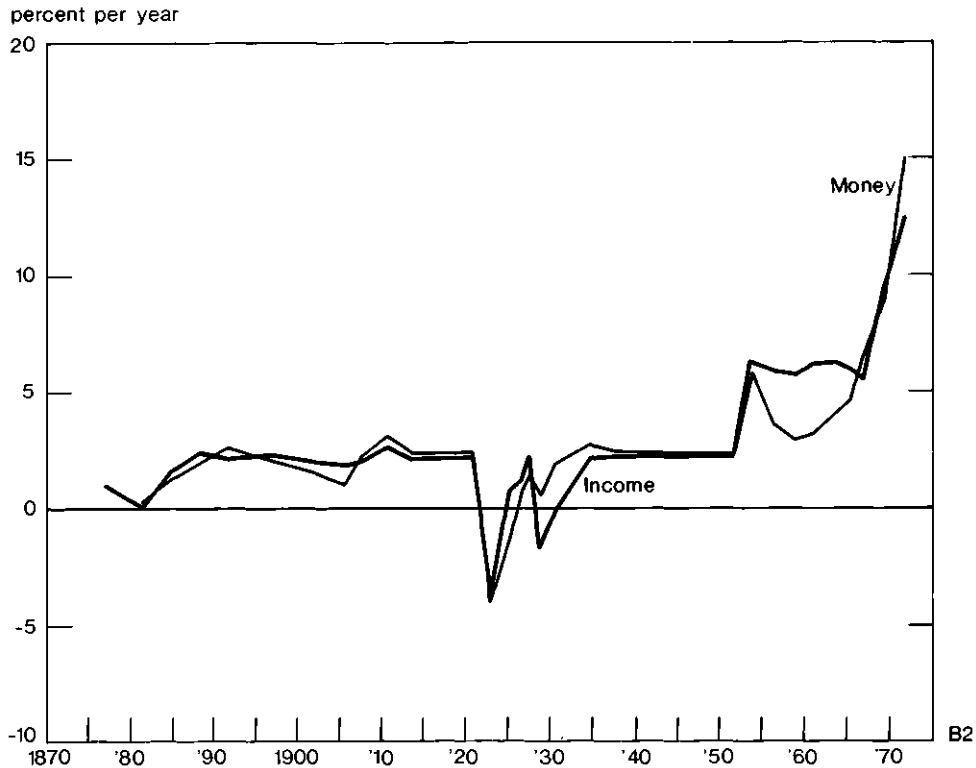
Chart 11.2 Actual and hypothetical rates of change of money and nominal income, and of prices and real income, United States, United Kingdom. (Hypothetical rates that replace actual values for special phases are average actual values for nonspecial phases.) **A1**, United States money and nominal income, actual.



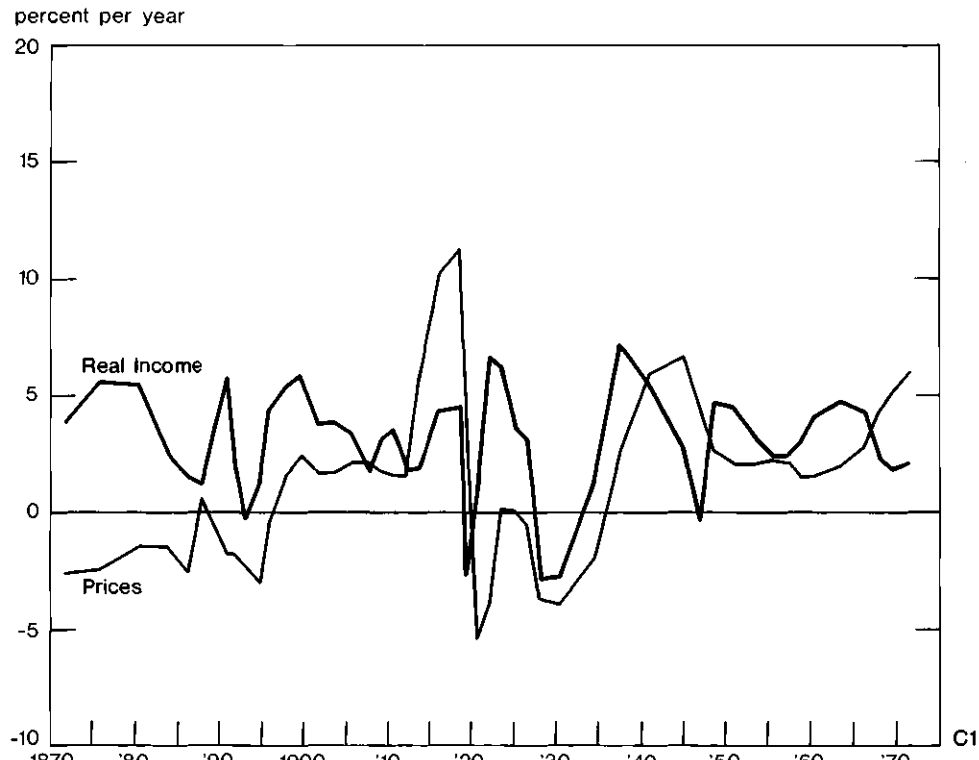
A2, United States money and nominal income, hypothetical.



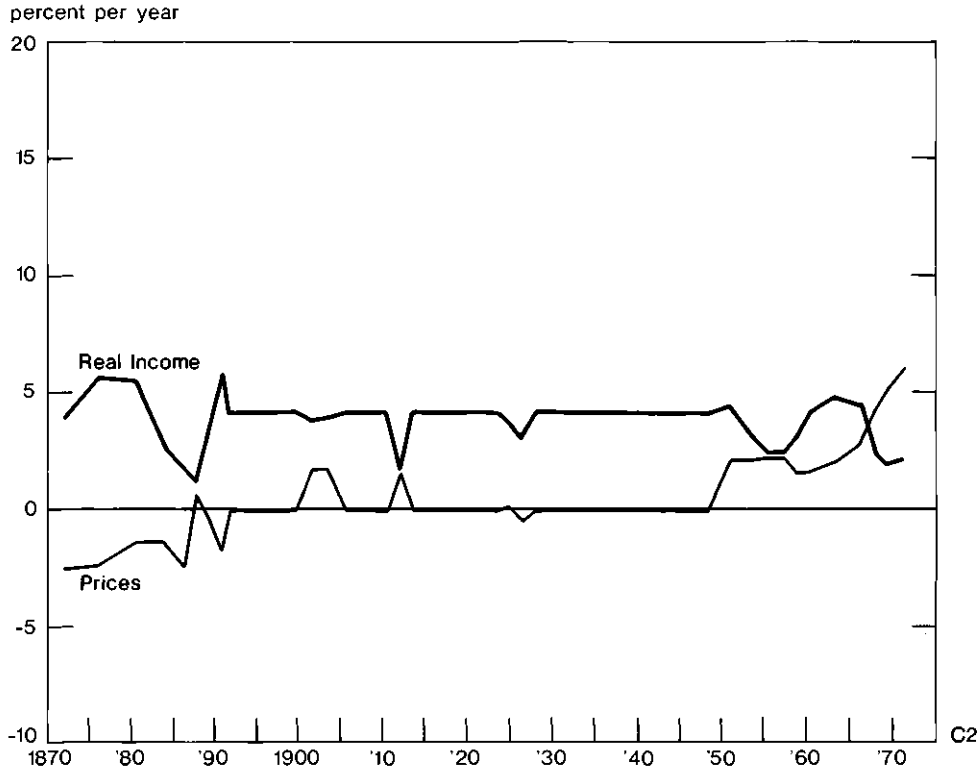
B1, United Kingdom money and nominal income, actual.



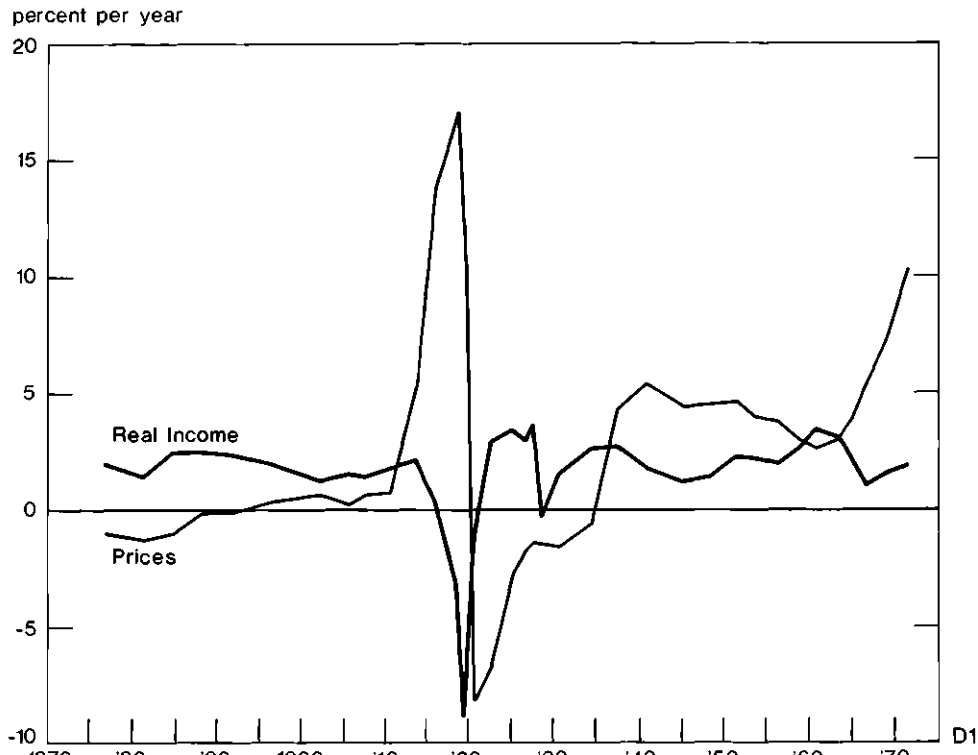
B2, United Kingdom money and nominal income, hypothetical.



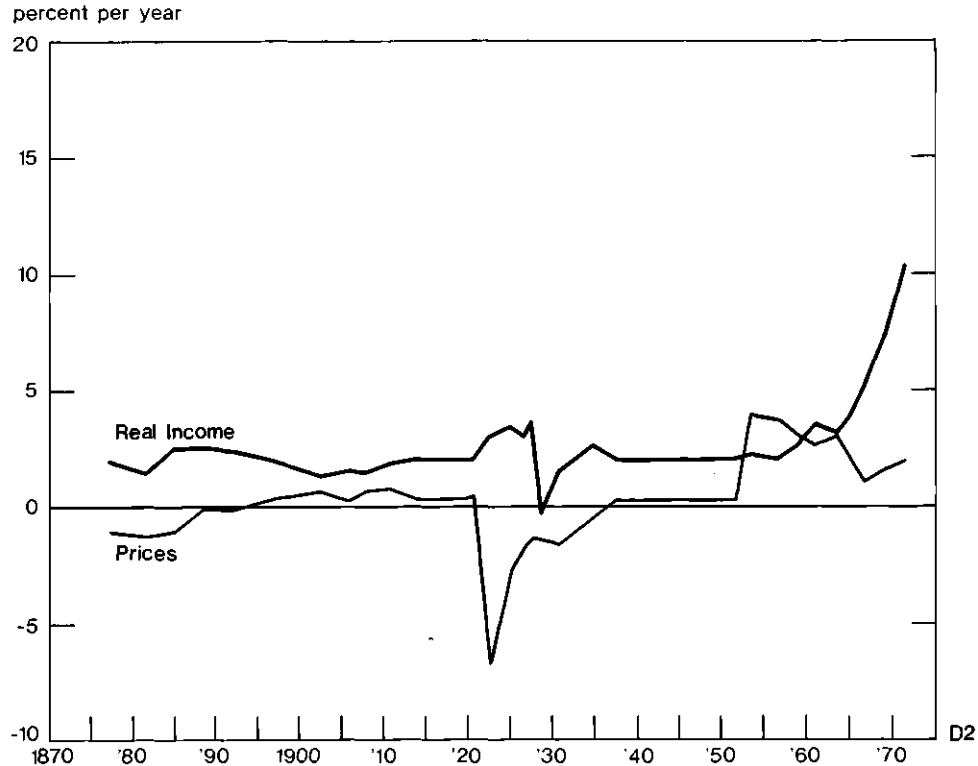
C1, United States prices and real income, actual.



C2, United States prices and real income, hypothetical.



D1, United Kingdom prices and real income, actual.



D2, United Kingdom prices and real income, hypothetical.

Table 11.3 **Mean Rate of Change of War, Additional Special, and Other Phase Observations**

Type of Phase	Number of Observations	Number of Years	Rate of Change: Money	Nominal Income	Prices	Real Income
		United States, 1873–1975				
War	10	20	10.3	9.9	5.1	4.8
Other special	15	29	0.6	0.2	−1.2	1.4
All special	25	49	5.9	5.5	2.2	3.2
Other	22	53	5.2	4.8	0.9	3.9
All	47	102	5.5	5.2	1.6	3.5
		United Kingdom, 1874–1975				
War	10	23	7.5	7.0	5.3	1.6
Other	25	78	2.5	2.7	0.6	2.1
All	35	101	3.9	3.9	1.9	2.0

the hypothesis that observed experience reflects primarily a self-generating long swing in real output produced by real forces cannot be accepted without a persuasive explanation of why these forces should have produced such different results in the two countries—an explanation that is at the moment notable by its complete absence.

11.3 The Role of Money in Long Swings

The episodic character of the long swings is consistent with a small set of economic variables playing a crucial role in their occurrence and diffusion, and the same set playing that role in all long swings. The variables could be peculiarly subject to disturbance and closely linked to other activities, and hence a likely bridge for the diffusion of disturbances; or, alternatively, they could be an essential element in the transmission mechanism, so that disturbances, wherever they originate, have diffused effects if and only if they trigger changes in such variables.

Our results strongly suggest that the quantity of money is such a key variable: for both the United States and the United Kingdom, the amplitude of changes in the quantity of money and the associated nominal magnitudes (nominal income and prices) is much wider than in real output; monetary institutions can be the source of serious disturbances, and the greater susceptibility of the United States institutions to such disturbances than of the United Kingdom institutions seems a likely source of the different incidence of deep depressions in the two countries; money is a pervasive element throughout the economy, so changes in the quantity of money will have widely diffused effects and will be a channel

Table 11.4 **Analysis of Variance of Rates of Change during War, Additional Special, and Other Phase Observations**

Source of of Variation	Number of Degrees of Freedom	Percentage Distribution: Degrees of Freedom	Percentage Distribution: Sum of Squares: Money	Percentage Distribution: Sum of Squares: Nominal Income	Percentage Distribution: Sum of Squares: Prices	Percentage Distribution: Sum of Squares: Real Income	Mean Square per Degree of Freedom: Money	Mean Square per Degree of Freedom: Nominal Income	Mean Square per Degree of Freedom: Prices	Mean Square per Degree of Freedom: Real Income
					United States, 1873–1975					
Within war	9	20	10.6	8.6	15.1	15.8	13.3	11.3	9.6	5.5
Within other special	14	30	33.8	37.1	15.8	51.2	27.3	31.6	6.4	11.5
Between war and other special	1	2	47.7	43.5	45.0	16.5	538.1	519.8	257.4	52.0
Within special	24	52	92.1	89.2	75.9	83.5	43.3	44.4	18.1	10.9
Between special and other	1	2	2.6	2.4	5.1	3.4	29.4	28.5	29.2	10.7
Total special	25	54	94.7	91.6	81.0	86.9	42.8	43.7	18.5	10.9
Within other	21	46	5.3	8.4	19.0	13.1	2.8	4.8	5.2	2.0
Total	46	100	100.0	100.0	100.0	100.0	24.5	26.0	12.4	6.8
					United Kingdom, 1874–1975					
Within war	9	26	24.6	27.1	29.2	66.6	11.7	11.3	13.7	2.3
Between war and other	1	3	38.9	32.4	35.4	2.1	166.7	121.7	149.1	0.6
Total war	10	29	63.5	59.5	64.6	68.7	27.2	22.4	27.2	2.1
Within other	24	71	36.5	40.5	35.4	31.3	6.5	6.4	6.2	0.4
Total	34	100	100.0	100.0	100.0	100.0	12.6	11.1	12.4	0.9

through which other disturbances are transmitted. Wide variability in the quantity of money is associated with wide variability in nominal income and real income both within the United States and the United Kingdom, between the two countries, and among a much wider range of countries.[21] We conclude that substantial changes in monetary growth are very likely both a necessary and sufficient condition for the emergence of substantial long swings in economic activity.

11.4 The Transmission Mechanism

Chapter 2 gives a theoretical analysis of the way changes in the quantity of money are transmitted to other variables and why a change in monetary growth is likely to give rise to a cyclical reaction pattern in nominal income, prices, real income, and interest rates. Chapters 5 through 10 document this process empirically. They demonstrate the close empirical relation between monetary changes and contemporaneous and subsequent changes in other magnitudes. Most important, for the present purpose, they demonstrate the gradual nature of the adjustment process and the long time it takes for a monetary change to be fully reflected in other phenomena, in particular, in public anticipations about the future behavior of prices.

A swing produced by monetary disturbances can, on the basis of this evidence, be expected to take a considerable time, as the observed swings do, and to display a consistent pattern of reaction of both nominal and real magnitudes, as the observed swings do. Our purpose has led us to concentrate on aggregates, but the same reasoning leads one to expect that monetary disturbances will produce systematic patterns in the reaction of such components of output as construction, other investment, consumption, and so on.

It follows that there is no inconsistency between our tentative judgment that changes in monetary growth are a crucial element in the generation of long swings and the finding of other investigators that there are systematic long-swing patterns in the behavior of real output.

11.5 Summary

Our chief conclusions can be stated briefly. First, Hanlet has been left out of most work to date on long swings. Second, those swings appear to represent smoothing of episodic disturbances rather than an internal cyclical mechanism that produces a roughly periodic and recurrent pulsation.

21. See J. R. Lothian, "The Demand for High-Powered Money," *American Economic Review* 66 (March 1976): 56–68; A. A. Walters, *Money in Boom and Slump*, 3d ed., Hobart Paper 44 (London: Institute of Economic Analysis, 1971); M. Friedman and A. J. Schwartz, "Money and Business Cycles," *Review of Economics and Statistics* 45, suppl. (February 1963): 32–64.